CHAPTER 3
Affected Environment and Environmental Consequences

I. INTRODUCTION

This chapter describes the environment being affected or created by the alternatives discussed in Chapter 2 and forms the scientific and analytic basis for the comparisons made between these alternatives. It also lists past, present, and reasonably foreseeable future activities considered in the cumulative effects analysis. The impacts for both alternatives are discussed for those issues considered to be factors in the decision being made. For each issue, this chapter addresses: a) the affected environment, b) direct and indirect effects, and c) cumulative effects. A discussion of the fuel reduction proposal's consistency with the Gallatin Forest Plan and other applicable laws, regulations, policies, and other direction is provided at the beginning of this chapter. Additional information may be found in the project file located at the Big Timber District Office.

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 modeled predictions of the effects and the actual effects may not occur exactly to the degree presented. More important than the exact effects, is the comparison of change between the proposed action alternative and the present condition (no action) as predicted by models and analytic projections.

General Description and History of the Area

The Main Boulder Fuels Reduction Project Area consists of roughly 2500 treatment acres, located approximately 30 miles southwest of Big Timber on National Forest System lands along an approximately 24 mile long corridor, which is approximately ½ mile wide, located between the Boulder River and the Inventoried North Absaroka Roadless Area or the Absaroka-Beartooth Wilderness.

The analysis area for the Main Boulder Fuels Reduction Project consists of the Main Boulder Watershed, which is made up of timber compartments 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129 and 136 totaling 147,211 acres. The analysis area consists of approximately 151,000 acres, including the adjacent private land. Approximately 82% of the acres in the timber compartments in the Main Boulder drainage are classified as wilderness and therefore have had only natural disturbance other than trail construction and associated maintenance activities. The Boulder River is eligible for consideration and possible inclusion into the National Wild and Scenic Rivers System as a Scenic or Recreation River.

Approximately 2% of the analysis area acres are privately owned. The majority of the analysis area is forested, with vegetation forming a continuous vertical and horizontal canopy. The cumulative effects area for some of the resources will vary from the analysis area depending on the environmental needs of the individual resource.

Recreation has become the predominant use in the corridor with approximately 250 structures, many of which are private residences, 25 recreational residences, 4 church camps, 6 Forest Service campgrounds and numerous trailheads.

II. CHANGES BETWEEN THE DRAFT EIS AND THE FINAL EIS

Section III Past, Present, and Reasonably Foreseeable Activities

- The last paragraph of reasonably foreseeable activities has additional verbage pertaining to future maintenance activities likely to occur.

Section VIII. Direct, Indirect and Cumulative Effects

- For Issue 1- Fuels, results of independent modeling done by the Boulder River Fuels Cooperative are included in Ch 3-31.
- For Issue 2- Noxious Weeds, the acres to be treated in the Effects of Ground-based scenarios and in Cumulative Effects was updated.
- For Issue 3- Water Quality, the Direct and Indirect Effects paragraphs for Alternative B, the proposed action, were modified.
- For Issue 4 Fisheries, an additional sentence was added to mitigation for Alternative B referring to modifications in the mitigation described in Chapter 2 for fisheries.
- For Issue 6-Wildlife, Ch. 3-64 Timber compartment analysis acres total 147,211 not including private land. There are Seven LAU's in located in 15 compartments.
- For Issue 8 Air Quality, Cumulative Effects for Alternative A, no action, was modified. Table 3-14 & 3-15, The Effects from Understory Burns had the unit of measure, miles, added to the column heading, Minimum Ambient Distance, for clarification purposes. For Alternative B, Direct and Indirect Effects, a statement was added to disclose that smoke from burning could cause temporary reductions in visibility in the AB Wilderness. Reference to the ozone standard was added to Applicable Laws, Regulations and Forest Plan Standards.

III. PAST PRESENT AND REASONABLY FORESEEABLE ACTIVITIES

Described below are several private and public activities that already have, or will likely occur in or near the project area. The past activities have contributed to the existing condition as portrayed by Alternative A (no action). These activities may produce environmental effects on issues or resources relevant to the proposal. Therefore, these activities have been considered in the "cumulative effects" analyses.

The NEPA requires consideration of "cumulative effects". A cumulative effect is the effect on the environment, which results from the incremental effect of the proposed action when added to other past, present, and reasonably foreseeable future actions (40CFR 1508.7). The first step in cumulative effects analysis is to determine how the proposed actions in the area contribute to the additive effects of the various resources.

The Main Boulder River Corridor is a narrow strip (approximately ½ mile in width) consisting of National Forest and private lands. Over the past twenty years there has been very limited harvest activity on National Forest lands in this drainage. There have been only 26 acres of past regeneration harvests, which have been certified as stocked. These areas are currently in the sapling size class. Three acres have been treated for aspen regeneration enhancement. Sanitation Salvage has occurred on 79 acres to remove dead trees caused by bark beetle infestations. An additional 101 acres of road right-of-way clearing has occurred in order to improve the visibility and safety of travel on the narrow one-lane Main Boulder Road.

Below is a summary of these harvest activities that occurred on Forest Service lands:

Table 3-1 Past Harvest Activity in the Main Boulder Drainage

Sale_Name	Compartment	Harvest Type	Acres	Year
Froze to Death #014735	127 128	Patch Clearcut Clearcut	5 10	1982 1982
Elkhorn #015442	116	Patch Clearcut	9	1982
Miller Creek Post&Pole #016820	117	Clearcut	2	1989 1989
Miller Creek Aspen #017687	117	Special Cut Aspen Regen	3	1995
Boulder Hazard Road Clearing #017737	121 124 127	Perm Clearing Perm Clearing Perm Clearing	27 15 23	1995/96 1995/96 1995/96
Box Beetle #017851	120	San/Salv I&D	13	1998
Boulder Fuels #017869	121	San/Salv I&D	62	2001
Windy Hicks #017992	118	San/Salv I&D	4	1998
Main Boulder Hazard Road Clearing #018149	116 117 118 121 124	Perm Clearing Perm Clearing Perm Clearing Perm Clearing Perm Clearing	7 6 9 5 9	2002 2002 2002 2002 2002

A hazard tree Categorical Exclusion was written for removal of dead and unstable “hazard trees” for a distance of 150 feet from either side of the Main Boulder Road. The contract was awarded and implementation was completed in the spring of 2004 on approximately 63 acres over a total distance of approximately three miles, with the majority of the trees located in the vicinities of Chippy Park and Box Canyon. Most of this recent mortality can be attributed to a very active Douglas-fir beetle epidemic in the Main Boulder drainage. Removing these dead and dying trees will provide for a safer travel corridor for the public.

There are six National Forest campgrounds, 1 FS permitted church camp, 25 permitted recreational residences on National Forest land, and several administrative sites located in the corridor. These areas have received routine maintenance over the years, such as removal of hazard trees and other general grounds maintenance procedures.

The Main Boulder River Corridor also contains approximately 250 private structures, many of which are private residences. The Whispering Pines subdivision, in itself, contains approximately 60 private residences. There are 3 church camps on the private lands adjacent to National Forest lands.

Christikon, one of the camps, hired a contractor to remove all of the dead and dying trees on their property in 2002/2003. This harvest occurred over an area of approximately 5-10 acres. In the vicinity of Chippy Park, approximately 20 acres of private land has had a leave tree harvest that occurred in fall 2003/spring 2004.

The Boulder River Cooperative has been awarded two grants, one from the USDI Bureau of Land Management, and another from the Montana Department of Natural Resources and Conservation, to assess and implement fuels reduction efforts on private land. The Boulder Fuels Reduction Cooperative has hired a project coordinator to manage the program and engaged a

consultant firm, Fire Logistics, to develop the Boulder River Community Assessment and Mitigation Plan. This plan, developed independently from the Main Boulder DEIS, assessed fire risk and fuel conditions in the Main Boulder Corridor, and identifies actions necessary on private land to protect private land values as well as providing for public and firefighter safety.

Approximately 70 of the private residences located in the corridor had fuel assessments conducted in June of 2003 by the Big Timber/Sweetgrass County Rural Fire Department. Three pilot projects were completed during the spring/summer of 2004 on private land around residences that are adjacent to the Forest Service's proposed project. Two of the pilot areas are occurring in the Whispering Pines Subdivision on small acreage (<1 acre each) surrounding private residences. The third pilot area is located in the vicinity of Crystal Springs. This fuel reduction activity will thin fuels for approximately a 150-foot distance along either side of the Main Boulder Road over a ten-acre parcel. Fuel activities have been completed or are currently occurring on approximately fifteen additional private sites. These treated areas could encourage additional private landowners to begin fuel reduction activities as well.

Approximately 50 or more additional private residences and/or corporate lands located in the river corridor could have some type of fuel reduction activities within the next two years.

Sweetgrass and Park County officials have applied for Forest Highway Access Money (through Federal Highways Administration appropriations) to widen some single lane portions of the Main Boulder Road (which is a county road). It is not known at this time whether or not these funds will be made available.

Fuel reduction maintenance treatments are expected to occur in the Main Boulder River Corridor for several years following the initial treatments, in order to maintain fuel conditions in a post-activity condition. These treatments could include underburning, prescribed burning, removal of insect killed and/ or hazard trees, and removal of additional small diameter trees and ladder fuels as they re-establish themselves. These future actions are likely to begin well outside of the life of this NEPA document and project (10-20 years out), so are not considered to be within the scope of this project. Additional NEPA and analysis would be conducted at the appropriate time to address these future maintenance activities.

IV. GALLATIN NATIONAL FOREST PLAN – FOREST-WIDE GOALS, OBJECTIVES, AND STANDARDS

Forest Plan Management 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 Main Boulder Fuels Reduction project area is mostly in designated in MA 5, MA.7, and MA 15. In addition, small amounts of MA 3, MA 6, MA 11, MA 12, and MA17 are also found within the project area. However, MA 7 is not mapped because it is often a very narrow streamside zone and not practical to map. See MA map on p. 1-19.

Direction can be found primarily in the Forest Plan sections on goals (FP, pp. II-1 to II-2), objectives (FP, pp. II-2 to II-7), standards (FP, pp. II-14 to II-29), and management area direction (FP, pp. III-24 to III-26 and III-33 to III-36).

The following is a short synopsis of the standards and guidelines established in the Forest Plan that are pertinent to this action. Direction can be found primarily in the Forest Plan sections on goals (FP, pp. II-1 to II-2), objectives (FP, pp. II-2 to II-7), standards (FP, pp. II-14 to II-29), and management area direction (FP, pp. III-19 to III-73). Both Alternatives A and B would be consistent with the goals, objectives and standards of the Forest Plan.

Visual Quality and Wild and Scenic River Summary

Scenery: The Forest Plan emphasizes the visual resource by providing direction for management activities that alter the natural landscape (FP, pg. II-3). Forest-wide direction is to “Provide visitors with visually appealing scenery” (FP, pg. II-1). During the development of the current Forest Plan, a Visual Management System inventory (VMS) (USDA Forest Service, 1974 National Forest Landscape Management, Vol. 2, Ch. 1, Ag Handbook #462 was conducted on the Forest. The survey considered three factors: the sensitivity of the observation points (which is the concern level of viewers); the distance of the landscape from the observation points; and the landscape character and variety class (which are the physical characteristics and visual diversity of the landscape). The resulting Forest Plan Visual Quality Objectives (VQOs) are a blending of the results from the VMS Inventory and other resource considerations. The VQOs are the Forest Plan standards for visual quality that provide large-scale guidance for the degree of acceptable landscape change for all management initiated landscape-altering activities (FP, pg. II-16). The VQOs that are assigned to specific land polygons in the Forest Plan are Preservation, Retention, Partial Retention, Modification, and Maximum Modification.

For this project, the Forest Plan VQO of Partial Retention applies to all those areas where fuel treatment is being proposed, except for those areas immediately around recreation sites where the VQO ranges from Partial Retention to Modification. The VQO Partial Retention, as defined on page VI-44 of the Gallatin National Forest Plan, means that the characteristic landscape may appear to be altered slightly and that any noticeable deviations must remain visually subordinate to the landscape character being viewed. The VQO of Modification is defined as land where human activity may dominate the characteristic landscape but must, at the same time, utilize naturally established form, line, color and texture. Since the observation points and corridors that were used for the inventory are the Main Boulder Road and the recreation sites, most of the project area is in the foreground viewing distance, where the details of line, form, color and texture play an important role in the scenery. As part of the analysis process for this specific

project, the view shed and viewing distances are further refined. Areas that are visible from the road are referred to as "seen areas" or "SAs". To meet Partial Retention, all harvest activities must not be visually dominant longer than 1 year after the fuel treatment and associated activities are completed. The Forest Plan VQOs do not provide guidance for changes to the scenery that result from natural events. In other words, the results of any fire due to natural ignitions are outside the scope of the VQOs.

The Forest Service is starting to incorporate the newer Scenery Management System (SMS) (Landscape Aesthetics: A Handbook for Scenery Management, USDA Forest Service, Agriculture Handbook Number 701, December 1995) principles and terminology into Forest Plan revisions and projects. The Gallatin National Forest Plan (1987) has not yet incorporated SMS and so the Forest Plan VQOs are still applicable to this project. However, some of the SMS concepts, such as scenic integrity and landscape character are being incorporated into the analysis for this project, since they tend to make the discussions more meaningful. SMS defines the term landscape character as an overall visual and cultural impression of a geographic area. It includes the natural scenic attributes of an area in combination with the existing land use patterns and cultural context that have become accepted over time as contributing to the landscape's sense of place. The landscape character description often includes both private and public land, since the combination of both form the overall visual image. According to the SMS Handbook, the term scenic integrity is a measure of the degree of intactness and wholeness of the landscape character.

Wild and Scenic River: Amendment No. 12 of the Gallatin National Forest Plan dated June, 1993 mandates that the Boulder River will be managed to protect its outstandingly remarkable values for future consideration and potential classification for inclusion into the Wild and Scenic River System. This Amendment defines the current eligibility classification of the Main Boulder River prior to formal Wild and Scenic River Study specifically as follows:

Recreation River:

- *from the Gallatin National Forest boundary to Blakely Creek,*
- *from Miller Creek to Bramble Creek*

Scenic River:

- *from Blakely Creek to Miller Creek,*
- *from Bramble Creek to the Wilderness boundary*

As a minimum, any future Study area will encompass the length of the river segment and one-quarter mile from each riverbank. Boundaries may include adjacent areas needed to protect the resources or facilitate management of the river area.

FSH 1909.12,8 and GNF Plan Amendment No. 12, defines standards to maintain these potential Scenic and Recreation River classifications. Although these standards do not directly address fuel treatment, they do address "Timber Production'. According to those standards, within a Scenic river corridor, "a wide range of silvicultural practices could be allowed provided that such practices are carried on in such a way that there is no substantial adverse effect on the river and its immediate environment. The river area should be maintained in its near natural environment. Timber outside the boundary but within the visual scene (sic.) area should be managed and harvested in a manner which provides special emphasis on visual quality". Within a Recreation river corridor, "timber harvesting would be allowed under standard restrictions to protect the immediate river environment, water quality, scenic, fish and wildlife, and other values".

Forest Plan Amendment 12 ("River Description and Reasons for Eligibility and Potential Classification in the Forest Plan"), in terms of "outstandingly remarkable values relevant to the Boulder River, is not very specific. Because of this, the ID Team and Regional Office Staff agree that the Forest Plan Visual Quality Objective of Partial Retention, that already covers the entire Main Boulder Corridor, is appropriate to use for analyzing potential impacts to scenery.

Recreation Summary

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) Maintain existing recreational hunting opportunities, 3) Provide safe public access, and 4) Continue the cabin rental program (FP, pg. II-2-3).

The Forest has determined the summer ROS classifications are "Rural" for the vast majority of the project area, with the extreme southern-most part of the area above Box Canyon being classified as "Roaded Natural Appearing." Winter ROS is defined as Semi-Primitive Motorized for the majority of the Main Boulder Corridor.

"Rural" settings are natural environments that are culturally modified yet attractive. Backdrop modifications range from obvious to dominant. Self-reliance on outdoor skills is of little importance, and there is little challenge and risk. Interaction between and evidence of other users may be high. "Roaded Natural Appearing" settings are generally characterized as mostly natural-appearing environments with moderate evidence of the sights and sounds of man. Resource modification and utilization practices are evident but harmonize with the natural environment. "Semi-Primitive Motorized" settings are predominately natural-appearing environments where there is often evidence of other users and moderate probability of solitude (FP, pg. VI-29-30).

The proposed action incorporates design criteria and mitigation to ensure compliance with the ROS classifications for the Main Boulder River Corridor.

Wilderness Summary

The Main Boulder project area represents a narrow roaded corridor into the Absaroka-Beartooth Wilderness. The Forest Service has the responsibility of assuring no unauthorized uses occur within the wilderness itself. This being the case, the Forest Plan provides direction to manage resources within the Absaroka-Beartooth to maintain their wilderness character and to provide for their use and protection (FP, pg. II-1. The 1964 Wilderness Act (P.L. 88-577) and the Absaroka-Beartooth Wilderness Act (P.L. 95-249) provide specific direction for the Absaroka-Beartooth Wilderness.

The proposed action does not include fuel reduction or burning activities in the wilderness. Additionally, wilderness boundaries that are adjacent to the proposed units will be monumented before fuel reduction activities begin in the unit.

Roadless Summary

The 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. Roadless areas are to be analyzed to determine the effects of any proposed activity that would substantially alter the roadless characteristics of IRAs so as to render them unsuitable for future designation as wilderness. Roadless qualities and characteristics to be evaluated under this mandate include:

Remoteness: Remoteness is a perceived condition of being secluded, inaccessible, and out of the way. Physical factors that can create a "remote" setting include topography, vegetative screening, difficulty of travel, and distance from human impacts such as roads and structures.

A user's sense of remoteness in an area is also influenced by the presence of roads, their condition, and whether they are open to motorized vehicles.

***Solitude**:* Solitude is a personal, subjective value defined as isolation from the sights, sounds, and presence of others and human development. Common indicators of solitude are the number of individuals or parties one may expect to encounter in an area during the day, or the number of parties camped within sight and sound of other visitors. Solitude is directly related to remoteness of an area and primitive, unconfined recreational opportunities.

***Natural Integrity**:* Natural integrity of an area is related to its physical setting and the extent to which long-term ecological processes are intact and operating. Impacts to natural integrity are measured by the presence and magnitude of human-induced change to the area. Possible impacts include phyiscal developments (e.g. roads, utility rights-of-way, fences, lookouts, cabins), recreation developments, domestic livestock grazing, mineral developments, wildlife and fisheries management activities, vegetative manipulation, and fire suppression activities.

***Apparent Naturalness**:* The apparent naturalness of an area means the environment looks natural to most people using the area. It is a measure of importance of visitors' perceptions of human impacts to the area.

Special Features: Special features are those unique geological, biological, ecological, cultural, or scenic features that may be located in the roadless portion of the project area.

***Manageability of Boundaries**:* This relates to the ability of the Forest Service to manage an area to meet the size criteria (minimum size requirement of 5,000 acres for wilderness) and the five elements discussed above.

No treatment or road construction is proposed within the North Absaroka IRA that would alter the potential eligiblity of the area for inclusion into the Wilderness system. With implementation of the proposed action, the only activity that would occur in roadless designation is a portion of the Main Boulder Station Unit, where trees and ladder fuels less than 8" dbh would be slashed and prescribed burning would follow the slashing treatment. These are both acceptable activities in areas designated as roadless.

Wildlife Summary

Threatened and Endangered Species. There is an abundance of law, policy and direction applicable to wildlife habitat considerations relative to resource management on National Forest lands. The Endangered Species Act (ESA) of 1973 mandates that the effects of land uses and management activities be evaluated as part of the biological assessment process for listed species. The National Forest Management Act (NFMA) of 1976 requires that the US Forest Service 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. 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. Ultimately, the Gallatin Forest Plan provides specific direction for management of wildlife habitat by various management areas (MA).

A biological Assessment was prepared by the District Wildlife Biologist and sent to the US Fish and Wildlife Service for review. Concurrence with the determinations was received on May 13, 2004.

The Service concurs that the proposed action is not likely to adversely affect the threatened grizzly bear or the threatened Canada Lynx, is not likely to jeopardize the continued existence of the nonessential experimental gray wolf, and would have no effect for the threatened bald eagle. Therefore, pursuant to 50CFR 402.13 (a), formal consultation on the species referred to above is not required.

Big Game The Forest Plan provides direction for increasing populations of big game animals (FP, pg. II-1), emphasizing forage and cover needs on big game winter range (FP, pg. II-3) and emphasizing management of special and unique wildlife habitats such as wallows, licks, talus, cliffs, caves and riparian areas (FP, pg. II-18).

Adequate security for elk will be maintained over time by providing hiding cover and road management. The 1982 elk logging study annual report contains procedures for analyzing elk habitat security as it is affected by timber harvest and road construction activities. An "elk effective cover" analysis based on this report will be conducted for timber sales and effective cover ratings of at least 70 percent will be maintained during general hunting season. The Forest Plan provides direction to maintain HEI at or above 70% (FP, pg. II-18). Maintain at least two thirds of the hiding cover associated with key habitat components over time. Key habitat components that are important to big game include moist areas (wallows, etc.); foraging areas (meadows and parks); critical hiding cover; thermal cover; migration routes and staging areas. These areas will be mapped and considered on a site-by-site basis during project area analysis.

As a part of the proposed project, design criteria and mitigation have been included to help maintain adequate hiding cover for elk. See wildlife mitigation on Ch. 2-35. The proposed slashing and burning on 450 acres of meadow types would increase and enhance forage production. Rejuvenation of aspen stands would also improve elk habitat. After implementation of the proposed action, the HEI rating as directed by the Forest Plan, would exceed the required 70% in all timber compartments associated with the project. See p. A-13.

Sensitive and Management Indicator Species 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 a species' existing distribution (FSM 2670.5.19). There are eight species listed as sensitive for Region 1. The Main Boulder analysis area (timber compartments 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129 and 136) does not provide suitable habitat for the trumpeter swan, so this species is not addressed in this EA for potential impacts from the proposed project.

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.

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 will affect any sensitive species (FSM 2670.32). The goal of the analysis should be to avoid or minimize impacts to sensitive species. If impacts cannot be avoided, the degree of potential adverse effects on the population or its habitat within the project area and on the species as a whole needs to be assessed.

Habitat that is essential for species identified in the Sensitive Species list developed for the Northern Region will be managed to maintain these species. Management Indicator Species, which have been identified as species groups whose habitat is most likely to be affected by forest management activities, will be monitored to determine population change.

In accordance with the Forest Plan, a biological evaluation (BE) was completed prior to implementation of activities that have the potential to effect sensitive species. As part of Forest Service Region 1 (R1) streamlining policy (August 17, 1995), it is no longer required to produce a "stand alone" biological evaluation for sensitive species. Affects of the proposed action to sensitive and management indicator species are addressed in the FEIS Chapter 3. Numerous mitigation measures and design criteria have been incorporated into the project to help protect sensitive species. See wildlife mitigation on Ch. 2-35.

Fisheries Summary

The Gallatin National Forest Plan provides broad direction for the management of forest fishery resources and more specific direction for management of sensitive species.

Goals (FP, p. II-1)

1. Maintain and enhance fish habitat to provide for increased fish population.

Objectives (FP, p. II-1)

1. Management of timber within riparian zones will be designed to improve fish habitat.
2. Projects to improve lake and stream habitat will be implemented.

Forest Plan Standards (FP, p. II-17)

1. Habitat that is essential for species identified on the *Sensitive Species* list developed for the Northern Region will be maintained to manage these species.
2. The Forest will be managed to maintain and where feasible, improve fish habitat capacity in order to achieve cooperative goals with the Montana Department of Fish Wildlife and Parks.

Riparian Direction: MA7 (FP, p. III-19). Refer to Item No. 29f that resolves FP discrepancy for timber management in riparian zones.

Goal: Manage the riparian resource to protect the soil, water, vegetation, fish and wildlife dependent upon it.

Standards:

Timber:

1. Design timber harvest to meet needs of riparian zone-dependent species."
2. Maintain sufficient trees within 30 feet of the stream to provide snag recruitment to create pools and enhance spawning gravels for fish habitat." **see Item No. 29f. which basically confirms that vegetation manipulation within riparian areas must meet some riparian dependent resource objective. This reflects the intent of the negotiated agreement with Trout Unlimited is resolving their appeal of the Forest Plan.*
3. Emphasize special logging practices which minimize soil disturbance."
4. Machine piling will not be allowed
5. Commercial thinning may be used to meet management area goals
6. Precommercial thinning may be used to provide rapid growth of trees for wildlife thermal cover.

Water and Soils:

1. Manage riparian vegetation, including over-story tree cover, to maintain streambank stability and promote filtering of overland flows.
2. Avoid using equipment, which causes excessive soil compaction and displacement.

Fish and Wildlife:

1. Provide for optimum water temperatures for cold-water fish species
2. Maintain suitable habitats for those species of birds, mammals, and fish that are totally or partially dependent upon riparian areas for their existence.

Fire:

1. Prescribed fire may be used to meet management area goals.

The Main Boulder Fuels reduction project incorporates numerous design features and mitigation measures in order to protect the soil, water, vegetation, fish and wildlife that are dependent on the riparian habitat in the river corridor. See fishery mitigation section on Ch. 2-32.

Water Quality Summary

Gallatin National Forest Plan Management Area 7 direction requires that manipulation within riparian areas occur only for the purpose of meeting riparian dependent resource objectives. Riparian areas are defined as the land and vegetation for approximately 100 feet from the edge of a perennial stream. Management Area direction for facility standards in riparian areas directs to: 1) Minimize the amount of material from road construction wasted into riparian areas and follow BMP's that apply to road construction. 2) Design road drainage to minimize the entry of sediment into streams. Road design will also provide for low risk of drainage failure and mass failure. 3) Minimize the number of stream crossings. The state of Montana requires that BMP's be implemented for all activities in order to comply with B1 Classification water quality standards.

Best Management Practices (BMP's) will be used to mitigate the impact of ground disturbing activities and minimize erosion and sedimentation, to streams and water courses (FP, pp. II-1, II-5 and II-23). The State of Montana requires that BMP's be used on all activities to comply with State water quality standards. A complete list of BMP's is located provided in Appendix C.

A detailed description of the BMP process and BMP's for the Main Boulder Fuel Reduction Project is included in Appendix C.

The 1991 Streamside Management Zone law and 1993 SMZ Rules of Montana also apply.

Fine sediment levels, resulting from Alternatives A and B, are within GNF Implementation Guidelines for spawning habitat composition in the Main Boulder River.

Beneficial aspects of wildfire to stream ecosystems will be retained by both alternatives, including large woody debris recruitment and nutrient cycling.

Standard BMP’s for protecting wetlands, bogs, springs, seeps, and other potential amphibian habitat will be observed. These include 50 foot buffers from the margins of such habitats and SWCP 11.05, which restricts tractor use in and near wetlands

Sensitive Plant Species

The Forest Service is mandated to maintain viable populations of all desirable native and non-native species under the National Forest Management Act (FSM 2670.232). There are provisions in the sale contract (C(T) 6.251# - Protection of Habitat of Endangered Species) to modify the sale activities should any individual plants or populations of plants be located once harvest has begun. Affects of the proposed action to sensitive plant species are addressed in this FEIS (Ch. 3-87). Sensitive plant surveys were conducted within the project area in 2002. There were no sensitive plants found in the project area. This project will not affect the viability of any sensitive plant populations. This project is in compliance with Forest Service policy on sensitive plant species and with direction in the Forest Plan.

Forest Plan Management Areas

The Main Boulder Fuels Project lies within eight management areas as described in the Forest Plan. The majority of the units lie in MA 5, 15, or 7.

Management Area 3 (MA 3) – These areas consist of non-forest, noncommercial forest and forested areas, which are unsuitable for timber production. They generally do not have roads passing through them. Topographic constraints and poor accessibility characterize these areas (FP, pp. III-6 through III-7). Management goals for MA 3: Managed essentially in their present condition to protect existing improvements and resources, with minimal investment for resource activities. Timber Standards 1) Classified as unsuitable for timber production. 2) Timber Salvage, firewood and other products removal may occur where access exists 3) Permit salvage of dead, dying or high hazard trees to prevent disease and insect population build-up that will adversely effect regulated timber stands (FP, pp. III-6 through III-7).

Management Area 5 (MA 5) – These areas consist of travel corridors that receive heavy recreation use. Areas included are portions of Gallatin Canyon, Boulder River, Yankee Jim Canyon, highway U.S. 212 in Cooke City vicinity, highways U.S. 191 and 287 in the West Yellowstone vicinity and areas adjacent to Hebgen Lake and Hyalite Reservoir (FP, pp. III-14 through III-16). Management goals for MA 5 include: (1) Maintain and improve the wildlife habitat values and the natural attractiveness of these areas to provide opportunities for public enjoyment and safety, (2) Allow a level of timber harvest consistent with goal 1 (FP, pp. III-14 through III-16). Timber Standards 1) Area is classified as suitable for timber production, 2) Manage to provide a diverse vegetative pattern, 3) Include even-aged and uneven-aged harvest method systems. The standards for harvest are in Forest Plan Appendix A-1, 4) shape and scale even-aged openings to replicate natural openings, 5) permit commercial and precommercial thinning if it enhances the recreational values of the area, 6) natural mix of species is desirable. Use species variety to improve visual quality, 7) Actively control tree damaging agents.

Management Area 6 (MA 6) – These areas are generally large blocks of undeveloped land with a trail system and a few roads passing through. They provide a wide variety of opportunity for dispersed recreation uses in a variety of terrain and vegetation types (FP, pp. III-17 through III-18). Management goals for MA 6 include: (1) Provide for a wide variety of dispersed recreational opportunities, (2) Provide additional public access to these areas. Timber Standards 1) Area is classified as unsuitable for timber production, 2) Harvesting of firewood, post and poles, or other products can take place adjacent to existing roads.

Management Area 7 (MA 7) – These consist of riparian management areas that will be managed to protect the soil, water, vegetation, fish and wildlife dependent on it (FP, pp. III-19 through III-23). These areas are classified as suitable for timber production if adjacent areas contain suitable timber (FP, pp. III-19 through III-23). Timber management activities will occur in these areas.).

Management Area 11 (MA 11) - These areas consist of forested big game habitat. They include productive forestlands that are available for timber harvest, provided that big game habitat objectives are met (FP, pp. III-33 through III-36). Management goals for MA 11 include: (1) maintain elk habitat effectiveness following timber harvest; (2) base vegetative management on vegetative characteristics needed for featured wildlife species; (3) allow a level of timber harvest consistent with goals 1 and 2; and (4) meet state water quality standards and maintain stream stability (FP, pp. III-33 through III-36).

Timber Standards 1) Area is classified as suitable for timber production, 2) Design timber harvest on big game winter ranges to enhance winter range capacity. 3) Include even-aged and uneven-aged harvest method systems, 4) Design even-aged openings so no point is more than 600 feet from cover, 5) No commercial thinning is planned, 6) Natural mix of species is desirable. 7) Actively control tree damaging agents.

Management Area 12 (MA 12) - These areas provide important habitat for summer or winter wildlife use in a variety of terrain and vegetative types. These areas also offer dispersed recreation opportunities (FP, pp. III-37 through III-39). Management goals for MA 12 include: (1) Maintain and improve the vegetative condition to provide habitat for a diversity of wildlife species; (2) Provide for a variety of dispersed recreational opportunities; (3) Provide forage for livestock consistent with goal 1. Timber Standards 1) Classified as unsuitable for timber production. 2) Harvest of post and poles and other wood products can take place adjacent to existing roads (FP, pp. III-37 through III-39).

Management Area 15 (MA 15) - These areas consist of open grasslands or steep rocky slopes interspersed with timber and are located in occupied grizzly bear habitat (Management Situation 1 and 2) and provide for dispersed recreation and livestock use (FP, pp. III-47 through III-49). Management goals for MA 15 include: (1) Meet grizzly bear mortality reduction goals as established by the Interagency Grizzly Bear Committee, (2) Manage vegetation to provide habitat necessary to recover the grizzly bear, (3) Provide forage for livestock consistent with goal 1, 4) Provide dispersed recreation opportunities consistent with goal 1. Timber Standards 1) Classified as unsuitable for timber production, 2) Allow harvest of post and poles and other wood products in areas adjacent to existing roads (FP, pp. III-47 through III-49).

Management Area 17 (MA 17) - These areas consist of grasslands or nonproductive forestlands on slopes of 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). Management goals for MA 17 include: Maintain or improve vegetative conditions and forage production for livestock and wildlife use. Timber Standards 1) Classified as unsuitable for timber production. (2) Allow harvest of post and poles and other wood products in areas adjacent to existing roads (FP, pp. III-52 through III-53).

V. OTHER SPECIFICALLY REQUIRED DISCLOSURES

Unique Characteristics of the Geographic Area

The project area lies approximately 30 miles southwest of the town of Big Timber, Montana. The Main Boulder Fuel Reduction Project Area consists of roughly 2500 treatment acres of National Forest Land, which lie along the Main Boulder River Corridor for a distance of about 24 miles and is intermixed with privately owned land. The project area is approximately ½ mile wide with the Absaroka-Beartooth Wilderness Area adjacent to the project area for about 2/3's of its length. The remaining area is adjacent to the Inventoried North Absaroka Roadless area. The Main Boulder River within the Forest boundary is required to remain eligible for classification into the Wild & Scenic River System as described on *Ch. 3-5.* There are no other ecologically critical areas known to occur in the project area. There would be no significant effects to wilderness or inventoried roadless areas as discussed *in Appendix A-29 through A-32.*

Effects of Alternatives on Prime Farmland, Rangeland, and Forest Land

Rangelands and productive (not prime) forestlands occur within the analysis area. The proposed action alternative will have no effect on the productivity of either private rangelands or public rangelands where grazing is a permitted use. Forested lands will be impacted by harvest activities mainly in MA 5, with some harvest impacts in MA7, MA3, MA11, and MA15. There are minimal areas in MA 6, MA12 and MA17 scheduled to have slashing and burning activities. See MA descriptions on Ch. 1-19. While timber harvest is compatible with these designations, uses other than timber management are given primary emphasis. None of the proposed actions would affect the ability of these lands to continue to grow trees.

Effects of Alternatives on Floodplains and Wetlands

By incorporating project design features, following BMP and SMZ regulations, as well as effective mitigation measures, floodplains and wetlands will not be adversely affected by the proposed action alternative.

Effects of Alternatives on Social Groups

The proposed action alternative would not have discernible effects on minorities, American Indians, women, or the civil rights of any United States citizen. Neither would it have a disproportionate adverse impact on minorities or low-income individuals.

Effects on Public Health and Safety

There would be no significant effects on public health and safety due to effective project design and mitigation measures as described on *Ch. 2-40.* Project implementation should improve public health and safety by reducing the probability of a catastrophic wildfire that would threaten public health and safety. The proposed fuels reduction treatments would also increase the amount of time available for evacuation, were a significant wildfire to occur.

Effects to Scientific, Cultural, or Historic Resources

There are several scientific, cultural, or historic resources or sites that have been found in the Main Boulder project area. It is a major drainage that served as a prehistoric as well as historic travel route. It was known as a spur of the Bannock Trail that filters out of the Yellowstone Park area down several drainage options. The drainage was a major historic access to several developed gold fields and provided some early agriculture to support the mining industry. This is an area with multiple previous archeological investigations with the most recent survey completed in the summer of 2003.

Previous work has indicated that there is not as high of a site density as might be expected, but there is a wide array of site types. There are historic mining sites, early “dude ranch” sites, historic agricultural sites, historic ranger stations, remnants of frontier battles, and an array of prehistoric site types.

The design measures associated with the proposed action for site protections on *Ch. 2-41* can easily be implemented so that no direct or indirect affects would result from the treatments prescribed in the units. *See Appendix A-9* for further details.

The Main Boulder Station, Four-mile Station and Box Canyon Station are important historic sites evaluated as eligible to be listed in the National Register of Historic Places. The evolution of the conifer encroachment into this drainage has set the stage for a different and threatening fire regime. If no actions are taken to reduce this threat, it is unlikely, that under many fire scenario’s. these historic ranger stations would be protected successfully.

Short-term Use versus Maintenance and Enhancement of Long-term Productivity

Short-term uses are those uses that generally occur annually. Long-term productivity refers to the ability of the land to produce a continuous supply of a resource. Minor amounts of soil loss and displacement would occur as a result of the proposed action. Application of the soil mitigation measures described on *Ch. 2-33* and BMP's in Appendix C would ensure this project will maintain long-term soil productivity and would be adequate to keep impacts within acceptable limits. Impacts to other resources (wildlife, aquatics, and vegetation) are limited in time and intensity and would not deplete their long-term productivity.

Irreversible and Irretrievable Commitment of Resources

An *irreversible* commitment of resources refers to the use or commitment of a resource that are incapable of being reversed or changed. For example, nonrenewable resources, such as minerals in the ore, would be removed forever during the milling of the ore and would be irreversibly lost or committed. Irretrievable commitment of resources refers to actions that result in changes to resources that cannot be recovered or regained.

Application of the noxious weed prevention design features described on *Ch. 2-34* should be effective at preventing or at least greatly reducing the spread of noxious weeds. If noxious weeds are introduced or expand into new areas, the loss of native vegetation to weed infestation would be a possible irretrievable effect, as it is not currently possible to totally eradicate them. While one could argue that an occasional landowner can eradicate weeds on a small area that is easily accessed and frequently treated, but total eradication of noxious weeds in a native landscape is unlikely. Weeds can be aggressively treated annually and reduced in cover percentages but there are no known success stories to indicate that noxious weeds can be totally eradicated from a native site that they have occupied for more than one growth/reproductive cycle.

This resource loss could potentially be irreversible as well, if active restoration to native species is not pursued. Depending upon the level and extent of native vegetation converted to noxious weed infestation, extremely intensive restoration work could retrieve lost native habitats.

It is anticipated that there would be no other irreversible or irretrievable commitments of resources associated with the implementation of the proposed action alternative as long as the project design criteria and mitigation measures are followed. Even though forested areas will be thinned and wood fiber removed, these resources are recoverable within a relatively short period of time (90-120 years).

Possible Conflicts with Other Land Use Plans, Policies, and Controls

The proposed action discussed in this EIS would not be inconsistent with the objectives of Federal, Regional, State, and Local land use plans, policies, and controls for the project area. The Sweet Grass County Comprehensive Plan does not apply to National Forest lands in the project area. The proposed action is compatible with the Boulder Community Fire Plan, which is currently being written by a private consultant hired by the Boulder River Fuels Cooperative. See the Endangered Species Act discussion below and *the, Biological Assessment* (Project File) regarding consultation and coordination with the U.S. Fish and Wildlife Service on effects to threatened and endangered species.

Energy Requirements and Conservation Potential of Alternatives

The energy required to implement Alternative B, the proposed action in terms of use of petroleum products is insignificant when viewed in the context of production costs and the effect on national and worldwide petroleum reserves.

Probable Adverse Environmental Effects That Cannot Be Avoided

Implementation of a fuels reduction project and the associated temporary road development proposal will not result in adverse environmental effects that cannot be avoided. Reclamation of any disturbed sites within one year after harvest activities are completed is proposed in association with the road related activities.

Environmental Justice

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations, directs Federal agencies to integrate environmental justice considerations into federal programs and activities. Environmental justice means that, to the greatest extent practical and permitted by the law, all populations are provided the opportunity to comment before decisions are rendered or are allowed to share in the benefits of, are not excluded from, and are not affected in a disproportionately high and adverse manner by government programs and activities affecting human health or the environment (RO 13898 and Departmental Regulation 5600-2).

VI. APPLICABLE LAWS AND REGULATIONS

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, Endangered Species Act of 1973, Migratory Bird Treaty Act (16 USC 703-711), Presidential Executive Order 12962 (June 1995), National Historic Preservation Act (as amended 1992), American Indian Religious Freedom Act, and Native American Graves and Repatriation Act, the Clean Air Act, Clean Water Act, 1964 Wilderness Act, and the Absaroka-Beartooth Wilderness Act Compliance with these laws is discussed below, or references within this document are noted. The State of Montana Water Quality Act (1969, 1975, 1993, 1996) is discussed below under *State Laws*.

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. The action alternative would be consistent with NFMA and management direction provided by the goals, objectives, and standards of the Forest Plan.

Endangered Species Act of 1973

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. If a threatened or endangered species, or species proposed for listing occurs in an area where a project is proposed, a Biological Assessment (BA) must be conducted. If the action will result in a "may affect" or "beneficial effect" determination for the species, consultation with the U.S. Fish and Wildlife Service must occur. If the action results in a "not likely to adversely affect" conclusion, informal consultation and a letter of concurrence must

be obtained from the U.S. Fish and Wildlife Service. If a "no effect" results, no consultation is necessary. To reduce effects of an action to an acceptable level, mitigation (coordination measures) may be necessary.

This analysis has complied with the Endangered Species Act, Section 7. A Biological Assessment for the preferred alternative (located in the Project File) was submitted to the US Fish & Wildlife Service for review. In a letter dated May 13, 2004 the US Fish and Wildlife Service reviewed the Biological Evaluation for the Main Boulder Fuels Reduction Project proposed action and concurred with the findings of the Big Timber Ranger District Wildlife Biologist. The findings are that the proposed action is not likely to adversely affect the threatened grizzly bear or the threatened Canada lynx, is not likely to jeopardize the continued existence of the nonessential experimental gray wolf, and would have no effect for the threatened bald eagle.

Migratory Bird Treaty Act (16 USC 703-711)

Migratory bird species are protected from harm under the Migratory Bird Treaty Act (MBTA). A January 2001 Executive Order requires federal agencies to ensure that environmental analyses of federal actions evaluate the effects of actions and agency plans on migratory birds, with an emphasis on species of concern.

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 by the following provisions relevant to the proposal:

> b. Identifying recreational fishing opportunities that are limited by water quality and habitat degradation and promoting restoration to support viable, healthy, and where feasible, self-sustaining recreational fisheries….
>
> h. Evaluating the effects of Federally funded, permitted, or authorized actions on aquatic systems and recreational fisheries and documents those effects relative to the purpose of this order…

National Historic Preservation Act, American Indian Religious Freedom Act, Native American Graves Protection and Repatriation Act

The Forest Service is mandated to comply with the National Historic Preservation Act (as amended 1993) [Public Law 89-665]. Section 106 of the NHPA requires that federal agencies with direct or indirect jurisdiction over undertakings afford the Advisory Council on Historic Preservation (ACHP) reasonable opportunity for comment on such undertakings that affect properties included in or eligible for inclusion to the National Register of Historic Places (NRHP) prior to the agency's approval of any such undertaking (36CFR800.1). Historic properties are identified by a heritage resource inventory and are determined as either eligible or not eligible properties for the National Register. Eligibility is reviewed, and concurrence given by the Montana Historic Preservation Office (MTSHPO). Sites that are determined eligible are then either protected in-place or adverse impacts must be mitigated. This process takes place prior to any decisions relative to the project.

The Forest Service has obligations under the American Indian Religious Freedom Act (AIRFA) of 1978 to "protect and preserve for American Indians their inherent right of freedom to believe, express, and exercise the traditional religions of the American Indian" [Public Law 95-442]. Executive Order 13007 of 1996 further directs federal agencies to accommodate access to, and ceremonial use of, Indian sacred sites by Indian religious practitioners and to avoid adversely

affecting such sites. Consultation activities took place primarily with the Crow; February 20, 2003, May 29, 2003, and July 18, 2003.

The Gallatin Forest Plan incorporates the requirements under the following statutes: the National Historic Preservation Act (1966) and the American Indian Religious Freedom Act (1978). Forest Plan standards applicable to this project reflect the mandates under the above statues include inventory procedures, evaluation procedures, protection/preservation procedures, and coordination/consultation procedures (see FP II-14 and II-17). The Main Boulder Fuels Project is consistent with the laws, regulations and Forest Plan direction discussed in this section.

Clean Air Act

Congress passed the Clean Air Act in 1963, and amended it in 1972, 1977, and 1990. The purpose of the act is to protect and enhance air quality while ensuring the protection of public health and welfare. The act established National Ambient Air Quality Standards (NAAQS), which must be met by state and federal agencies, and private industry. States are given primary responsibility for air quality management. Section 110 of the Clean Air Act requires States to develop State Implementation Plans (SIP) what identify how the State will attain and maintain NAAQS, which are identical to the Montana standards for PM_{10} (particulate mater with less than 10 microns. The SIP is promulgated through the Montana Clean Air Act and implementing regulations. The regulations provide specific guidance on maintenance of air quality, including restrictions on open burning (ARM 16.8.1300). The act created the Montana Air Quality Bureau (now under DEQ) and the regulatory authority to implement and enforce the codified regulations.

The NAAQS have been established for carbon monoxide, nitrogen oxide, sulfur dioxide, lead, ozone, and PM_{10}. There are numerous types of pollution that could be controlled, but particulate matter is the primary pollutant of concern. The $PM_{2.5}$ standard requires concentrations of $PM_{2.5}$ not to exceed a 24-hr average of 65 ug/m^3 (micrograms per cubic meter). Average annual arithmetic $PM_{2.5}$ concentrations are not to exceed 15 ug/m^3.

The August 1977 Clean Air Act amendments designated areas into PSD (Prevention of Signification Deterioration) classes. Class 1 airsheds are given the most protection from human caused air pollution in order to protect their pristine character. Class II airsheds allow for a greater amount of human caused pollution. The EPA has not yet identified any Class III airsheds.

The Montana DEQ is currently cooperating with the Western Regional Air Partnership (WRAP) to establish visibility goals, monitoring plans, and control measures to comply with regional haze visibility standards in all Montana Class I areas including Yellowstone National Park.

The Gallatin NF Forest Plan in Forest Wide Standards pp. II-23 requires that the Forest will cooperate with the Montana Air Quality Bureau (now DEQ) in the SIP and smoke management.

Clean Water Act

The Clean Water Act provides the overall direction for the protection of the nations waters from both point and non-point source of water pollution. The Montana Water Quality Act establishes general guidelines for water quality protection. It requires the protection of the state's water as well as the full protection of existing and future beneficial uses. All of the streams within the analysis area for the proposed Main Boulder Fuels Reduction Project are classified as B1 streams under the Montana Water Classification system. Streams within the Absaroka Beartooth Wilderness Area are designated as A1. The Administrative Rules of Montana (ARM 17.30.623) require that waters classified as B1 are suitable among other things for the "growth and propagation of salmonid fishes and associated aquatic life.

The 1964 Wilderness Act and the Absaroka-Beartooth Wilderness Act

The 1964 Wilderness Act (P.L. 88-577) and the Absaroka-Beartooth Wilderness Act (P.L. 95-249) provide specific direction for the Absaroka-Beartooth Wilderness. The Wilderness Act, defines wilderness as an "area where the earth and its community of life are untrammeled by man…"; wilderness retains "its primeval character and influence, without permanent improvements", which is to be "managed so as to preserve its natural conditions…"; wilderness "generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable…". It also has outstanding opportunities for solitude or a primitive and unconfined type of recreation.

The Absaroka-Beartooth Wilderness was established on March 27, 1978. This Act set aside almost 1,000,000 acres on the Gallatin, Custer, and Shoshone National Forests as part of the National Wilderness Preservation System. In designating the Absaroka-Beartooth, Congress assured this enduring wilderness resource would be secured for the American people of present and future generations.

State Laws

The State of Montana Water Quality Act (1969, 1975, 1993, 1996)

State Laws: The State of Montana Water Quality Act requires the state to protect, maintain, and improve the quality of water for a variety of beneficial uses. Section 75-5-101, MCA established water quality standards based on beneficial uses. The Department of Environmental Quality designates the Main Boulder River as B1 Classification. Streams within the Absaroka Beartooth Wilderness Area are designated as A1. Waters classified as B1 must be suitable for drinking, culinary, and food processing purposes after conventional treatment; bathing, swimming and recreation; growth and propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supply. A 5 NTU turbidity increase above naturally occurring turbidity is allowed in B1 waters. Surface waters within the Absaroka Beartooth Wilderness are classified as A1, which have similar suitability criteria for beneficial uses except that no turbidity increase above naturally occurring turbidity is allowed.

VII. OTHER GUIDANCE

Riparian Area Protection

Gallatin National Forest Plan (GNFP) direction requires that vegetative manipulation within riparian areas will occur only for the purpose of meeting riparian dependent resource objectives. Riparian areas are defined as the land and vegetation for approximately 100 feet from the edge of a perennial stream, and intermittent streams of sufficient size to include a distinct riparian vegetation community and rock substrate stream channel.

Management Area direction for facility standards in riparian areas directs to:

- minimize the amount of material from road construction wasted into riparian areas and follow BMP's that apply to road construction;
- design road drainage to minimize the entry of sediment into streams (road design will also provide for low risk of drainage failure and mass failure);
- minimize the number of stream crossings; and
- minimize short-term sedimentation during bridge or culvert installation (FP, pg. III-22).

The State of Montana requires BMP implementation for all activities in order to comply with B1 Classification Water Quality Standards. In addition, State of Montana BMP's restrict harvest

activities within 50 feet of any wetland, including seeps, springs, marshes, wallows, or bogs. The Montana Forestry BMP's are included in Appendix C, which are required to be followed in all timber harvest and road construction activities.

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 Forest Plan Direction A.5 (page II-1) requires the Gallatin NF to meet or exceed State of Montana water quality standards.

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.

2526.02 – Objectives

1. To protect, manage and improve riparian areas while implementing land and resource management activities.
2. To manage riparian areas in the context of the environment in which they are located, recognizing their unique values.

2526.03 – Policy

1. Manage riparian areas in relation to various legal mandates, including, but not limited to, those associated with floodplains, wetlands, water quality, dredged and fill material, endangered species, wild and scenic rivers, and cultural resources.
2. Manage riparian areas under the principles of multiple-use and sustained yield, while emphasizing protection and improvement of soil, water, and vegetation, particularly because of their effects upon aquatic and wildlife resources. Give preferential consideration to riparian-dependent resources when conflicts among land use activities occur.
3. Delineate and evaluate riparian areas prior to implementing any project activity. Determined geographic boundaries of riparian areas by onsite characteristics of water, soil, and vegetation.
4. Give attention to land along all stream channels capable of supporting riparian vegetation (36 CFR 219.27e).
5. Give special attention to land and vegetation for approximately 100 feet from the edges of all perennial streams, lakes, and other bodies of water. This distance shall correspond to at least the recognizable area dominated by the riparian vegetation (36 DFR 219.27e). Give special attention to adjacent terrestrial areas to ensure adequate protection for the riparian-dependent resources.

Objectives and policies outlined the Forest Service Manual (FSM 2670) for the management of sensitive species:

Objectives (FSM 2670.22)

1. Develop and implement management practices that ensure that sensitive species do not become threatened or endangered because of Forest Service practices.
2. Maintain viable populations of all native fish species in habitats distributed throughout their geographic range on National Forest Service Lands.

3. Develop and implement management objectives for populations and/or habitats of sensitive species.

Policy

1. Assist States in achieving their goals for conserving endemic species.

Land Use Strategy for WCT and YCT:

The Upper Missouri Short Term Strategy for Conserving Westslope Cutthroat Trout (UMWCT short term strategy) was finalized into a "Land Use Strategy" in April 2001. The final Strategy provides implementation direction for the MOU that was adopted in 1999. Region One has been an integral player in the development of this strategy.

The initial short-term land-use strategy for WCT was adopted in 1996 by the GLT to apply towards management of YCT on the Gallatin. During the March 21st, 2002, GLT meeting, a decision was made to apply the finalized Land Use Strategy for implementing the 1999 MOU and Conservation Agreement for WCT in Montana to YCT populations on the Gallatin National Forest. 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. The habitat management guidelines outlined in the TU Settlement Agreement (i.e., manage habitats at a level of at least 90% of their inherent potential) serve as the reference level associated with impact determinations.

"At the broad-scale, aquatic systems on BLM or National Forest System lands should be managed with the following goals:"

1. Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection and restorations of aquatic systems…
2. Maintain or restore spatial and temporal connectivity, where deemed beneficial within and between watersheds….
3. Maintain or restore the physical integrity of aquatic systems (e.g., channel types channel stability, and instream habitat components…
4. Maintain or restore groundwater and surface water quality necessary to support healthy riparian, aquatic and wetland ecosystems….
5. Maintain or restore a sediment regime, which is consistent with the maintenance of healthy populations. Elements of sediment regime include timing, volume, rate and character of sediment input, storage and transport.
6. Maintain or restore groundwater and instream flows sufficient to create and sustain riparian, aquatic and wetland habitats and to retain patterns of sediment, nutrient and wood routing….
7. Maintain or restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands
8. Maintain or restore the species composition and structural diversity of plant communities in riparian zones and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, erosion and channel migration control, and delivery of large wood.

Impact Determinations for New Activities:

Defer any new federal land management action if it cannot be modified to prevent un-acceptable aquatic/riparian habitat degradation. Only activities that provide for improvement or a significant upward trend toward optimum conditions for aquatic and riparian habitats should be considered. The objective is to maintain progress toward, in an acceptable timeframe, 90% of optimum

condition. In situations where the existing condition value for an individual habitat criterion is determined to be below the optimum condition value, only activities that provide for improvement or an upward trend should be considered. *Where watershed restoration actions result in a short-term downward trend but provide for a long-term benefit, it will be important to focus on the end benefit to both the integrity of the physical system and population.*

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. One intent of the Agreement was to provide more specific direction on timber harvest in riparian areas. Forest Service Action #4 (outlined in the Agreement) states: "The Gallatin National Forest agrees that vegetative manipulation within riparian areas will occur only for the purpose of meeting riparian dependent resource objectives such as watershed, wildlife, or fisheries. Timber harvest activities designed to meet timber management objectives will not be scheduled in riparian areas. The Agreement further defines riparian areas as "the land and vegetation for approximately 100 feet from the edges of perennial streams, and intermittent streams of sufficient size, to include a distinct riparian vegetation community and rock substrate stream channel. This area should correspond to at least the recognizable area dominated by riparian vegetation."

Northwest Rivers Council Settlement Agreement:

The Amendment No. 12 of the Gallatin National Forest Plan dated June, 1993 mandates that the Boulder River will be managed to protect its outstandingly remarkable values for future consideration and potential classification for inclusion into the Wild and Scenic River System. This Amendment defines the current eligibility classification of the Main Boulder River prior to formal Wild and Scenic River Study specifically as follows:

Recreation River:

- *from the Gallatin National Forest boundary to Blakely Creek,*
- *from Miller Creek to Bramble Creek*

Scenic River:

- *from Blakely Creek to Miller Creek,*
- *from Bramble Creek to the Wilderness boundary*

As a minimum, any future Study area will extend the length of the river segment and one-quarter mile in width from each riverbank. Boundaries may include adjacent areas needed to protect the resources or facilitate management of the river area.

Forest Service Manual Direction

FSM 5150 Fuel Management:

5150.2 - Objective. To identify, develop, and maintain fuel profiles that contribute to the most cost-efficient fire protection and use program in support of land and resource management direction in the forest plan.

5150.3 - Policy. Integrate fuel management and fire management programs in support of resource management objectives.

1. Use an interdisciplinary approach to integrate fuel management planning into all appropriate activities.

   a. Identify, through an economic analysis, the most cost-efficient fuel profile to meet resource management direction in support of the fire protection program. Consider a full range of fuel management alternatives, including no treatment. Fuel management activities must be responsive to long-term site productivity, utilization opportunities, and air quality considerations.
   b. Where a management activity, such as timber sales, thinning, or road construction, contributes to an unacceptable fuel profile, modify that activity to reduce its incremental contribution to the fuel profile.
   c. On lands where repetitive management activities will occur, evaluate the projected fuel profile to determine the most cost-efficient time(s) of entry and the level of treatment(s).

2. Manage fuel in accordance with fire management direction in the forest land and resource management plan.

   a. Expend funds for fuel management only for the purpose of resource protection. Do not allow such expenditures to exceed the expected cost plus net value change that might occur without treatment.
   b. Where the planned treatment meets other resource management objectives, such as site preparation for reforestation, identify the benefits and costs in the economic analysis to determine appropriate funding needs (FSM 5152).

3. Follow the safety requirements in FSH 6709.11, Health and Safety Code Handbook, and FSH 5109.32a, Fireline Handbook (FSM 5103).

VIII. DIRECT, INDIRECT, AND CUMULATIVE EFFECTS

Issue 1: A wildfire could threaten public and firefighter safety within the Main Boulder River Corridor. 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 Main Boulder River Corridor.

Indicator: The distribution of fuel loadings by size class and tons/acre, as well as the vertical and horizontal continuity/arrangement within the fuel bed. A fire risk analysis is performed using the following models:

Forest Vegetation Simulation (Fire/Fuel Effects extension) (FVS-FFE) - This model is used to indicate changes to fire behavior by comparing the current condition (with no treatment) against the proposed treatments. It simulates fuel dynamics and potential fire behavior over time, in the context of stand development and management (e.g., proposed silviculture and fuel treatments). FVS-FFE modeling generated several components (crown bulk density, canopy depth and crown fuel load) that were then run in the NEXUS model to determine potential fire type (active, passive or surface fire).

NEXUS – NEXUS is an Excel spreadsheet that links surface and crown fire prediction models. Using inputs from FVS-FFE simulations for the no treatment and proposed treatment alternatives, NEXUS 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.

BEHAVE – This model is a set of interactive computer programs for fire behavior prediction and fuel modeling. Fire behavior predictions can be obtained including rate of spread, flame length, intensity, area, perimeter and spotting distance.

Fire Weather Conditions – 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. Recent wildland fire events suggest that these conditions are typical.

Affected Environment (General)

Nearly all of the Main Boulder River Corridor is forested with densely stocked, closed canopy stands of lodgepole pine, Douglas-fir, and subalpine fir/spruce. *(See Vegetation Structure/Diversity, Appendix A-15).* Forest habitat types for the analysis area are categorized into five distinct fire groups based on habitat types (Fischer and Clayton 1983). The dominant fire habitat types consist of: Fire Group (FG) 0 (scree, rock, meadow, grass ridges); 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 3-2, Ch. 3-25* provides a description of the mean fire return interval and historical fire type associated with each of the fire habitat type groups.

Table 3-2 Fire Habitat Type Groups common in the Main Boulder River corridor.

Fire Habitat Type Group	*Fire Regime (Mean fire interval *)*	*Fire Type*
0	No estimate available	These habitats normally do not burn intensely and usually support only ground fires. They can serve as anchor points and firebreaks in most cases.
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 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)

Affected Environment (Fuel Type and Arrangement)

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

The lack of small, stand-replacing fires and frequent, low intensity surface fires within the drainage (which were historically more typical for this area) has led to higher tree densities and the formation of a continuous horizontal fuel-bed through the length of the corridor. Stand 'densification' has resulted in little or no space between the crowns of trees. As a result, a fire could spread quickly through the crowns, unlike a slower moving surface or ground fire. The increasing stand densities and fuel loadings, along with the continuous fuel-bed arrangement (both horizontal and vertical), are key components for the occurrence of an extreme crown fire situation.

The analysis area is also currently experiencing an epidemic of Douglas-fir beetle mortality in the larger diameter Douglas-fir trees (*Insect & Disease Analysis, Appendix. A-26).* As standing dead and down trees become more frequent, the volume of surface fuel will increase, resulting in the

likelihood that a small, low intensity ground fire could become a large, uncontrollable crown fire (NEXUS modeling, Project File).

Affected Environment (Public and Fire Fighter Safety Concern)

The NEXUS and BEHAVE fire models were used to evaluate potential fire behavior and to model representative forested stands proposed for treatment within the Main Boulder corridor. The models assess changes in average rates of spread, flame length, intensity, and also provide fire predictions for the transition of surface fires to crown fires. These models can be used to compare the effects of treatments between alternatives. Using NEXUS and BEHAVE, the average rate of spread for an active crown fire and surface fire was found to be 1 to 2.5 miles per hour for the existing fuels conditions. The extreme behavior of a crown fire would make an unsafe situation for ground firefighting forces to implement control tactics that would be effective. Using NEXUS in conjunction with FVS-FFE Model, results indicate that over 80% of the forested stands within the Boulder River corridor currently contain conditions conducive to active crown fire potential.

Alternative A – No Action

Direct and Indirect Effects

Alternative A would have no effect on changing the probability of an uncontrollable crown fire occurring from what currently exists within the Boulder River corridor. Without hazardous fuel reduction activities, forested areas would continue to be densely stocked. There would be little, if any, space between the crowns of individual trees. A wind-driven fire would be expected to move quickly from the ground to the forest canopy, killing most of the trees in its path. Fire behavior of this kind – a running crown fire – is the most resistant to suppression control of any fire type. As such, risks to public and firefighter safety would not be changed from the current situation.

Small and intermediate size trees would continue to contribute to a continuous fuel layer extending from the ground to the crowns of the larger, dominant trees. This vertical continuity of fuel provides a fire that might otherwise only consume ground fuels and surface litter, a path into the tree crowns.

Aspen, a keystone tree species, would continue to decline in representation throughout the drainage due to shading by conifers. Aspen would decline in vigor and clones would continue to be lost to encroaching conifers. The ability of these areas to act as ‘heat sinks’ would decline as their size and numbers decline.

Cumulative Effects

The suppression strategy would continue to be ‘control and confine’ due to the popularity of the Boulder River 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 are currently experiencing a Douglas-fir beetle epidemic, 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 and an increase in the probability that, once ignited, a wildfire would have sufficient material that it would quickly escape attempts to contain it. Using NEXUS and BEHAVE, the average rate of spread for an active crown fire and surface fire under the existing conditions was found to be 1 to 2.5 miles per hour. With the additional fuels expected to accumulate without treatment, the rate of spread would increase proportionately to the amount of additional fuels.

Alternative B- Proposed Action

Direct and Indirect Effects

A variety of treatment measures designed to reduce or modify the volume and arrangement of fuels in the Main Boulder Drainage are proposed within the forested stands. Treatments include thinning trees to increase the space between standing trees, slashing of conifers and prescribed burning in meadow areas, piling and burning of activity fuels, jackpot burning (treatment of concentrations of activity fuels), and underburning (a combination of burning natural and activity related fuels), all of which will help to reduce ladder fuels and surface fuel loadings for the proposed treatment units.

The proposed action would reduce the probability of a human-caused fire becoming an uncontrollable crown fire by increasing the effectiveness of initial attack fire fighting forces. The reduced potential for a crown fire would provide time for public evacuation, if needed, and greatly increase firefighting capabilities and firefighter safety. Fire behavior would be changed from crown fire to surface fire after the proposed treatments, resulting in the average rate of spread decreasing to .1 to .5 miles per hour. Based on modeling results, firefighter and public safety would be improved by changing the fire behavior from a crown fire to a surface fire after the proposed treatments have been completed. The very high rate of spread for an active crown fire prior to proposed stand treatments would make the task of public evacuation on the single lane road difficult while trying to dispatch firefighting resources to the fire.

Alternative B includes design criteria necessary to meet the objectives for other resources (wildlife habitat, visuals, silviculture, fishery, hydrology, cultural resources, and sense of place) that contribute to the character of the Main Boulder Drainage. Modeling of the effectiveness of fuel treatments using NEXUS, in combination with the incorporation of site-specific analysis that includes stand characteristic variability, shows that the treated areas meet the objective of reducing the potential for active crown fire.

The proposed units, consisting of predominately Douglas-fir, continue to show improvement by taking the active crown fire potential and lowering it to a 'conditional' fire. A 'conditional' fire is defined as having conditions for a sustained active crown fire present, but the conditions for initiation may not be present. The analysis of the proposed treatments identified in this alternative show fire behavior reduction in the treated areas based on both modeling and incorporating personal knowledge of site-specific stand variations. However, it is important to note that it is expected that leave clumps (small untreated forested areas) and other design criteria devised to meet additional resource objectives would increase fire behavior to some degree from the optimum proposed fuel treatments.

By incorporating the unit design land features such as existing meadows and rock outcrops, carefully planning the placement of leave clumps, and by varying treatment intensities within and adjacent to other units as well as the wilderness boundaries, it will help to break up the vertical and horizontal fuel continuity. Fire handlines could be used to protect some key leave clumps and a mosaic of underburning in and adjacent to other leave clumps will be used depending on stand structure and characteristics.

In summary, by incorporating the above design features, the effectiveness of the fuel treatments will be increased above the modeled effectiveness due to the limitations of the models.

Direct, Indirect Effects of the Proposed Treatments by Group

Refer to *Ch.2-15* for a detailed description of the proposed silvicultural stand treatment groups.

Aspen Regeneration (Occurs Within All Stand Treatment Groups): Remove all conifers within and around the aspen clone. Fuels resulting from the surrounding area and in the standing aspen would be piled and removed or burned.

Removing conifers from aspen stands, followed by disturbance or burning is expected to trigger aspen regeneration from the root mass below the ground. Absent any competition for light and moisture from the conifers, the newly regenerated aspen should grow more quickly and rapid growth should be sustained for a longer period.

Treatment would reduce the volume of standing trees and down and dead fuels within or proximate to the clone. The regenerated clone would act as a “heat sink” since aspen tends to retain moisture in fallen and decaying leaves late into the fall. Improving the size and number of aspen stands in the corridor would break up the horizontal and vertical fuel continuity. Not all aspen clones will be treated in order to retain the Visual Retention objectives in the drainage.

Stand Treatment Group 1: Tree harvest would emphasize removing small, and intermediate sized Douglas- fir and lodgepole pine. Varying amounts of larger, mature trees would also be removed. Increasing the spacing between trees would break-up the horizontal fuel continuity that exists today and reduce the probability that a fire entering the stand would carry across the crowns of individual trees. Segregating shorter and taller trees to distinct areas within a stand increases the average distance from the ground to the tree crowns, thereby reducing the probability that a ground fire would move into the tree crowns.

However, the effectiveness of this type of treatment would be reduced, primarily in the Douglas-fir stands. Clumps of trees left untreated and reduced canopy thinning in order to meet other resource design criteria objectives will allow some fuel continuity to remain. In some units that contain large Douglas-fir, residual trees may be still be spaced too close together to totally prevent crown fire under all conditions. The clumps and remaining individual trees may still be somewhat susceptible to loss from a passive crown fire. However, maintaining enough space between the clumps in conjunction with other fuel reduction treatments, including underburning, jackpot burning, hand piling, would reduce the potential that a fire in any single clump would spread to other nearby clumps.

A combination of hand piling and/or mechanical piling of activity related fuels, followed by pile burning, would reduce the volume of standing and down material available to support a fire. Fuel treatments are designed to leave enough downed material on the ground to provide for nutrient recycling, wildlife needs, and seedling microsites, but not so much as to support an uncontrollable fire. A target range of approximately 5 to 10 tons per acre of materials would be left on the ground, which would likely only support a readily controllable, low-intensity ground fire.

Stand Treatment Group 2: Stand density reduction would emphasize removing small and intermediate sized trees from heavily stocked stands. Increasing the spacing between trees would break-up the horizontal fuel continuity that exists today and reduce the probability that a fire that entered the stand, would carry across the crowns of individual trees. Segregating shorter and taller trees to distinct areas within a stand increases the average distance from the ground to the lower portions of the tree crowns, thereby reducing the probability that a ground fire would move into the crowns. The effectiveness of the treatment would be reduced by the need to leave some clumps untreated. Since tree crowns are somewhat smaller, spacing between trees would likely average less than Stand Treatment Group 1.

The clumps and individual trees would remain somewhat susceptible to loss from a surface fire since the lower branches would be close to the ground. As with Stand Treatment Group 1, a combination of hand piling, and/or mechanical piling of activity related fuels followed by pile burning, would reduce the volume of standing and down material available to support a fire. Follow up fuels treatments, such as underburning may be used to mitigate the concerns identified with remaining ladder fuels and low branches.

Burning piles of smaller trees along with the fuels resulting from harvest will reduce the volume of standing and down material available to support a fire. Fuel treatment objectives are designed to achieve a balance between leaving a moderate amount of material on the ground to provide for nutrient recycling, wildlife needs, and seedling microsites, but not so excessive as to add to a uncontrollable fire. A target range of approximately 5 to 10 tons per acre of materials would be left on the ground, which would likely only support a readily controllable, low-intensity ground fire.

Stand Treatment Group 3: Since this treatment group applies to non-forest areas, tree harvest would occur mainly at the edges (transition zones) between the grass, forb and brush community and adjacent forest. The proposed treatment would enhance the discontinuous fuel arrangement that currently exists.

Stand Treatment Group 4: Tree harvest in Unit 25 would emphasize removing trees from heavily stocked stands of mature lodgepole pine along with other species occurring underneath. The mature lodgepole is, for the most part, infected with mistletoe (See *page A-26*) and irregularly spaced. The trees growing underneath form a dense secondary layer with branches extending to the ground.

Widening the spacing between this secondary layer (10x10' to 17'x17') would reduce the horizontal and vertical fuel continuity that exists today. The probability that a fire, which entered the stand, would carry across the crowns of individual trees would be reduced to a passive crown fire.

The effectiveness of the treatment would be reduced by the need to leave some clumps untreated. Since clumping of the smaller trees would improve the fuel arrangement from the more continuous stocking that occurs today, the treatment would be an improvement over existing conditions. By incorporating into the unit design, land features such as existing meadows and rock outcrops, carefully planning the placement of leave clumps, and varying treatment intensities within and adjacent to other units and wilderness boundaries, fuel continuity would be further broken up. However, the post-treatment tree densities would still be greater than with Stand Treatments 1 and 2.

The clumps would be somewhat susceptible to loss from a surface fire since the lower branches would be close to the ground. However, maintaining enough space between the clumps in conjunction with a variety of fuel treatments, including underburning, would reduce the potential that a fire in any single clump could spread to others.

A combination of hand piling and/or mechanical piling of activity related fuels, followed by pile burning, would reduce the volume of standing and down material available to support a wildfire. Fuel treatment objectives would be to achieve a balance between leaving a moderate amount of material on the ground to provide nutrient recycling and wildlife needs, but not so excessive as to add to a uncontrollable fire. A target range of approximately 5 to 10 tons per acre of materials would be left on the ground, which would likely only support a readily controllable, low-intensity ground fire.

Stand Treatment Group 5: Tree harvest in Unit #14A would emphasize removing standing dead, dying, large, and intermediate sized Douglas-fir that are affected by Douglas-fir beetle. While some trees would be left, mortality is heavy in this unit and harvest would be more extensive than would occur with the other stand treatments designed to meet the objectives for fuel management.

The extent of tree mortality, resulting from attack by Douglas-fir beetle, creates a need to remove more standing dead trees than would be necessary to satisfy the objectives for fuels management in a comparable stand of live trees. The resulting stand would consist of fewer live and dead trees, spaced much more widely apart than is presently the case. Open grown areas of large diameter Douglas-fir would occur. Clumps or small groups of live and older dead trees would be left as needed to meet other design criteria and resource needs.

A combination of hand piling and/or mechanical piling of activity related fuels, followed by pile burning, could be used to reduce the volume of standing and down material available to support a wildfire. Fuel treatment objectives would be to achieve a balance between leaving a moderate amount of material on the ground to provide nutrient recycling and wildlife needs, but not so excessive as to add to a uncontrollable fire. A target range of approximately 5 to 10 tons per acre of materials would be left on the ground, which would likely only support a readily controllable, low-intensity ground fire.

Stand Treatment Group 6: Tree removal of Douglas-fir on dry sites that were once predominantly occupied by aspen and grass would be emphasized. The resulting stand would consist of fewer conifers trees with an increase in the area dominated by aspen and grass. Tree spacing and concerns of horizontal and vertical fuel continuity do not apply in Stand Treatment Group 6.

Understory burning and pile burning would reduce the volume of standing dead and down material present to support a fire. Some materials would be left on the ground to provide for nutrient recycling and wildlife needs, but not so much as to support anything but a readily controllable, low-intensity ground fire.

Cumulative Effects Combined for all Treatment Groups

The NEXUS and BEHAVE runs created by using the methods of fuel reduction proposed with the Stand Treatment Groups show a reduction in fire behavior. Fire behavior indicated a change from crown to surface fire after the proposed treatments are completed. On an average day in the drainage, that would result in a rate of spread that would be decreased from the existing condition of 1 - 2.5 mph to .1- .5 mph after the treatments are completed. This is an average decrease over the entire project. The rate of decrease for individual units would vary by treatment and

there would still be areas within the project (leave clumps of trees and areas of heavier crown density) where more extreme fire behavior may occur (crown fire). This reduced rate of spread would increase firefighter and public safety by lowering potential fire behavior, and in turn increase the amount of time for evacuation of the Main Boulder Corridor, if it would become necessary.

It is projected that the proposed treatment areas, which currently have a high likelihood of active crown fire, will be reduced to conditional crown fire or ground fire after treatment. This means a crown fire could still occur if the right combination of environmental conditions are present including wind, slope, and dry conditions.

The proposed Stand Treatments, when fully implemented, will reduce the threat of crown fire in the Main Boulder Drainage. By increasing the likelihood that any fire start would remain small and controllable, firefighter safety would be enhanced and additional time would be provided to take measures needed to protect the public. In combination with effective fuels treatments on private inholdings, the proposed treatments associated with Alternative B would meet the purpose and need of the project.

In addition, independent of this analysis, the consultant hired by the Boulder River Fuels Reduction Cooperative used a different fire model to analyze fire risk and rate of spread and came to the same conclusion as the Forest Service analysis. The Forest analysis, backed up and verified by this independent assessment, shows clearly and concretely that the implementation of Alternative B will drastically slow down an intense crown fire in the Main Boulder Corridor as well as minimize the risk of a human caused start in the Main Boulder Corridor becoming a running crown fire.

Irreversible and Irretrievable Commitments of Resources

There would be no irreversible or irretrievable commitments of resources due to the fuel reduction activities and prescribed burning associated with the proposed action.

Applicable Laws, Regulations, and Forest Plan Guidance

Consistency with Gallatin Forest Land Management Plan – A review of the Gallatin Forest Plan direction applicable to this project indicates that the proposed action treatments are consistent with that direction. The use of a variety of prescribed burning methods that meet the objectives for Management Areas are described below.

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.
- Prescribed fire (planned or unplanned ignitions) may be utilized to support management area goals. (Fire Item 5, FP p. II-28)

- Prescribed fire objectives for smoke management will be met within the constraints established by the Montana State Airshed Group's Memorandum of Understanding. (Fire Item 6, FP p. II-28)

Issue 2: This project could increase the spread and density of noxious weeds throughout the proposed project area and adjacent private lands and wilderness where suitable habitat exists. 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 by reduction in the forest canopy cover. Proposed changes in the Main Boulder River Corridor could create habitat for noxious weeds and reduce competitive success of native vegetation.

> **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 both on maps and in tabular form).

Affected Environment: Noxious weeds have a long-term biological impact on the ecosystem 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.

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

The Main Boulder River Drainage has extensive existing populations of noxious weeds. Spotted knapweed and sulfur cinquefoil are concentrated in and around the lower eight units of the proposed project area, while oxeye daisy can be found throughout the proposed project area. Canada thistle and hounds tongue are found throughout the project area, generally in widely scattered locations associated with disturbed soil (roadsides, timber harvest units and construction sites). Following are brief descriptions of the primary noxious weeds found in the Main Boulder.

Spotted Knapweed

Originally from Eurasia, spotted knapweed has become well established throughout the western United States. Spotted knapweed is a perennial that lives up to nine years, producing 5,000 - 40,000 seeds/sq 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 soil 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; wildlife and livestock forage and increased soil erosion. "Spotted knapweed reduces livestock and wildlife forage. Watson and Renny (1974) found that spotted knapweed infestations decreased bluebunch wheatgrass yield by 88%. Elk use, as estimated by pellet groups/acre, was reduced 98% on spotted knapweed dominated range compared to bunchgrass-dominated sites (Hakim 1979)," (Shely and Petroff.1999. 351).

"Spotted knapweed dominance on bunch grass 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 sited compared to bunchgrass-dominated sites. Bare ground was greater and water filtration rates were less on

spotted knapweed sited than on bunchgrass sites (Lacey et al. 1989)"Sheley and Petroff. 1999. page 351).

Habitat at risk - Spotted knapweed prefers areas with open forest-grassland interface on well developed to dry soils. Knapweed has been observed at elevations ranging from1, 900 to 10,000 feet and in precipitation zones ranging from 8 to 79 inches (Sheley and Petroff. 1999. page 351). Within the area analyzed under "cumulative effects" there are currently 20 known acres of spotted knapweed. Spotted knapweed is well adapted to the Main Boulder Drainage environment and capable of growing anywhere within the analysis area given sunlight and a seed source.

Sulfur Cinquefoil

Sulfur 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.

Sulfur 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 sulfur cinquefoil grows with spotted knapweed, cattle will graze the knapweed over the cinquefoil (Rice et al 1991).

Habitat at risk - The species is adapted to a wide range of environmental conditions. It occurs in open grasslands, shrubby areas, open forests and logged areas, roadsides, and waste areas. It cannot survive under full canopy cover, (Werner and Soule 1976). There are currently approximately 5 scattered acres of sulfur cinquefoil in and near the Main Boulder River drainage.

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 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 Ranger District. It is estimated to cover some 211 acres on the district, primarily 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.

Hounds tongue

Houndstongue is native to Eurasia and has spread throughout the United States and Canada. It is found in Washington, Oregon, Wyoming, and Montana. Hounds tongue is a strong competitor 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 will avoid it, (Upadhyaya and Cranston 1991). Hounds tongue plants are able to resist mowing and severe drought.

Habitat at risk – Hounds tongue prefers hot, dry summers and cold winters and soils ranging from well drained, relatively course, alkaline soils to clay subsoil in open coniferous forest. It is shade tolerant plant and thrives in wetter grasslands. It is frequently found on roadsides, meadows and disturbed places. The plant is very widespread on the Big Timber district along roadsides, timber harvest units, timber landings, skid trails, burn pile areas and areas of livestock impact such as at trailheads and livestock watering areas and trails. It is carried by livestock and wildlife into many suitable habitats and can be found in scattered and remote locations. Although too widespread to measure, it is estimated to occupy about 195 acres on the Big Timber Ranger District. It is located in the Main Boulder River drainage from the Main Boulder Station horse pasture up to Box Canyon Guard Station. These populations are usually relatively small, isolated and associated with disturbed or impacted soil or plant communities.

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 pastures, and forms dense populations. 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 reduce the amount of organic matter contributed below ground annually, and in turn may slow the rate of nutrient cycling," (Sheley and Petroff, 1999. page 284).

Habitat at risk **–** These include meadows, native grasslands, waste grounds and roadsides. Oxeye daisy grows in relatively nutrient poor to nutrient rich soils (Sheley and Petroff. 1999. page 283). Oxeye daisy has been mapped using GPS and currently occupies about 124 acres on the Big Timber Ranger District, much of which is in the Main Boulder River Drainage on private and public land. In the Main Boulder it appears at present to be associated with the riparian areas of the Main Boulder River, although it has been rapidly moving into native and non-native meadows throughout the analysis area.

Table 3-3 current weed populations for each proposed unit.

Unit Number	Species	Acres inside unit currently with weeds	Acres adjacent to unit (within 500') with weeds
M Boulder St	Spotted knapweed Sulphur cinquefoil	None	0.8 0.8
#1	Spotted knapweed	0.23	5.6
#2	Oxeye daisy Spotted knapweed	0.0 1.4	1.3 7.2
#3	Oxeye daisy Spotted knapweed	0.1 0.3	0.7 no data
#3B	Oxeye daisy Spotted knapweed	0.3 0.5	0.6 no data
#3C	No Weeds Present	0	0
#4	Spotted knapweed Sulfur cinquefoil	0.2 0.2	2.4 2.4

Unit Number	Species	Acres inside unit currently with weeds	Acres adjacent to unit (within 500') with weeds
#5	Oxeye daisy	0.1	none
#5A	Oxeye daisy	0.05	1.85
#5B	Oxeye daisy	none	1.5
#5C	Oxeye daisy	0.1	1.9
#6	No Weeds Present	0	0
#7	Oxeye daisy	none	1.0
#7A	Oxeye daisy Sulfur cinquefoil	0.5 0.5	0.6 no data
#7B	Oxeye daisy Sulfur cinquefoil	0.1 0.2	2.2 no data
#8	Oxeye daisy	0.4	0.8
#8A	Oxeye daisy	none	0.2
#9	Oxeye daisy	0.5	1.3
#10	Oxeye daisy	none	1.2
#11	Oxeye daisy	0.2	1.8
#12	Oxeye daisy	0.1	0.9
#13	Oxeye daisy	1.5	0.8
#14	Oxeye daisy	none	0.1
#14A	Oxeye daisy	none	0.1
#15	Oxeye daisy	1.3	0.3
#16	Oxeye daisy	0.5	1.9
#16A	Oxeye daisy	0.7	0.3
#17	Oxeye daisy	0.1	0.1
#17A	Oxeye daisy	0.4	1.1
#18	Oxeye daisy	1.6	No data
#18A	Oxeye daisy	1.8	No data
#19	Oxeye daisy	1.9	No data
#19A	Oxeye daisy	0.5	No data
#19B	Oxeye daisy	0.7	No data
#20	No Weeds Present	0	0
#20A	No Weeds Present	0	0
#21	Oxeye daisy	5.8	10.1
#22	Oxeye daisy	0.6	5.9
#22A	Oxeye daisy	3.0	12.8
#23	Oxeye daisy	0.1	1.0
#24	Oxeye daisy	11.2	16.9
#25	Oxeye daisy	1.8	0.3
#25A	Oxeye daisy	9.5	4.8
#26	Oxeye daisy	0.7	0.5
#26A	Oxeye daisy	none	0.4
#27	Oxeye daisy	0.9	0.4
#28	Oxeye daisy	0.89	0.3
#29	Oxeye daisy	0.09	No data
#30	Oxeye daisy	0.6	No data
#31	Canada thistle Houndstongue Oxeye daisy	0.1 0.1 none	5.4 5.4 no data
#32	No Weeds Present	0	0

Noxious Weed Risk

This analysis was carried out using data from the Gallatin National Forest GIS database, USDA-FS R1 Weed Risk Assessment, TSMRS (Timber Stand Management Resource Survey) database, existing fuels data, weed literature and research documents.
Predictability in weed spread generally follows the parameters used by the R1 Weed Risk Assessment, (see Table 3-4): 1) Are there existing weeds within or adjacent to the proposed disturbance area? Is the habitat suitable for weed expansion? In addition there are important variables to consider including 3) vectors contributing to weed dispersion or spread, 4) mitigations, effectiveness of mitigations.

Table 3-4: 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
M Bldr St	Spotted Knapweed Sulphur cinquefoil	No No	Yes Yes	Yes Yes	High High
#1	Spotted knapweed	Yes	Yes	Yes	Very High
#3	Oxeye daisy Spotted knapweed	Yes Yes	Yes No data	Yes Yes	Very High High
#3B	Oxeye daisy Spotted Knapweed	Yes Yes	Yes No data	Yes Yes	Very High High
#3C	No Weeds Present	No	No	Yes	Low
#4	Spotted Knapweed Sulfur cinquefoil	Yes Yes	Yes Yes	Yes Yes	Very High Very High
#5	Oxeye daisy	Yes	No	Yes	High
#5A	Oxeye daisy	Yes	Yes	Yes	Very High
#5B	Oxeye daisy	No	Yes	Yes	High
#5C	Oxeye daisy	Yes	Yes	Yes	Very High
#6	No Weeds Present	No	No	Yes	Low
#7	Oxeye daisy	No	Yes	Yes	High
#7A	Oxeye daisy Sulfur cinquefoil	Yes Yes	Yes No data	Yes Yes	Very High High
#7B	Oxeye daisy Sulfur cinquefoil	Yes Yes	Yes No data	Yes Yes	Very High High
#8	Oxeye daisy	Yes	Yes	Yes	Very High
#8A	Oxeye daisy	No	Yes	Yes	High
#9	Oxeye daisy	Yes	Yes	Yes	Very High
#10	Oxeye daisy	No	Yes	Yes	High
#11	Oxeye daisy	Yes	Yes	Yes	Very High
#12	Oxeye daisy	Yes	Yes	Yes	Very High
#13	Oxeye daisy	Yes	Yes	Yes	Very High
#14	Oxeye daisy	No	Yes	Yes	High
#14A	Oxeye daisy	No	Yes	Yes	High
#15	Oxeye daisy	Yes	Yes	Yes	Very High
#16	Oxeye daisy	Yes	Yes	Yes	Very High
#16A	Oxeye daisy	Yes	Yes	Yes	Very High
#17	Oxeye daisy	Yes	Yes	Yes	Very High
#17A	Oxeye daisy	Yes	Yes	Yes	Very High
#18	Oxeye daisy	Yes	No data	Yes	High
#18A	Oxeye daisy	Yes	No data	Yes	High

Unit #	Species	Weeds present within unit	Weeds present adjacent to unit	Habitat suitable for weed expansion	Risk of weed invasion
#19	Oxeye daisy	Yes	No data	Yes	High
#19A	Oxeye daisy	Yes	No data	Yes	High
#19B	Oxeye daisy	Yes	No data	Yes	High
#20	No Weeds Present	No	No	Yes	Low
#20A	No Weeds Present	No	No	Yes	Low
#21	Oxeye daisy	Yes	Yes	Yes	Very High
#22	Oxeye daisy	Yes	Yes	Yes	Very High
#22A	Oxeye daisy	Yes	Yes	Yes	Very High
#23	Oxeye daisy	Yes	Yes	Yes	Very High
#24	Oxeye daisy	Yes	Yes	Yes	Very High
#25	Oxeye daisy	Yes	Yes	Yes	Very High
#25A	Oxeye daisy	Yes	Yes	Yes	Very High
#26	Oxeye daisy	Yes	Yes	Yes	Very High
#26A	Oxeye daisy	No	Yes	Yes	High
#27	Oxeye daisy	Yes	Yes	Yes	Very High
#28	Oxeye daisy	Yes	Yes	Yes	Very High
#29	Oxeye daisy	Yes	No data	Yes	High
#30	Oxeye daisy	Yes	No data	Yes	High
#31	Canada thistle Houndstongue Oxeye daisy	Yes Yes No	Yes Yes No data	Yes Yes Yes	Very High Very High Low
#32	No Weeds Present	No	No	Yes	Low

Alternative A - No Action

Direct and Indirect Effects

With the no action alternative, trees will continue to grow, the canopy within stands will slowly increase in density, and conifers will continue to encroach on meadows and open areas throughout the Boulder Drainage in both the riparian corridor and in the Wilderness. Tree pathogens and insects will continue to take their toll. The Main Boulder Drainage is currently considered ripe for wildfire. There are vast amounts of dead wood and continuous fuel buildups, especially in the upper portion of the Boulder River Corridor.

The effect of wildfire on weeds in the Main Boulder Drainage will be dependent on many of the factors mentioned above; burn intensity, time of year, weeds present, soil moisture at time of burn, if there is a mosaic burn pattern and events that follow the burn such as rainfall which may cause soil erosion, bare ground, etc. Experiences on the Big Timber District, have shown that wildfires have not created new infestations of noxious weeds even where weeds were present along a nearby roadway. In some cases, existing weed patches have expanded locally but there has been no expansion of noxious species into weed free areas.

The worst-case scenario would be a catastrophic wildfire burning under very hot conditions and killing trees from rim to rim in the canyon. 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 lack of competition. Timothy would very likely expand in cover. In the Lower Boulder (vicinity of Units 1-7) knapweed would be the noxious weed that might expand the most. In the Upper Boulder, oxeye daisy and Canada and musk thistle may be the most likely to increase. This description supposes a high fire severity, however, as mentioned in the paragraph above, there have been no observed rapid colonization of noxious weed species on burned sites simply because they have burned.

Under a more typical wildfire scenario, there would be patches of burned and unburned tree canopy with a mosaic pattern of burned vegetation, underburning 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. The major contributing factor to weed proliferation under both a wildfire scenario and a timber harvest scenario is the amount, location, and duration of soil disturbance. Ground disturbing fire suppression activities such has hand or dozer line construction could 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 wind blown seeds, free from competition by existing plants.

Cumulative Effects

In Alternative A, the no action alternative, there would be continuation of small timber sales in the Main Boulder such as the ROW Timber Sale in 2003 and 2004. 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 sale contract requirements. It is expected that weeds would continue to spread very slowly. See description above for wildfire effects of the no action alternative.

Alternative B - Proposed Action

Effects of Proposed Roads

The Action Alternative proposes the construction of up to 7.4 miles of low standard, temporary road in support of timber and fuels material removal. That length of road equates to approximately 22 acres of disturbed ground. In general, road margins represent the most disturbed and 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 wind blown seeds, free from competition by existing plants. As such, proposed roads are the most detrimental aspect of this project from the perspective of weeds, weed control and native plant communities.

Effects of Ground-Based Harvest Type Scenarios in the Main Boulder

The following narratives describe possible ground-based harvest systems that may be used for removing wood fiber from the units or for temporary road building. These types of treatment units would occur on up to approximately 1060 acres having slopes of $\leq$ 35%. The following assessments presume that weed mitigation is also in place:

Whole Tree Yard using conventional ground based logging, log on 8" settled snow or over frozen ground

Assumptions: designated skid trails every 75 feet, except where converging
All materials come to a large landing or several smaller landings
Conventional tracked or rubber tired skidder
Cannot access slopes above 35%
Several large and/or small landings per unit
Hand falling
Sound, non-activity fuels (these are pre-existing down trees or limbs) greater than 4" diameter, yarded out
Non-activity fuels less than 4" diameter left in units
Up to 7.4 miles new temporary road, to be reclaimed following harvest

Effects: Low levels of ground disturbance, very little soil disturbance
Low levels of damage to existing understory plant community
Damage to residual trees, may have to be removed at another time causing multiple entries and creating more disturbance
Large areas of soil disturbance at landings Areas of soil disturbance are concentrated near Main Boulder Road making future weed treatment easier and more accessible
Areas of disturbance are concentrated along the temporary roads and distributed throughout units. Soils over much of the harvest area could be within a short distance of bare or disturbed soil.

Whole Tree Yard, using conventional logging (tractor logging and tree skidding)

Assumptions: designated skid trails every 75 feet, except where converging
All materials come to a large landing or several smaller landings
Conventional tracked or rubber tired skidder
Cannot access slopes above 35%
Several large and/or small landings per unit
Hand falling
Sound, non-activity fuels (these are pre-existing down trees or limbs) greater than 4" diameter, yarded out
Non-activity fuels less than 4" diameter left in units
Up to 7.4 miles new temporary road, to be reclaimed following harvest

Effects: Multiple skid trails, creating bare soil and understory disturbance
Multiple feeder trails created by pulling trees into the skid trails, creating areas of understory damage and soil disturbance.
Damage to residual trees, which may have to be removed at another time, causing more disturbance or lengthening the period of disturbance, creating additional bare soil or necessitating re-entry.
Large areas of disturbed soils at landings. Multiple piles of non-activity fuels burned within units
Areas of disturbance are concentrated along the temporary roads and distributed throughout units. Soils over much of the harvest area could be within a short distance of bare or disturbed soil.

Whole Tree Yard using a Feller-buncher

Assumptions: Feller-buncher walks into the unit on the forest floor, not over snow

Designated equipment and skid trail every 50 feet. Trail density would be greater than with any other system.
Trees are piled within the unit after cutting for removal by tracked vehicle
Very little slash (activity fuels) left in unit
Trees are delimbed at or near the road, creating converging skid trail areas and large centralized piles.
Generally cannot access slopes above 35%
As with conventional logging, up to 7.4 miles of new temporary road would be required using these systems

Effects: For weeds, the benefits of this system over conventional logging systems are:
No feeder trails are created so there is less ground disturbance
There is less damage to the residual trees, reducing the need for re-entry and further ground disturbance
However, the ground disturbance along the skid trails is quite high due to repeatedly dragging bundles of trees the length of the skid trail
Effects of temporary roads same as above.

Harvester Systems: Cut-to-Length and Feller-Buncher Harvesters

Assumptions: Trees de-limbed and either piled for removal or cut-to-length on site.

Small diameter slash (small limbs, branch tips, needles, cones, bark and other small wood debris) from de-limbing is placed in the path of the harvester machine. The resulting slash mat cushions the harvester tracks as it moves forward into the unit. These two systems generate approximately equal slash volumes.
Generally cannot use over snow
Create and "walk on" a slash mat 12 feet wide and approximately 8 " thick
25 feet reach of the harvester arm each direction right and left of machine
Generally cannot access slopes above 35%
Operability limited in areas of exposed rock.
Timber and non-activity fuels larger than 4" diameter are taken out along the slash mats and are not left in units or along slash mats.
Following harvest, slash mats are picked up and piled or left as is along the 12 foot corridor and are then burned
Multiple landings, one at end of each harvester trail
As with conventional logging, up to 7.4 miles of new temporary road would be required using these systems

Effects: No data is available to aid in determining whether there would be sufficient small slash generated during harvest to adequately cushion the harvester thus preventing ground disturbance
Approximately 24% of each unit will be impacted by compacted slash. This is the percent of the unit that will be needed to lay down slash for the harvester to access and harvest trees and fuel.
Following harvest, slash will be either burned in the rows or gathered by a grappler into piles along the slash corridor and then burned. To create a circular pile about eight feet in diameter and six feet tall means that there will be a burn pile every 18 feet along the length of the harvester corridor. Each pile will then be burned, potentially creating circles of partially sterilized soil every 18 feet.

These circles would consist of chemically modified, bare spots awaiting colonization by well-adapted, aggressive, non-native species
Multiple small landings, one at the end of each harvester trail
Very little damage to residual trees, therefore no re-entry needed
Effects of temporary roads same as above.

In summary, to minimize 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. Helicopter logging was discussed but was not seriously considered due to cost, logistics, and availability. With this information, these are the ground based harvest techniques that should be used to minimize impacts to expansion of the weeds in order of preference:

1) Whole tree yarding using any logging system over 8 inches of settled snow.

a. Little or no new road building (cut and fill, etc)
b. No site prep using scarification or ripping following harvest
c. Burning to occur at the landings
d. Complete harvest and treatment in one entry, with no re-entry to further harvest damaged trees at a later date

2) Whole tree yarding using a harvester system such as a feller-buncher, operating on frozen ground with rubber tired skidder or other low impact haul equipment.

e. Maximize spacing between skid trails.
f. Same as mitigation above in #1

3) Whole tree yarding using conventional logging over frozen ground

- Maximize spacing between skid trails
- Same as mitigation above in #1

4) Cut-to-Length or feller-buncher harvester systems using a multi-purpose machine that creates and utilizes a slash trail.

5) Conventional ground based logging, using hand felling, tractor skidding, piling and burning the slash within the units.

- Proposed 7.4 miles of new temporary roads
- Site preparation using scarification or subsoil ripping techniques following harvest

Effects of Burning

The effects of burning on the proliferation of weeds are varied depending on burn intensity, time of year, weeds present, soil moisture at time of burn, and other factors. In general, prescribed burning without any associated ground disturbance (road building and timber harvest) results in far less weed expansion than with burning associated with ground disturbing activities. If burning removes the entire overstory canopy (stand replacing wildfire) and burn intensities are high, a large percentage of weed seeds may also be burned. Under these conditions, native herbaceous plants may also have been damaged and be slow to recover, colonize bare ground, combat hydrophobic soils, and compete with non-native species.

In general, on the Big Timber District, wildfires occurring in areas having weed infestations similar to those in the Main Boulder have not experienced increases in noxious weeds following burning, although weedy native species initially colonized bare ground under formerly timbered areas, (Black Butte Wildfire, Pers Conv., C. Ronneberg, 2004). There are approximately 400 acres of meadow type areas in the Main Boulder Fuels Reduction project proposed for prescribed burning with minimal timber harvesting. Underburning may also occur in some of the timber harvest units in order to meet the 5 to 10 tons per acre downed fuel retention objectives. If Forest Service

vehicles remain on the roadways and ground disturbing practices related to fire line construction activities don't occur or are minimized, it is anticipated that the spread of weeds in these burn units will be relatively low, with the exception of areas in the lower Boulder that are already infested with knapweed or sulfur cinquefoil, or are immediately adjacent to areas infested with these weeds. Knapweed and sulfur cinquefoil populations are likely to expand somewhat if burning removes the trees that have shaded the ground.

Effects of the Proposed Action on Meadows

With the implementation of the mitigations, effects of the proposed action on meadow habitats will be minimized. Because there would be no mechanical harvest equipment and very little new temporary road construction in meadow areas (possibly some along edges of meadows), there would be little exposed or compacted soil. The prescribed burning activities would not super heat soils and native vegetation would regenerate quickly because the root systems would remain intact.

Direct and Indirect Effects

The potential effects of the proposed action on the spread of noxious weeds are of two types: direct and indirect.

The 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. This mitigation has been used in timber sale and mining contracts throughout the region and is a proven method to reduce weed spread with the exception of weeds such as Canada thistle, which has a wind disseminated seed. If off-road equipment is power washed and inspected between units, then there will generally be 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 indirectly result in the spread of weeds. This type of invasion can be made less likely by strategically locating the untouched leave islands where weed populations are adjacent. As can be seen from the table above, weed populations exist in many proposed units and within 500 feet of nearly every proposed unit.

Table 3-3, Ch 3-34 shows 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. Habitat Suitability is based on literature review, TSMRS database information, field review, knowledge of the Boulder River Corridor, and experience with weed treatment. 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; "None" is when the habitat is not suitable.

There are 30 units at "Very High" risk of weed invasion, 16 units at "High" risk of invasion and 5 units at "Low" risk of invasion. Note that units with a combination of high and very high risk have been counted as very high risk in this summary. There are no units that are basically at no risk for invasion. The Boulder River Corridor is at high risk for increased weed invasion due to the widespread existing seed source and suitable habitat found throughout the area.

It is possible that extensive changes involving overstory removal, ground disturbance, and burning could result in invasion of weed species that do not currently inhabit the Main Boulder. There are many species such as yellow toadflax that are nearby in Sweet Grass County but are not currently in the Boulder Drainage. Seeds of many noxious weeds, and native weedy

colonizer species, can remain viable in the soils for many, many years, up to 80 years as demonstrated by some studies.

Another point to consider is that timely monitoring and treatment of weeds is an expensive proposition. However, this project is important from a life and property protection standpoint

Cumulative Effects

In addition to the direct and indirect effects of the proposed action, ongoing activities will contribute to a slow expansion of weeds in the Main Boulder Drainage. Private land is a concern, in that some private landowners treat noxious weeds and some do not. As private land is resold, new construction occurs, and recreation visitors come to the area from far away places, weeds are brought in, and populations will slowly expand. It is also likely that noxious weed species, that are not currently present, will be introduced. Presently, knapweed and sulfur cinquefoil populations are shrinking due to aggressive treatment on public and private land, while oxeye daisy, houndstongue, and thistle species are expanding.

There are currently approximately 100 acres of noxious weeds in the Main Boulder Drainage. These areas became infested over the course of over 100 years of human activity and land use. The proposal of up to 1060 acres of timber harvest on slopes $\leq$ 35 %, up to 7.4 miles of new, low-standard temporary road, up to 1040 acres of hand or other specialized treatments on slopes >35% (approximately 200 of these acres on slopes >35% may be inoperable due to the terrain), and 400 acres of prescribed burning (in addition to the proposed underburning of some timber harvest units), represents human disturbance and activity on a scale exceeding any in the past. 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.

Irreversible and Irretrievable Commitments of Resources

If noxious weeds are introduced or expand into new areas, the loss of native vegetation to weed infestation would be a possible irretrievable effect, as it is not currently possible to totally eradicate them. One could argue that an occasional landowner can eradicate weeds on a small area that is easily accessed and frequently treated, but total eradication of noxious weeds in a native landscape is unlikely. Weeds can be aggressively treated annually and reduced in cover percentages but there are no known success stories to indicate that noxious weeds can be totally eradicated from a site they have occupied for more than one growth/reproductive cycle.

This resource loss could potentially be irreversible as well, if active restoration to native species is not pursued. Depending upon the level and extent of native vegetation converted to noxious weed infestation, extremely intensive restoration work could retrieve lost native habitats.

Applicable Laws, Regulations, and Forest Plan Guidance

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 93-629), 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 II-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.

Numerous mitigation measures have also been established to minimize weed infestation and spread in the project area.

Issue 3: Proposed fuel treatments, along with the cumulative effects of existing roads and recreation and private land development could have an effect of water quality by potentially introducing additional sediment to the Boulder River and tributaries. Increased nutrients in the Boulder River from prescribed burns may exceed water quality standards.

> **Indicator:** Sediment yield as measured in tons/year and percent over natural modeled at the Forest Boundary and primary tributaries is a management indicator for water quality.

Affected Environment: The Boulder fuels reduction project occurs on primarily terraces and lower slopes along the main stem of the Boulder River between the Forest Boundary and Box Canyon. The Boulder River above the Forest Boundary has a watershed area size of about 224.5 square miles. The USGS gage #06187500, Boulder River at Contact (near the Forest Boundary), which was operated intermittently between 1911 and 1982 had an average discharge of 377 cfs, and average annual water yield of about 273,680 acre feet. Most of the streamflow in the Boulder River occurs in response to snowmelt with May (14.5% of annual total), June (42.6%), and July (21.5%) the largest average water yield months. All of the Boulder fuel treatments occur in terraces above the river or in watersheds of ephemeral or perennial tributaries to the Boulder River. The primary streams in the project area include Falls Creek, Hawley Creek, Fourmile Creek, Upsidedown Creek, and the East Fork of the Boulder.

Water quality in the Boulder River is excellent (USFS, 1982). The Boulder River is a calcium-sulfate-bicarbonate dominated system and is well buffered (150-300 mg/L of TDS) and is low in nutrients. The Boulder River meets Montana B1 water quality standards throughout the project area. Robust filamentous algae growth in riffles prompted a cooperative Montana DEQ and USFS monitoring program in 1993 (Levine, 1996). The monitoring found low levels of nitrate - nitrogen, ortho-phosphate, total nitrogen, and total phosphorous at 7 sites (stream and adjacent shallow groundwater wells), no consistent relationship between river and adjacent well nutrient chemistry. The densest concentration of filamentous algae was noted above Box Canyon, which is above any suspected nutrient sources (pit toilets, livestock, septic systems). No 303(d) listed stream segments occur in the project area. The Montana DEQ 303(d) list of impaired watershed lists the Boulder River from the mouth to 5 miles upstream as partially meeting aquatic life support, cold water fishery and primary contact recreation due to dewatering and flow alteration from agriculture. This upstream end of this impaired segment is about 28 river miles below the project area.

Alternative A – No Action

Direct and Indirect Effects

Under this alternative, no actions would be undertaken over the next several years to respond to the purpose and need identified in *Chapter 1-13*. The opportunity to reduce fuel accumulations would be deferred. 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, which are susceptible to lethal fire and to insect and disease outbreaks. No harvesting of timber would occur. There would not be any road reconstruction or construction in the project area. The actions identified in the design criteria and mitigation section would also not be done including the resource improvement projects. The R1R4 analysis for Alternative A shows that existing timber harvest sediment would continue to decline from 2003 to 2004. No additional fire sediment or increase in road sediment would occur unless there was a significant wildfire event.

Table 3-5 Main Boulder Fuels - Alternative A

Year	Natural sediment tons/year	Timber sediment tons/year	Road sediment tons/year	Prescribed Fire sediment tons/year	Total sediment tons/year	%Over natural sediment	Cumulative %over natural sediment
2003	1302	0.9	32.7	0	1335.6	2.57	51
2004	1302	0.7	32.7	0	1335.4	2.55	51
2005	1302	0.45	32.7	0	1335.1	2.53	51
2006	1302	0.2	32.7	0	1334.9	2.51	51
2007	1302	0	32.7	0	1334.7	2.51	51
2008	1302	0	32.7	0	1334.7	2.50	51
2009	1302	0	32.7	0	1334.7	2.50	51
2010	1302	0	32.7	0	1334.7	2.50	51
2100	1302	0	32.7	0	1334.7	2.50	51

Sediment yields would decline from 2.57% over natural to 2.5% over natural by 2008. In the short run the water quality effects of the no action alternative would be the same as the proposed action (immeasurable and insignificant). In the long run, the no action alternative would not reduce the potential of wildfire ignition in the treatment areas. Wildfire in the Main Boulder River canyon has the potential to result in extensive impacts to soil erosion, debris flows, and sediment loadings to the Boulder River. An analysis of a hypothetical 38,400 acre wildfire in the Boulder River canyon (1/3 high burn intensity, 1/3 moderate burn intensity, and 1/3 low burn intensity) resulted in a R1R4 model estimate of 52.2% over natural first year sediment yield increase. A moderate to large size wildfire would also have potential for large short-term increases in nutrients to the Boulder River. The no action alternative would forgo the fuels management opportunity to reduce the likelihood of extensive water quality impacts from a large wildfire in the Boulder River Canyon.

Cumulative Effects

The R1R4 sediment modeling was run for Alternative A in a cumulative mode accounting for all existing roads, timber harvesting, and residential, and recreational developments in the Main Boulder watershed to the Forest Boundary at the mouth of the canyon. Timeframe for the cumulative effects analysis is 1980 to 2011. Overall sediment and nutrient impacts of Alternative A are immeasurable and insignificant. Since effects are insignificant, no cumulative impacts with other sediment or nutrient impacting activities in the Boulder River would occur.

Alternative B - Proposed Action

Direct and Indirect Effects

Potential effects of the Main Boulder Fuels Reduction Project were analyzed by a qualitative assessment of potential sediment yield from prescribed burn projects and evaluation of low severity spring burns on the Gallatin NF. The effects of mechanical fuel reduction were also qualitatively disclosed based on observations of selection timber harvesting techniques. Sediment yield levels for each alternative were evaluated using the R1R4 sediment model (Cline et.al, 1981) and adjusting sediment coefficients based on existing road and timber harvest unit conditions. The sediment model was run in a cumulative fashion accounting for all existing roads, timber harvesting, and residential, and recreational developments in the Main Boulder watershed to the Forest Boundary at the mouth of the canyon. The R1R4 model used in the sediment analysis is designed to address the cumulative effects of timber harvest operations, road construction, and fire. The model does not attempt to analyze the effects of grazing and mining activities (other than vegetation removal and road construction) or individual episodic storm events. 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 averaged over long periods, the models' accuracy is best when averaged over several years. The model is less reflective of individual drought or flood years. The R1/R4 Sediment model focuses on slope processes and estimates the water and sediment delivered to the main channel by forest management within the watershed, including the headwater stream channels. However, the routing of sediment and water through the main channel is limited to broadly based regional curves as no main channel hydrologic or hydraulic processes are modeled directly.

Gallatin National Forest Sediment guidelines include:

Table 3-6 Gallatin NF Sediment Guidelines

Category	Management Objective	% Fines	Annual % over Natural	20 Year % over Natural Cumulative
A.Sensitive Species and/or Blue Ribbon Fisheries	**90%**	**21-24%**	**30%**	**300%**
B.Regionally or Locally Significant Fisheries	**75%**	**25-27%**	**50%**	**500%**
C.Viability Consideration	**60%**	**28-30%**	**60%**	**600%**
D.Non-fishery, Maintain Channel Integrity	**--**	**--**	**100%**	**1000%**

The annual % over natural is the amount the sediment in the watershed at the accounting point (Forest boundary). Natural (baseline) is the amount of average annual sediment, which would be produced in the absence of any man caused disturbances (primarily roads and timber harvest). The 20-year cumulative sediment yield is the cumulative total of average annual sediment for the previous 20 years. This figure is an approximation of the process of sediment accumulation and storage in a stream channel system from disturbances (aggradation) and the gradual cleaning of accumulated sediment (degradation) as watershed disturbances recover and/or are reduced.

The proposed prescribed burns include up to 2258 acres, which include underburns in 8 units that are primarily non-forested (5B, 5C, 7A, 7B, 8A, 17, 17A, and 20A). Other possible underburns could be completed after timber harvest and/or slash reduction and pile burning in 39 units (Main Boulder Station (MBS), 1, 2, 3, 3A, 3B, 4, 5, 5A, 6, 7, 8, 9, 10, 11, 12, 14, 14A, 15, 16, 17, 18A, 19, 19A, 19B, 20, 21, 22, 23, 24, 25, 25A, 26, 26A, 27, 28, 29, 30, 31, 32).

The underburns could result in localized erosion and soil displacement with associated delivery to stream channels (sediment). However, erosion and sediment from these proposed spring burns are anticipated to be very minor. Examination of several spring and fall burns on Gallatin NF broadcast burns a few months to two years after treatment has documented very quick revegetation. Spring burns on the Gallatin NF have re-vegetated usually 2-6 weeks after treatment. In general spring burns do not attain sufficient heat to result in more than low intensity with pockets of moderate burn intensity. Fall understory burns have a greater potential for erosion since the drier duff conditions usually burn more deeply and the treated areas typically do not revegetate until the following spring.

Typically understory burns result in shallow surface combustion that leaves roots intact. Nutrient mobilization and usually ample soil moisture during March-May often result in robust grass/forb regrowth and shrub resprouting.

Pile burns would occur on about 2237 acres in 41 units including units (MBS, 1, 2, 3, 3A, 4, 5, 5A, 6, 7, 8, 9, 10, 11, 12, 14, 14a, 15, 16, 16A, 17, 18, 18A, 19, 19A, 19B, 20, 21, 22, 23, 24, 25, 25A, 26, 26A, 27, 28, 29, 30, 31, and 32). Pile burns typically burn the duff and upper soil horizon more deeply than understory burns and take longer for re-vegetation. However the piles are surrounded by unburned areas, which act to contain erosion to the area of the pile. Spring rains in the proposed treatment areas are typically frontal storms of low intensity as opposed to summer storms which although usually less overall precipitation, are convective driven with cells of high intensity. Actual areas of erosion and sediment delivery within the proposed Main Boulder Fuels burns are expected to be minor and very localized -- primarily in areas where more intensive storms impact burned areas before revegetation occurs.

Erosion and sediment increase from the mechanized treatments and timber removal could result from temporary road construction, skid trails, log yarding, landings, and piling disturbance. These effects were evaluated for the proposed action (Alternative B) using the R1R4 sediment model which was run in a cumulative fashion accounting for all existing roads, timber harvesting, and residential, and recreational developments in the Main Boulder watershed to the Forest Boundary at the mouth of the canyon. The model was run assuming all understory burns, temporary road construction, and timber harvest was done in a 4-year period (2004 to 2007). Results include:

Table 3-7 Main Boulder Fuels – Alternative-B (Proposed Action)

Year	Natural sediment tons/year	Timber sediment tons/year	Road sediment tons/year	Prescribed Fire sediment tons/year	Total sediment tons/year	% Over natural sediment	Cumulative % over natural sediment
2003	1302	0.9	32.7	0	1335.6	2.57	51
2004	1302	11.0	33.8	2.5	1347.1	3.08	51
2005	1302	19.1	34.6	0.45	1356.2	3.23	52
2006	1302	24.3	34.6	0.22	1361.1	3.29	53
2007	1302	15.0	33.7	0	1350.7	2.98	53
2008	1302	9.9	32.7	0	1344.6	2.78	54
2009	1302	5.4	32.7	0	1340.1	2.66	54
2010	1302	2.2	32.7	0	1336.9	2.56	54
2011	1302	0.2	32.7	0	2636.9	2.52	54

The sediment model estimated that the 7.4 miles of temporary road construction over a 4-year period would increase road sediment by a maximum of 1.9 tons/year in year 3 (2006). Timber related sediment from slashing, harvesting, skidding, and yarding is estimated to increase sediment by a maximum of 24.3 tons in 2006. Fire sediment from understory burns was modeled, assuming all burns were done in 2004 (in actuality understory burns would be done over the life of the project 6-8 years), which would result in a 2004 increase of 2.5 tons. Total sediment yield was projected to increase from 2.57% over natural in year 1 (2003) to 3.29% over natural in 2006 (year 3) and increase of 0.72% and decrease to pre-project levels by 2011. Actual project scheduling would extend the implementation longer than the 2004-2007 timeframe for the sediment model, which would result in maximum year increases less than 0.72%. Sediment recovery to pre-project levels, however, would also be extended and would occur about 3-4 years after implementation is completed. The 0.72% increase is too low to be measurable in the Boulder River in terms of actual concentration or physical or biological effects. None of the treatments are expected to have measurable sediment increases to any of the tributary streams of the Boulder River. The projected sediment effects are well within Gallatin Sediment guidelines for annual (30% over natural) or 20 year cumulative sediment (300% over natural).

A concern with the burns is the potential for nutrient enrichment of the Boulder River. Conversion or organic vegetation to inorganic nutrients and reduced plant uptake after fires can result in increased leaching of nutrients to streams. Nutrient increases in streamflows have been measured in several research watersheds from wildfires – usually most prominently immediately after the wildfire event. The understory and pile burns in the Main Boulder Fuels project has considerably less biomass consumption and burning depth than wildfires and would not be expected to have measurable nutrient effects in the Boulder River.

Overall sediment and nutrient impacts of the proposed Main Boulder Fuels reduction project (Alternative B) are immeasurable and insignificant.

The Main Boulder Fuels Reduction Project would be in compliance with the Montana Water Quality Act and Administrative Rules of Montana, WQLS/TMDL constraints, and with Gallatin NF Forest Plan direction for water quality protection. Sediment modeling indicates that project sediment increases are immeasurable and well within the Gallatin NF sediment guidelines.

Cumulative Effects

The R1R4 sediment modeling was run for Alternative B in a cumulative mode accounting for all existing roads, timber harvesting, and residential, and recreational developments in the Main Boulder watershed to the Forest Boundary at the mouth of the canyon. Timeframe for the cumulative effects analysis is 1980 to 2011. Overall sediment and nutrient impacts of Alternative B are immeasurable and insignificant. Since effects are insignificant, no cumulative impacts with other sediment or nutrient impacting activities in the Boulder River would occur.

Irreversible and Irretrievable Commitments of Resources

There would be no irreversible or irretrievable effects to water quality due to BMP's, unit design criteria, and identified mitigation measures.

Applicable laws, regulation, and Forest Plan Guidance

State Laws: The State of Montana Water Quality Act requires the state to protect, maintain, and improve the quality of water for a variety of beneficial uses. Section 75-5-101, MCA established water quality standards based on beneficial uses. The Montana Department of Environmental Quality has designated all non-wilderness surface waters in the project area as B1 Classification. Waters classified as B1 must be suitable for drinking, culinary, and food processing purposes after conventional treatment; bathing, swimming and recreation; growth and propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supply. A 5 NTU turbidity increase above naturally occurring turbidity is allowed in B1 waters. Surface waters within the Absaroka Beartooth Wilderness are classified as A1, which have similar suitability criteria for beneficial uses except that no turbidity increase above naturally occurring turbidity is allowed.

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 C, which are required to be followed in all timber harvest and road construction activities. Forest Plan Direction A.5 (page II-1) requires the Gallatin NF to meet or exceed State of Montana water quality standards.

The proposed action is consistent with all of the above mentioned laws and Forest Plan Standards. They will be strictly adhered to upon implementation of the proposed action. Additional protective mitigation has also been established for the project.

Issue 4: Fuel reduction, including timber harvest, construction of roads and log landings, disturb soils and increase potential for erosion and sediment transport and deposition in streams. Increased fine sediment in streams has been shown to reduce habitat quality and cause adverse effects to fish populations. Harvest activities may reduce riparian integrity and bank stability. Fuel reduction treatments may also reduce the amount of large woody debris (LWD) recruited to stream channels. LWD in mountain streams creates structurally diverse and complex habitats that are important for all life stages of fish.

> **Indicator:** Project fuel treatments and activities in riparian zones against channel sensitivity analysis. Evaluate relative importance of LWD in project area streams and potential for LWD reductions after treatment. Evaluate potential for adverse habitat effects due to increased sediment using R1/R4 sediment model results and established guidelines.

Affected Environment: The following narrative describes the affected environment for aquatic resources within the cumulative effects analysis area boundary. The analysis area for aquatic resources includes the following subwatersheds within the Main Boulder Drainage: Bramble Creek, Bridge Creek, Clear Creek, East Chippy Creek, East Fork Boulder River, Falls Creek, Fourmile Creek, Froze to Death Creek, Miller Creek, Ruby Creek, Ruby Creek tributary, Shorty Creek, Speculator Creek, unnamed tributary to Boulder River, Upsidedown Creek, and the main Boulder River downstream to the National Forest boundary.

Forest Plan implementation guidelines, outlined in an Agreement with the Madison-Gallatin Chapter of Trout Unlimited, classifies streams into four different categories (Class A, B, C, and D) each with unique fisheries management and habitat goals. Class A streams are the highest value streams from a fishery standpoint, and they include streams that are inhabited by sensitive fish species. Also included are streams that provide spawning and rearing habitat that are important for the maintenance of nationally and internationally renowned fisheries of the area. Genetically "pure" YCT inhabit the Boulder drainage upstream of Box Canyon, in the South Fork Boulder River, the East Fork Boulder River, and the East Boulder River upstream of the Brownlee Creek confluence. Lower densities of YCT occupy habitats in the main Boulder River downstream of Box Canyon; however, most YCT in lower reaches are hybridized. Two tributary streams, Hawley and Bridge creeks, also support pure populations of YCT. Because of the presence of genetically pure YCT, and because of its importance as a recreational fishery, the Boulder River and its fish bearing tributaries are considered Class A streams. The fish population objectives for Class A streams as outlined in the Agreement, 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. Habitat management guidelines established in the Agreement are more stringent for Class A streams in terms of management goals and objectives. According to the guidelines, Class A streams are to be managed at a level of at least 90% of their inherent habitat potential (i.e., sediment concentrations, in spawning gravels, pool frequencies, pool habitat quality, streambank stability). These guidelines serve as the reference level associated with impact determinations and effects analysis. In other words, the Boulder Fuels Project proposal may not cause direct, indirect, or cumulative effects that result in habitat quality, for affected habitat attributes, falling below 90% of the streams inherent potential. It is assumed that a high level of habitat protection will result in no, or negligible affect on viability of the population. These guidelines are also intended to ensure that State Water Quality standards are met and the stream meets all designated beneficial uses for B1 streams, including "growth and propagation of salmonid fishes and associated aquatic life".

The key point for the TU Agreement is that habitat must be managed at a high level of capability ($\geq$ 90% of pristine conditions). When conditions are at 90%, no additional degradation is allowed. If habitat is at or near pristine condition, then some flexibility exists within constraints of the TU Agreement.

Streams are not similar in terms of their inherent sensitivity to changes in streamflow or sediment discharge, their inherent stability, or their ability to recover from flow and sediment related change. In other words, response to imposed change is not uniform among stream types. Some channel types are inherently very stable, while other channel types are naturally unstable and can be significantly altered by sediment increases or riparian disturbances. Thus, it is important to understand the sensitivity of individual streams in order to evaluate affects on channel stability and fish habitat quality. The affected environment description includes a channel sensitivity analysis that is later used to help predict the relative direction and magnitude of potential effects on channel morphology and fish habitat quality.

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 production, 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 brief description of existing fish habitats and populations.

Channel type analysis

All stream reaches in the project area were characterized using the Level II classification scheme outlined by Rosgen (1996). Bridge Creek, East Fork Boulder River, unnamed tributary to the Boulder River, East Chippy Creek, Clear Creek, the lower most reach of Fourmile Creek, some reaches of the main Boulder River, and the lower most reach of Bramble Creek all have B2 and B3 channel types (*see Table 3-8, p. 3-55*). B2 and B3 channel bed materials are dominated by boulders (B2) and cobbles (B3) with lesser amounts of gravel. They have moderately steep gradients approaching 5% and are moderately entrenched and confined. They typically have moderate energy and low sediment supply with correspondingly low bedload transport rates. The channel bed and banks are considered stable and contribute only small quantities of sediment during runoff events. These streams are subject to high spring runoff events with comparatively low late summer flows. Channel sensitivity to increased streamflow or sediment discharge is low for B3 channels and very low for B2 channels. Streambank erosion potential is low (B3) to very low (B2). Riparian vegetation has negligible controlling influence on streambank stability.

Froze to Death Creek, Falls Creek, Miller Creek, Speculator Creek, Upsidedown Creek, and Shorty Creek all have B2a and B3a channel types (*see Table 3-8. p. 3-55*). B2a and B3a channels bed materials are dominated by boulders (B2a) and cobbles (B3a) with lesser amounts of gravel. They have moderately steep gradients approaching 10% and are moderately entrenched and confined. They have high energy and low sediment supply with correspondingly low bedload transport rates. The channel bed and banks are considered stable and contribute only small quantities of sediment during runoff events. These streams are subject to high spring runoff events with comparatively low late summer flows. Channel sensitivity to increased streamflow or sediment discharge is low and streambank erosion potential is low (B3a) to very low (B2A). Riparian vegetation has negligible controlling influence on streambank stability.

Ruby Creek , the tributary to Ruby Creek, and some reaches of the main Boulder River have B4 channel types. B4 channels bed materials are dominated by gravel and cobble with few boulders. They have low to moderate gradients (2-4%) and are moderately entrenched and confined. They typically have moderate energy and moderate sediment supply with low to moderate bedload transport rates. The channel bed is typically characterized as a series of rapids with irregular spaced scour pools. The B4 channel type is considered relatively stable and is not a high sediment supply stream channel. Channels are moderately sensitive to increased streamflow or sediment discharge. Streambank erosion potential is moderate and riparian vegetation has moderate controlling influence on streambank stability.

Upper reaches of Bramble Creek, and Fourmile Creek in the project area are A2 channel types with predominately boulder substrates and lesser amounts of cobble and gravel. A2 channels are

steep (≥10%), deeply entrenched and confined streams with high energy, low sediment supply and correspondingly low bedload transport rates. The channel bed and banks are very stable and contribute little to sediment supply. Streambank erosion potential for A2 channels is very low and riparian vegetation exerts negligible influence on streambank stability.

Habitat Conditions

Habitat conditions in all tributary streams are near pristine. Except for the Boulder River, only a short reach of each stream is outside the Wilderness boundary and within the project area. Except for the Main Boulder Road crossings, streams have not been subject to anthropogenic disturbances like roading, timber harvest, and grazing. Some LWD clearing has occurred above the Boulder Road crossing in some tributary streams. Scour pools downstream of large boulders are the primary pool formative feature. Extremely high gradients and large fluctuations in annual streamflow limits habitat availability in most of the streams. Very little spawning or rearing habitat occurs because of high gradients. Large woody debris is scarce in the A2, B2a, B3a, and B2 channels because most is transported downstream during high flow events. Because those channels are deeply incised, LWD that falls over the channel is typically suspended far above the bank full water surface elevation and contributes little habitat for fish. Large woody debris can be an important component for fisheries habitat in the lower gradient B3 and B4 reaches. An upstream water diversion dewaters Miller Creek during late summer.

For the Boulder River, and to a lesser extent the East Fork Boulder River, large woody debris is an important component for fisheries habitat along channel margins. LWD jams also create excellent habitat in lower gradient reaches of the Boulder River. The LWD jams create flow obstructions sufficient for significant amounts gravel to be deposited, creating excellent spawning habitat. Spawning habitat is extremely limited in tributary streams because of their high gradient nature. Therefore, the majority of reproduction occurs in the main stem Boulder River in association with LWD accumulations. The importance of tributaries for providing spawning and rearing habitat for spawning fluvial trout in the Boulder River is minimal.

Fish populations

Fish populations were surveyed in most tributary streams during the summer of 2003 to determine species composition and relative abundance. Low densities of rainbow and brook trout (e.g., 3-5 fish/100 meters) were found in most streams. For Froze to Death Creek, no fish were found above the Boulder Road culvert, which has a 7-foot drop and creates a fish passage barrier. No fish were found in Bramble Creek, Miller Creek or Shorty Creek. Low densities of rainbow/cutthroat trout hybrids were found in Ruby Creek, the tributary to Ruby Creek, and Clear Creek. No surveys were conducted for Upsidedown Creek so species composition and abundance is not known. Numerous Yellowstone cutthroat trout were found in Bridge Creek, and previous electrophoretic analysis has verified genetic purity. Electrofishing surveys in the East Fork Boulder River found numerous Yellowstone cutthroat trout, rainbow trout, brook trout, and cutthroat/rainbow hybrids. Numerous brook and rainbow trout of various size classes were also found in Speculator Creek.

The Boulder River drainage has regional and national recognition as a recreational fishery. Trout species in the Boulder River include brook, brown, rainbow, rainbow/YCT hybrids, and Yellowstone cutthroat trout (YCT). Genetically “pure” YCT inhabit the Boulder drainage upstream of Box Canyon, in the South Fork Boulder River, the East Fork Boulder River, and the East Boulder River upstream of the Brownlee Creek confluence. Lower densities of YCT occupy habitats in the main Boulder River downstream of Box Canyon; however, most YCT in lower reaches are hybridized. Two tributary streams, Hawley and Bridge creeks, also support pure populations of YCT. Yellowstone cutthroat are considered a *Sensitive Species* by the Forest Service and a *Species of Special Concern* by the Montana Department of Fish, Wildlife and Parks. Primary causes for decline throughout their historic range include competition and hybridization with introduced non-native salmonids, habitat degradation, and population

fragmentation. The primary cause for decline in the Boulder drainage is competition and hybridization with non-native species. Fragmentation, or geographic isolation, occurs when a local population or group of interbreeding individuals becomes isolated from other local populations.

The resident and fluvial spawning patterns of interconnected populations allows for individual sub-populations (e.g., sub-populations in tributary streams to the Boulder River) to suffer genetic losses or go extinct due to environment disturbance like wildfire. Populations persist; however, when individuals from other nearby streams recolonize an area after local extirpation. Much of this connectivity has been lost in the Boulder Drainage because many culverts under the Main Boulder Road are barriers to fish passage.

Table 3-8. Management interpretations of channel types within the project area (from Rosgen 1996, pg 8-9)

Stream Name	Stream Types	Channel Sensitivity[a]	Recovery Potential[b]	Sediment Supply[c]	Bank erosion potential	Vegetation controlling influence[d]
Froze to Death	B2a/B3a	very low/low	excellent	very low	very low	negligible
Falls Creek	B2a/B3a	very low/low	excellent	very low	very low	negligible
Unnamed trib	B2	very low	excellent	very low	very low	negligible
E.Chippy Cr.	B2/B3	very low/low	excellent	very low	very low	negligible
Shorty Creek	B3a	low	excellent	very low	low	negligible
Miller Creek	B2a/B3a	very low/low	excellent	very low	very low	negligible
Speculator Cr.	B2a/B3a	very low/low	excellent	very low	very low	negligible
Bramble Creek	B2a/A2	very low	excellent	very low	very low	negligible
Fourmile Creek	B3/A2	low/very low	excellent	very low	low	negligible
Ruby Creek	B3/B4	low/moderate	excellent	low/moderate	low	moderate
Ruby Cr. trib	B4	moderate	excellent	moderate	low	moderate
Clear Creek	B2/B3	very low/low	excellent	very low	very low	negligible
Upsidedown Cr.	B2a	very low	excellent	very low	very low	negligible
Bridge Creek	B2	very low	excellent	very low	very low	negligible
EastFk. Boulder	B2	very low	excellent	very low	very low	negligible
Boulder River	B3	low	excellent	low	low	moderate
Boulder River	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

Method for Analysis

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 is evaluated against treatment activities that may influence their stability.

Because potential sediment effects to trout vary according to life-stage specific habitat requirements, it is important to evaluate potential sediment effects on each of the various habitat components. The channel sensitivity analysis provided in the affected environment descriptions will be 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 quality and incubating fish eggs, a relationship between percent sediment yield over natural and fine sediment accumulation (% sediment $\leq$ 6.3mm) in spawning gravels was established for streams throughout the Gallatin NF. The predictive equation is {y=19.06 + 0.24(x)}, where (x) is the predicted percent increase in sediment yield over natural calculated using the R1/R4 sediment delivery model, (y) is the predicted percent of deposited fine sediment less than or equal to 6.33mm, (19.06) is the y-intercept which reflects the predicted (mean) fine sediment deposition in spawning gravels for streams throughout the Gallatin, and (0.24) is the slope of the relationship. The slope of the relationship is most important in determining the relative magnitude and direction of change. It is important to recognize that the R1/R4 model predicts the amount of sediment delivered to channels and the above linear relationship predicts the amount of sediment retained in the channel. Under equilibrium conditions, most fines delivered to a stream will be flushed from the system. Above some threshold input level, however, they may begin to accumulate in the system, particularly in low velocity reaches.

Application of this model provides an estimate of incremental change in fine sediment deposition in spawning gravels associated with predicted sediment yield changes for each alternative. The estimated sediment concentrations are then compared to sediment/survival curves developed for cutthroat trout embryos (Irving and Bjornn 1984) and the 24% sediment guideline for Class A streams. Both the R1/R4 sediment delivery model and sediment/survival curves are a very simplified approximation of complex processes that determine sediment production and fish embryo survival. The modeled relationship between sediment yield and sediment retention in spawning gravels is also an over-simplification. Because of this, resulting values are not considered definitive or absolute; rather they are used only to evaluate the relative magnitude and direction of change in spawning habitat quality and survival effects to compare alternatives. Developed relationships have also been helpful in establishing sediment yield guidelines for Gallatin National Forest streams (see Table 3-9). The "Annual" and "Cumulative" guidelines were developed from correlations between R1/R4 modeled estimates and actual fine sediment concentrations measured in streams throughout the Gallatin Forest.

Table 3-9. Habitat management objectives and sediment guidelines

Stream Class	Habitat mgmt. Objective	Fine sediment concentrations in spawning gravels *(guideline)*	Annual sediment yield % over natural *(guideline)*	Cumulative sediment yield % over natural *(guideline)*
Class A Sensitive species and/or Blue Ribbon fisheries	90% (of potential habitat capability)	<24% (%fines < 6.3mm)	30%	300%
Class B Regionally or locally important fisheries	75% (of potential habitat capability)	25-27% (% fines < 6.3mm)	50%	500%
Class C Supports fish but limited recreational value	60% (of potential habitat capability)	28-30% (% fines < 6.3mm)	60%	600%
Class D Non-fishery	maintain channel integrity	NA	100%	1000%

Environmental Effects

The following analysis describes anticipated direct, indirect, and cumulative effects to riparian integrity, fish habitat and populations. Effects are described for each alternative. The analysis characterizes the direction of effect, the magnitude or intensity of the anticipated effect, and the duration of the effect.

The spatial bounds for evaluating direct, indirect, and cumulative effects to aquatic resources include the main Boulder River downstream to the forest boundary, and reaches of each tributary stream within the project area.

The analysis for direct and indirect sediment effects incorporates all previous timber sale and road construction activities that have occurred in the Boulder drainage upstream of the forest boundary. Thus, the direct and indirect sediment effects analysis are cumulative in nature. The analysis estimates changes through year 2011. As such, the temporal bounds for direct, indirect, and cumulative effects includes all past, present and reasonably foreseeable actions through 2011.

Alternative A - No Action.

Direct and Indirect Effects

For the no action alternative, 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 A would result in *no effect*, beyond existing conditions, to fish populations or habitat. However, it is worth noting that without fuel reduction, the potential for a higher intensity fire along the Boulder River Corridor increases and post-fire vegetative recovery time would also increase. Fish populations have evolved with wildfire and the ecological processes associated with them. Wildfires play an important role in maintaining spatial and structural diversity, habitat complexity and nutrient cycling. However, when fire size, frequency, intensity, or

severities are outside the range of natural variability (i.e., fuel loading is excessive), there is potential for watersheds to be burned beyond their adaptive limits. With large-scale high severity fires, there is a potential threat to watershed integrity and associated fish species persistence. Existing fuels loads are high throughout the drainage, including riparian corridors. Treatments associated with the proposed action alternative will not reduce the likelihood of a large-scale stand replacement fire in the upland Wilderness areas of the Boulder drainage. However, treatments associated with the proposed action alternative are intended to reduce burn severity along the Boulder River Corridor. Reducing the severity of a future wildfire along the corridor could have some beneficial affect to riparian integrity and fish habitat quality. Those benefits would not be realized for the no action alternative.

Cumulative Effects

Sediment yield increases from timber harvest and road building that have occurred prior to this proposal are accounted for in the sediment yield analysis. Other reasonably foreseeable activities are not expected to contribute measurable levels of sediment to area streams.

Effect determination for Alternative A without mitigation: No Effect

Mitigation for Alternative A: There would be no fuels treatment, therefore no mitigation is proposed at this time.

Effect determination for Alternative A with mitigation: No Effect

Alternative B - Proposed Action

Direct and Indirect Effects

Treatment affects on riparian integrity and streambank stability:

Based on the channel sensitivity analysis, the proposed action poses little threat to the physical integrity of riparian areas or streambank stability. Channels have stable stream banks with a low to very low sensitivity to disturbance. Riparian vegetation exerts low to negligible control on channel form and bank stability. In addition, mitigation measures, including SMZ rules are designed to reduce or eliminate potential for adverse affects on riparian integrity or bank stability (see Mitigation for Alternative B described below). With the mitigations included in the proposed action, fuel treatments are designed to maximize the amount of LWD available for recruitment to stream channels. Mitigation measures described below substantially reduce the potential for adverse LWD related impacts. For example, no treatment would be allowed within 15 feet of streams and all large trees leaning toward the channel will not be harvested. Reducing some understory trees will bring riparian stand density to more normal stocking levels in the absence of wildfire. Reducing high fuel loads along riparian corridors will also reduce the potential for high intensity wildfires along the corridor.

Sediment Effects: Sediment entering stream channels can affect channel shape and form, stream substrates, the structure of fish habitats, and the structure and abundance of fish populations. Potential sediment effects to trout very according to life-stage specific habitat requirements, because different life stages utilize different habitats. Sediment effects on adult and juvenile trout can occur when sediment concentrations exceed the capacity of the channel and pools fill or riffles become more embedded. Adverse effects to young trout (e.g., egg through fry life stages) can occur when fine sediment concentrations increase in spawning gravels. Treatments that minimize the influx of fine sediments will favor the maintenance of high quality habitats for all life stages.

Increasing proportions of fine sediment in substrates have been associated with reduced intra-gravel survival of embryos for brook trout (Hausle and Cobble 1976; Alexander and Hansen 1986), and rainbow trout (Witzel and MacCrimmon 1981; Irving and Bjornn 1984. The effects of fine sediment on survival of incubating cutthroat trout has been studied less than for other salmonid species. In laboratory studies, Irving and Bjornn (1984) found that elevated fine sediment (less than 6.3mm) levels significantly reduced survival of cutthroat trout.

Annual and cumulative percent sediment over natural estimates are compared to guidelines established for various stream classes. If those guidelines are met, it is assumed that the 90% spawning habitat management objective is being met. Sediment yield analysis results for the proposed action are presented in the water quality section of the EIS. Results from the R1/R4 sediment delivery model show that existing sediment yield (delivery) for the Boulder drainage above the forest boundary is estimated at 2.57% over natural with a 51% cumulative increase (Table X in the water quality analysis). The majority of the increase over natural is attributed to existing main system roads along the corridor. The 2.57% baseline figure is used to compare sediment increases caused by the proposed action. According to modeled estimates, this alternative may increase sediment delivery an additional 0.72% over baseline, to a high of 3.29% over natural (Table X in the water quality analysis). Modeling results show sediment yield declining to near existing conditions in year 2011 once all treatments are completed and temporary roads are reclaimed. The 3.29% estimate is far below the 30% annual sediment delivery guideline established for Class A streams. It is assumed that sediment yield rates below 30% have negligible effect on reproductive success for high gradient mountain streams throughout the Gallatin. The cumulative rate is also below the 300% guideline established for Class A streams.

To compare the relative increase in fine sediment concentration in spawning gravels among alternatives, the predictive equation {y = 19.06 + .24x} was used. This equation was derived from regressions between % over natural estimates from the R1/R4 sediment model and measured fine sediment concentrations for streams throughout the Gallatin Forest. The resulting values are not considered absolute. Rather, they are only used to compare the relative magnitude of sediment increase among alternatives. For the no action alternative, the modeled fine sediment concentration is 19.06%. For the proposed action, the modeled fine sediment increase is 19.24%, a slight increase over the no action alternative. Based on literature reviews and empirical studies, optimal fine sediment concentration in cutthroat trout spawning gravels is <24% (Table 4). If spawning gravel sediment concentrations are below 24%, it is assumed that the 90% spawning habitat management objective is being met for a Class A stream.

Pools are areas of higher velocity during peak flows, but at low flows their depth creates a depositional environment for fine sediment. Increased sediment from timber harvest and road construction could influence the amount and quality of juvenile and adult pool habitat if sediment increases are sufficient to alter channel morphology by filling in pools. For lower gradient sensitive channel types with high sensitivity to increased sediment, excessive sediment loading can reduce maximum pool depth and residual pool volume. 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 B4 and C4 channels in watersheds with extensive road development. For A2, A3, B2, and B3 channel types there was no apparent relationship between residual pool volume or depth and road development.

Except for some B4 reaches in the main Boulder River, all streams in the project area are classified as B2, B3 or A2 channel types with predominately boulder substrates and lesser amounts of cobble and gravel. All of these channel types have a high capacity to carry and flush sediment. A2, A3, B2, and B3 channel types have a low to very low sediment supply and low to very low sensitivity to increased sediment discharge (Rosgen 1994, pg. 8-9). The B4 reaches in the main Boulder River have moderate sediment supply and are moderately sensitive to increased sediment discharge. It is unlikely that the slight predicted increases in sediment for the proposed action would affect pool depth because of their high gradients and resiliency to changes

sediment discharge. Furthermore, large boulders form most pools in tributary streams and depth is maintained primarily by site specific scour processes around those flow obstructions. The slight predicted increase is well within annual fluctuations in sediment discharge for the drainage. Thus, the estimated slight sediment increase would have *no effect* on pool habitat quality for any of the streams within the project area.

Cumulative Effects

The R1/R4 sediment model accounted for cumulative sediment yield increases from proposed timber harvest, temporary roads and prescribed burning associated with the proposed action. In addition, all existing roads, past timber harvest activities, and residential and recreational developments in the main Boulder drainage to the Forest boundary were accounted for in the sediment modeling exercise. Other reasonably foreseeable activities are not expected to contribute measurable levels of sediment to area streams. Thus, cumulative effects analysis results are the same as those for direct and indirect effects analysis.

Effect determination for Alternative B without mitigation

The proposed action includes all mitigation for riparian and aquatic resources that was proposed during the development of the alternative. In other words, mitigation measures designed to protect riparian and aquatic resources are an integral part of the proposed action. Specific treatments, including silvicultural and fuel prescriptions of the proposal were designed to accommodate aquatic mitigation measures. Therefore, Alternative B would not be implemented without mitigation measures described below.

Mitigation for Alternative B

The underlying goal of mitigation 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. Mitigation included in the fuels treatment prescription are intended to meet several objectives:

1. To protect riparian vegetation and soil in a manner that maintains an effective sediment filter.
2. To protect riparian vegetation in a manner that allows for effective thermal regulation.
3. To protect the integrity of stream channels and banks
4. To maintain an effective source of LWD of larger sizes classes for fish habitat
5. to maintain floodplain stability
6. To maintain diverse, complex habitats (e.g., maximizing LWD) which is critical for long-term persistence of fish populations.

1. Unit wide mitigation measures for fisheries can be found on *Ch. 2-32.* In addition to fishery mitigation measures, other mitigation proposed under other resource areas will also protect riparian and aquatic resources

Unit specific design criteria and mitigation intended to meet these objectives are outlined in Appendix B.

Effect determination for Alternative B with mitigation: No Effect

Irreversible and Irretrievable Commitments of Resources

There would be no irreversible or irretrievable effects to fisheries as long as unit design criteria and identified mitigation measures are followed.

Applicable laws, regulations, and Forest Plan direction:

The proposed action is consistent with the direction given in the Forest Service Manual (FSM), FP Standards and Guidelines (Fisheries/MA7), Land use Strategy for WCT and YCT, YCT Conservation Management Direction and Guidelines, Executive Order 12962 and the SMZ Rules. Additional restrictive mitigation will also be applied with implementation of this project.

- Forest Service Manual -FSM 2526 Riparian Area Management and FSM 2670.22 Sensitive Species Management
- GNF Forest Plan (p. II-1) – Fisheries and (p.II-17) Sensitive Species: The Gallatin National Forest Plan provides broad direction for the management of forest fishery resources and more specific direction for management of sensitive species
- 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.
- Land Use Strategy for WCT and YCT - The Upper Missouri Short Term Strategy for Conserving Westslope Cutthroat Trout (UMWCT short term strategy) was finalized into a "Land Use Strategy" in April 2001. The final Strategy provides implementation direction for the MOU that was adopted in 1999. Region One has been an integral player in the development of this strategy. The initial short-term land-use strategy for WCT was adopted in 1996 by the GLT to apply towards management of YCT on the Gallatin. During the March 21st, 2002, GLT meeting, a decision was made to apply the finalized Land Use Strategy for implementing the 1999 MOU and Conservation Agreement for WCT in Montana to YCT populations on the Gallatin National Forest.
- Cooperative Conservation Agreement for Yellowstone Cutthroat trout within Montana. In 1998, the Gallatin and Custer National Forests joined numerous other agencies and the Crow Tribe in forming the Cooperative Conservation Agreement for Yellowstone Cutthroat Trout within the state of Montana
- 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.

Issue Statement 5: Harvesting and other fuel management activities could affect the integrity of the scenery in the Main Boulder drainage. This could also affect the scenic integrity of the landscape viewed from the Main Boulder River, which in turn, could affect the eligibility and potential classification of specific sections of the Main Boulder River for inclusion into the Wild and Scenic River System

Recreation River (sections that have some development along the shoreline):

- *the Boulder River from the Gallatin National Forest boundary to Blakely Creek,*
- *from Miller Creek to Bramble Creek*

Scenic River (sections that are free of impoundments):

- *the Boulder River from Blakely Creek to Miller Creek,*
- from Bramble Creek to the Wilderness boundary as a Scenic River.

Indicator: The level of visually discernible dominance of deviations from the area's scenic integrity and character caused by the fuel treatment and harvest activities, as viewed primarily from the Main Boulder Road, the Boulder River and the recreation sites. Other sections of this document are addressing the fish, water quality and wildlife, also listed as "outstandingly remarkable values" in the Forest Plan.

Affected Environment - Scenery and Wild & Scenic River

Landscape Character

Landscape character is the overall visual and cultural impression of a geographic area that includes its natural scenic attributes in combination with the land use patterns that have become accepted over time, contributing to the area's sense of place and character. In the Main Boulder, there is a partnership between the cultural influences and the natural setting.

The scenery is one of the primary reasons that residents and visitors are drawn to the Main Boulder drainage. There is an overarching sense of being in an environment where humans have a place but that is dominated largely by natural processes, highlighted by the rustic nature of most of the houses and cabins tucked back or into the trees; long stretches of thick, tangled coniferous woods punctuated by open meadows; the boulder strewn river edged with deciduous trees and shrubs; the roughness of the road itself, which exaggerates distances and the sense of remoteness; the ruggedness of the almost desert-like cliffs at the canyon mouth that change to sweeping conifer and scree covered subalpine slopes further up-canyon; and the immediate proximity to the Wilderness, which literally envelopes the drainage and is part of one of the largest undeveloped areas in the continental US. This landscape character or overall setting is as important to the residents as it is to the recreationists.

Today's recreationists come to the drainage to enjoy the natural setting and solitude to fish, camp, or to venture beyond the roads and recreation sites into the wilderness. They expect rustic structures interspersed with rugged, generally undeveloped natural-appearing scenery.

Photos taken around the turn of the century from different viewpoints within the drainage show the landscape that the early homesteaders and miners saw must have been somewhat different. Besides having significantly fewer cultural features than today, those early photos show a greater component of aspen and other deciduous vegetation, as well as larger meadow openings where homesteaders settled. Providing some clues about past fires, there are numerous visible patches of trees with fire scars, most likely from lightning strikes, on the canyon's sweeping side slopes where conifers display a more uniform, finer texture. Where mineral deposits provided sufficient incentive for early miners to explore, today's viewers are often unaware of the mining history of the drainage. There are no overtly recognizable remnants from those activities visible from the road except the old townsite of Independence, which is outside of the project area.

Scenic Attractiveness

This area falls into the Rocky Mountain Region, "Yellowstone Rockies Sub region" Character Type of the Visual Management System ("Visual Character Types and Variety Class Descriptions", R-1 80-11, USDA Department of Agriculture, Forest Service, Northern Region), which is the document used as a frame of reference to classify landscape features as to their degree of scenic quality. Based upon the landforms, rock forms, vegetation, and water forms of the project area, it can be classified as mostly in the "distinctive" category (of three categories: distinctive, common and minimal). In addition, there are Forest Service structures and some private structures eligible to be listed on the National Register of Historic Places, which contribute as cultural elements to the visual quality and landscape character of the area. One criteria for the "distinctive" category is "strong patterns created by the interplay of coniferous, deciduous, and grass vegetation". Currently in the Main Boulder drainage, especially along the river and in the open meadows, this interplay is visible. However, the amount of this deciduous element seems to be declining, especially in and around the meadows, thus reducing this desired visually scenic component.

Landscape Visibility

The key observation points and corridors being used for scenery analysis and for determining project compliance with the Forest Plan standard for visual quality are those areas from which the majority of people are viewing the scenery in the drainage. They consist of the Main Boulder Road and the National Forest recreation sites. For analyzing potential impacts to the eligibility and potential inclusion of the Boulder River into the Wild and Scenic River System, the views looking out from the river are being used as well. Critical viewing distances for this project range from immediate foreground to near middle ground. The significance of viewing distance is that in the immediate foreground, the finer elements of line, form, color, and texture are more important (i.e. ground surface treatment, stump heights, slash treatment, and vegetation diversity). In the near middle ground, line, form, color, and texture are still important but they become more generalized.

This project takes into account how viewers interpret the scenery. While these three key observation points overlap (road, recreation sites and the river), there are distinctly different ways of viewing. These consist of dynamic (moving), static (not moving), viewer superior, viewer neutral, or viewer inferior. Along stretches of the road where there are neither pullouts nor other reasons to stop, the scenery is viewed while moving. Generally along these stretches, no immediate foreground scenery becomes a focal point, except where there is a bend in the road preceded by a straightaway. In these cases, the area along the bend becomes a focal point, especially where the terrain is sloped uphill, exposing more ground surface toward the viewer. Views from recreation sites are static for longer time periods, and are generally not as focused as dynamic views along the road.

Views from the road and recreation sites are either viewer-inferior (when the viewer is below the area being viewed), viewer-neutral (viewer and area being viewed are at the same level), or viewer-superior (when the viewer is above the area being viewed). The dynamic views from the road into this project area are most often viewer-neutral, which means that the trees in the foreground usually block the trees farther away from the viewer. In some cases where viewers are actually looking uphill, their angle of viewing parallels the ground surface as it slopes up. These views are still considered viewer-neutral, with the trees in front blocking those farther away. The amount of blockage is dependent upon the density of the larger trees, the diameter of their trunks, the density of the shrub component, and the amount of small trees having crowns that are continuous to the ground. Views from the river are either viewer-neutral or viewer-inferior.

Scenic Integrity (Existing Visual Condition)

Scenic integrity or Existing Visual Condition refers to the current condition of the scenery and the degree of intactness of the landscape character of National Forest land. In other words, scenic integrity measures the amount and effect of visible deviations from the characteristic landscape. The existing condition determines whether the Forest Plan standard for visual quality (Partial Retention for most areas, and a range of Partial Retention to modification within recreation sites) is being met on National Forest lands (See also *Ch. 3-5* "Forest Plan Management Direction"). In general, the National Forest land as viewed from the road and river, has a moderate to high level of scenic integrity and is currently meeting the Forest Plan standards. The recreational residences, recreational church camp, and Forest Service administrative sites are dominant structures, although they are rustic and low in profile, often overpowered by the towering canyon walls behind them, and in many cases almost completely hidden from sight by the dense forest surrounding them. There are occasional individual and/or small concentrations of visible stumps, providing evidence of some past logging, public firewood gathering and roadside hazard tree removal. The campgrounds, trailheads, and other Forest Service recreation sites are fairly rustic, providing settings that are generally naturally appearing and possess some vegetative screening between the road and the sites. Old roads that were used for past logging are overgrown and

fairly unrecognizable. There is one visible, unsigned road that leads into a gated Forest Service gravel pit. Other unsigned, primitive roads are mainly residential driveways or lead to dispersed camping areas. In general, the project area when viewed from the Main Boulder Road, recreation sites, and the Main Boulder River currently displays only minimal signs of past timber harvest that are recognizable by visitors.

Alternative A: No Action

Direct/Indirect Effects

The no action alternative would have no direct effects to the scenery or to the potential classification of the Boulder River. The scenery that viewers have become accustomed to over the last 80 years would remain unchanged in the short term. It is likely however, that within the areas proposed for units in the proposed action alternative Treatment Groups 1 and 5, there would be an increase in the number of individuals and groups of visible, brown-needled, dead conifers that succumb to Douglas-fir beetles. In those very dense intermediate and small tree areas included in Treatment Group 2 and to a lesser extent, some of the other Treatment Groups, viewers would continue to see an increase in the number of dead and dying small diameter trees fallen or leaning at an angle across other suppressed trees, creating the impression of a somewhat wild, dark, impenetrable forest. Over time, viewers would likely notice a decrease in the size of open meadows as conifers slowly fill in, and a continuation in the decline of the aspen component in the project area. The aspen decline would become most noticeable during autumn, with less golden foliage to create a dramatic counterpoint against the green of the conifers.

Along with the indirect effect of increasing the risk for an uncharacteristically large crown fire, as discussed in the fuels section of this document, would be the high risk of an extremely dramatic and instant change in the character of the scenery due to wildfire. Houses, cabins, camps, or campgrounds that are currently nestled into the trees, if they survived a fire, could likely be surrounded by blackened dead conifers within their immediate foreground, perhaps even filling 100% of their viewsheds. Although the dead trees would remain black for many years, the ground surface, depending on burn severity would soon become covered with herbaceous forbs and grasses, ultimately softening the harsh monotonal post-crown fire scenery.

In terms of Forest Plan standards, the no action alternative would meet the Visual Quality Objective of Partial Retention as well as the eligibility for potential classification of the Main Boulder River for inclusion in the Wild & Scenic River System. Likewise, an uncharacteristically large, crown fire, caused by natural ignitions, would not change compliance of the landscape and the river with the Forest Plan standards for scenery or Wild & Scenic.

Cumulative Effects

In terms of scenery or Wild & Scenic River eligibility, there would be no cumulative effects of the no action alternative. Existing harvests on National Forest lands would not visually dominate, nor would the recreation residences and recreation sites. However, if fuel reduction activities were not accomplished on either National Forest land or private land, the risk for a scenery character changing fire event would continue to increase.

Alternative B: Proposed Action

Direct/Indirect Effects

Reducing and breaking up the continuity of fuel loadings in the project area enough to decrease the risk of a large fire (as discussed in the Fuels section), would have the indirect effect of decreasing the risk for a large-scale immediate change in the character of the scenery. However, even the fuels reduction work proposed with the proposed action alternative would not eliminate

all risk to the scenery from wildfire. Harvesting and other fuel management activities could have a direct effect on the integrity and character of the scenery.

All of the six Treatment Groups, as described on *Ch.2-15*, propose a variety of types, sizes, and amounts of trees be cut. Harvesting these trees would leave visible stumps and more open forested areas. All six treatment groups, except the portion of Treatment Group 6 which is in the North Absaroka Roadless Area uphill from the Main Boulder Station, would have some amount of mechanical equipment required for the removal of trees, which would necessitate equipment driving off of the road surface. All six treatments also propose a variety of prescribed or pile burning to further reduce fuels.

The design criteria and mitigation measures on *Ch. 2-37* (Scenery, Wild & Scenic and Recreation) were developed specifically to reduce the potential impacts to the integrity of the scenery that could be caused by the proposed timber harvesting. By following these design and mitigation criteria, the impacts would not visually dominate and the scenic integrity of the corridor would be maintained, thus meeting the Forest Plan Visual Quality Objective of Partial Retention and the Wild and Scenic River standards. Implementation of the mitigation would reduce the visual dominance of stumps in the foreground; roads and skid trails constructed for this project; structures that depend upon vegetative screening; slash piles; staging and decking areas, and markings on trees used as directions for logging contractors. The mitigation measures are also designed to maintain the current ambience inside the recreation sites; eliminate unnatural appearing vegetation transitions by feathering or shaping edges of units, and avoidance of thinning on only one side of the road.

In determining where the mitigation is most needed, each unique viewing situation was considered. As described in "Landscape Visibility, in the "Affected Environment" section for scenery in this document, some viewing situations place more emphasis on the "seen" area. One such example, is where the view from the road is viewer-superior and looks northeast, over Unit 14A and abuts the Wilderness Boundary. To avoid creating an obvious straight line at the unit's eastern edge along the Wilderness, the mitigation require edge shaping and gradating. Likewise, in determining where to apply Mitigation #7 (cutting stumps), the viewing situation as well as the ability of the terrain (surface boulders/screening vegetation/convoluted terrain) to visually absorb stumps would be considered. Where the stumps appear visually dominant, mitigation would be applied. In addition, the amount of post-harvest visual penetration would be considered, because viewers would be able to see more deeply into/through these units after they have been thinned and treated with prescribed fire.

Even with implementation of the mitigation and the integrity of the scenery maintained, the character of the treated forested areas would be changed, but would still be mostly natural appearing. In Treatment Group areas 1,2, 4 and 5, viewers who are familiar with those forested areas (that appear somewhat wild or untamed, dark, in places full of dense spindly trees that are standing, leaning or lying on the ground, and in places seemingly impenetrable) would be able to discern the difference after harvesting because those areas would appear more open, brighter, and would have significantly less vegetative cover with an increased viewer visual penetration. To avoid these forested areas appearing manicured or heavily managed as a result of thinning, the mitigation and the treatment prescriptions require leaving up to an additional 15-20% of each unit's overall acreage untreated. As stated in Scenery mitigation #5, these untreated areas would be spatially distributed to accomplish the goals of providing additional screening for structures; leaving natural appearing patterns, clump and individual tree retention especially where the viewing situation places emphasis on the seen areas. Even where Treatment Design Criteria A calls for removing all conifers around a viable aspen clone for 100 ft, some small clumps or individual trees might be left, depending upon the viewing situation.

The prescribed burning that would occur in some of the Treatment Group units after thinning, would have no visually dominant effect on the scenery, except for the slash piles that would also be burned. Even if a few intermittent trees were scorched, these proposed prescribed burns

would be primarily low intensity, ground fires or slash pile burning. The ground would appear black immediately following the burn, but after the first season would green up from residual rootstocks and adjacent annual seed sources.

Cumulative Effects

In terms of the scenery and the Wild & Scenic River values, there could possibly be some cumulative effects that would result from some specific past actions on National Forest lands as well as potential future actions on private lands.

Three of the units proposed in the Action Alternative are situated between the Main Boulder Road and small existing clearcuts: proposed Unit 1 is located adjacent to the "Froze to Death" harvest; proposed Unit 7 is located adjacent to the "Elkhorn" harvest; proposed Unit 13 is located adjacent to the "Miller Creek" harvest. Sufficient vegetative screening, in the form of clumps and individuals, must be left between the Main Boulder Road and each of these three proposed units, to keep the existing harvests from becoming visually dominant. However, with proper application of the design criteria and mitigation listed for scenery and Wild & Scenic River, those existing harvests would not become visually dominant.

The roadside hazard tree removal project, that occurred during the past winter, resulted in some residual stumps being visible along the road. These stumps could have a minor cumulative visual impact along with the stumps and harvesting proposed in the proposed action alternative.

As both private landowners and recreation residents on National Forest land become more concerned with the potential effects of wildfire in the drainage and engage in fuel reduction activities, the risk of a scenery character-changing large fire would decrease. However, more of their structures could become visible, changing the visual character of the corridor. The National Forest lands that would be treated in the Action Alternative are currently interspersed with private land that exhibits some of the untamed, seemingly impenetrable, densely forested qualities. If all of the forested lands adjacent to the Main Boulder Road were to be treated for optimum fuel conditions, the sense of place tied to the character of those forested lands would be somewhat gone. However, the more open characteristics within the drainage enjoyed by earlier visitors could be just as appropriate and enjoyable, as long as the fuel reduction activities were carefully designed to allow the integrity of the scenery to be maintained and to prevent structures from becoming visually dominant. Achieving this situation would maintain the eligibility of the Main Boulder River for potential classification and inclusion into the Wild & Scenic River System.

Irreversible and Irretrievable Commitments of Resources

There would be no irreversible or irretrievable effects for scenery or Wild and Scenic River values. After implementation of the proposed action, the Main Boulder River Corridor will appear less timbered than what currently exists, but will more closely resemble the scenic quality of historic times.

Applicable laws, regulations, and Forest Plan Direction

The proposed action 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 management areas are described in detail in Chapter 3 of the Forest Plan (FP, pp. III-2 through III-73). The majority of the Main Boulder Fuels Reduction project area is in designated MA 5. There are areas of MA 3, MA 7, MA 11, MA 12, MA15, and MA17 also found within the project area. However, the MA 7 is not mapped because it is often a very narrow streamside zone and not practical to map.

Direction can be found primarily in the Forest Plan sections on goals (FP, pp. II-1 to II-2), objectives (FP, pp. II-2 to II-7), standards (FP, pp. II-14 to II-29), and management area direction (FP, pp. III-24 to III-26 and III-33 to III-36).

The proposed action is consistent with the goals, objectives, and standards of the Forest Plan.

Issue 6. Effects to wildlife and plant species, including threatened, endangered and sensitive species, management indicator species and other species of concern and effects to wildlife and plant habitats, including snags management, riparian areas, biodiversity, biological corridors, old growth late successional habitat, and wildlife and general habitat improvements goals.

> **Indicator:** Impacts to wildlife species were evaluated by assessing quantitative factors relative to habitat change; e.g. loss of denning/nesting/foraging habitat, loss of security/thermal cover, loss of snags, loss of coarse woody debris component, road density, etc. and qualitative factors such as potential for disturbance or displacement

Concern: The cumulative effects of existing roads, recreational use, past timber harvest, activities on adjacent private property and the proposed activities in the project area could have negative impacts on wildlife species through habitat alterations. Disruptions associated with human activities can disturb and/or displace wildlife, resulting in greater energy expenditures, potential relocation into poorer quality or unfamiliar habitat, and increased vulnerability to predation, competition with other animals or adverse effects from humans elsewhere.

Scale of Analysis: The analysis area for evaluating effects of this project on wildlife species and their habitat was based on timber compartment boundaries. The compartments on the District were used to establish lynx analysis units (LAU) with suitable lynx habitat. The total acreage of the combined compartments used for this analysis is 147,211 acres, not including private lands within compartments. The area affected by the project includes approximately 2,500 acres located in 51 separate treatment areas. These treatment units are also distributed fairly equally among eight separate lynx analysis units. Preliminary treatment proposals consist of pre-commercial thinning, commercial thinning, aspen treatments and thinning, and broadcast and prescribed burning. The spatial scale chosen for this assessment was based on average home range sizes of various wildlife species singled out for effects assessment; e.g. threatened, endangered and sensitive species, management indicator species and other wildlife species of concern. Recognizing that home range sizes vary widely for different wildlife species, it was determined that LAU boundaries provide an adequate spatial scale for analysis based on the following:

1. LAU boundaries are based on hydrologic and topographic features and do not change over time.
2. The seven LAU's used for this analysis cover 15 timber compartments; an area more than large enough to encompass the home range of most wildlife species of concern for the project.
3. All proposed actions associated with this project are confined within the boundaries of the LAU's used for effects assessment.

Temporal scale for effects analysis includes the timing and duration of projects actions of one to ten years for direct and indirect effects. This period allows for consideration of direct impacts caused by the proposed action, which is expected to take one to five years to complete thinning and commercial activities and five to ten years to complete prescribed burning activities. Indirect effects of the project might continue to occur after the completion of project implementation.

Cumulative effects assessment requires consideration of past, present and reasonably foreseeable future events. Vegetation altering processes like timber harvest, wild and prescribed

fire, agriculture, residential and road development, livestock grazing, and mining can have very long-lasting (e.g. hundreds of years) effects on wildlife habitat, many of which are permanent. Past impacts to wildlife habitat are reflected in the current baseline vegetation and road data used for analysis of the proposed project. 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 wildlife habitat incurred by the currently proposed Main Boulder fuels reduction project.

Proposed fuel reduction activities in the Main Boulder drainage have the potential to negatively affect big game winter range, snag dependent species and lynx and grizzly bear habitat. There is established elk winter range included in the treatment area, and forest plan amendments establish minimum snag retention requirements (Amend.15), big game cover definitions (Amend. 14) and grizzly bear access within recovery zones (Amend. 19). In addition, species recovery planning, conservation assessment, and agreements for lynx and grizzly bears, in cooperation with the U.S. Fish and Wildlife Service, have specific direction that must be incorporated into the project.

Following the mitigation and design criteria for wildlife associated with this project should minimize effects to the various wildlife species. These mitigation measures and design criteria can be found in *Ch. 2-35*.

Alternative A - No Action.

Direct and Indirect Effects

For the no action alternative, there would be no fuel reduction activities conducted in any of the proposed treatment units adjacent to the Main Boulder River. Thus, there would be no potential impact to threatened, endangered or sensitive species habitats; or any other wildlife or plant species of concern that occurs in the project area. Alternative A would result in *no effect*, beyond existing conditions, to wildlife and sensitive plant populations or habitat. However, the risk or potential of a catastrophic wildfire event would persist. If such an event were to occur with existing fuel conditions, it is likely that a majority of the wildlife habitat in the project area would have little or no value for food and cover for an indefinite period depending on the intensity of the wildfire event. Because the fuel conditions described within the treatment units actually extends well up into the wilderness on both the eastern and western aspects of the drainage, any wildfire in the drainage would also have the potential to damage an area many times larger than the proposed project area. In addition, because of wilderness designation any post fire rehabilitation would be very limited. The proposed action alternative may not reduce the likelihood of a large-scale stand replacement fire in the upland Wilderness areas of the Boulder drainage. However, treatments associated with the proposed action alternative may affect the extent and severity of any potential wildfire and would also reduce burn severity along the Boulder River Corridor. Limiting the extent of a large stand replacing fire and reducing the severity of a wildfire along the river corridor could have some beneficial effect for a host wildlife species and their associated habitats. Those potential benefits would not be realized for the no action alternative.

Cumulative Effects

There are no expected cumulative effects that would result from the no action alternative with regard threatened endangered and sensitive species or for general wildlife and sensitive plants. However, the continued threat of a catastrophic wildfire coupled with the current fuel loads could result in effects to a larger acreage and would likely impact adjacent non-federal and private lands. This potential by itself represents a continued cumulative threat to wildlife populations and

there associated habitats. Current and planned fuels treatment on private in-holdings within the Main Boulder River corridor would more or less become in-effective in the event of a stand replacement wildfire; and would result in no net benefits from these treatments to wildlife or habitat on private or federal lands.

Alternative B – Proposed Action

Direct and Indirect Effects

The direct, indirect and cumulative effects associated with the proposed action are analyzed on the following pages and have separated by classification of the species being analyzed.

Proposed fuel reduction activities in the Main Boulder drainage have the potential to negatively affect big game winter range, snag dependent species and lynx and grizzly bear habitat. There is established elk winter range included in the treatment area, and Forest Plan amendments establish minimum snag retention requirements (Amend.15), big game cover definitions (Amend. 14) and grizzly bear access within recovery zones (Amend. 19). In addition, species recovery planning and conservation assessment and agreements for lynx and grizzly bears, in cooperation with the U.S. Fish and Wildlife Service, have specific direction that must be incorporated into the project.

Following the mitigation and design criteria for wildlife associated with this project should minimize effects to the various wildlife species. These mitigation measures and design criteria can be found on *Ch. 2-35.*

Issue 6A. Effects to Threatened and Endangered Species

There are four species present on the Gallatin National Forest that are federally protected under the Endangered Species Act (ESA). These species include the grizzly bear, Canada lynx, bald eagle and gray wolf (USFWS 2003).

Grizzly Bear (*Ursus arctos*) – status: threatened

> **Indicator:** Effects to grizzly bears were evaluated by assessing impacts to important grizzly bear habitat components such as hiding cover, foraging habitat, and motorized access route densities.

The grizzly bear is listed as threatened under the ESA. The Yellowstone Grizzly Bear Recovery Zone is now referred to as the Primary Conservation Area (PCA) under the Draft Conservation Strategy for Grizzly Bear in the Yellowstone Area (GBCS). Since grizzlies are moving beyond the PCA boundary, the GBCS recognizes the need to monitor grizzly bears outside the PCA as well. For this purpose, an area extending 10 miles beyond the PCA is included in for tracking demographic trends in the grizzly bear population, and grizzlies are to be included in impact analyses for land management actions within both the PCA and the 10-mile surrounding area (IGBC 2000:21-23). There are currently no standards in the GBCS or the Forest Plan specific to grizzly bears for management actions outside the PCA; however, grizzly bears are protected under ESA regardless of where they occur.

The Main Boulder fuels reduction project analysis area used 7 Lynx Analysis Units that incorporate 15 timber compartments representing an area of approximately 147,211 acres in size. Approximately half of the analysis area is within the PCA and the remainder is within 10 miles of the PCA boundary. The analysis area provides suitable habitat for grizzlies and greater than ninety percent of the analysis area is within the Absaroka-Beartooth wilderness. Grizzlies are well established and known to inhabit the wilderness portion of the planning area and occasionally grizzly sign or sightings occur outside the PCA. Grizzly bears are also rarely to occasionally known to occur in the non-wilderness portion of the area surrounding the Main Boulder River, but are not known to be consistently present in this narrow canyon bottom.

The effects of roads and road use associated with this project were already described and analyzed in the 2004 Biological Opinion and incidental take statement on the Effects of the Gallatin National Forest Plan on Grizzly Bears (U.S. Fish and Wildlife Service 2004). This project will not impart effects of roads or road use in addition to those already covered in the biological opinion. Consultation on the effects of roads is complete and therefore the roads are considered as part of the environmental baseline for grizzly bears.

Grizzly Bears – Hiding Cover

Affected Environment

Criteria used to evaluate existing vegetative habitat conditions for grizzly bears in the Main Boulder analysis area were based on an internal Forest Service memo (USDA 1989). This memo was intended to provide guidance for habitat management within the grizzly bear PCA; however, the criteria are useful for assessing habitat conditions outside the PCA as well. 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 1989). Within the Main Boulder Fuel reduction project analysis area the majority of moist forest cover types suitable for grizzly bears is located in the wilderness and less than one percent would be affected by project actions.

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. This analysis revealed that there are approximately 82,889 acres of moist forest habitat types within the Main Boulder analysis area. Of this, approximately 60,508 acres (73%) are currently in a condition to provide hiding cover for bears.

Direct, Indirect and Cumulative Effects

Since mitigation and design criteria for the project will be followed and the proposed treatment units are oriented along a linear corridor within a quarter mile of a maintained county right-of-way and have been designed to retain between 30-50% cover, representing less than 5% of available hiding cover in the analysis area, and should enhance hiding and foraging habitat in the future; the proposed action alternative would not have any direct, indirect or cumulative affects on important hiding cover for grizzly bears.

Grizzly Bears – Foraging Habitat

Affected Environment

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. Fire is a natural disturbance process in the northern Rockies. Stand replacement fires change the forest composition to concentrate biomass at the ground level, providing increased forage in the form of herbaceous plants (Lyon et.al. 2000:6). Blanchard and Knight (1996) reported that grizzly bear s benefited from increased production of forbs, tubers, and roots after the 1988 fires in the Greater Yellowstone ecosystem. Forest fires not only provide improved vegetative forage conditions for grizzly bears in the short term, but also improve forage conditions for potential grizzly bear prey species. Grizzly bears may be attracted to the burn area in search of potential food sources. The Main 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 Main

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 10,430 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 is a key food source for grizzly bears in the Yellowstone Ecosystem. The whitebark pine zone is the area above 8,000 feet in elevation that is capable of producing old growth timber. Old growth characteristics are very important for bears in this habitat component. It takes, on average, over 100 years for whitebark pine trees to produce cones in quantity to so that red squirrels will collect and cache them. Grizzly bears normally raid these cache sites for the seeds that are so highly prized by bears (USDA 1989). There are 19,553 acres of whitebark pine habitat within the analysis area, of which approximately 9,960 acres are currently in an old growth condition.

Bears include meat in there diet whenever possible. They are capable of killing large and small game, but often feed on carrion left behind by other predators or from natural mortalities. Big Game winter ranges provide an important food source for grizzly bears in the form of carrion from winterkilled ungulates. The Main Boulder analysis area contains abundant big game winter range on south and west facing slopes in lower elevations.

Effects Direct, Indirect and Cumulative

The majority of proposed treatment units are located in relatively moist forest and meadow habitats adjacent to the Boulder River. Fuel reduction operations could occur in fall, winter or spring; but would be limited by environmental conditions and other restrictions (see mitigations listed above). Grizzly bears tend to frequent moist habitats during summer months in search of food. Grizzly bears tend to avoid humans, but they are rare to infrequent visitors in the Main Boulder corridor because of the summer traffic associated with campgrounds, church camps and permanent and seasonal developed residences. On the other hand, the resulting enhancement to habitats from treatments and prescribed burning 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 proposal. Big game winter range will be enhanced and expanded by the proposal. 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 5-7 year period. However, specific mitigation was added that limit the total impact in the PCA to 250 acres or less in any given years operations and stagger all actions in the corridor to minimize impacts to one area and offer alternative habitat and travel corridors for bears. Effects of the proposal would be temporary with improved forage conditions persisting in the burn area for several years after harvest is complete.

Indirect effects to grizzly bear foraging habitat are expected to be minimal. 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 effect to grizzly bear foraging habitat in the analysis area would 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 wilderness 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 TE&S species and wildlife with respect to first assessing threats to human life and property. The proposed actions 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.

Grizzly Bears – Motorized Access Route Densities

Affected Environment

Human access is an important factor to consider in assessing the condition of habitat for grizzly bears. Half of the Main Boulder fuel analysis area is within the PCA, where access standards apply; and half of the area is outside the PCA where standards do not apply. However, because the analysis area is all in or within ten miles of the PCA, 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. Whether roads themselves have negative effects on bear habitat is debatable. Some studies (Legwork 1978, Jonkel 1982 in: IGBC 1987:145) have indicated that grizzly bears avoid roads and areas of high road density, while others (Erickson 1977 in: IGBC 1987:145) noted the use of roads by bears for travel. However, roads and trails allow for easier human access into grizzly bear habitat, which can result in disturbance, displacement, or even mortality of bears. Access routes may also provide travel corridors for bears to move into human developments where their presence likely will not be tolerated.

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

Under the preferred alternative short stretches of (approximately 1 to 2 miles) of temporary road would be required annually to access treatment units. A total of approximately 7.4 miles of temporary roads would be necessary throughout the duration of the project. All temporary roads would be within one-quarter mile of the existing Main Boulder road. This small amount of road would add approximately one to two more miles of motorized access route density annually over the projected five years of project implementation. The no action alternative would have no direct, indirect or cumulative impacts on open road density for grizzly bears.

Cumulative effects on road densities within the analysis area include past road and trail development for transportation management 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 existing motorized roads and trails are limited primarily to the main road and some small spurs and sections of trail outside the wilderness. Due to the limited road system and the small portions of trail outside the wilderness, future travel management for the Main Boulder analysis area will likely emphasize non-motorized recreation and some limited motorized winter 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 main 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 Main Boulder analysis area is popular 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 some very old records of grizzly bear harvest in the analysis area, but no recent mortalities have occurred. In addition, grizzly bear predation on sheep is an annual problem in the last remaining sheep allotment in the wilderness. No mortalities have resulted from these predations and restrictions are in place in the existing permit to prevent this response to predation unless they occur outside of the wilderness (bears are captured and relocated in these instances). Conflicts between hunters who leave a harvested big game animal have occurred, but are largely undocumented unless a negative encounter results.

Determination of Effects

Grizzly bears are known to occasionally be present within the Main Boulder analysis area, but have rarely been recorded in the project vicinity (i.e. along or adjacent to the Main Boulder River outside the wilderness). Grizzly bears may be attracted to the project area in search of food or food smells associated with campgrounds, camps and residences; and there is a potential for bear-human conflicts. However, the activities associated with the planned project are not expected to increase the potential for these types of conflicts. All proposed project actions are within one-quarter mile of an existing county road. 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, and the fact that a portion of the project is within the PCA; it is determined that the project may affect, but is not likely to adversely affect the grizzly bear or its habitat. Concurrence with this determination from the US Fish and Wildlife Service was received in a letter dated May 13, 2004 (Located in the Project File). Consultation has remained open with the U.S. Fish and Wildlife Service regarding project development since their letter of concurrence.

Canada Lynx (Lynx Canadensis) – status: threatened

> **Indicator:** Directions for evaluating federal actions relative to lynx habitat conditions are provided in the Canada Lynx Conservation Assessment and Strategy (LCAS) (Ruediger et al. 2000). The project was evaluated for compliance with LCAS standards. To address LCAS habitat standards, effects to Canada lynx were evaluated by assessing project contribution to the proportion of unsuitable lynx habitat and impacts to lynx denning and foraging habitat.

The Canada lynx was listed as a threatened species under the ESA in March 2000. The lynx is a medium sized wildcat associated with forested environments. Lynx require a range of habitat conditions for survival and reproduction. Forest cover is preferred for travel, resting and hunting. In general, lynx habitation in the Gallatin National Forest is defined as coniferous forest in the elevation range between 6,000 and 8,800 feet with habitat types where spruce (Picea engelmannii), or subalpine fir (Abies lasiocarpa) are the indicated climax species. Moist Douglas-fir (Pseudotsuga menziesii), habitat types were also included as lynx habitat. Where habitat type information was not available, lynx habitat was mapped as coniferous forest in the same elevation range, with north, northeast or east exposure, or on level or rolling slopes that would hold enough moisture to produce a mesic environment.

Lynx denning habitat is typically associated with mature forest of complex structure, particularly in the form of course woody debris on the forest floor. Dead and down material and overhead cover present in older forest provides security and escape cover for lynx kittens (Reudiger et. al. 2000: 1-4). Foraging habitat is generally representative of those areas that are most likely to support year round use by the lynx's primary prey species, snowshoe hare (*Lepus americanus*).

Snowshoe hares select densely stocked forest stands with a high production of horizontal cover within approximately ten feet of the ground (Hodges 2000:184). These forest types provide hares security cover from predators, and contain abundant food in the form of stems and branches accessible to hares from the ground in summer and over snow accumulation in the winter. Optimal snowshoe hare habitat in the Main Boulder analysis area is best represented by densely stocked sapling to pole aged conifer stands. The Main Boulder Fuels reduction project involves seven lynx analysis units (LAU). The Contact Mountain LAU coincides with timber compartments 112 and 116. The Main Boulder LAU coincides with timber compartments 117 and 118. The Monument Peak LAU coincides with timber compartments 119, 120 and 121. The Carbonate Mountain LAU coincides with timber compartments 122 and 123. The Four Mile Creek LAU coincides with timber compartments 124 and 125. The Falls Creek LAU coincides with timber compartments 126 and 127; and the Mount Rae LAU coincides with timber compartments 128 and 129.

Canada Lynx – LCAS Standards
Directions for evaluating federal actions relative to lynx habitat conditions are provided in the Canada Lynx Conservation Assessment and Strategy (LCAS) (Ruediger et. al. 2000). The specific standards that apply to the Main Boulder fuels project are listed below:

- In the absence of guidance from a landscape scale assessment, limit disturbance within each LAU so that if more than 30% of lynx habitat is currently in unsuitable condition, no further reduction of suitable condition shall occur as a result of vegetation management activities by federal agencies (p. 7-3)
- Management actions (e.g. timber sales, salvage sales, fuels treatments) shall not change more than 15% of lynx habitat within a LAU to an unsuitable condition within a 10-year period (p.7-5).
- Within a LAU, maintain denning habitat in patches generally larger than 5 acres, comprising at least 10% of lynx habitat. Where less than 10% denning habitat is currently present within a LAU, defer management actions that would delay development of denning habitat structure (p. 7-4).

Canada Lynx – Proportion of Unsuitable Habitat

Affected Environment

Lynx habitat in an unsuitable condition includes those areas that have recently experienced some form of disturbance, either natural or man-caused, that severely reduced or eliminated forest cover. Such areas do not provide suitable foraging or denning opportunities for lynx, nor do they provide sufficient cover for lynx travel or resting purposes. Lynx habitat in the Main Boulder analysis area that is currently in an unsuitable condition is due to recent past timber and salvage harvest activity.

Seven LAUs are affected by the Main Boulder fuels reduction proposal. The Contact Mountain, Main Boulder and Monument Peak LAUs cover the eastern portion of the analysis area and the Carbonate Mountain, Four Mile Creek, Falls Creek and Mount Rae LAUs cover the western portion of the analysis area. Past timber harvest has been limited to scattered small sales and salvage and hazard tree harvest to remove and reduce Douglas fir beetle infestations. Total forest harvest for all management purposes in the analysis area, since 1982, amounts to approximately 209 acres. The analysis area covers an area approximately 135,825 acres in size, of which on average 82,770 (61%) meet LCAS criteria for lynx habitat. The Contact Mountain LAU covers 24,100 acres, of which 8,955 (37%) meet LCAS criteria for lynx habitat. The Main Boulder LAU is 12,400 acres in size, of which 5,533 (44%) meet LCAS criteria for lynx habitat.

The Monument Peak LAU is 24,400 acres in size, of which 9,390 (38%) meet LCAS criteria for lynx habitat. The Carbonate Mountain LAU is 21,500 acres in size, of which 8,625 (40%) meet LCAS criteria for lynx habitat. The Four Mile Creek LAU is 23,400 acres in size, of which 8,260

(35%) meet LCAS criteria for lynx habitat. The Falls Creek LAU is 16,900 acres in size, of which 4,712 (28%) meet LCAS criteria for lynx habitat. The Mount Rae LAU is 13,200 acres in size, of which 4,755 (36%) meet LCAS criteria for lynx habitat. Currently unsuitable conditions in all the represented LAUs represent less than 3% of the lynx habitat (2,100 acres). Furthermore, total proposed treatments across all units represent less than 2% of all lynx habitat currently in the analysis area.

Direct, Indirect and Cumulative Effects

Under the preferred alternative the total proposed treatment distributed across all treatment units represents potential impacts to less than 2% of mapped suitable lynx habitat. Furthermore, no single LAU will have more than 7% (approximately 360 acres in the Main Boulder LAU) of the suitable lynx habitat affected by proposed treatments. Most LAUs will only have between 1% and 5% of the suitable lynx acreage affected by proposed actions. Therefore, fuel reduction activities proposed in the project area would have no direct, indirect or cumulative effects on the proportion of lynx habitat in unsuitable condition. Since the preferred alternative does not have any affect on the proportion of unsuitable lynx habitat within the Main Boulder analysis area, the project is in compliance with the first and second LCAS standards listed above

Canada Lynx -- Denning Habitat

Affected Environment

Lynx denning habitat for the LAUs in the Main Boulder analysis area was estimated using GIS and standard mathematical conversions to identify forest types known to provide the overhead cover and course woody debris selected by lynx as denning habitat. These types consist of mature and old growth Douglas fir and lodgepole pine with at least 70% canopy closure, and pole-sized or older spruce/subalpine fir forest with canopy closure of 40% or greater.

There is approximately 32,638 acres of denning habitat in the analysis area representing 65% of the total lynx habitat in the area. No more than 6% of this habitat would be affected by proposed activities in any given LAU in the analysis area, except possibly in the Main Boulder LAU where as much as 13% may be affected. In addition, even though portions of proposed treatment units in each LAU are classified as lynx denning habitat, proximity to the Main Boulder road, recreational activities, residences and higher human activity and presence would likely preclude den site selection in these areas even if habitat were optimal for lynx.

Direct, Indirect and Cumulative Effects

Analyses revealed that lynx denning habitat LCAS criteria would be met or exceeded within every LAU in the Main Boulder analysis unit. Furthermore, where lynx denning habitat was identified in the analyses, its close proximity to recurring recreation activity and human presence would likely preclude use as denning habitat by lynx whether the areas are treated or left untreated. Therefore, direct effects to lynx denning habitat from the proposed action are negligible.

Indirect effects to lynx denning habitat would occur from the removal of live, dead and damaged trees that would eventually contribute to the course woody debris component important for future denning habitat. Portions of each treatment unit will be left untreated (Minimum 15 - 20% retention of untreated in each unit) and some dead and down material would be left on site after treatment, but the majority of this habitat component for future denning habitat would be removed from treatment units. However, because such a small portion of denning habitat will be affected in each LAU and abundant denning recruitment area persists outside the treatments within each LAU the indirect effects to lynx denning habitat are discountable.

Cumulative effects to lynx denning habitat in the Main Boulder analysis area are not expected to be a significant concern in the LAUs that make up the analysis area; because the agencies ability to affect change in any of these LAUs is limited because between 60% and 80% of each LAU is within the wilderness and exempt from active management decisions.

Canada Lynx – Foraging Habitat

Affected Environment

There are no specific standards in the LCAS relative to lynx foraging habitat. However, foraging habitat is an important component of lynx habitat, particularly its distribution relative to available denning habitat. Past harvest activities and natural processes of forest succession have produced the available foraging habitat within the Main Boulder analysis area. Foraging habitat was estimated using existing cover data to identify the proportions of younger, dense stands that would provide optimal forage and cover conditions for the lynx's primary prey species, snowshoe hare. Older forest habitat (excluding denning habitat so as not to over represent available lynx habitat) was also evaluated for potential to provide habitat for alternative prey species such as red squirrels (*Tamiasciurus hudsonicus*) and grouse.

Approximately 23,136 acres of foraging habitat currently exists in the Main Boulder analysis area, distributed relatively evenly across all of the LAUs in the planning area. Foraging habitat represents roughly 46% of the lynx habitat in all LAUs, and is relatively well distributed in proximity to available denning habitat. Approximately 75% of the treatment units are also expected to produce additional lynx foraging habitat over time. Managed wildfires and other stochastic events in conjunction with the proposed fuels treatment projects should be adequate to replace existing foraging habitat as trees grow out of reach for snowshoe hares.

Direct, Indirect and Cumulative Effects

The Main Boulder analysis area currently provides abundant lynx foraging habitat that is relatively well distributed across all of the LAUs in the analysis area. The proposed treatments may affect a small portion of lynx foraging habitat within some of the LAU's, but should not cause any permanent impact preventing the lynx from persisting and reproducing in the ecosystem. Regeneration could be negatively affected by treatment operations as some established seedlings would be trampled, crushed or torn up by foot travel, tree felling, tree skidding and construction of new temporary roads and skid trails for access to treatment units and tree removal. Although some seedlings may be killed or damaged and development of lynx foraging habitat may be slightly delayed, natural regeneration would proceed and treatment units would still likely contribute to lynx foraging habitat within 15 to 20 years after project completion. The portions of lynx habitat across all treatment units would also become available across a staggered period based on the timing of completion of treatments across a 5 to 7 year period.

Indirect effects to lynx foraging habitat may occur from increased recreational access to treatment areas, because of the reduction in physical barriers and more open situation after treatment. This could result in a delay in regeneration of seedlings and other habitat components. The potential for these indirect impacts will be minimized by an increase in signage and the installation of barriers at intersections of temporary roads and existing routes and where any undesired use occurs.

Cumulative effects to lynx foraging habitat include: impacts from adjacent private in-holdings, past fire suppression efforts, past harvest and wilderness designation. Impacts on private lands could range from similar fuels treatments around structures or in forested stands, prescribed burning in treated stands and construction of new permanent or temporary structures. All of these activities could result in a decrease in lynx foraging habitat. However, fuels treatments on private lands

could result in delayed benefits similar to the proposed treatments on National Forest. This could result in improved lynx foraging habitat within the 15-20 year window discussed earlier.

Past fire suppression efforts have reduced the amount of lynx foraging habitat within the Main Boulder analysis area that would have been established through natural processes. Past timber harvest has produced a small proportion of the lynx foraging habitat currently available in some of the LAUs affected by the proposed fuel reduction project. Designation of a large portion of the entire Main Boulder drainage has had the most profound effect on lynx foraging habitat by both protecting large expanses of habitat and limiting the options for harvest and fuels management.

Determination of Effects

Lynx are not currently known to be present within the Main Boulder Analysis area; however, lynx occurrence has been document just south of the planning area in the last 15 years through trapping records. The majority of all proposed activities would occur in an area adjacent to a maintained County road and an area of increasing and annual human presence. The project is not likely to have direct or indirect effects to lynx foraging or denning habitat as described above. All applicable standards in the LCAS would be met under each alternative for the project. Given the fact that the analysis areas represent a very large area that is primarily within designated wilderness, the likelihood of lynx inhabiting the area is relatively high, but also considering that the project has a minimal footprint within lynx habitat and meets all LCAS standards, it has been determined that the project may affect, but is not likely to adversely affect Canada lynx. Concurrence with this determination from the US Fish and Wildlife Service was received in a letter dated May 13, 2004 (Located in the Project File). Consultation has remained open with the U.S. Fish and Wildlife Service regarding project development since their letter of concurrence.

Bald Eagle (*Haliaeetus leucocephalus*) – Status: threatened

> **Indicator:** Effects to bald eagles were evaluated by assessing project impacts to bald eagle nesting habitat and foraging habitat.

The bald eagle is typically associated with large lakes (>80 aces) and major river courses (USDI 1994:2). They feed primarily on fish and carrion. Bald eagles are known to occur during both summer and winter along the Yellowstone River and the Boulder River in the first ten miles from its confluence with the Yellowstone River. The areas of known presence for nesting and wintering eagles are located approximately ten to twenty miles north of the project area. Within the project area eagles are only occasional winter visitors foraging on fish when open pools occur in the Boulder River and on carrion from winter killed or road killed ungulates.

Bald Eagle – Nesting Habitat

Affected Environment

The Main Boulder analysis area does not contain any large lakes to provide suitable nesting habitat for bald eagles, and there are no known nest sites along the Boulder River in the vicinity of the project.

Direct, Indirect and Cumulative Effects

Since the project area does not provide suitable nesting habitat for bald eagles, there would be no direct, indirect or cumulative effects to bald eagle nesting habitat under any of the project alternatives.

Bald Eagle – Foraging Habitat

Affected Environment

Bald eagles are rare fall and winter residents, but infrequently known to fish in the Boulder River and scavenge animal carcasses along the Main Boulder road in the vicinity of the proposed project. The river corridor and road run direct through the middle of the Main Boulder analysis area. There are fish in the Main Boulder River and some of its tributary streams and many suitable perch trees from which eagles might fish. Ungulate winter ranges in the Main Boulder corridor at lower elevations in the analysis area probably provide some carrion for bald eagles.

Direct, Indirect and Cumulative Effects

Limited harvest would occur up to 15 feet of the river (see mitigation measures) and retention mitigation guidelines have been incorporated that will insure that adequate number and distribution of perch trees are available for bald eagles. All treatments will be conducted during periods when bald eagles are unlikely to be present in the drainage. In the event that eagles are in an area of a treatment, there are numerous foraging sites and perches along the river corridor where eagles can disburse. Therefore, the project would have no direct, indirect or cumulative effects to bald eagle foraging habitat.

Determination of Effects

Since the project will not affect bald eagle nesting or foraging habitat, it has been determined that there would be **no effect** on bald eagles. Concurrence with this determination from the US Fish and Wildlife Service was received in a letter dated May 13, 2004 (Located in the Project File). Consultation has remained open with the U.S. Fish and Wildlife Service regarding project development since their letter of concurrence.

Gray Wolf (*Canis lupus*) – Status: endangered; nonessential, experimental population treated as 'proposed' outside of National Parks and Wildlife Refuges

> **Indicator:** Effects to gray wolves were evaluated by assessing project impacts to known den or rendezvous sites, and impacts to important prey areas such as big game winter range.

Gray wolves were reintroduced to the Greater Yellowstone Ecosystem in 1995 and 1996 as a non-essential, experimental population under the ESA. Since the original animals were released in Yellowstone National Park, they have begun to expand spread throughout the ecosystem as expected. Wolves have been observed on national forest lands in the Absaroka and Beartooth Mountain Ranges, and the Main Boulder analysis area is within the home range of an established wolf pack. There are likely some packs that have not been designated, because no large-scale trapping and radio-collaring effort has been conducted in the drainage to date. Two wolves were radio-collared in the Dry Fork area just north and east of the analysis area in 2003.

Gray wolves are habitat generalists, and make use of a wide variety of habitat types throughout the course of their lives. Management emphasis for gray wolves is directed at maintaining sustainable populations of gray wolf prey species, primarily ungulates. Maintaining the health and productivity of big game winter range is a primary objective of managing for wolf recovery.

Gray Wolf – Den or Rendezvous Sites

Affected Environment

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. There are no known wolf den or rendezvous sites in the Main Boulder analysis area at the present time.

Direct, Indirect or Cumulative Effects

Since there are no den or rendezvous sites in the Main Boulder analysis area, the project will have no direct, indirect or cumulative effects to these important reproductive sites.

Gray Wolf – Primary Prey Species

Affected Environment

Big Game ungulates provide the primary prey species for wolves. The Main Boulder analysis area provides year-round habitat for elk (*Cervus elaphus*), deer (*Odocoileus* spp.) and moose (*Alces alces*). Winter ranges for elk and deer are found throughout the analysis area where south and west exposure occurs. Moose are present at low densities throughout the project area in winter and sporadically during other seasons. 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 Main Boulder analysis area. The frequency and rates of traffic along the Main Boulder road is likely 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.

Direct, Indirect and Cumulative Effects

The proposed treatment activities would likely displace grazing and browsing ungulate prey species from the treatment areas. The project could also temporarily degrade forage conditions in the treatment units for wolf prey species by damaging grasses, shrubs and browse trees with logging and burning operations. New road construction would be kept to a minimum, with a maximum of less than 2 miles of new road required annually for the duration of the project to access treatment units. 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. Fuels reduction contractors would not be allowed on roads closed to the public except in the performance of duties directly related to the project; i.e. they would not be allowed to take passenger vehicles behind locked gates for personal recreation purposes.

Cumulative effects to wolf prey species include past vegetation management effects on habitat, effects from private lands and travel management practices. The Main Boulder analysis area is primarily wilderness, which has limited management activities and affected wildfire suppression response. For these reasons, much of the analysis area is mature and reaching a climax state; which provides more limited foraging habitat for ungulate prey species. Private lands activities have both a positive and negative impact on wolf ungulate prey. Many private landowners in the analysis area maintain pastures, irrigated land and more open landscapes that provide year-round forage for ungulates. However, the increased presence of humans and resulting activities may alter ungulate use patterns for some species, affecting there ability to forage on private and adjacent federal lands or causing stress during critical periods. Road densities have historically and presently been very low within the analysis area because the majority of the area is

designated as wilderness. However, the concentration of Main Boulder road and adjoining spur roads in the blend of non-wilderness federal private land along the Main Boulder River may affect ungulate distribution. Many ungulate preys are likely discouraged diurnally (during daylight hours) from using the better foraging areas in this corridor. The proposed treatments will increase the amount and distribution of ungulate foraging habitat and winter range. This may encourage wolves to expand their range into the analysis area and prey on the increased and more disbursed ungulate population.

Determination of Effects

Since the project is proposed adjacent to the home range of an established wolf pack, is likely part of the home range of an undesignated pack and could have minor effects on wolf prey species, it has been determined that the project may impact wolves, but is not likely to jeopardize the gray wolf population. Concurrence with this determination from the U.S. Fish and Wildlife Service was received in a letter dated May 13, 2004 (Located in the Project File). Consultation has remained open with the U.S. Fish and Wildlife Service regarding project development, since their letter of concurrence.

Issue 6B. Effects to Forest Service Sensitive Species

A Biological Evaluation (BE) is required to determine how a proposed action may affect any sensitive species. Sensitive species are those plants and animals identified by the Regional Forester for which population viability is of concern. Sensitive wildlife species on the Gallatin National Forest include trumpeter swan, harlequin duck, black-backed woodpecker, northern goshawk, peregrine falcon, flammulated owl, wolverine and western big-eared bat. The Main Boulder analysis area does not provide suitable habitat for trumpeter swan, so this species is not addressed for potential impacts from the proposed project.

Harlequin Duck (*Histrionicus histrionicus*)

> **Indicator:** Effects to harlequin ducks were addressed by evaluating project impacts to nesting and foraging habitat.

The harlequin duck is a member of the tribe Mergini (sea ducks) and is taxonomically related to eiders (*Somateria spp.*), scoter (*Mellanitta spp.*) and oldsquaw (*Clangula hyemalis*). This small sea duck has the unusual habit of using two very different habitat types during its annual migration and life cycle. During the winter it lives along the rocky coasts of northern California north throughout the Gulf of Alaska. There is also a separate eastern population on the Atlantic seaboard ranging from Cape Cod to Newfoundland. During the summer breeding season harlequins migrate inland to cold fast flowing streams and rivers. They nest on rocky or rubble-strewn banks or preferably on small gravel bars or boulders within the river or stream course. Harlequins feed almost entirely on macro invertebrates during the breeding season that are attached to rocks and boulders in streams and rivers. Typically harlequin ducks arrive on breeding areas already paired with mates. Although, some unpaired adults and juveniles may follow pairs to breeding streams.

Harlequin Duck – Nesting and Foraging Habitat

Affected Environment

On the Big Timber Ranger District, the only known areas harlequin ducks breed are on the upper reaches of the Main Boulder River. They typically arrive in mid to late April, breed, and produce offspring usually by the beginning of July, but may not fledge young until August or September. During their time on breeding areas, harlequins rarely leave the river or stream corridor and only

leave the water to sit on egg clutches or bask on rocks and gravel bars (Personal Observation). There are currently estimated to be 5 to 10 pairs of harlequin ducks present annually on the Main Boulder River (based on annual surveys). Nesting habitat for harlequin ducks is present with the Main Boulder analysis area and in the project area, although habitat for this species is limited to the river corridor and does not extend on to adjacent land areas where treatments are proposed. Adequate foraging habitat is present in the Main Boulder River and some tributaries. Foraging habitat is comprised of rocks boulders and gravel substrate that provides adequate substrate and oxygenation in which macro invertebrate populations can thrive and persist.

Direct, Indirect and Cumulative Effects

Harlequin duck nesting habitat is present in the Main Boulder analysis area and within the proposed project area. Proposed treatments are not likely to impact these nesting areas because all known nest are located on gravel bars and debris piles within the watercourse. Furthermore, mitigations have been incorporated that provide for buffering and retention of trees and snags along the river and tributaries. In addition, treatment timing restrictions between April and November would provide protections against potential impacts to nesting harlequin ducks. Treatment activities may affect nesting of harlequin ducks, but again mitigations for buffers and timing restriction should limit any potential impacts. Protections provided for nesting habitat would also provide for harlequin foraging habitat.

Indirect effects to harlequin ducks may result from changes in river hydrology and ecology, however by implementing design criteria and mitigation, increased sediment and water quality impacts are not expected to result from treatment activities. Mitigations incorporated in to project specifications that limit activity within 15 feet of the river or streams should eliminate any impacts from this source. Cumulative effects from past, current and future human presence and recreation could impact nesting, but unless a significant increase in these activities is realized cumulative effects should be negligible.

Determination of Effects

The project would not remove or alter existing harlequin duck nesting or foraging habitat, and adequate habitat remains in the analysis area to provide resources for multiple pairs of harlequin ducks. The project may have minor disturbance effects, and/or indirect effects on harlequin nesting and foraging habitat, therefore it has been determined that the project may impact individuals or habitat, but would not lead to a trend toward federal listing of harlequin ducks.

Black-backed Woodpecker (*Picoides arcticus)*

> **Indicator:** Effects to black-backed woodpecker were addressed by evaluating project impacts to nesting and foraging habitat.

The black-backed woodpecker is an insectivorous bird that inhabits the boreal and montane forests of North America. This bird is highly adapted to fire as a natural disturbance process, as evidenced by the soot-colored plumage of its solid black back, which provides excellent camouflage as the bird forages on charred trees (Dixon and Saab 2000). Black-backs key in on early post-fire coniferous forest habitat in search of insects that feed upon dead and dying trees in burned areas. Hutto (1995) described the black-backed woodpecker as more restricted to burned forest habitat than any other forest bird species thought to be dependent upon any particular vegetative cover type in the northern Rockies. The black-back is primarily a sedentary species; i.e. it does not migrate seasonally, and may stay in the area of a particular burn as long as the insects upon which it feeds remain abundant (Dixon and Saab 2000). Woodpecker populations generally occupy burned areas for 1-6 years post fire, with peak densities occurring at 3-4 years after the fire (Caton 1996).

Black-backed Woodpecker – Nesting Habitat

Affected environment

Like most woodpeckers, the black-backed is a primary cavity nester, meaning that it excavates a hole in a tree for its nest site. Nests are typically built in sapwood, which decays more quickly than heartwood. Both live and dead trees are used for nesting, although the majority of nests are found in snags, possibly due to the thicker sapwood layer found in dead trees (Dixon and Saab 2000). Various tree species are used for nests including Douglas-fir, and lodgepole pine, which are common in the project area. Black-backs and other woodpeckers are most abundant in habitat that contains a high density of snags (Hoffman 1997:4).

Direct, Indirect and Cumulative Effects

There are no recently burned forest stands within the project area. The nearest recently burned area in proximity of the project location large enough to support the presence of black-backed woodpeckers is approximately six miles to the south and east in the 2001 Monument Fire perimeter (approx. 1,200 acres). The likelihood of black-backs occupying snag tree for nesting in the project area is negligible. Proposed prescribed burning may individually torch particular trees creating potential habitat for the species, but unless large expanses of forest are charred it is unlikely that black-backs would be attracted into the project or analysis area. Because adequate habitat is not present or expected to be created in the project area, no indirect or cumulative effects are expected as a result of project activities.

Black-backed Woodpecker –Foraging Habitat:

Affected Environment

Black-backed woodpeckers seek out recently burned forest for the abundance of insects associated with dead and dying trees. Black-backs feed mainly on larvae of wood-boring beetles of the *Ceramycidae and Buprestidae* families, engraver beetles and mountain pine beetles (*Dendroctonus ponderosae*) (Dixon and Saab 2000:4). Live and dead trees infested with insects are used as foraging sites, but standing dead trees were used 99% of the time in a study of black-backs in burn forest (Kreisel and Stein 1999). Smaller diameter trees may be used in foraging as opposed to nesting. Foraging habitat for black-backs in the project area is limited because no large scale burned areas are present within the project area. There is an abundance of dead and dying trees as a result of Douglas-fir beetle infestation. Approximately twenty to thirty percent of the mature trees in the analysis area are estimated to be infected and either dead or dying from this forest pest. Black-backs may be utilizing these areas to forage, but were not detected during surveys. (Surveys conducted by Curran Johnson, Bio. Tech., in spring/summer 2001, reports on file at Big Timber Ranger District Gallatin N.F.)

Direct, Indirect and Cumulative Effects

Fuel reduction activities and prescribed fire activities in the project area may remove some black-backed woodpecker foraging habitat. However, because there are no large-scale burned areas in the vicinity of the project, woodpeckers are not likely to be present. Furthermore, the large area of beetle-killed Douglas fir, even if black-backs are attracted to these areas, would not be negatively affected by project actions because there are many more acres of this infestation that are located in the wilderness adjacent to the project that will not be treated. For these reasons, the likelihood that these activities would have a detrimental effect on any black-backs in the area, are negligible. Because black-backed woodpeckers are not likely to be present in the project area, no indirect or cumulative effects to foraging habitat are expected.

Determination of effect

There are no direct, indirect, or cumulative effects to black-backed woodpecker nesting or foraging habitat expected in the Main Boulder project or analysis area. Furthermore, there are no large-scale burned areas in the vicinity of the project area that would attract black-backed woodpeckers near to the project area. Therefore, it has been determined that the proposed action may impact individuals or habitat, but would not lead to a trend toward federal listing of the black-backed woodpecker.

Northern Goshawk (*Accipiter gentilis*)

> **Indicator:** Effects to northern goshawks were addressed by evaluating project impacts to nesting and foraging habitat.

A member of the accipiter family of forest hawks, the goshawk is dependent on forested habitat for nesting, fledging young and foraging habitat. On the Big Timber Ranger District, goshawk nest are typically found at lower elevations (less than 7,500 feet), in mature to old growth, closed-canopy Douglas-fir, lodgepole pine and spruce/subalpine fir types on gentle to moderate slopes. In particular many nest locations are located in tributary drainages off of larger water courses and are usually located at least one half mile from developed roads or permanent structures. Minimum patch size for goshawk nest sites is 25 acres, with a patch of at least 125 acres considered optimal (Warren 1990:23). Younger forests (pole sized and larger trees), including small openings, can provide suitable foraging habitat. Goshawks typically occupy a home range of approximately 6,000 acres during the nesting season. The home range includes nesting, post-fledging and foraging habitat and may include a variety of successional stages (Reynolds et. al. 1992:21-27).

Northern Goshawk – Nesting Habitat

Affected Environment

Suitable nesting habitat for goshawks is provided in the larger patches of mature to old growth forests in the Main Boulder analysis area. The better habitat is concentrated in the upper or southern most treatment units (Units 14 thru 32). However, there are no known or recently active nest locations within the project area. Goshawks have been sited in the vicinity of the proposed project, but surveys in the area have not resulted in the discovery of any active nests. There is speculation that these birds are occupying nests in side drainages in the wilderness where access and detection are difficult.

Direct, Indirect and Cumulative Effects

Proposed treatments within the Main Boulder Project Area will remove and alter some mature and old-growth forest that could be suitable for goshawk nesting. Mitigations have been included in the project and contractor standards that were designed to protect and buffer any active raptor nest. Specifically, no activity would be permitted within one-quarter mile of any active goshawk nest between March 1 and June 31 and a 100-foot buffer would be retained around the nest tree during treatment of the unit. Indirectly, the proposed treatments may cause goshawks to abandon particular nest sites in future years. However, goshawks normally have up to 5 alternate nests constructed on any given territory and nests located further from the Main Boulder road and higher levels of traffic and human presence would likely improve nest success and reduce disturbance. Cumulative effects to goshawk nesting are not expected because there is abundant nesting habitat immediately adjacent to project treatment areas. Most of the suitable goshawk nesting habitat is located in the wilderness, which would further reduce the potential for any impacts. Furthermore, the threat of wildfire would be reduce after treatments are completed providing more protection for remaining nesting habitat and reducing the threat of a catastrophic wildfire event.

Northern Goshawk – Foraging Habitat

Affected Environment

The Main Boulder analysis area contains suitable foraging habitat that is well distributed relative to goshawk nesting habitat. Goshawks hunt for small mammals and medium to large sized birds, typically in closed canopy forest (Graham et. al. 1999:5). They prefer a more open forest understory to provide for maximum flight maneuvering and prey visibility. Goshawks may also hunt forest openings for prey, typically from perch trees along the forest edge (Graham et. al. 1999:5). Many common goshawk prey species include the American robin (*Turdus migratorius*), Steller's Jay (*Cyanocitta auratus*), northern flicker (*Colaptes auratus*), and blue grouse (*Dendragapus obscurus*) are relatively abundant following recent burning and forest successional management (Graham et. al. 1999:5, Hutto 1995).

Direct, Indirect and Cumulative Effects

The project will temporarily alter and may remove some goshawk habitat. Northern goshawks on the Gallatin National Forest rely on mixed conifer and aspen habitat with relatively closed canopy conditions for foraging. Proposed treatments may remove some over-story cover and reduce forest understory to such an extent that it may discourage use of these sites by goshawk prey species. Goshawks may not use these sites for several years until regeneration reaches a stage where prey species return in relative abundance. However, the prescriptions for treatment and accompanying prescribed burning in certain units should enhance goshawk foraging habitat over time. Treatment operations may preclude goshawks from foraging in or near units under treatment, but abundant alternate foraging habitat will be present both during and after the project is completed.

Indirect effects to goshawk foraging habitat could occur through the alteration post treatment habitat for some goshawk prey species. Prescriptions allow for the removal of some snags (Forest Plan snag retention guidelines will be adhered to) that provide nest sites and insect prey for a number of goshawk prey species.

Cumulative effects to goshawk foraging habitat include private land activities, past timber management activities and past fire suppression efforts. Goshawks tend to avoid areas where human presence and activities are present. Most goshawk nests are located in patches of mature forest where structure and human presence does not occur. There are no known goshawk nests located on private lands within the analysis area. Past timber management has resulted in the removal of suitable foraging habitat in some areas. Fire suppression efforts, particularly in Douglas-fir habitat, have precluded some potential low intensity ground fires that would have produced the open stand condition favored by goshawks.

Determination of Effects

The project will remove or alter some existing goshawk nesting and foraging habitat. However, adequate nesting and foraging habitat is abundant in adjacent untreated areas primarily in wilderness. Treatment may also result in improved goshawk foraging habitat that is exhibited by more open understory characteristics favored by goshawks. The project may have minor disturbance effects, and/or indirect effects on goshawk nesting or foraging habitat, therefore it has been determined that the project may impact individuals, but would not lead to a trend toward federal listing of northern goshawks.

Peregrine Falcon (*Falco peregrinus*)

Indicator: effects to peregrine falcons were addressed by evaluating project impacts to

nesting and foraging habitat.

The peregrine falcon was delisted; i.e. removed from the Endangered Species List, in August 1999 and is now treated as a sensitive species by the Forest Service. The peregrine is a predatory bird that feeds almost exclusively on other avian species. Peregrines nest in cliff and rock formations typically associated with hydrographic features such as rivers and lakes. Riparian habitat and open meadows are preferred hunting areas for peregrines.

Peregrine Falcon – Nesting Habitat

Affected Environment

In 1989 three juvenile peregrine falcons were hacked from a site on Tepee Mountain located within the analysis area. Hacking involves feeding young in a box on location and eventually releasing these birds for their first flight. This process allows birds to develop an affinity for the location and hopefully return to the site in subsequent years to attempt reproduction. There have been numerous sightings of individual peregrine falcons in the Main Boulder drainage since this attempted reintroduction, but no successful reproduction or nesting has been confirmed either at the original hack site or any alternate nesting location. Though, there are several cliff and rock formations in the Main Boulder analysis area that may provide suitable nesting sites for peregrine falcons.

Direct, Indirect and Cumulative Effects

The Peregrine Falcon Recovery Plan recommends that no human activity be allowed within one-half mile of occupied nesting sites (USDI 1984:88). Because there are no past or presently occupied nest sites in the analysis area and none of the proposed treatments would extend into the cliff and rock formations, which could provide suitable nesting sites, the project would be in compliance with this recommendation. There are no indirect or cumulative effects to peregrine falcon nesting habitat anticipated from the proposed action.

Peregrine Falcons – Foraging Habitat

Affected Environment

The Main Boulder analysis area provides some suitable foraging habitat (i.e. open meadows and riparian areas) for peregrine falcons, and the project site is well within the foraging distance for birds from the historic hack site and other suitable cliff nesting sites. Peregrines feed almost exclusively on other birds. Hutto (1995) found many bird species to be relatively abundant in recently burned or harvested areas. Common prey species for peregrines include black birds, jays, doves, shorebirds, ducks and many smaller songbirds (USDI 1984:8), all of which have been detected in early postfire and early successional forest habitat (Hutto 1995). The Main Boulder fuels treatment, when they are completed, will likely provide improved peregrine foraging habitat into the future and may encourage a peregrine pair to occupy nesting habitat that is available in the area.

Direct, Indirect and Cumulative Effects

Because peregrine falcons are not known to occupy any of the suitable nesting areas and are likely only temporary or transient residents in the analysis area; no direct, indirect or cumulative effects on peregrine falcon foraging habitat are expected from the project. Beneficial effects to peregrine foraging and nesting habitat may be realized after the project is completed and falcons discover improved foraging in the area.

Determination of Effects

Given the history of peregrine falcons hacking in the analysis area and the possibility that peregrines will one day nest and reproduce and utilize the project area; they were considered in this analysis. However, because they have no past or present history of occupying nesting habitat or attempting reproduction, it has been determined that the project would have no effect on individuals or habitat, and would not lead to a trend toward federal re-listing of peregrine falcons.

Flammulated Owls (*Otus flammeolus*)

> **Indicator:** Effects to flammulated owls were addressed by evaluating project impacts to nesting and foraging habitat.

Flammulated owls are small, migratory owls that inhabit dry open forest types. These birds show a strong preference for yellow pines, particularly Ponderosa pine (*Pinus ponderosa*) for nesting habitat, although Douglas-fir and aspen (*Populus tremuloides*) may be used as well (McCallum 1994:22). Flammulated owls feed exclusively at night. They hunt primarily insects, which they capture aerially, glean from foliage, or take from the ground (McCallum 1994:27).

Flammulated Owl – Nesting Habitat

Affected Environment

There is no Ponderosa pine present in the Main Boulder analysis area, but there is abundant mature Douglas-fir and aspen scattered throughout the project and analysis area. There have been several surveys conducted for flammulated owls in the Main boulder watershed in recent years. Approximately fifteen miles of linear survey route have been conducted in search of owls. Playback tapes of flammulated owl calls were the method of detection employed in these surveys. There were no positive detections from any of the surveys conducted.

Direct, Indirect and Cumulative Effects

Proposed fuel reduction treatments may remove or alter some suitable nesting habitat for flammulated owls, but owls are not known to be present and resulting habitats may also improve habitats and encourage owl occupancy. Furthermore, flammulated owls tend to be very tolerant of humans and are known to nest near human developments. Effects from mechanized disturbance are not well documented, but McCallum (1994:41) suggests that any type of moderate disturbance levels should not have adverse impacts on the species. Therefore, there should be no direct, indirect or cumulative effects to nesting habitat resulting from the project.

Flammulated Owl – Foraging Habitat

Affected Environment

Foraging habitat for flammulated owls is represented by forest stands with low to medium stem density and a high ground cover of grasses and shrubs (Goggans 1986). Forest/grassland edges are preferred foraging habitat (McCallum 1994:24).

Direct, Indirect and Cumulative Effects

Fuels treatment would likely affect all proposed units in a positive manner with regard to flammulated owl foraging habitat. Currently, almost all units in the project area have high stem densities. The proposed prescriptions would actually improve foraging habitat after treatment, by providing optimal open forest conditions. No disturbance effects are anticipated, since treatment operations would occur during daylight hours, and flammulated owls hunt exclusively at night.

Indirect effects to foraging habitat could result from delayed regeneration of grass/forb/shrub understory habitat, if sprouting plants are damaged by equipment and/or compaction. In addition, the potential for noxious weed infestation could indirectly affect foraging habitat for owls.
Cumulative effects to flammulated owl foraging habitat involve past timber management in the project area. Past timber harvest in the area has been limited in scope, but has potentially removed some suitable foraging habitat and may have had short term damaging effects to grass and shrub foraging habitat along forest edges. However, past harvest has also likely created or improved foraging habitat for flammulated owls in some areas by opening up the tree canopy and reducing stem density, which would stimulate shrub and grass growth.

Determination of Effect

Given the flammulated owls strong preference for grassland/forest edge foraging habitat, and the potential for some minor damage to some foraging habitat in close proximity to suitable nesting, it has been determined that the project may impact individuals, but would not lead to a trend toward federal listing of flammulated owls.

Wolverine (*Gulo gulo*)

> **Indicator:** Effects to wolverine were addressed by evaluating project impacts to denning and foraging habitat.

Wolverines are medium sized forest carnivores about which relatively little is known. They are secretive and thought to stay in forest cover as much as possible. Although wolverines are powerful carnivores capable of taking down prey animals much larger than themselves, they are opportunistic omnivores with a generalists foraging strategy that includes scavenging animal carrion, feeding on berries and insect larvae, as well as direct predation of small, medium and large mammals and birds (Banci 1994:113). All wolverines tend to avoid humans, and females with young are particularly sensitive to human disturbance. Females den 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 (Copeland 1996:94-95). Wolverines have not been documented in the Main Boulder analysis area, but are likely to occur at higher elevations in wilderness habitats.

Wolverine – Denning Habitat

Affected Environment

Wolverine denning habitat is present within the Main Boulder analysis area. Although there may be suitable denning areas in the project area, the proximity of roads and human activity would render this habitat unsuitable. Therefore, there is no suitable denning habitat in the project area.

Direct, Indirect and Cumulative Effects

Proposed fuel reduction treatments would not alter or remove any suitable wolverine denning habitat. Wolverines den in the winter (Banci 1994:110). Some treatment operations may occur in the winter denning period but the majority of activities would occur in fall and spring. Further, optimal wolverine denning areas are located in wilderness a suitable distance from any treatment units that no disturbance is expected. Therefore, the project would have no direct, indirect or cumulative effects to wolverine denning habitat.

Wolverine – Foraging Habitat

Affected Environment

Generally, wolverines are opportunistic omnivores in summer and primarily scavengers during winter (Banci 1994:111). Since wolverines are basically habitat generalists with an opportunistic foraging strategy, it is difficult to define foraging habitat. A study by Hornocker and Hash (1981) of wolverines in Montana indicated a preference for mature to intermediate forest types. The Main Boulder analysis area provides many food items common in the wolverine's diet, including small, medium and large prey animals, winter range for carrion, insects, berries and bird eggs. Although the project area proximity to human occupation and linear orientation along the Main Boulder River corridor where relatively consistent activity occurs when wolverines are not denning, may preclude wolverines from foraging in the project area because of their shy nature. In general, the proposed treatments may cause some short-term impacts to wolverine foraging, but would likely improve habitat for wolverine prey species and other food sources in the long term.

Direct, Indirect and Cumulative Effects

Fuels treatment activities would alter the habitat of numerous wolverine prey species including small mammals, birds and insects, potentially reducing populations of some species within the project area. In addition, disturbance associated with mechanized equipment and increased human presence associated with the project could preclude wolverine foraging activities in the area. Wolverines could still forage in the area at night and in adjacent wilderness, but sensitivity to human presence could cause wolverines to avoid the area all together during project implementation.

Indirect effects could result from reduced populations of some prey species. Removal of snags and logs could alter habitat, so as to potentially reduce populations of some bird and small mammal species in years following treatment. However, the opposite effect could also be realized with increases in some species of small and large mammals and bird species associated with more open forest canopy structure. The project would also reduce cover; e.g. snags, down logs and other woody debris, for wolverines foraging in the area in subsequent years.

Cumulative effects to wolverine foraging habitat would result from actions on adjacent private lands and from past timber harvest. Private land activities themselves are not expected to encompass large acreage of additional habitat alteration, but the human presence by itself may alter or preclude wolverine foraging in these areas. Past timber harvest activities in the area have removed habitat suitable for wolverine foraging and altered the structure and capability of foraging habitat.

Determination of Effects

Wolverines are likely to be present in the Main Boulder analysis area, and may be present but are not expected in the project area. However, because there is potential for some disturbance and minor impacts on wolverine foraging habitat associated with the proposed action, it has been determined that the project may impact individuals or habitat, but would not lead to a trend toward federal listing of wolverines.

Western Big-eared Bat (*Plecotus townsendii)*

> **Indicator:** Effects to western big-eared bats were addressed by evaluating project impacts to roosting and foraging habitat.

The western big-eared bat occurs in a variety of habitats, although its distribution is correlated to the availability of suitable caves for roosting (IDFG 1995:2). Caves and abandoned mineshafts serve as daytime roosts and winter hibernacula (Kunz and Martin 1982). Female bats congregate in warmer areas of the roost ceiling to form maternity colonies (Finch 1992:17). This bat species feeds almost exclusively on moths. They hunt along forest edges at night and

capture most of their prey from the air using echolocation, although they are also capable of gleaning insects from foliage (IDGF 1995:6-7).

Western Big-eared Bat – Roosting Habitat

Affected Environment

There are a few known caves in the Main Boulder analysis area that could provide roosting habitat for bats; however, there are no known occurrences of bats inhabiting these caves. In 1992, the Gallatin National Forest contracted a survey of cave sites on the Forest. This survey, which included caves located in the Main Boulder Analysis area, resulted in no positive detection of bat species or evidence of bat occupation of any cave located on the Forest. There were no signs of bats; e.g. guano, carcasses, etc. in the caves.

Direct, Indirect and Cumulative Effects

There are no known caves that might support bat roosting area within or near the Main Boulder Fuel Reduction Project, so the project should have no direct, indirect or cumulative effects on bat roosting habitat.

Western Big-eared Bat – Foraging Habitat

Affected Environment

The western big-eared bat tends to select for edge habitats between streams and mountain slopes, where riparian vegetation may be an important component of foraging habitat (Clark et. al. 1993). Riparian habitat and forest edges are abundant in the Main Boulder analysis area.

Direct, Indirect and Cumulative Effects

Riparian habitat would not be affected by the proposed fuel reduction treatments. Some forest edge habitat would be altered, but additional forest edge would be created by proposed treatments. Disturbance should not be a factor, since western big-eared bats are active nocturnally and no activities are proposed within one-half mile of any known roost location. Therefore, because western big-eared bats are not known or expected to be present in the area and any potential impacts to bat foraging are considered negligible no direct, indirect or cumulative effects to bat foraging habitat are expected.

Determination of Effect

The project would have no effect on roosting habitat and although there could be minor effects on forest edge foraging habitat, impacts to prey population would be negligible. Therefore, the project would have no impact on western big-eared bats.

Sensitive Plant Species

> **Indicator:** Effects to sensitive plant species were addressed by evaluating project impacts to sensitive plant populations and habitats that could support sensitive plant species.

Sensitive Plant Species – Populations

Affected Environment

Sensitive plant surveys were conducted in the Main Boulder corridor in 2002. Surveys contracted to a certified botanist and conducted at random and at habitat specific sites through the area of the proposed fuels treatments in the main Boulder analysis area. No sensitive plant species were

found in any of the areas proposed for fuel treatment.

Direct, Indirect and Cumulative Effects

Since no sensitive plant populations were found in any of the areas proposed for fuel treatment, there would be no direct, indirect or cumulative impacts from the proposed project.

Sensitive plant Species – Habitat

Affected Environment

Most sensitive plant species on the Gallatin National Forest are associated with relatively undisturbed, and often fragile, environments such as alpine areas and riparian habitat. Proposed fuel reduction treatment units are in an area where disturbance from various sources has occurred since settlers came to Montana. In addition, there are no known populations of any sensitive plant populations and riparian habitat in the project area will have very limited disturbance and specific mitigation measures have been incorporated to protect these habitats. There are no alpine habitats located in the project area.

Direct, Indirect and Cumulative Effects

The proposed fuel reduction in areas that have been consistently disturbed since settlement of the area; where sensitive plants are not expected to occur. Riparian impacts would be limited and no alpine habitat would be affected. All new temporary roads will be located in areas that avoid potential impact with sensitive species. Therefore, the project would have no direct, indirect or cumulative effects on known or expected sensitive plant habitat.

Determination of Effects

Since the project is proposed in an area with consistent disturbance, no riparian or alpine habitat would be affected, and surveys failed to detect any sensitive plants in or around proposed treatment units, the project would have **no impact** on sensitive plant species.

Issue 6C. Effects to Management Indicator Species

Management indicator species (MIS) are wildlife species whose habitat is most likely to be affected by forest management practices, thereby serving as indicators of habitat change. Five terrestrial MIS are identified for the Gallatin National Forest (USDA 1987:11-19), including grizzly bear, bald eagle, northern goshawk, American marten and elk. The first three of these MIS have been addressed in previous sections for threatened and sensitive species. Marten and elk will be addressed in the following section.

American Marten (*Martes Americana*)

> **Indicator:** Effects to martens were evaluated by assessing project impacts to denning and foraging habitat.

The American marten is a MIS for mesic old growth habitat on the Gallatin National Forest. These small forest carnivores select cool, moist, mature and old growth forest for the majority of their habitat needs. Spruce and subalpine fir cover types provide high quality habitat for martens, based on the capacity to produce large amounts of course woody debris and the corresponding structure preferred by martens. Douglas-fir and lodgepole pine also provide marten habitat in cool moist sites. Martens select habitat for availability of den sites and foraging opportunities, both of which are associated with snags and down trees.

Marten – Denning Habitat

Affected Environment

Forest carnivore surveys have indicated that marten are present within the Main Boulder analysis area. Female martens use den sites for bearing (natal dens) and raising (maternal dens) their young. Live trees, snags, logs and rocks provide the majority of den structures. Den sites associated with trees, snags and logs are typically in large boles characteristic of mature old growth forest successional stages (Buskirk and Ruggiero 1994:17). The Main Boulder analysis area includes a large proportion of mature or older forest. Mature and old growth forests in moist habitat types that provide marten denning sites represent approximately 40% of the analysis area.

Direct Indirect and Cumulative Effects

Martens appear to prefer late successional forest types over other forest structure, but evidence also suggest that they will utilize habitats in proportion to their availability in an area. Further, the most prominent feature in marten habitat appears to be a requirement for course woody debris structure at or near the ground (Buskirk and Ruggiero 1994:22). The Main Boulder analysis areas currently provides and abundance of marten denning habitat. In fact, the purpose and need for the project are a direct result of an overabundance of both heavy and fine fuels that have accumulated in the project area. The proposed fuel treatment will remove and alter forest structure and remove some potential marten denning habitat. However, there will be abundant marten denning habitat within one-quarter mile of any of the proposed treatment units adjacent to the project area. There is little information regarding marten response to disturbance from noise and activity associated with use of mechanical equipment, harvest activities or increased human presence. Kits are born in March or April and stay with their mother until late summer (Buskirk and Ruggiero 1994:7), so spring and early summer treatments could potentially result in maternal den abandonment. Given the timing of some proposed treatments in spring and summer, kits might be mobile, but movement from established den sites could increase kit vulnerability to predation, direct impact to maternal dens, exposure or other factors.

Indirect effects of the proposed action would occur as a result of habitat alteration. Course woody debris is an important component of marten denning habitat Martens are closely associated with late successional stage forest, but might use younger forest stands with large amounts of dead woody material. Fuels treatments will reduce the amount of course woody debris and the amount of snags and live trees available for recruitment for potential future denning habitat.
Cumulative effects to marten denning habitat in the Main Boulder analysis area include past timber management practices and fire suppression efforts. Past timber management has reduced the amount of available denning habitat through the removal of mature and old growth forest types. Old growth in all compartments is well above the Forest Plan standard of 10% in the project and analysis areas. Old Growth habitat is important to martens in terms of providing large amounts of course woody debris materials. Timber harvest not only removes the forest canopy that provides cover and foraging opportunities for martens, but also typically leaves behind far less dead standing and down woody material than remains after a fire or other natural disturbances. Past fire suppression efforts have likely protected large tracts of existing marten habitat, while at the same time, reduced the amount of snags and logs in the Main Boulder analysis area. In fact, in much of the area habitat that may be considered optimal marten habitat may not be present now, if a more natural fire regime was historically allowed.

Marten – Foraging Habitat

Affected Environment

Although martens are capable of killing prey both larger and smaller than themselves, they also make use of carrion, bird eggs, berries and insects (Buskirk and Ruggiero 1994:18). Primary marten prey species are most abundant in mature forest (e.g. red-backed voles *Clethrionomys* spp. and red squirrels *Tamiasciurus hudsonicus*) and moist meadows or riparian habitat (e.g. meadow voles *Microtus* spp.).

Direct, Indirect and Cumulative Effects

The proposed fuels treatments will likely have some lasting impacts on the number and distribution of marten prey species in the project area. However, abundant habitat and associated prey species will remain in the analysis area within one-quarter mile of all treatment units, but within the treated area it is unlikely that martens will use resulting habitats.

Indirect effects to foraging habitat would result from removal of mature live trees, snags, and woody debris; which would eventually provide the recruitment of required forest structure that provides habitat for marten prey species. Martens also depend on down woody materials to provide access for hunting prey animals beneath the snow. Berry production could potentially be postponed by damage to sprouting shrubs from treatment operations. However, along treatment boundaries where mature forest edges are created by treatment, increased light to the forest floor may stimulate increase shrub production and availability of meadow prey species.

Cumulative effects to marten foraging habitat are similar as described above for marten denning habitat, and are mostly related to the removal of mature trees, dead trees and snags, which would eventually contribute course woody debris for martens to use as den sites, resting areas, and foraging habitat.

Elk (*Cervus elaphus*)

> **Indicator:** Effects to elk were addressed by evaluating project impacts to elk cover and forage availability.

The Forest Plan has designated elk as a MIS for big game habitat (USDA 1987:11-19) under the premise that by managing for productive elk habitat, we will be managing for most big game species. Elk are common throughout the Main Boulder analysis area, but are not frequently present in the habitat adjacent to the Main Boulder road where the project area is oriented except during winter. Lower elevation (less than 7,500 feet) south and west facing slopes provide winter range for ungulates, while higher elevations provide spring, summer and fall range. Elk habitat was evaluated in terms of providing cover and forage needs. Project effects were evaluated for changes to elk habitat relative to security and vulnerability.

Elk – Hiding and Thermal Cover

Affected Environment

Hiding cover provides security from potential predators, and thermal cover is used to regulate body temperature from overheating in summer and from chilling in winter. The Main Boulder analysis area provides suitable hiding and thermal cover in mature, closed-canopy forest habitat.

Direct, Indirect and Cumulative Effects

Proposed fuel treatments will remove some mature forest and open the forest canopy. This will likely make some portions of treatment units unsuitable for hiding and security cover, but there are mitigation measures that have been incorporated into all prescriptions that provide for the retention of forest patches (15 - 20% of each unit will be left in patches that are a minimum of 30-50 foot in diameter and are irregular in shape) that will provide some measure of hiding and thermal cover for elk. In addition, abundant hiding and thermal cover will be available for elk within one-quarter mile or less from all treatment areas.

Indirect effects to elk hiding and thermal cover involve the potential seasonal displacement of elk from cover that is currently available, into areas of cover that may be less suitable to feel secure or properly regulate body temperatures. Although, it is expected that adjacent habitat will meet the requirement of elk currently using the project area, primarily for winter range.

Cumulative effects to elk hiding and thermal cover in the Main Boulder analysis area include past timber management and fire suppression efforts. Past timber management likely reduced the amount of hiding and thermal cover for elk in portions of the area. Fire suppression efforts have affected the forest structure and may have contributed to an abundance of mature forest type fewer stands in younger age classes. Dense young forest stands may provide a component of hiding and thermal cover that is currently lacking or deficient in the analysis area.

Elk – Foraging Habitat

Affected Environment

Elk are herbivorous ungulates that depend on grasses, forbs and other herbaceous plants in summer, and browse and woody plants during late fall, winter and spring. The Main Boulder analysis area provides elk foraging habitat in natural meadows, forest openings, deciduous shrub lands, and recently disturbed areas where the forest canopy has been removed. Adjacent private in-holdings in the analysis area are primarily pasture and more open landscapes that provide additional elk foraging areas.

Direct, Indirect and Cumulative Effects

The proposed project would impact elk foraging habitat in treatment units by damaging herbaceous plants and shrubs. Disturbance effects from treatment activities and increased traffic on roads can cause elk to move up to on-half mile away from small-scale timber operations (Lyon et. al. 1985:2). Foraging habitat in the project area would still be available to elk in adjacent untreated units and within one-quarter mile of all treatment units in the project area. Mitigation measures have been incorporated that would stagger treatments, so that no more than two adjacent units are treated annually. Thus, the units treated first would recover and provide excellent elk forage before the last units are treated. Proposed prescribed burning would have a short-term negative impact on elk foraging, but would ultimately provide more and higher quality elk forage.

Indirect effects could include delayed production of browse species in treatment units if sprouting shrubs are damaged by harvest operations or killed during prescription burning.

Cumulative effects to elk foraging habitat in the Main Boulder analysis area include past timber management and fire suppression efforts. Timber management practices in the analysis area have generally benefited elk foraging habitat by removing forest canopy and concentrating plant biomass in forage plant species. Fire suppression efforts have had an opposite effect on elk foraging habitat by encouraging a more forested condition and reducing the amount of the area

that supports forage plants and browse species.

Elk – Security and Vulnerability

Affected Environment

Removal of forest cover and changes to forest structure can have impacts on elk populations by removing security cover and increasing hunter access and visibility. The Main Boulder analysis area receives high levels of recreational use year-round. Although the number of hunters using the area has dropped off in recent years, there are still large numbers of hunters using the area during annual fall hunting seasons, when elk security and vulnerability become an issue. Elk vulnerability to hunting pressure is influenced by the availability of security cover and juxtaposition of hunter access.

Direct, Indirect and Cumulative Effects

The Main Boulder fuel reduction treatments would not affect elk security cover. Mitigations for retention of patches would provide ample security cover for elk. Although small amounts of new road would be constructed to access treatment units, these roads would not be open to the public during project implementation and would be closed and rehabilitated following completion of treatments. Most of the treatments would be accessed from the existing Main Boulder road or would be accessed through locked gates where the only motorized access is by motorcycle or ATV. Provisions will be incorporated into the contract that prohibit passenger vehicle access behind locked gates by contractor personnel for the purposes of hunting, transporting hunter, or transporting game carcasses. Since the proposed treatment units would have no effect on elk security cover, and hunter access levels would remain virtually the same with or without the project, the proposed action would have no direct, indirect or cumulative effects on elk security and vulnerability in the Main Boulder analysis area.

Elk – Road Densities and HEI

Affected Environment

Overall road densities in the Main boulder analysis area (compartments 116, 117, 118/136, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, and 129) are generally at higher levels than recommended for big game management. Open road density for the combined analysis area is currently at 0.24 miles per square mile. Road density effects to elk are commonly measured in terms of an elk habitat effectiveness index (HEI). The Forest Plan requires that HEI ratings of at least .70 be maintained in timber sale planning. The Forest Plan analysis area for HEI is based on the timber compartment. For the purposes of this analysis compartment 118 and 136 were combined to more accurately analyze the effects to elk habitat because these units are adjacent and represent an ecological unit that is used by the local elk population. All of the compartments analyzed meet or exceed Forest Plan Standards for HEI. *See Appendix A-13 (Road Density and Elk Effective Cover as measured by HEI).*

Under the proposed action alternative short stretches of temporary road would need to be constructed for access to treatment units. New road construction would add approximately 7.5 miles of road across in compartments 116 (1.5 mi.), 117 (2.7 mi.), 118 (1.7 mi.), 120 (0.5 mi.), 124 (0.7 mi.), and 127 (0.4 mi.) . This small amount of road has little measurable effect, and HEI remains above the .70 required level across all units where temporary roads are proposed.

Of this total, approximately 4.8 miles 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 by using existing roads on private or National Forest land. 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 reconstruction 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. See Maps 2-5 through 2-8 on Ch. 2-27 through 2-30.

The no action alternative would have no direct indirect or cumulative effects on HEI in any of the compartments represented.

Issue 3D. Effect to Other Wildlife Species of Concern

Migratory Bird Species

> **Indicator:** Effects to migratory bird species were addressed by evaluating impacts to nesting and foraging habitat for those species potentially affected by the proposed action.

Migratory bird species are protected from harm under the Migratory Bird Treaty Act (16USC 703-711). A January 2001 Executive Order requires federal agencies to ensure that environmental analyses of federal actions evaluate the effects of actions and agency plans on migratory birds, with emphasis on species of concern.
Hutto et. al. (1992) studied the effects of silvicultural treatments on forest birds in the Rocky Mountains. They documented the tendencies of over 60 forest bird species to be either more or less abundant in clearcut and partially cut forested habitats. All species sampled were neotropical migrant species, which winter in southern latitudes. Nineteen species demonstrated increase presence in partially cut forest; while the remaining species sampled showed declines. Although the majority of migratory bird species in this study showed a decline, some species showed increases and other species that were not sampled in this study prefer more open forest habitat and thrive in these environments (Hutto et. al. 1992).

Migratory Bird Species –Effects to Nesting Habitat

Affected Environment

Of the more than sixty species of migratory birds studied by Hutto etc. al. (1992), the majority may be found nesting on the Big Timber Ranger District and are likely to find suitable nesting habitat in the Main Boulder analysis area. Of these, at least 25 species have been detected in the vicinity of the Main boulder fuel reduction project area. All twenty-five species are neotropical migrant species and are known or suspected to nest in the Main Boulder drainage. The migratory bird species likely to find suitable nesting habitat within the Main Boulder analysis area include (listed by common name) red-tailed hawk, Northern goshawk, American kestrel, northern flicker, dusky flycatcher, Hammond's flycatcher, mountain bluebird, Townsend's solitaire, American robin. veery, hermit thrush, warbling vireo, solitary vireo, yellow-rumped warbler, orange-crowned warbler, yellow warbler, MacGillivray's warbler, Wilson's warbler, western tanager, black-headed grosbeak, rufous-sided towhee, chipping sparrow, white-crowned sparrow, dark-eyed junco and pine siskin. Eight additional migratory bird species are known to nest on the Big Timber Ranger District, but have not been detected in the in the project vicinity. These include the red-napped sapsucker, western wood pewee, tree swallow, house wren, song sparrow, lazuli bunting, indigo bunting and Cassin's finch.

In Summary, the Main Boulder analysis area may provide suitable nesting habitat for at least 25 known species, but could provide nesting habitat for as many as 150 species of neotropical and resident bird species. Mitigation measures have been incorporated into the project design that would limit activities in treatment units between from April 1st thru the end of October annually;

unless surveys by the District Biologist or other qualified personnel reveal that activities would not affect migratory birds or other threatened or sensitive wildlife species.

Direct, Indirect and Cumulative Effects

Direct effects from fuel treatment activities would alter up to approximately 2,500 acres of potential nesting habitat for ground, shrub and tree nesting species that might be present in the project area. Movement of heavy equipment, felling, skidding of trees, and trampling by people would destroy some ground-nesting habitat. Shrubs and saplings would be cleared in some areas and the many live and dead trees would be cut and removed from treatment units. Migratory birds nest in spring, and some species may have successfully fledged young by early summer. The timing of commencement of treatment operations is contingent on wildlife concerns, weather conditions, access, and soil condition requirements. Noise activity associated with the project could disturb and/or displace nesting birds, potentially resulting in nest abandonment.

Direct effects to ground nesting species would be temporary, since ground vegetation is expected to recover quickly. Shrubs would take longer to come back, but regeneration is expected to occur within a few nesting seasons. Regeneration of live trees and removal of standing dead and snags would not be replaced in the treatment areas for approximately 30 to 50 years. The treatment areas are likely to be maintained in a more open landscape to meet fuels objective even in the future. The abundance of large acreages of adjacent undisturbed forest, shrub and ground nesting habitat should offset any short and long term impacts to migratory bird nesting habitat.

Indirect effects of the proposed project would be associated with increased competition for adjacent nesting habitat in years after harvest is completed. Secondary cavity nesters (birds that nest in cavities previously excavated by other species) would be impacted by removal of existing cavity trees. With fewer acres of habitat available, some birds might be inclined to nest in substandard habitat, where they would be more vulnerable to predation, exposure, or other adverse effects. Other species more adapted to more open forest stands, meadows or aspen regenerated areas may occupy and demonstrate and increase in population in treated areas.

Cumulative effects to nesting birds would result from timber management and activities on adjacent private lands, past timber harvest and past fire suppression efforts. Recent and proposed fuels and timber harvest activities on adjacent private lands will affect an estimated 1,000 acres of private lands that could provide nesting habitat. Some timber harvest has already occurred on private land and additional fuels treatments are proposed on up to approximately 750 acres around private residences, special use residences and private camps. Since we have no vegetative data for land outside the National Forest boundary, this land was excluded from the project analysis area; however it is likely that harvest outside the National Forest boundary had or will have similar impacts on forest habitats for nesting birds.

Past fire suppression in the analysis area has kept burned forest nesting habitat to a minimum. Many migratory bird species are specifically adapted to nest in recent burn areas or rely on the successional development of burn area for nesting. Fire suppression effects, since the early 1900's have kept wildfire burns in the area to very small acreages. The largest known fire in the area occurred in 2003 and burned less than 20 acres. Five additional small fires started within the analysis area in 2002 and 2003, but were promptly controlled at less than 1/10 acre each.

Migratory Bird Species – Effects to Foraging Habitat

Affected Environment

Of the 25 migratory bird species determined to be present within the Main Boulder analysis area, 17 are insectivorous, 5 feed on both insects and seed, and 3 feed on vertebrates. Insects

proliferate in an area infected by Douglas-fir bark beetle. Douglas fir beetle and other diseases that create an environment for insects to thrive infect a large proportion of the trees analysis area. Seeds from cone crops produced by pines, spruce and firs represent a large seed source for migratory birds in the area. There are an abundant insects and seed sources for migratory birds throughout the analysis area. The proposed treatments will affect a relatively small proportion of habitat in the analysis area that provides forage for migratory birds and may result in habitats that provide differing, but valuable foraging habitats for these and other species in the future.

Direct, Indirect and Cumulative Effects

Direct effects of the proposed fuels reduction treatments include removing the source of some of the insect prey base and seed sources found in these more mature forest habitats. These treatments could also temporarily reduce the number of small vertebrates entering or inhabiting the area in search of insect prey. Treatment operations would churn up soil and disturb the understory and ground, which could obscure the visibility of seeds. Removal of some large and small live trees will reduce the overall abundance of seeds available to migratory bird in the project area. On the other hand, felling trees and lopping tops and branches could make some seeds more available to birds and small mammals.

Indirect effect of the proposal would result from temporary increased competition for reduced food resources in following years. Not only would treatment remove the insect larvae currently contained within trees, it could significantly reduce the breeding population of insects to provide a future prey base.

Cumulative effects of the proposal on migratory bird foraging habitat are similar to those described above for nesting habitat. Fuels reduction treatments on adjacent private lands would further reduce the prey population for insectivorous and seed eating bird species. Past timber harvest in the project area also likely resulted in smaller insect population, although probably not significantly based on the timber sale history in the drainage. However, insects and disease are more prevalent in mature forest than young forest, and decades of successful fire suppression have left the analysis area with a considerable proportion (48% in compartment 129 and >69% in all other compartments) of mature and old growth forest. Personal use firewood gathering could remove more foraging habitat, but access to firewood is limited to the area along the Main Boulder road, so firewood collection is not expected to have a major impact on foraging habitat for migratory birds. Insect trapping (Douglas-fir beetle traps) to prevent the infestation of live trees within the project area could also have a very minor impact on the available prey base for insectivorous birds.

Irreversible and Irretrievable Commitments of Resources

There are no irreversible or irretrievable commitments of resources for any threatened or endangered species, sensitive plant or wildlife species, or management indicator species as a result of implementation of the proposed action.

Applicable laws, regulations, and Forest Plan Guidance

There is an abundance of law, policy and direction applicable to wildlife habitat considerations relative to resource management on National Forest lands. The Endangered Species Act (ESA) of 1973 mandates that the effects of land uses and management activities be evaluated as part of the biological assessment process for listed species. The National Forest Management Act (NFMA) of 1976 requires that the US Forest Service 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. 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. Ultimately, the Gallatin Forest Plan provides specific

direction for management of wildlife habitat by various management areas (MA). The Forest Plan provides direction for increasing populations of big game animals (FP, pg. II-1), emphasizing forage and cover needs on big game winter range (FP, pg. II-3) and emphasizing management of special and unique wildlife habitats such as wallows, licks, talus, cliffs, caves and riparian areas (FP, pg. II-18). By following the design criteria and mitigation measures for wildlife outlined on *Ch. 2-35* of this document, implementation of the proposed action would be consistent with all of the above laws, policies and guidelines.

Issue 7: Fuels management activities could affect recreation opportunities by affecting the sense of place, displacing recreationists, and/or creating conflicts at recreation sites or on the Main Boulder Road.

> **Indicator:** The location and treatment of proposed units in relation to developed recreation facilities, dispersed use areas, and private land must be known in order to determine impacts to recreation opportunities. Changes to the physical setting surrounding recreation use areas on National Forest System lands should be evaluated in relation to the visual quality and maintenance of vegetative screening.

Affected Environment: The Main Boulder drainage has served as a recreational hub for more than 100 years. This area is the first easily accessible area of National Forest System lands in the Rocky Mountains when traveling west on Interstate 90. The area is popular with both out-of-state tourists and local residents. The Boulder drainage is located within an approximate hundred-mile radius of almost one fifth of the population of Montana. The Main Boulder Road (a Sweet Grass and Park County road) runs the length of the drainage through National Forest lands. This road is unique in that it provides a dead end, roaded corridor deep into the Absaroka-Beartooth Wilderness and provides many diverse recreation opportunities to National Forest users and others. Past recreation analysis for the Main Boulder indicates that most Forest users do not want the recreational setting and opportunities to change. People like it the way it is; social values are high. The analysis area for recreation begins in the vicinity of the Main Boulder Ranger Station and continues south to approximately one mile south (upstream) of Box Canyon.

In the Main Boulder, NFS lands are interspersed with private lands, which are used primarily for recreation. Three church camps, two dude ranches, and many houses and cabins are located on these private inholdings. Recreation properties in the Boulder have been desirable, in part because of the forested setting and the rural ambiance or sense of place found in the Boulder. Very few permanent residents live south of the Forest boundary in the Boulder.

Both private and Forest recreation use is primarily limited to the summer season from June through September. On a busy summer weekend, there could be as many as 3,000 people or more using the forest and private inholdings south of Main Boulder Ranger Station. Fall hunting attracts much fewer people and, visitors during the remainder of the year are very few indeed.

Existing Recreation Opportunity Spectrum (ROS) Classifications

The ROS classification for the Main Boulder drainage outside designated wilderness ranges from Rural (R) and Roaded Natural (RN) in the summer to Semi Primitive Motorized (SPM) in the winter.

R settings are natural environments that are culturally modified yet attractive. Backdrop modifications range from obvious to dominant. Self-reliance on outdoor skills is of little importance, and there is little challenge and risk. Interaction between and evidence of other users may be high. This is the existing setting of the proposed project area for the “summer” season (with the exception of the upper half of proposed unit 30).

RN settings are generally characterized as mostly natural-appearing environments with moderate evidence of the sights and sounds of man. Resource modification and utilization practices are evident but harmonize with the natural environment. The upper half of proposed Unit 30 is within this setting for the "summer" season.

SPM settings are predominately natural-appearing environments where there is often evidence of other users and moderate probability of solitude. Vegetation alterations are very small in size and number and are widely dispersed and visually subordinate. This setting characterizes the majority of the Main Boulder drainage in the "winter" season when snow covers the landscape. Very little recreation use occurs in the drainage at this time of year due to weather conditions and the fact the access is extremely limited due to snow conditions. The counties do little snow plowing on the Main Boulder Road.

Dispersed Recreation Opportunities on NFS Lands:

Due to the proximity of the Absaroka-Beartooth Wilderness, motorized use in the Main Boulder is primarily limited to the county road. Several trailheads in the drainage allow horse users, hikers, and hunters opportunities to access the wilderness and backcountry; however, the inherent steepness of the Boulder limits the opportunity for short, easy day hikes or rides within the proposed project area. Dispersed usage off-trail (bushwhacking) is limited primarily to hunters and fishermen. Table 3-10 describes the Forest Service trails and trailheads within the project area: See Maps 2-1 through 2-4 (*Ch. 2-23 through 2-26*) for approximate locations of these trails.

Table 3-10 Descriptions of Trails and Trailheads within the Main Boulder Project Area

Trailhead and Trail	Description
Grouse Creek Trail, #14	This trail begins at the Main Boulder Ranger Station. The trail is used extensively during the summer months by the neighboring dude ranch and into hunting season. The trailhead itself is a shared parking facility with the historic Ranger Station and has an accessible toilet. This trail is well maintained.
Falls Creek Trail, #19	The Falls Creek Trail receives intermittent maintenance and very little use. There is no designated trailhead or signs to inform the public of its existence.
Great Falls Creek Trail, #18	The Great Falls Creek Trail provides access along the Main Boulder River and into the Absaroka-Beartooth Wilderness. The developed trailhead and trail receive moderate amounts of use during the summer season and are well maintained. Less use occurs during hunting season.
Graham Creek Trail, #117	The Graham Creek Trail accesses the East Boulder Plateau. The developed trailhead and trail receive limited use during the summer and fall. The trail is well maintained.
Speculator Creek Trail, #21	The Speculator Creek Trail accesses the Absaroka-Beartooth Wilderness and the West Boulder Plateau. Although there is a developed trailhead, the trail is not routinely maintained and receives very little use.
Placer Basin Trail, #2	The Placer Basin Trail accesses the east side of the Main Boulder River and the Absaroka-Beartooth Wilderness. The developed trailhead and trail receive considerable use during the summer season, especially from neighboring church camps. Less use occurs in the fall. The trail is well maintained.

Fourmile Trail, #22	The Fourmile Trail and Trailhead receive high use from a neighboring dude ranch and hunters. The trail accesses the Absaroka-Beartooth Wilderness and is well maintained. The trailhead area has a toilet, and the area immediately adjacent to it serves as a dispersed camping site.
Upsidedown Creek Trail, #26	The Upsidedown Creek Trail and Trailhead serve the Lake Plateau area of the Absaroka-Beartooth Wilderness and receive heavy use from the public and the neighboring church camp during the summer and early fall. The trail is well maintained.
Bridge Creek Trail, #25	The Bridge Creek Trail serves the Absaroka-Beartooth Wilderness. The trail and undeveloped trailhead receive relatively light use from hunters and other backcountry users. The trail is well maintained.
Box Canyon Trailhead and East Fork Trail, #27	Box Canyon Trailhead serves the upper end of the Boulder drainage and the Absaroka-Beartooth Wilderness and is considered the furthest destination up the Boulder for all vehicles but ATVs, motorcycles, and 4-wheel drives. This highly developed trailhead receives heavy use during the summer and into the fall hunting season and serves the East Fork Trail, #27 and the upper Main Boulder Road (used as a trail), and the surrounding area serves as a dispersed campsite.

Several frequently used dispersed campsites exist along the Main Boulder Road that are historically used by campers or for river access. The Forest Service has encouraged use at some of these sites by erecting toilets and fire grates. Most of these sites receive heavy use during the summer. See Maps 2-1 through 2-4 *(Ch. 2-23 through 2-26*) for approximate locations of these sites.

Table 3-11 Heavily Used Dispersed Camp Sites with Descriptions

Heavily Used Dispersed Sites	Description
Site on the river, west of Graham Creek Trailhead.	This undeveloped site receives a moderate amount of summer overnight use. No facilities.
Sites between Aspen and Chippy Park.	Two major undeveloped sites exist between Aspen and Chippy Park Campgrounds. Both of these sites receive heavy overnight summer use. No facilities.
Site just below Shipping Corrals	This semi-developed dispersed site receives heavy use from summer overnight and day-use recreationists. A toilet is located here.
Lower Fourmile.	This semi-developed dispersed site receives heavy use from summer overnight and day-use recreationists. Fire grates and a toilet are located here.
Fourmile Trailhead.	Campers at this site utilize the toilet at the trailhead. Overnight use is heavy during summer and early fall.
Amour Fishing Access	This day-use site is located above Hillary Bridge and is primarily used as a fishing access for the Main Boulder River. Use is relatively low. No improvements are located here.
Box Canyon	Campers at this site utilize the toilet at the trailhead. Overnight use is heavy during summer and early fall.

Snowmobiling

Snowmobiling opportunities are very limited in the Main Boulder due to the proximity of designated wilderness and the lack of consistent snowpack in the lower portions of the drainage. However, the Sweet Grass Recreation Association, in cooperation with the Forest Service, Sweet Grass and Park Counties, and the State of Montana, grooms the Main Boulder Road for snowmobile use during the winter months. Parking of towing vehicles and snowmobile trailers normally occurs on NFS lands, usually in the vicinity of Camp Mimanagish (but this location may change, depending on the snowpack). Because of ice buildup on the road, the club is authorized to groom through the Hicks Park Campground, then continues up the Main Boulder Road past Box Canyon and to the deep snow country above the old town site of Independence. Snowmobile use is relatively light in the drainage. See Maps 2-1 through 2-4 *(Ch. 2-23 through 2-26*) for approximate locations of these areas.

Outfitting

There are at least eight outfitters who serve the Boulder drainage in the vicinity of the proposed project. Use consists primarily of day-use horseback rides and fishing.

Developed Recreation Opportunities on NFS Lands

There are six developed campgrounds on NFS lands in the Main Boulder. They normally receive moderate weekday use during the summer months and heavy use on summer weekends and holidays. Little use occurs at other times of the year. See Maps 2-1 through 2-4 (*Ch. 2-23 through 2-26)* for approximate locations of these campgrounds.

Table 3-12 Developed Campgrounds in the Main Boulder

Campground Name	Services Available	Restrictions
Falls Creek	Potable water, toilet, fire grates, tables.	No trailers. Pack-it-in/Pack-it-out. No fee.
Big Beaver	Toilet, fire grates, tables	Pack-it-in/Pack-it-out. No fee.
Aspen	Potable water, toilet, fire grates, tables. Some sites handicapped accessible.	$5.00/night fee. Pack-it-in/Pack-it-out.
Chippy Park	Potable water, toilets, fire grates, tables. Some sites handicapped accessible.	$5.00/night fee. Pack-it-in/Pack-it-out.
Hells Canyon	Toilets, fire grates, tables.	Pack-it-in/Pack-it-out. No fee.
Hicks Park	Potable water, toilets, fire grates, tables.	$5.00/night fee. Pack-it-in/Pack-it-out.

Shipping Corrals Picnic Area:

This day-use site is primarily used for fishing access to the Main Boulder River. There are picnic tables and fire grates here. A toilet is shared with the dispersed campsite just downstream of the Shipping Corrals site.

Recreation Residences:

Recreation residence special use authorizations allow the holders to occupy NFS lands. These permits normally authorize a cabin with an outbuilding or two. The authorization does not give the holder exclusive use of the site but, rather, allows them to have their facility on NFS lands. There are presently 25 recreation residences in the Main Boulder drainage. These special use permits date back to the 1930s, and cabins are somewhat concentrated in the Falls Creek area, the Speculator Creek area, the Fourmile area, and the Clear Creek area. The cabins receive

varying amounts of use, primarily during the summer and fall. The permittees are authorized a lot (a specific area) to put their improvements on. They are responsible for the maintenance of that area under direction from the Forest Service.

Camp Mimanagish:

Camp Mimanagish is a permitted church-run organizational camp located on NFS lands just north of Hells Canyon. This camp serves hundreds of campers, primarily during the months of June and July. Camp managers are reluctant to inhabit the camp during the higher fire dangers of August and September.

Fourmile Cabin:

This Forest Service cabin is available for rent to the public and is heavily used.

Box Canyon Station

This Forest Service cabin is an administrative facility.

Main Boulder Ranger Station:

This historic Ranger Station is in the process of being restored and converted to a house museum and visitor center. This complex also serves as a workstation and includes Forest Service housing, a barn and workshops, a paved trail system to the Ranger Station, and parking at the Grouse Creek Trailhead.

Direct and Indirect Effects of the Alternatives

Direct Effects are those that will alter the recreation use or opportunities at Forest Service recreation facilities and in dispersed areas. Indirect effects would cause changes to the area's setting, including ambiance and sense of place, which is usually caused by the change in scenery and screening from vegetative treatment. (*See Scenery section on Ch 3-58 for additional information).*

Alternative A – No Action

Direct and Indirect Effects

This alternative would not affect existing recreational opportunities, settings, or activities. The existing landscape character and sense of place would remain the same.

Cumulative Effects

Chances for catastrophic wildfire would continue to be a high threat in the drainage, possibly causing major changes to recreation opportunities and settings in the future. In the worst-case scenario, a running crown fire could incinerate the entire drainage burning developed Forest Service recreation facilities. Improvements at campgrounds, dispersed campsites, and trailheads could be destroyed and unusable. Forest Service and special use cabins could be reduced to ashes, unusable to permittees and other recreationists. Directional, informational, and interpretive signage could be consumed leaving potential public confusion. Hazards from falling snags would make all forms of travel difficult and dangerous. The physical setting and sense of place could change dramatically from a forested environment to one of moonscape resulting in less recreational visitation, which would have negative ramifications to permitted outfitters. Impacts from less severe or smaller wildfires would be less and/or more concentrated.
It is anticipated that private land fuel treatments would continue. These treatments would have no affect to the Forest's recreation opportunities. Private land treatments could, however, cause

additional impacts to the recreation setting and sense of place in the Boulder by making private developments more visible.

Alternative B - Proposed Alternative

Direct and Indirect Effects

When considering the effect on recreation opportunities and use, it is important to recognize the relation between the effects on visual quality and the recreational setting or sense of place to recreationists. The recreational setting, which includes the amount of thick and screening vegetation in the drainage, will be modified due to fuel treatments. For more information please see Scenery section on *Ch 3-58*.

The proposed fuels management activities included in the proposed action coincide with other activities expected to take place on private lands in this high recreation use corridor. All existing recreation opportunities will continue to be available but in a modified visual setting. Although fuel treatments may displace or prevent recreation use at some facilities and could affect dispersed opportunities, this will occur on a limited, short-term basis. The area's long-term recreation opportunity is not expected to be affected. All proposed activities, with the exception of treatment within the upper part of Unit 30, are within the Rural ROS category during the important heavily used summer months. The upper part of Unit 30 is a Roaded Natural category. (Refer to the ROS description settings above.) Rural and Roaded Natural settings by definition are environments where cultural modifications have taken place and will continue. Long-term winter season ROS settings will also be maintained. Deep snow and lack of public use will continue to influence the amount of managed recreation use offered or needed in the drainage.

Most Forest Service recreation facilities are within proposed fuel treatment units (*see Table 3-13)* and may be temporarily affected by this alternative. Traffic along the Main Boulder Road may be delayed for short periods of time. Public use of some recreation sites such as trails, trailheads, and heavily-used dispersed sites may be curtailed during treatment due to hazardous situations from equipment, logging operations, and other fuels activities. It is not anticipated that the ability to utilize other Forest Service recreation facilities, recreation residences, or Camp Mimanagish would be affected.

Because the vast majority of recreation use occurs during the warm summer months, activity in that time period would affect the most Forest users. During treatment, the surrounding area would be less natural appearing due to on-going fuel treatment activities and machinery use. Ultimately, this will result in more open and visible areas throughout the drainage. Noise from logging, slashing and piling, etc. will provide less solitude for recreationists. Logging and hauling, especially in summer, has the potential of creating hazardous situations for recreationists and road users. By conducting harvest and skidding treatments during the winter (November through April), providing adequate warning signs, public exposure to potential hazards and effects would be minimized. No treatment would occur within approximately 100 feet of any campground, heavily used recreation site, recreation residence, or Camp Mimanagish (fuels treatment in these areas are the responsibility of the permittee or Forest Service maintenance crews).

Dispersed use, such as hunting, may impacted within active treatment areas. Removal of the vegetative cover also has the potential of affecting the way hunters ultimately use the area. Permitted outfitter and guides, in some cases, may be temporarily displaced by fuel treatment activities.

Snow removal on the Main Boulder Road is anticipated to increase for the duration of the project, which would allow better access for winter users such as snowmobilers and skiers. On the other hand, plowing further up the Main Boulder Road than the historic parking area at Camp Mimanagish would also temporarily impact the amount of groomed snowmobile trail available in the drainage.

See Maps 2-1 through 2-4 *Ch. 2-23 through 2-26)* for approximate locations of the facilities listed below.

Table 3-13 Treatment units and the Forest Service recreation facilities found within those units for the proposed alternative:

UNIT #	Forest Service Recreation Facility Found Within Unit
MBS	Main Boulder Ranger Station, Grouse Creek Trailhead, Grouse Creek Trail, #14.
1	None
2	None
3	Five recreation residences (Nafts, Larsen, Kisling, Johnson, Jacoby), Great Falls Creek Trailhead, Great Falls Creek Trail, #18. Two additional recreation residences (Allred and Dailey) and Falls Creek Trail, #19 are located in close proximity to this unit.
3B	Two recreation residences (Harsha, Hanson), Falls Creek Campground.
3C	None.
4	Graham Creek Trail, # 117. The Graham Creek Trailhead and the dispersed site below this trailhead are located in close proximity to this unit.
5	None.
5A	None.
5B	None.
5C	None. Big Beaver Campground is located in close proximity to this unit.
6	None.
7	One recreation residence (Kunda). Aspen Campground is located in close proximity to this unit.
7A	None.
7B	None. Two dispersed sites between Aspen and Chippy Park are located in close proximity to this unit.
8	None.
8A	None.
9	Shipping Corrals Picnic Area, dispersed site below Shipping Corrals. Chippy Park Campground is located in close proximity to this unit.
10	None.
11	None.
12	None.
13	None.
14	None.
14A	None.
15	None.
16	One recreation residence (Bobzien)
16A	None.
17	None.
17A	One recreation residence (Carlson), Speculator Trailhead, Speculator Trail, # 21.
18	Placer Basin Trailhead, Placer Basin Trail, #20.
18A	One recreation residence (Wilmoth), Camp Mimanagish.
19	None.
19A	Hells Canyon Campground.
19B	None.
20	None.
20A	None.
21	Two recreation residences (Fuchs, DeBelly), Lower Fourmile Dispersed site.
22	Four recreation residences (Wilson, Voges, Yapunich, Moore), Fourmile Guard Station, Fourmile Trail, #22.
22A	Fourmile Trailhead, Fourmile dispersed site.

UNIT #	Forest Service Recreation Facility Found Within Unit
23	None. One recreation residence (Bray) is located in close proximity to this unit.
24	One recreation residence (Mandeville), Armour Fishing Access.
25	Three recreation residences (James Rooney, John Rooney, Johnson)
25A	One recreation residence (Gretchen Rooney), Hicks Park Campground, Upsidedown Creek Trailhead.
26	Upsidedown Creek Trail, #26.
26A	None.
27	Bridge Creek Trailhead, Bridge Creek Trail, #25.
28	None.
29	None.
30	Box Canyon Trailhead, Box Canyon Dispersed Site.
31	Box Canyon Guard Station, East Fork Trail, #27.
32	Trail Access of Main Boulder Road.

Recreation impacts on private lands within the Forest boundary will to be similar to the National Forest. Mitigation found on *Ch. 2-40* is identified to ease effects to public and private recreationists.

Cumulative Effects

As society becomes more aware of wildland/urban interface concerns and the possible loss of personal property from wildfire, more private lands in the Boulder will be treated to reduce fuels in attempts to “fireproof” the area. Expanded treatment (Forest Service and private) should lower risk and potential loss from wildfire.

Past harvest treatments on private land and NFS lands have done little to change recreation opportunities or the setting of the Main Boulder. Additional fuel treatments on private lands are not anticipated to affect recreation opportunities. Private land treatments could, however, cause additional impacts to the setting and sense of place in the Boulder by making private developments more visible.

Irreversible and Irretrievable Commitments of Resources

There are no irreversible or irretrievable commitments of resources for recreation values. There will be visual changes in the corridor, with the treatment areas appearing more open, but these changes will be more similar to the visuals that were common historically.

Applicable laws, regulations, and Forest Plan Guidance

Implementation of the proposed action would comply with the recreation guidance set forth in the Forest Plan for all management areas found in the project area..

Issue 8: Understory and pile burning associated with the Main Boulder Fuels project may temporarily increase $PM_{2.5}$ levels along residential areas in the Main Boulder Canyon and impact the adjacent Absaroka Beartooth Wilderness.

Smoke from the Main Boulder Fuels project may temporarily obscure visibility along the Main Boulder Road and temporarily obscure views to scenery.

> **Indicator:** Smoke in as measured in $PM_{2.5}$ in tons of total emissions, tons/day, and in downwind concentrations in ug/m3.

Affected Environment: Air quality within the Main Boulder Canyon area is excellent with very limited local emission sources and consistent wind dispersion. Existing sources of emissions in the Main Boulder Canyon area include occasional construction equipment, vehicles, road dust, residential wood burning, wood fires, and smoke from logging slash disposal. Emissions are very limited with no local visible sources of impairment. Wind dispersion throughout the entire Main Boulder Canyon area is robust, with no visible inversions or localized concentrations of emissions. Down valley drainage is frequently robust during nighttime and early morning hours. The Main Boulder Canyon Fuels Reduction Project area is primarily within Montana airshed 10 (Yellowstone) in Sweetgrass County with a small part in 8B Park County near the Main Boulder Station and from Hells Canyon south to Box Canyon (Montana DSL, 1988, p D-15). The entire the Main Boulder Canyon area is considered to be in attainment by the Montana DEQ. The nearest non-attainment area is Butte for PM_{10} (115 miles to the west). All of the area and the entire Gallatin NF is a Class II (for PSD purposes). The nearest Class I area is Yellowstone National Park which is 16 to 37 miles to the south.

No specific information is available concerning existing air quality within the Main Boulder Canyon area. The nearest particulate data is from the East Boulder Mine EIS (MSDL, USFS, DHES; 1992, (*Ch. 3-63*) documented PM_{10} at the East Boulder mine site at an annual geometric mean of 9 ug/m^3 and a maximum 24hr PM_{10} concentration of 35 ug/m^3. The emissions from the East Bounder mine sources are predominantly dispersed to the northeast with no visible effects within the Main Boulder project area. The DEQ has estimated that for southwest Montana, including the Absaroka Range, a PM_{10} background of 5 ug/m3 (annual average) is appropriate. No other sources of industrial emissions occur in the analysis area.

The nearest non-attainment areas is Laurel and Billings (71 miles and 90 miles east of the mouth of the canyon at the Forest Boundary) which have 7 major $S0_2$ and particulate sources including the Exxon oil refinery, Conoco oil refinery, Northwest Energy coal fired electric power generating facility, Western Sugar beet factory, Yellowstone Energy Limited Partnership coke fired cogeneration power plant, Montana Sulphur and Chemical sulfur recovery facility, and the Cenex oil refinery. The Billings and Laurel sources are currently permitted for 1,928 tons of PM_{10}/year and 16,481 tons of $S0_2$ year. Currently Billings is in non-attainment for carbon monoxide and $S0_2$ and Laurel is in non-attainment for $S0_2$. The predominant west to southwest winds carry most of the Billings/Laurel emissions to the east and away from the project area. No other sources of industrial emissions occur in the analysis area other than very small local sources.

The major source of emissions in the Yellowstone valley are the cities of Big Timber and Livingston with vehicle exhaust, wood burning smoke, and road dust although both communities are in compliance with National Ambient Air Quality Standards (NAAQS). Big Timber and Livingston emissions visibly do not impact the Boulder River valley and are strongly dispersed by predominant and robust S and SW wind direction with very robust wind gradients. Other types of emissions in the Yellowstone valley include vehicle and agriculture equipment exhaust, road dust, wood smoke from residential, smoke from pile burning, broadcast burning, and wildfires. Wildfires in the Absaroka Range within the last 20 years have had a low frequency (Sixmile fires in 1989 and 1999, Thompson Creek fire in 1991, Fridley, Hoppe, and Monitor fires in 2001, and the Rough Draw Complex of the

Rough Draw fire and Brundage fire in 2003). Regional wildfire smoke has accumulated within the area during periods of extensive wildfire activity in 1988, 1994, 2000, and 2003. The prime source of wildfire emissions is from central and southern Idaho, and SW Montana. Smoke can also impact the Boulder Canyon area from wildfires in Yellowstone National Park as occurred in 1988.

Generally the project area does not develop temperature inversions, which 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 Wind Energy Resource Atlas of the U.S. (Elliott et.al., 1986) shows the Boulder Canyon as an area of high wind energy. The Main Boulder Canyon has some potential for cumulative concentrations of smoke and residential and transportation emissions but visible inversion conditions do not occur. Up valley winds during daytime and down valley wind (cold air drainage) at night can dominate valley winds more than overall prevailing wind direction on ridge tops.

Alternative A - No Action

Direct and Indirect Effects

In the short run the air quality effects from the no action alternative are less than the action Alternative B since the emissions from the pile and understory burning would not occur. In the long run, the no action alternative would not allow the opportunity to reduce the potential of wildfire ignition in the treatment areas. Wildfire in the Main Boulder River area has the potential to result in extensive smoke and air quality impacts from $PM_{2.5}$ and PM_{10} 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 the Main Boulder Canyon.

Cumulative Effects

Air resources are somewhat unique in that the past impacts to air quality are not usually evident or cumulative. The geographic scale of the air quality analysis consists of air quality modeling of each burn at 0.1 mile to 50.0 miles radius from each unit with consideration to sensitive receptors south of the Main Boulder Canyon. With the no action alternative, no units would be harvested and no understory burning or pile burning would occur, however the likelihood of a large wildfire in the Main Boulder Canyon at some point in time is higher.

Alternative B - Proposed Action

Direct and Indirect Effects

Potential air quality effects of the Main Boulder Canyon Fuels Reduction Project were analyzed using USFS R1 NEPA evaluation procedures for prescribed fire projects (Acheson et.al., 2000) which can be downloaded from the USFS R1 air quality website at http://www.fs.fed.us/r1/gallatin/air.index.shtml. The decision analysis in the procedure document was not used in lieu of the Smoke Impact Spreadsheet (SIS) model (Air Sciences, 2003), which updates the modeling specified in the USFS R1 guidance. The SIS model uses an excel spreadsheet to link to the FOFEM5 model for broadcast burn fuel loading, the Consume model for pile burn emissions, and the CalPuff model for dispersion modeling. The SIS model was run for each of the units in prescribed burn (understory burn) mode and in pile burn mode for all of the units, which have piles. Air quality mitigation measures are listed in *Appendix B-2 through B-4.*

Direct effects of the burns include particulate emissions from pile burning and the understory burns. The understory burns produce a centralized plume due to a concentrated burn area while pile burns result in multiple plumes which consolidate into a central plume. The SIS model - FOFEM5

component was used for the understory burns while the Consume Pile Wizard was used for the pile burns. Model results include:

Table 3-14 Effects from possible Understory Burns

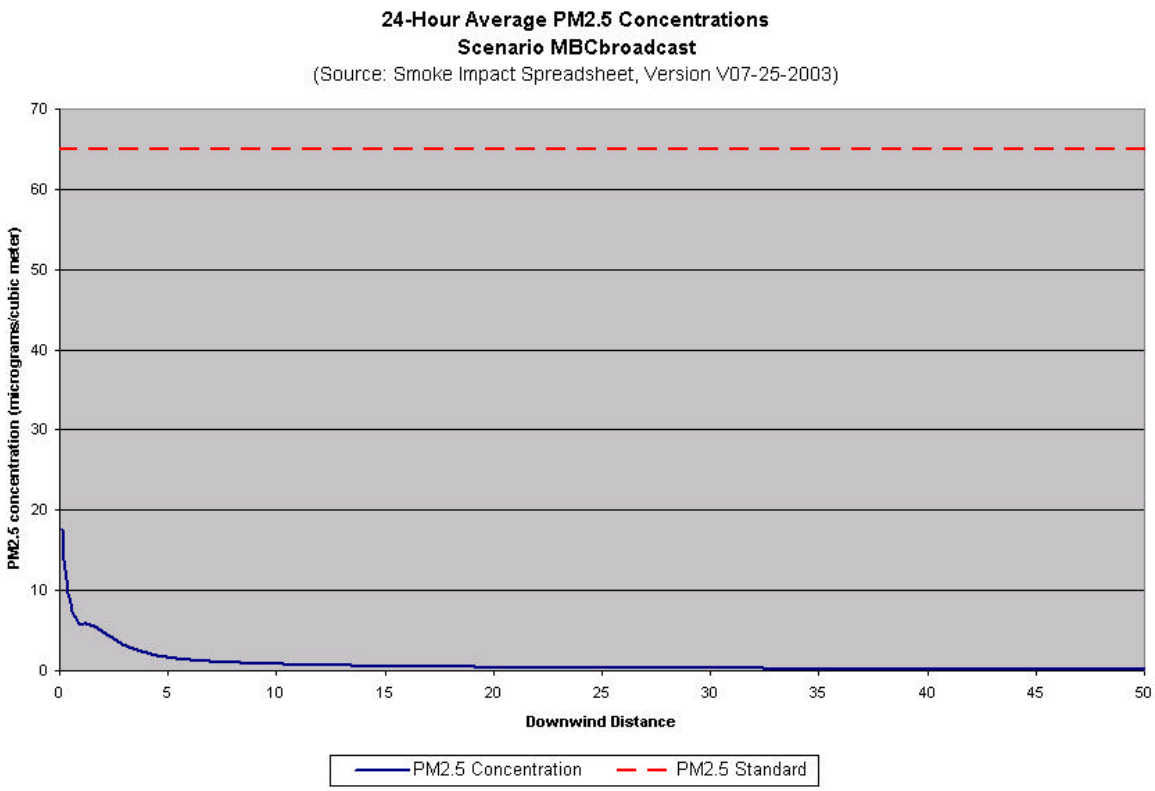
			PM2.5	PM2.5	PM2.5	PM2.5	Minimum
		PM2.5	0.1 mile	0.5 mile	1.0 mile	5.0mile	Ambient
Unit	Acres	Tons	ug/m3	ug/m3	ug/m3	ug/m3	Distance
							miles
MBC	60	2.6	7.6	8.4	5.8	1.6	0.1
1	19	0.8	11.1	5.4	4.1	0.5	0.1
2	19	0.8	11.8	5.7	4.5	0.6	0.1
3	11	0.4	8.1	4.1	2.9	0.3	0.1
4	26	1	11.9	5.4	4	0.7	0.1
5/5A	26	1.1	12	5.5	4.1	0.7	0.1
5B/5C	65	0.3	1.2	0.4	0.3	0.075	0.1
6	17	0.6	9.2	4.2	3.1	0.4	0.1
7	126	4.7	29.2	14	9.7	2.9	0.1
7A	11	0.05	0.07	0.2	0.16	0.03	0.1
7B	31	1.2	19.4	9.1	6.4	1.5	0.1
8	56	2.4	19.6	9.1	6.5	1.5	0.1
8A	35	0.16	1.4	0.56	0.3	0.1	0.1
9	40	1.5	15	6.9	5.1	1	0.1
10	24	0.9	11	5	3.7	0.6	0.1
11	30	1.1	12.5	5.7	4.3	0.7	0.1
12	71	2.7	21.1	9.9	7	1.7	0.1
13	59	2.8	21.6	10.7	7.9	1.8	0.1
14/14A	52	2	16.8	7.8	5.6	1.2	0.1
15	4	0.15	4.9	1.8	1.1	0.1	0.1
16	47	1.8	5	1.8	1.1	0.1	0.1
17	29	1.1	1.3	0.5	0.3	0.08	0.1
17A	27	1.4	14.8	7.7	5.7	0.9	0.1
18	75	4.9	30	15.4	10.2	3	0.1
18A	105	6.8	36	18.9	12.4	4.2	0.1
19A	15	1	14	7.2	5.4	0.7	0.1
19B	10	0.4	7	3.2	2.3	0.27	0.1
20	8	0.5	11	5.3	4	0.4	0.1
20A	3	0.01	0.3	0.1	0.08	0.01	0.1
21	54	3.1	23	12.9	9.1	2	0.1
22	39	2.2	20.9	11.1	8.2	1.4	0.1
23	30	1.7	16.6	7.7	5.6	1.1	0.1
24	218	12.4	49	24.4	15.8	7.2	0.1
25	104	5.9	32.7	16	10.8	3.6	0.1
25A	51	2.9	21.8	10.5	7.4	1.8	0.1
26	50	2.8	21.7	10.4	7.4	1.8	0.1
27	146	8.3	40	19.3	12.5	4.9	0.1
28	25	1.4	15.4	7.2	5.4	0.9	0.1
29	36	2.1	18.2	8.6	6.2	1.3	0.1
30	215	12.3	49	24.3	15.7	7.1	0.1
31	79	4.5	27.8	13.4	9.1	2.8	0.1
32	65	2.4	19.8	9.3	6.6	1.6	0.1
Total	2046	100.5					

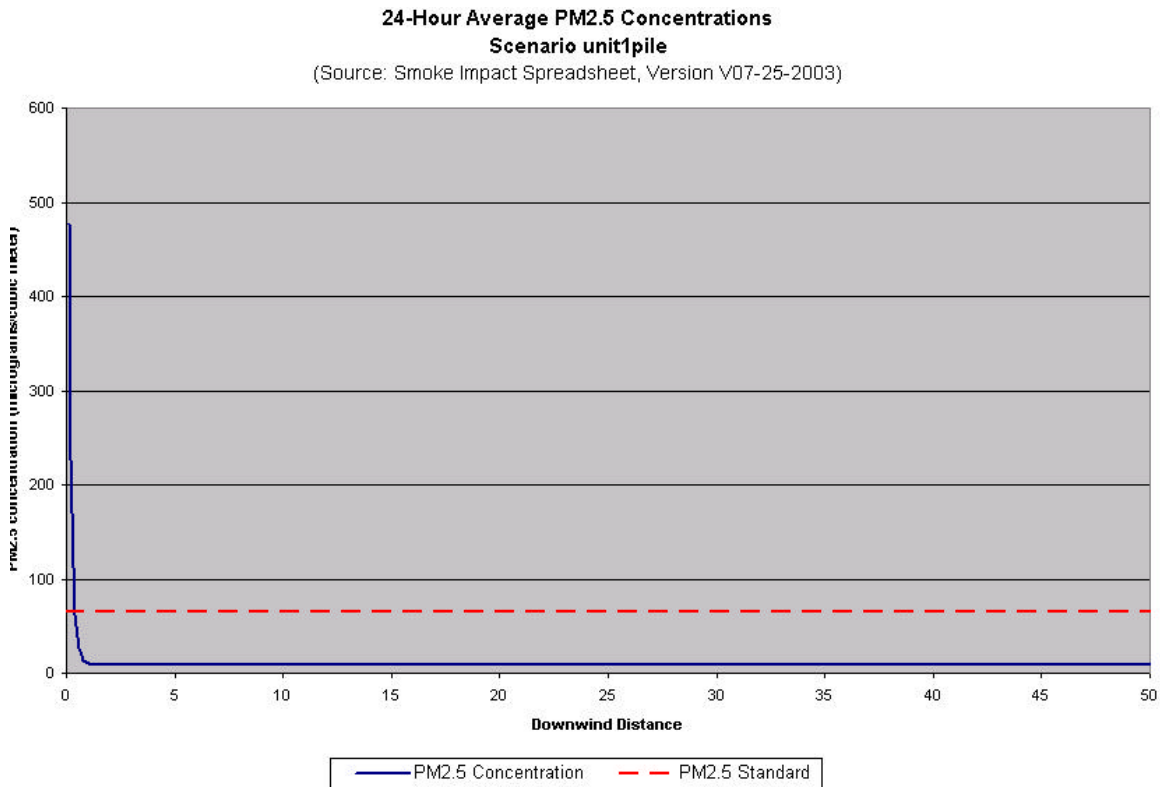
Table 3-15 Effects from Pile Burning

						PM2.5	PM2.5	PM2.5	PM2.5	Minimum
				PM2.5	PM2.5	0.1 mile	0.5 mile	1.0 mile	5.0mile	Ambient
Unit	**Acres**	**# Piles**	**Piles/day**	**Tons**	**tons/day**	**ug/m3**	**ug/m3**	**ug/m3**	**ug/m3**	**Distance miles**
MBC	155	50	50	0.44	0.09	59	4.9	1.3	1.1	0.1
1	19	285	57	0.5	0.1	68	5.6	1.4	1.2	0.15
2	19	330	83	0.72	0.15	98	8	2.1	1.7	0.2
3	49	735	73	1.2	0.12	87	41	0.18	1.5	0.15
3B	10	150	50	0.23	0.05	59	3.3	1.25	1.1	0.1
3C	25	375	50	.7	0.09	59	4.8	1.4	1.1	0.1
4	26	390	78	0.72	0.18	120	9.8	2.5	2.1	0.2
5/5A	26	390	78	0.75	0.15	100	8.2	2.1	1.8	0.2
6	17	250	83	0.45	0.15	99	8.1	2.1	1.8	0.2
7	126	1900	500	4.45	0.89	597	48	12.4	10.6	0.5
8	56	840	420	1.68	0.84	563	45	11.7	10	0.5
9	40	600	200	1.08	0.36	238	19.1	4.9	4.2	0.3
10	24	300	300	0.36	1.08	358	28.8	7.4	6.4	0.4
11	30	450	450	0.8	0.8	537	43.1	11.1	9.6	0.5
12	71	1065	532	1.9	0.95	635	51	13	11.3	0.5
14	11	165	165	0.3	0.3	197	15.8	4.1	3.5	0.3
14A	41	615	615	1.09	1.09	734	59	15	13	0.5
15	4	60	60	0.11	0.11	71	5.8	1.5	1.27	0.2
16/16A	69	1080	540	1.92	0.96	644	51.7	13.4	11	0.5
17	29	725	725	0.71	0.71	477	38	10	8.5	0.4
18	75	1035	518	3.33	1.11	746	60	17.5	13.3	0.5
18A	105	2625	656	4.6	1.15	776	62	16	13.8	0.5
19	37	925	925	1.64	1.64	1104	88.7	22.9	19.7	0.6
19A	15	375	375	0.67	0.67	778	36	9.3	8	0.4
19B	10	250	83	0.45	0.15	99	8.1	2.1	1.8	0.2
20	8	200	200	0.36	0.36	238	19	4.9	4.2	0.3
21	54	1350	1350	2.4	2.4	1612	129.5	38	28.7	0.7
22	39	975	975	1.73	1.73	1164	93.5	24	20.7	0.6
22A	39	975	975	1.73	1.73	1164	93.5	24	20.7	0.6
23	30	750	750	1.33	1.33	895	72	18.6	15.9	0.6
24	218	5450	1362	9.6	2.42	1626	130.6	33.7	28.7	0.7
25	104	2600	1300	4.62	2.31	1552	124.7	32.1	27.6	0.7
25A	51	1275	1275	2.27	2.27	1522	122	31.6	27	0.7
26	50	1250	1250	4.44	2.22	1492	119.8	30.9	26.5	0.7
26A	30	750	750	1.33	895	72	18.6	19	15.9	0.6
27	146	3650	1216	6.48	2.16	1452	116.6	30	25.8	0.7
28	25	625	625	1.11	1.11	746	59.9	15.4	13.3	0.5
29	36	900	900	3.2	1.6	1075	86.3	22.3	19.1	0.6
30	215	5375	1344	9.56	2.39	1605	129	33.2	28.5	0.7
31	79	1975	988	3.5	1.75	1180	94.7	24.4	21	0.7
32	65	1625	812	2.9	1.45	969	77.8	20	17.2	0.6
Total	2298			87.1						

The modeling results include projected emissions from all of the units which total 100.5 tons of $PM_{2.5}$ for understory burns and 87.1 tons of $PM_{2.5}$ for pile burns for a total of 187.6 tons. The burning would be implemented over a period of 5-8 years so any 1-year of emissions would likely not exceed 50 tons. Direct effects of the burns include particulate emissions from pile burning and understory burns. Actual concentrations would be about 4 to 10-uq/m3 greater depending on the background concentration of $PM_{2.5}$. The understory burns produce a centralized plume due to a concentrated burn area while pile burns result in multiple plumes which consolidate into a central plume.

The chart below is from the SIS run for the MBC unit understory burn. Projected $PM_{2.5\ emissions}$ are below the 65 ug/m3 $PM_{2.5}$ standard all distances from the burn. This unit has a minimum ambient distance of 0.1 miles. The minimum ambient distance is the spacing from the burn the public would have access to the air when outside of a vehicle. Access to the air triggers the 24hour average $PM_{2.5}$ 65 ug/m3 standard.





The chart above is from pile burn unit 1 where $PM_{2.5}$ concentrations are much higher close to the unit although total $PM_{2.5}$ emissions are similar to the understory burns. The pile burns have minimum ambient distances of 0.1 to 0.7 miles. Within the minimum ambient distances the public will be warned about high smoke concentrations and advised not to travel outside of a vehicle. Most of the pile burn areas with the highest minimum ambient distances are in the southern part of the project and not heavily used when pile burning would be done (generally November and December or in April or May). Pile burn units would only be burned one unit at a time to avoid cumulative smoke effects between units. All burns would disperse to low concentrations beyond 5-10 miles. In units adjacent to the Absaroka Beartooth Wilderness some of the Wilderness could be within the minimum ambient distance where exceedences of the $PM_{2.5}$ standard are expected.

Spring burns would likely occur during a period of more wind dispersion than fall understory or pile burning, due to longer spring daytime length, and higher mixing heights. The understory and pile burn smoke plume would likely also disperse to the north and east along the north end of the Boulder canyon. $PM_{2.5}$ from burns would not likely be measurable at Big Timber since the smoke would tend to disperse to the SE. Some concentration of smoke could occur near Boulder Canyon residences, particularly near units 2 and 3 if pile burn smoldering phase were trapped by nighttime inversions hence the constraining of units MBC and 1-4 with minimum ambient distances of 0.1 to 0.2 miles to avoid $PM_{2.5}$ exceedences at the residences. Outside of the minimum ambient distances the smoke concentrations are expected to be within NAAQS and State of Montana air quality standards. Main Boulder Fuels Reduction Project burns would 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_{10} air quality impacts. The State Airshed Group, Monitoring Unit in Missoula, evaluates forecast meteorology and existing air quality statewide by individual airshed and specifies restrictions when smoke accumulation is probable due to inadequate dispersion.

Indirect effects would include some localized visibility reduction from the plumes. Some obscurement of visibility for driving along the Boulder Canyon road could occur in narrow bands during understory or pile burning. Smoke could also cause temporary visibility reductions from the same units in nearby areas of the Absaroka Beartooth Wilderness. Dispersion of the plumes would be expected to quickly mix the project smoke to insignificant visibility impact levels.

In the long run, the proposed action alternative would allow the opportunity to reduce the potential of wildfire ignition in the treatment areas. Wildfire in the Main Boulder River area has the potential to result in extensive smoke and air quality impacts from $PM_{2.5}$ and PM_{10} emissions.

Cumulative Effects

Air resources are somewhat unique in that the past impacts to air quality are not usually evident or cumulative. With the proposed action alternative, units would be harvested and understory and/or pile burning would occur, thus reducing and breaking up the continuity of the fuel loadings in the treated portions of the corridor. The likelihood of a large wildfire occurring in the Main Boulder Canyon would be reduced by lowering the fuel concentrations and breaking up the vertical and horizontal fuel continuity. There would be a significantly lower chance of a fire start to occur and turn into a large fire in the river corridor after the fuel treatments are completed. However, even with the proposed fuels treatments, it is possible that given the right combination of weather related conditions, a large wildfire event could still occur in the drainage.

The Main Boulder Fuel Reduction Project emissions would be cumulative only with the local emission sources described in the affected environment occurring at the time of burning. Main Boulder Fuels Project cumulative effects for air quality are very limited since there are very few sources of emissions in the Main Boulder Canyon. Cumulative concentrations from individual unit burns will not occur since only 1 understory burn unit or pile burn unit will occur at any one time with little potential for chronological overlapping. Cumulative effects would likely be the same as disclosed in the Direct and Indirect Effects and are constrained by the air quality design criteria and mitigation measures on *Ch. 2-33 and Appendix B-2.*

Irreversible and Irretrievable Commitments of Resources

By incorporating the specific guidelines for air quality, which are outlined in the mitigation section and on Table B-1, there would be no irreversible or irretrievable commitments of resources for air quality. As stated above, the impacts to air quality are not usually evident or cumulative.

Applicable laws, regulations, and Forest Plan Guidance

Congress passed the Clean Air Act in 1963, and amended it in 1972, 1977, and 1990. The purpose of the act is to protect and enhance air quality while ensuring the protection of public health and welfare. The act established National Ambient Air Quality Standards (NAAQS), which must be met by state and federal agencies, and private industry. States are given primary responsibility for air quality management. Section 110 of the Clean Air Act requires States to develop State Implementation Plans (SIP) what identify how the State will attain and maintain NAAQS, which are identical to the Montana standards for PM_{10} (particulate mater with less than 10 microns). The $PM_{2.5}$ standard requires concentrations of $PM_{2.5}$ not to exceed a 24-hr average of 65 ug/m^3 (micrograms per cubic meter). Average annual arithmetic $PM_{2.5}$ concentrations are not to exceed 15 ug/m^3. The SIP is promulgated through the Montana Clean Air Act and implementing regulations. The regulations provide specific guidance on maintenance of air quality, including restrictions on open burning (ARM 16.8.1300). The act created the Montana Air Quality Bureau (now under DEQ) and the regulatory authority to implement and enforce the codified regulations.

The NAAQS have been established for carbon monoxide, nitrogen oxide, and sulfur dioxide, lead, ozone, and PM_{10}. There are numerous types of pollution that could be controlled, but particulate matter is the primary pollutant of concern. The NAAQS 24 hour standard requires concentrations of $PM_{2.5}$ not to exceed a 24hr average of 65 ug/m3 (micrograms per cubic meter) of air. Average annual arithmetic concentrations of $PM_{2.5}$ are not to exceed 15 micrograms per cubic meter of air.

The August 1977 amendments designated areas of the nation into PSD (Prevention of Signification Deterioration) classes. Class 1 airsheds are given the most protection from human caused air pollution in order to protect their pristine character. Class II airsheds allow for a greater amount of human caused pollution. . All of the project area is within a Class II airshed. The EPA has not yet identified any Class III airsheds.

The Montana DEQ is currently cooperating with the Western Regional Air Partnership (WRAP) to establish visibility goals, monitoring plans, and control measures to comply with regional haze visibility standards in all Montana Class I areas including Yellowstone National Park.

The Gallatin NF Forest Plan in Forest Wide Standards pp. II-23 requires that the Forest will cooperate with the Montana Air Quality Bureau (now DEQ) in the SIP and smoke management plan.

By incorporating the specific guidelines for air quality, which are outlined in the mitigation section of the FEIS on Ch. 2-33 and in Table B-1, implementation of the proposed action would comply with all of the laws, policies, and guidelines that are discussed above.