CHAPTER 3
Affected Environment and Environmental Consequences

3.1 INTRODUCTION

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

The impacts discussed in this chapter are for those issues considered to be significant 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 for each issue. A discussion of the proposal's consistency with the Gallatin Forest Plan and other applicable laws, regulations, policies, and other direction is provided. Appendix A includes discussion and consistency for issues that were not considered to be significant. Additional information may be found in the Project File that is located at the Livingston 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 based on professional analysis or are modeled predictions of the effects. The actual effects may not occur exactly to the degree presented. More important than the exact effects, is the comparison of change between the alternatives, the current condition Alternative 1 (no action), Alternative 2 (proposed action), and Alternative 3 (proposed action and Meadow Creek Burn), as predicted by models and analytic projections (See Maps M-3 & M-4).

3.2 PAST, PRESENT, AND REASONABLY FORESEEABLE ACTIVITIES THAT MAY CONTRIBUTE TO CUMULATIVE EFFECTS

Consistent with the Council for Environmental Quality (CEQ) guidance,[a] past, present, and reasonably foreseeable activities are considered in the cumulative effects analysis for each resource area relative to the specific potential future effects of the proposal. For each of the significant issues discussed in this chapter, those cumulative effects that pertain to the issue are presented. Because the project's direct and indirect effects vary in time and space, each resource issue has a defined specific cumulative effects analysis area and timeframe that is pertinent to the specific resource and the issue being

[a] Council on Environmental Quality, Guidance on the Consideration of Past Actions in Cumulative Effects Analysis, June 24, 2005 Memorandum.

considered. The resource discussions evaluate the degree to which past, present, and future actions influenced or will influence the affected environment.

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

General Description of the Analysis Area

The analysis area for the project consists of the Smith Creek Wildland Urban Interface (WUI) boundary as defined in the Park County Community Wildfire Protection Plan (approximately 23,200 acres). The analysis area consists of a mixture of National Forest System (NFS) and private lands (many of which are outside of the Gallatin National Forest boundary). See the Vicinity and Activity Area Maps. All of the proposed treatment units are located within Timber Compartment 221, which has a total acreage of 17,154 acres. Approximately 3,808 acres (22%) of these acres are privately owned and 13,346 acres (78%) are national Forest lands. The cumulative effects area for many of the resources will vary from the project analysis area depending on the environmental parameters of the individual resource.

The overriding geological features for the analysis area dictate elevation zones, variations in topography and climate regimes. These general components along with other determinants such as temperature, effective precipitation and hydrologic regime tend to dictate the vegetation components of the area. A predominance of Douglas fir (Pseudotsuga menziesii) and lodgepole pine (Pinus Contorta) occur throughout the area; to a lesser degree a mix of Englemann spruce (Picea engelmannii), sub-alpine fir (Abies lasiocarpa), aspen (Populas tremuloides), big sagebrush (Artemisia tridentate), other shrub-steppe, meadows and riparian complexes exist.

Elevations within the analysis area range from 5800’ to 8500’ and topographic features are typical of mountainous regions, with rolling hills to steep terrain with saddles and ridges. No major federal or state highways are within the project area. However, US route 89 lies approximately ten miles to the west of the project area. The major access to the area is mostly via a Park County maintained route, which parallels the southern portion of the watershed analysis area. The Shields River road along the southern end; the eastern topographical Livingston/ Big Timber District boundaries; and the Lewis and Clark/ Gallatin National Forest Boundaries along the north; as well as the western forest boundary define the overall project area. Leaving the analysis area to the west, federal lands quickly turn to private. Within the project area there are approximately thirty recreational cabins intermixed with several year round residences. The private lands can best be described as the rural mountain community of Smith Creek.

These subdivision(s) are well populated; they have a rural character common to Montana's mountain communities. The western edge of the analysis area occurs at the forest boundary and transitions to the largely private agricultural/ranch lands of the Upper Shield River Valley. The dominant cover type of lodgepole pine and Douglas fir can generally be found on the relatively drier sites. Often, the moist sites may favor Englemann spruce or quaking aspen. The park and meadow complexes are dominated by grass and sagebrush communities. Riparian complexes (seeps, springs, fens and willow carrs**)** are found throughout. Forested stand conditions can be described, in the non-managed stands, as mature forests with active insect and disease activity. Most stands in this cover type had a natural establishment following the last stand-replacement disturbance, such as fire, insect outbreak or both.

Historical Activity and Uses

Past activities (last 100 years) within the analysis area include fire suppression, timber harvest and associated roadbuilding, hunting, recreational activities, and livestock grazing. Fire suppression, along with livestock grazing in portions of the analysis area have altered plant communities' biomass production, species composition, and diversity. Conifers have encroached into non-forested areas historically kept from climax conditions with frequent fire. Noxious weeds were introduced and infestation levels have increased in some areas. Past logging and road building have also contributed to altered habitats in portions of the analysis area. Wildlife management of big game populations by permit has evolved to present day hunting permits, seasons, and protections.

In the summer of 2005, a fishery improvement project occurred in reaches of an unnamed tributary of Smith Creek. Root wads and large woody debris was placed into the creek to enhance fishery habitat.

Major fires occurred in the analysis area in the mid eighteen hundreds. Recent fires in the vicinity include the Smith Creek Fire in 1994 that burned 1400 acres, portions of which lie within the analysis area.

Changes in patterns of land ownerships in the Smith Creek drainage occurred on approximately 4,500 acres due to the Galt land exchange in 1991-1993 and 2600 acres due to the Goat Creek Land Exchange in 1999 (Including Section 1 which contains treatment Units A1, A2, B, and D). Much of this land was extensively roaded and harvested prior to acquisition by the Forest Service. In 1993, 1994, and 1995 approximately 25 miles of road within the newly acquired Forest Service land in the Smith Creek drainage were decommissioned and rehabilitated to improve water quality.

Past harvest activities in timber compartment 221 are outlined on Table 3-1 below and shown on Map M-9. Many of the National Forest Land regeneration harvest acres were on lands that were previously harvested private lands that were acquired by the Forest Service in the early 1990s through the Galt Land exchange. The majority of these harvested acres have regenerated and many are densely stocked with young conifers. Approximately 1900 acres of these regeneration harvest acres were pre-commercially thinned in the 1970s-1990s.

Table 3-1 Acres of Past Harvest (Prior to 1960- 2000) in Compartment 221

Years of Harvest Activity	Acres of Private Land (Intermediate Harvest)	Acres of Private Land (Regeneration Harvest)	Acres of National Forest Land (Intermediate Harvest)	Acres of National Forest Land (Regeneration Harvest)
Prior to 1960	0	578		140
1961-1980	203	340	81	2117
1981-2000		5	321	1618
Totals	**203**	**923**	**402**	**3875**

Current Activity and Uses

Private land exists within the Forest Service administrative boundary in several locations within the analysis area. These private lands have been subdivided and contain many seasonal use cabins and several four season homes. The highest concentrations of private residences are located along Smith Creek and the East Fork of Smith Creek. The largest group of residences is the Smith Creek Subdivision located in the southwest corner of Section 6. Additional residences are scattered throughout Sections 5 and 7. Some of the private landowners have conducted thinning activities and/or other fuel reduction activities on their private lands.

The Three Peaks Grazing Allotment and the currently vacant Meadow Creek Allotment lie within the project area. The Smith Creek Allotment is located north of the project area. A recent Decision Notice was issued for managing these allotments allowing for adaptive management techniques to be utilized in these allotments to allow for grazing adjustments that are compatible with projects such as Smith Creek Vegetation Project (Upper Shields Allotments Decision Notice and FONSI, September 2006)..

The Smith Creek WUI (analysis area) is highly roaded and also includes several Forest Service trails. The area has thus become popular with motorized recreationists; especially users of ATVs. The presence of many closed roads makes management of ATVs particularly difficult. The new Gallatin National Forest Travel Plan (Dec. 2006) identifies designated motorized routes in the drainage. All other routes currently in use will become closed to motorized use. National Forest System Trails or Road systems currently used by recreationists in the project area include Scab Rock Trail #261, Lower Scab Rock Trail #262, East Fork of Smith Creek Road, and the Main Smith Creek Road. Recreational/scenic driving is one of the most popular recreational uses on Forest Service roads in the analysis area. Dispersed camping occurs at several sites along the main Smith Creek Road #991. Some snowmobiling occurs during the winter months. There are no marked or groomed snowmobile routes in the area, but many owners of cabins on private land use snowmobiles for access to their cabins and for recreation.

Special funding was allocated, and road maintenance treatments to improve road conditions and sediment concerns in the project area will be completed during the summer of 2007. This maintenance includes up to 53 armored drainage dips, spot surfacing around eleven live stream crossings, and road grading on Smith Creek Road #991 (Shields River junction to MP 5.16), Goat Mountain Road #6636 (Smith Creek junction to MP 2.64), and East Fork of Smith Creek Road (Smith Creek junction to MP 2.30. work (Pre-Project Road Maintenance,Table A-24, Map M-5)

The Smith Creek drainage is also popular with horsemen, hikers and to a lesser extent, mountain bikers. Many of these users have cabins on the adjoining private property. The public also utilizes the Smith Creek area for firewood gathering. There are currently no outfitters permitted by the National Forest operating in the Smith Creek drainage.

There are no developed recreation opportunities in the Smith Creek drainage. No cabins, developed campgrounds, recreational residences or organizational camps are located in the drainage.

Potential Future Activity and Uses

Weed treatments will continue as a part of the regular district weed management program and are likely to increase somewhat due to pre-harvest mitigation (pp. 2-33 & 2-34). Recreation in the form of camping, hiking, fall hunting, trail riding, and backcountry driving will likely continue. Grazing of the allotments is proposed to continue under the conditions described in the Upper Shields Allotment EA (July 2006) and Decision Notice (September 2006), which includes utilization of adaptive management techniques. Cattle grazing on the Three Peaks Allotment may be altered somewhat post-treatment to protect aspen regeneration.

Shields River Road #844 from MP 0.00 at the end of the paved Shields River County Road to MP 1.52 at the junction with the Smith Creek Road #991.would be used to access to all units associated with the action alternatives (Alternatives 2 & 3). The Forest Service is currently waiting on federal funding to upgrade this road to ML5, a paved, two lane, heavy duty road. All NEPA work associated with these improvements has been completed (See map of proposed improvements in Project File).

The Gallatin National Forest recently developed a management plan for all transportation routes including both motorized and non-motorized on the forest. Changes in travel management in the Smith Creek area due to the new Gallatin National Forest Travel Plan include:

- New seasonal restrictions on Goat Creek Road #6636 starting in the southwest corner of Section 1 : closed Dec 2 - June 15
- East Fork Smith Creek Road #6635 - lower gated closed Oct 15 - Jun 15 (change from Jan1 - Apr 30)
- Smith Creek Road #991 - new gate where road enters southern border of Section 31. Gate closed Dec 2 - June 15
- East Fork Smith Creek / Bitter Creek area - new designated ATV/Motorcycle/Mtn bike trails
- Honey Run Trail #130 - the portion of the trail along the ridge of Bald Ridge will be closed to motorized
- 10-20 miles of uninventoried motorized routes in the Smith Creek and Shields drainage will not be designated as motorized routes and thus closed to motorized use.
- Development of an ATV parking area at the junction of Roads # 7710 and #991.

Other reasonably foreseeable actions that may occur in the project area on private lands include increased subdivision and private land development. Private individuals may conduct additional forest thinning and fuel reduction activities on private lands as there is currently National Fire Plan grant money available from the county for these types of activities. Private lands will continue to conduct agricultural activities such as farming and ranching. Hunting seasons managed by the State of Montana Department of Fish, Wildlife, and Parks will likely continue. No specific areas have been identified for these activities at this time. The Forest Service has no control over activities such as these occurring on private land.

3.3 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 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). All three alternatives would be consistent with the goals, objectives and standards of the Forest Plan.

Recreation Summary

The Gallatin National Forest Plan directs the Forest to provide for a broad spectrum of recreation opportunities in a variety of Forest settings (FP, pg. II-1). The Forest Plan recognizes objectives for recreation settings by incorporating the Recreation Opportunity Spectrum (ROS), which provides a framework for stratifying and defining classes of outdoor recreation environments, activities, and experience opportunities (FP, pg. II-2). Furthermore, the Plan specifically identifies as objectives activities that will be managed 1) to provide for users' safety, 2) that existing recreational hunting opportunities will be maintained, 3) that recreation trails will provide safe public access, and 4) to continue the cabin rental program (FP, pg. II-2-3).

The Gallatin National Forest Travel Plan (December 2006) contains language updating and further defining the forest-wide goals, objectives and standards for recreation. The Travel Plan recognizes the goal of "providing for a variety of recreation opportunities on the road and trail system that allows for the enjoyment of the Forest's backcountry, wilderness, rivers, lakes, topography, wildlife, snow and historical assets" (TP, Detailed Description of the Decision, I-1).).The ROS classification for the Smith Creek drainage ranges from Roaded Natural (RN) and Semi Primitive Motorized (SPM) in the summer to Semi Primitive Motorized (SPM) in the winter.

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. All of the proposed treatment areas are in Roaded Natural areas in the summer.

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 Smith drainage in the "winter" season when snow covers the landscape. Some dispersed snowmobiling occurs in the drainage during the winter but is generally limited to owners of cabins in the area. All of the proposed treatment areas are in Semi Primitive Motorized areas in the winter.

The action alternatives (Alternative 2 & 3) incorporate design criteria and mitigation to ensure compliance with the Travel Plan and ROS classifications for the Smith Creek project area.

Wildlife Summary

Forest Plan Standard for Wildlife and Fish, page II-18, section 6.a.3 – Big game winter range will be managed for forage and cover.

Forest Plan Standard for Wildlife and Fish, page II-18, section 6.a.5 – Maintain hiding cover associated with key habitat components.

Forest Plan Standard for Wildlife and Fish, page II-18, section 6.a.7 – Standards for snag and down woody material will be utilized.

Forest Plan Standard for Wildlife and Fish, page II-18, section 6.a.8 – Emphasis will be given to the management of special and unique wildlife habitats such as wallows, licks, talus, cliffs, caves, and riparian areas.

Forest Plan Standard for Wildlife and Fish, page II-18, section 6.a.11 – Roads and forest cover will be managed to provide habitat security and diverse hunting opportunity.

Forest Plan Standard for Wildlife and Fish, page II-18, section 6.a.12 – Habitat that is essential for species identified in the Sensitive species list developed for the Northern Region will be managed to maintain these species

Forest Plan Standard for Wildlife and Fish, page II-18, section 6.a.13 – Indicator species will be monitored.

Forest Plan Standard for Threatened and Endangered Species, page II-18, section 6.b.all.

The Smith Creek project proposed vegetation units are all located within Forest Plan Management Area (MA) 8 (timber management). Standards relative to

wildlife within this MA includes providing for wildlife habitat improvement when consistent with MA goals and to incorporate considerations for wildlife in the project planning process.

Sensitive Plant Summary

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 (CT) 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 EA (pp. A-70 through A-74).

Sensitive plant surveys were conducted within the project area in summer of 2006. 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.

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.

Applicable Forest Plan Standards (FP, p. II-17) relating to fisheries include:

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. Applicable riparian standards include:

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 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 in 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.
7. Shade tolerant tree species which occur as an understory in sapling stands will be left during pre-commercial thinning to promote multi-storied stands."

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 Smith Creek Vegetation Treatment Project proposal 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 pp. 2-30 & 2-31.

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 (BMPs) 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 B.

A detailed description of the BMP process and BMP's for the Smith Creek Vegetation Treatment Project is included in Appendix B.

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

Fine sediment levels, resulting from Alternatives 1-3, are within GNF Implementation Guidelines for spawning habitat composition in Smith Creek and the East Fork of Smith Creek.

Beneficial aspects of wildfire to stream ecosystems will be retained by all three 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

Forest Plan Management Areas

The harvest and thinning units associated with both action alternatives occur primarily in MA8 (timber) with some linear inclusions of MA7 (riparian). MA 7 is not mapped because it consists of very narrow streamside zones that are not practical to map. Section 1 currently reflects a Management Area 99 on Map M-10. Sections on Map M-10 that are displayed as MA 99 were previously privately owned and traded to the Forest Service in 1997 with the Goat Creek Land Exchange. These sections have not officially been assigned management areas after that land trade. The interim management direction for areas such as these is to manage them the same as adjacent areas. Section 1 is the only section containing

treatment units that is currently unclassified. The proposed units in Section 1 are adjacent to MA8 on the north, east and south boundaries, so the interim direction is to treat it as such. The remaining unclassified sections within the analysis area do not contain treatment units included in the action alternatives. The Meadow Creek prescribed burn (Unit J) associated with Alternative 3 is in MA10. The remaining MAs within the analysis area do not contain treatment units. All fuel reduction activities associated with the proposed action comply with Forest Plan guidelines for the applicable MAs. (See pp. 1-11 & 1-12 and MA Map M-10). The applicable MA direction, goals, and standards associated with the alternatives include:

Management Area 7 (MA 7) – These are riparian management areas (FP, pp. III-19 through III-23). The management goal for MA7 is to manage the riparian resource to protect the soil, water, vegetation, fish and wildlife dependent upon it (FP p. 2-21)

Timber standards: (1) These areas are classified as suitable for timber production if adjacent areas contain suitable timber, (2) Manage to provide a diverse vegetative pattern, (3) Design timber harvest to meet needs of riparian zone-dependent species, (4) Maintain sufficient trees within 30 feet of the stream to provide snag recruitment, (5) Emphasize special logging practices which minimize soil disturbance, (8) Machine piling will not be allowed (FP, p. III-21).

Wildlife and Fish Standards: (1)Fish habitat improvement projects consistent with management area goals will be scheduled, (2) Maintain suitable habitats for those species of birds, mammals, and fish that are totally or partially dependent upon riparian areas for their existence

Water and Soils Standards: (1) Manage riparian vegetation, including overstory tree cover to maintain streambank stability and promote filtering of overland flows, (2) Avoid using equipment which causes excessive soil compaction and displacement.

Some of the harvest units associated with Alternatives 2 & 3 would have small linear inclusions located in MA7. BMP's and SMZ rules will be followed in these areas. Hand-thinning methods will be utilized in riparian areas.

Management Area 8 (MA 8) - These areas consist of lands that are suitable for timber management. Although these areas consist primarily of capable forest land, there are inclusions of non-forest and nonproductive forest lands (FP, pp. III-24 through III-26). Management goals for MA 8 include: (1) Provide for productive timber stands and optimum timber growing potential; (2) Develop equal distribution of age classes to optimize sustained timber production and improve vegetative diversity; (3) Allow for other resource uses if compatible with the first two goals (4) meet state water quality standards and maintain stream stability (FP, p. III-24).

Timber Standards (1) Area is classified as suitable for timber production, (2) Include both even-aged and uneven-aged harvest method systems, (3) Encourage harvest of posts and poles and other products in existing stands to promote volume increase and meet the demand for these products, (4) Favor Douglas-fir and lodgepole pine in management, however, retain other species for species diversity, (6) Actively control tree damaging agents (FP III-25).

Wildlife and Fish Standards: (1) Provide for fish and wildlife habitat improvement when consistent with management area goals, (2) Project plans will incorporate considerations for wildlife and fish (FP III-24).

Fire Standards: (1) Prescribed fire may be used to meet management area goals.

The majority of treatment acres in the harvest units associated with Alternatives 2 & 3 occur in MA8. Thinning and other vegetation treatments would favor Douglas-fir and lodgepole pine for management, would improve the health and vigor of the remaining trees, would lower the likelihood for insect epidemics at the stand level, and would help to promote age class and species diversity in the project area, which are all consistent with the above-mentioned standards.

Management Area 10 (MA 10) - These areas contain open grasslands which provide forage for livestock interspersed with suitable timber lands (FP, pp. III-30 through III-31). Management goals for MA 10 include: (1) Maintain healthy stands of timber and promote a level of timber growth consistent with other goals (2) Improve range management to optimize livestock grazing; (3) Use timber harvest to create transitory livestock range.

Fire Standards: (1) the wildfire response will be control, (2) Contain or confine responses may be used before and after fire season, (3) Prescribed fire may be used to meet management area goals (FP, p. III-31).

Wildlife and Fish Standards: (1)Fish and wildlife habitat improvements consistent with management area goals may be scheduled.

Water and Soil Standards: (1) Meet water quality standards and maintain channel stability.

Unit J in Alternative 3 would consist of a prescribed burn, located in MA10. A 100 foot no burn buffer would be established along Meadow Creek to ensure protection of riparian values including channel stability.

3-4 OTHER DISCLOSURES

Unique Characteristics of the Geographic Area

The Project Area is located on the west side of the Crazy Mountains along the northwest corner of the Livingston Ranger District; approximately 35 miles north of Livingston, Montana in the Smith Creek drainage**.** The Park County Community Wildfire Protection Plan (Project File), completed in spring of 2006 identified the Smith Creek drainage as a wildland urban interface (WUI) that is at risk from potential wildfire.

The section of the Crazy Mountains where this fuels reduction project is proposed, offers scenery that is typical to many mountainous areas in Montana. In the viewsheds specific to this project, there are some visually scenic topographic landmarks, such as Goat Mountain, Scab Rock and Bear Mountain. Dense conifer stands cover the flat and rolling terrain, intermittently broken by open meadows and some talus slopes on ridges. There are infrequent stands of deciduous trees such as aspen or cottonwood, especially in wetter areas and along the streams that add visual interest and variety.

Smith Creek and the East Fork of Smith Creek flow through the project area. There are no 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, Section D. Recreation (pp. A-14 through A-24).

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

Rangelands and productive (not prime) forestlands occur within the analysis area. None of the alternatives will have significant effects on the productivity of either private rangelands (no activities are scheduled to occur on private lands) or public rangelands where grazing is a permitted use (See Appendix A, Section C, Livestock Grazing). Forested lands will be impacted by harvest activities mainly in MA 8, with minor harvest impacts in MA7. Timber management is given primary emphasis in MA8. There is one area (Unit J, Alternative 3) in MA10 scheduled to have prescribed burning activities. Livestock grazing and timber production are given primary emphasis in MA10. See MA descriptions in pp. 1-11 & 1-12. 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 any alternative.

Effects of Alternatives on Social Groups

None of the proposed alternatives would have discernible effects on minorities, American Indians, women, or the civil rights of any United States citizen. Neither would they 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 use of effective project design and mitigation measures as described on pp. 2-37 & 2-38. Project implementation should improve public health and safety by reducing the probability of a catastrophic wildfire that would threaten public health and safety. Implementation of 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 is one historic site that has been found in the Smith Creek project area. Prehistoric sites are rare in the lower elevations of the Crazy Mountains with most prehistoric sites occurring at high prominences with several sites recorded around the project area but not nearby. There is potential for historic sites related to early sheepherding, homesteading, and logging operations, but none have been documented.

The design measures associated with the action alternatives for site protections on p. 2-39 can easily be implemented so that no direct or indirect affects would result from the treatments prescribed in the units. See Appendix A, Section I, pp. A-82 thruA-84 for further details.

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. Only minor amounts of soil loss and displacement would occur as a result of the action alternatives. Application of the soil mitigation measures described on pp. 2-32 & 2-33 and BMP's in Appendix B 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.

It is anticipated that there would be no irreversible or irretrievable commitments of resources associated with the implementation of the action alternatives 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

None of the alternatives would be inconsistent with the objectives of Federal, Regional, State, and Local land use plans, policies, and controls for the project area. All of the alternatives are compatible with the Park County Community Wildfire Protection Plan (Project File), which was completed in spring of 2006. See the, Biological Assessment (Project File) regarding consultation and coordination with the U.S. Fish and Wildlife Service on effects to threatened and endangered species. The alternatives are also consistent with the Yellowstone Cutthroat Trout Conservation Strategy.

Energy Requirements and Conservation Potential of Alternatives

The energy required to implement either of the action alternatives 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 vegetation treatment project will not result in adverse environmental effects that cannot be avoided.

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). Numerous public

involvement opportunities as well as two scoping comment periods and an official comment period regarding this EA have and will be provided to the general public.

3.5 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. Compliance with these laws is discussed in this chapter following the effects analysis for each significant issue and in Appendix A after the discussion for each issue that is not significant. or references within this document are noted. Laws that are not specifically related to a particular issue are outlined below.

National Forest Management Act of 1976 / Gallatin Forest Plan

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

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

3.6 DIRECT, INDIRECT, AND CUMULATIVE EFFECTS

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

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

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

Past and current activities in both the Smith Creek watershed include livestock grazing (including the recent Upper Shields Grazing Allotment Revisions), approximately 1,125 acres of timber harvest on private lands and 4,275 acres of harvest on National Forest lands in the last 40+ years (much of this harvest was conducted before the Forest Service acquired these previously privately owned lands), revegetation on the majority of these acres, pre-commercial thinning activities on approximately 1900 acres of National Forest lands, changes in patterns of land ownerships on approximately 4,500 acres due to the Galt land exchange in 1991-1993 and 2600 acres due to the Goat Creek Land Exchange in 1999 (Including Section 1 which contains treatment Units A1, A2, B, and D), road obliteration of approximately 25 miles of road after the Galt land exchange, hunting, and year-round recreational activities.

Although, data suggests that major portions of the Crazy Mountains were impacted by fire in 1849, 1855 and 1863, the only major fire in the analysis area since then was the 1994 Smith Creek fire, which burned 1,000 acres. Since 1863, fires have been suppressed and it is reasonably foreseeable that they will continue to be actively suppressed in the analysis area when conditions permit. Therefore, it is foreseeable that a large fire will likely occur in the near future.

It is unlikely that there will be other vegetation treatment projects in the analysis area on National Forest system lands in the foreseeable future, other than possible maintenance of the current project. Fuel reduction on private property will likely continue for several years. Other reasonably foreseeable actions include implementation of the recent decision for the Gallatin National Forest Travel Management Plan and continued recreational use of the area (See pp. 3-1 through 3-6 for a more detailed description of past, current, and reasonably foreseeable activities).

Issue 1 - <u>Water Quality:</u> Proposed vegetative treatments, along with the cumulative effects of existing roads, recreation, and private land development could have an adverse effect on water quality by potentially introducing additional sediment to Smith Creek and East Fork Smith Creek and tributaries. Conversely, without treatment, a catastrophic wildfire could also adversely affect water quality in these streams.

Scale of Analysis: The geographic and temporal scale of water quality analysis consists of cumulative sediment modeling of all National Forest and private lands, roads, and recreational developments. The R1/R4 model was used for sediment analysis for all activities from 1980 to 2013 at an accounting point of Smith Creek and East Fork Smith Creek respectively at their confluence. In addition, the R1/R4 model was run for the entire Smith Creek watershed at the confluence with the Shields River.

Affected Environment

The Smith Creek Vegetation Treatment Project would occur primarily in upper Smith Creek and East Fork Smith Creek with a prescribed fire unit in the upper end of Meadow Creek. Smith Creek above the confluence with the Shields River has a watershed area size of about 25.1 square miles. The primary streams in the project area include Upper Smith Creek (10.2 $mi^{2)}$, East Fork Smith Creek (5.6 mi^2), Goat Creek, and Meadow Creek.

The Smith Creek watershed has had extensive historical roading and timber harvesting. Many of the roaded and harvested areas were on private land which was purchased in the early 1990's. In 1993, 1994, and 1995 about 25 miles of roads on National Forest land were obliterated in the Smith Creek drainage which has resulted in a recovering Smith Creek watershed, reduced sediment input, and re-vegetating timber harvest and road corridors. The 25.1 mi^2 Smith Creek watershed has about 53 miles of open roads and 25 miles of decommissioned roads (ripped, drained, slashed, seeded, and closed to motorized use). Current Smith Creek sediment levels are estimated to be about 6.4% over natural at an R1/R4 sediment model at an accounting point at the Shields River confluence. Historical roading and timber harvesting activity has elevated instream sediment concentrations in East Fork Smith Creek and in Smith Creek which is described in detail in the fisheries section of this EA. The environmental consequences section of this EA summarizes sediment modeling for those 2 drainages.

The Montana DEQ 303(d) list in the 2006 Montana Integrated Water Quality Report http://www.deq.mt.gov/CWAIC/wq_reps.aspx?yr=2006qryId=7382 lists the upper segment of Shields River (41.6 miles) from the headwaters to Cottonwood Creek and partially supporting beneficial uses for aquatic life support, cold water fishery, and primary contact recreation. Probable causes for listing are bank erosion, dewatering, flow alteration, other habitat alterations, riparian degradation, siltation from agriculture, grazing, silviculture, hydro-modification, and flow regulation/modification. In the project area the primary cause of impairment is historically upstream timber harvest (silviculture). The Shields River TMDL is currently being developed by the Montana DEQ (via contract with CONFLUENCE Inc.), which is currently under DEQ review. The Shields TMDL will then be released for review and final preparation with formal release sometime in 2007. The Smith Creek Vegetation Treatment Project is being designed to be fully compliant with the Shields TMDL requirements which include road, timber harvest, and fuel reduction technique BMP's.

All streams supporting fish in the analysis area are Category A (see below) due to the presence of Yellowstone cutthroat trout. Smith Creek is a HUC6 watershed, while East Fork Smith Creek and Upper Smith Creek are HUC7 watersheds. R1/R4 sediment modeling for the Shields River Watershed Risk Analysis (USFS, 2005a) indicates extensive recovery of the Smith Creek and Shields river sub-watersheds since the road obliteration work in 1993-1995.

Sediment standards for Smith Creek are listed in the Gallatin NF Travel Plan Standard M-1 for Water, Fisheries, and Aquatic Life**.** In watersheds with streams currently at or above fish habitat management objectives, proposals for road and trail construction, reconstruction and maintenance will be designed to not exceed annual sediment delivery levels in excess of those in Table 3-2 Sixth-code Hydrologic Unit Codes (HUCs) are the analysis unit for sediment delivery (and other habitat parameters), except where a sixth code HUC artificially bisects a watershed and is therefore inadequate for analysis of impacts to aquatic habitat and aquatic organism meta-populations. In such cases, appropriate larger units will be analyzed (e.g. 5th code HUCs). Within the analysis unit, sediment delivery values in Table 3-2 will serve as guidelines; however, sediment delivery values denoted in individual 7th code HUCs may temporarily exceed sediment delivery rates denoted in Table 3-2, in the following circumstances:

1. The HUC does not contain a fragmented sensitive or MIS fish population;
2. The majority of HUC's in the analysis unit remain within sediment delivery values listed in Table 3-2;
3. Other core stream habitat (e.g. pool frequency, pool quality) or biotic (e.g. macro-invertebrates, fish populations) parameters within the HUC do not indicate impairment as defined by Montana Department of Environmental Quality (MDEQ); and
4. Sediment delivery levels will return to values listed in Table 3-2 within 5 years of project completion.

Table 3-2 Substrate Sediment and Sediment Delivery by Stream Category

Category	Management Objective (% of reference*)	% Fine Substrate Sediment (<6.3mm)	Annual % > Reference** Sediment Delivery
A Sensitive Species and/or Blue Ribbon fisheries	90%	0 – 26 %	30%
B All other streams (formerly Classes B, C, D)	75%	0 – 30 %	50%

**% of reference = % similarity to mean reference condition; reference conditions range = X-Y*

***Reference = observed relationship between substrate % fines and modeled sediment delivery in reference (fully functioning) GNF watersheds*

Smith Creek contains Yellowstone Cutthroat trout which categorizes Smith Creek and tributaries as Category A streams (See mitigation for fisheries pp. 2-30 & 2-31).

Methodology for Analysis

Potential effects of the Smith Creek Vegetation Treatment Project were analyzed by an 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 evaluated based on sediment modeling and observations of fuel reduction techniques and results on the Gallatin NF. 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 Smith Creek watershed to the confluence with the Shields River.

The key sub-watersheds (Upper Smith Creek and East Fork Smith Creek were also modeled. 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.

Direct and Indirect Effects

Alternative 1 – No Action

Under the no action Alternative 1, no actions would be undertaken over the next 5-10 years to respond to the purpose and need identified in Chapter 1. Road maintenance treatments for 2007 are modeled as completed in 2007 (improved stream crossings at perennial streams, adding armored drainage dips each 1000', and reshaping the road prism and ditches and adding additional drainage). The opportunity to reduce fuel accumulations would be deferred. No treatments such as hand piling, thinning, or broadcast burning would be done. No vegetative treatments would be undertaken to treat stands. No harvesting of timber would occur. There would not be any additional road reconstruction, construction, or additional road improvements in the project area. No additional fire sediment or increase in road sediment would occur.

Table 3-3 Smith Creek at EF Confluence - Alternative 1 – No Action

Year	Natural Sediment Tons/Year	Fuel Treatment Sediment Tons/Year	Road Sediment Tons/Year	Total Sediment Tons/Year	% Over Natural Sediment
2007	40	0	10.9	50.9	27.3
2008	40	0	10.9	50.9	27.3
2009	40	0	10.9	50.9	27.3
2010	40	0	10.9	50.9	27.3
2011	40	0	10.9	50.9	27.3
2012	40	0	10.9	50.9	27.3
2013	40	0	10.9	50.9	27.3
2014	40	0	10.9	50.9	27.3

Table 3-4 EF Smith Creek at Smith Creek Confluence - Alternative 1 – No Action

Year	Natural Sediment Tons/Year	Fuel treatment Sediment Tons/Year	Road Sediment Tons/Year	Total Sediment Tons/Year	% Over Natural Sediment
2007	65.5	0	10.0	75.5	16.1
2008	65.5	0	10.0	75.5	16.1
2009	65.5	0	10.0	75.5	16.1
2010	65.5	0	10.0	75.5	16.1
2011	65.5	0	10.0	75.5	16.1
2012	65.5	0	10.0	75.5	16.1
2013	65.5	0	10.0	75.5	16.1
2014	65.5	0	10.0	75.5	16.1

Table 3-5 Smith Creek at Shields River Confluence - Alternative 1 – No Action

Year	Natural Sediment Tons/Year	Fuel Treatment Sediment Tons/Year	Road Sediment Tons/Year	Total Sediment Tons/Year	% Over Natural Sediment
2007	562	0	35	597	6.2
2008	562	0	35	598	6.2
2009	562	0	35	598	6.2
2010	562	0	35	598	6.2
2011	562	0	35	598	6.2
2012	562	0	35	598	6.2
2013	562	0	35	598	6.2
2014	562	0	35	598	6.2

With Alternative 1, for both upper Smith Creek and East Fork Smith Creek, sediment levels are not increased due to fuel treatments but also not decreased due to additional road improvements associated with the project. Both drainages would meet the Category A 30% over natural sediment standard. Wildfire in the Smith Creek drainage has the potential to result in extensive impacts to soil erosion, debris flows, and sediment loadings to the Shields River. The Shields Risk Analysis (USFS, 2005) used a combination of SIMPPLEE and R1R4 modeling to estimate decadal average wildfire potential sediment increase to 73% over natural for upper Smith Creek and 23% over natural for East Fork Smith Creek. An analysis of a hypothetical 6,400 acre wildfire in Smith Creek (1/3 high burn intensity, 1/3 moderate burn intensity, and 1/3 low burn intensity) resulted in a R1R4 model estimate of 69.6% 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 Smith Creek. The no action alternative would forgo the fuels management opportunity to reduce the likelihood of extensive water quality impacts from a large wildfire in Smith Creek.

Alternative 2: Proposed Action

The proposed vegetation treatments include up to 359 acres of ground based harvesting, 112 acres of hand thinning, 84 acres of helicopter thinning, 66 acres of ground based harvesting/hand treatments, and 143 acres of helicopter thinning and hand thinning. The main potential for increase sediment occurs in Units A, B, D, and G where tractor harvest equipment will be used. Potential sediment increases are greatly reduced due to the winter logging requirement for ground based harvesting. The hand treatment and helicopter thinning have very limited potential to increase sediment due to minimal ground disturbance. Pile burns typically consume 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 Smith Creek fuels are expected to be minor and very localized, primarily in areas where more intensive storms impact treated areas before revegetation occurs. If the fuel treatment areas in upper Smith Creek and EF Smith Creek were clearcut, estimated water yield using a water balance technique (ECA method) would be a 1.2% increase for upper Smith Creek and 1.5% for EF Smith Creek. This is much too low of potential change to be measurable or result in low flow reductions. In actuality the partial canopy reduction methods being proposed will result in an estimated 20% of clearcut water yield increase or about a 0.24% to 0.3% increase.

Erosion and sediment increase from the mechanized ground based treatments and timber removal could result from skid trails, log yarding, landings, and piling disturbance. These effects were evaluated for the proposed action (Alternative 2) using the R1R4 sediment model which was run in a cumulative fashion accounting for all existing roads, timber harvesting, residential, and recreational developments in the Smith Creek watershed to the Shields River confluence. The model was run assuming vegetation treatments, pile burns, temporary road reopening, and timber harvest was done in a 2 year period (2008 to 2009). The model was also run with road treatments as displayed in Ch 1-6. Results are displayed in Tables 3-6 through 3-11 below:

Table 3-6 Smith Creek at EF Confluence –Alternative 2 with Road Treatment A

Year	Natural Sediment Tons/Year	Fuel Treatment Sediment Tons/Year	Road Sediment Tons/Year	Total Sediment Tons/Year	% Over Natural Sediment
2007	40	0	10.9	50.9	27.3
2008	40	0.4	10.5	50.9	27.3
2009	40	0.7	10.2	50.2	25.5
2010	40	0.6	10.2	51.3	28.3
2011	40	0.4	10.2	50.6	26.5
2012	40	0.3	10.2	50.5	26.3
2013	40	0.2	10.2	50.4	26.0
2014	40	0.1	10.2	50.3	25.7
2014	40	0	10.2	50.2	25.5

Table 3-7 Smith Creek at EF Confluence – Alternative 2 with Road Treatment B/C

Year	Natural Sediment Tons/Year	Fuel Treatment Sediment Tons/Year	Road Sediment Tons/Year	Total Sediment Tons/Year	% Over Natural Sediment
2007	40	0	10.9	50.9	27.3
2008	40	0.4	10.2	50.6	26.5
2009	40	0.7	9.8	50.5	26.3
2010	40	0.6	9.8	50.4	26.0
2011	40	0.4	9.8	50.2	25.5
2012	40	0.3	9.8	50.1	25.0
2013	40	0.2	9.8	50.0	25.0
2014	40	0.1	9.8	49.9	24.8
2014	40	0	9.8	49.8	24.5

Table 3-8 - EF Smith Creek @ Smith Crk Confluence Alt 2 with Road Treatment A

Year	Natural Sediment Tons/Year	Fuel Treatment Sediment Tons/Year	Road Sediment Tons/Year	Total Sediment Tons/Year	% Over Natural Sediment
2007	65.5	0	10.0	75.5	16.1
2008	65.5	.5	9.5	75.5	15.3
2009	65.5	.7	9.3	75.5	15.3
2010	65.5	.4	9.3	75.2	14.8
2011	65.5	.3	9.3	75.1	14.6
2012	65.5	.2	9.3	75.0	14.5
2013	65.5	.1	9.3	74.9	14.3
2014	65.5	0	9.3	74.8	14.2

Table 3-9 - EF Smith Creek at Smith Ck confluence- Alt 2 with Road Treatment B/C

Year	Natural Sediment Tons/Year	Fuel Treatment Sediment Tons/Year	Road Sediment Tons/Year	Total Sediment Tons/Year	% Over Natural Sediment
2007	65.5	0	10.0	75.5	16.1
2008	65.5	.5	9.0	75.0	14.5
2009	65.5	.7	8.8	75.0	14.5
2010	65.5	.4	8.8	74.7	13.9
2011	65.5	.3	8.8	74.6	13.8
2012	65.5	.2	8.8	74.5	13.7
2013	65.5	.1	8.8	74.4	13.6
2014	65.5	0	8.8	74.3	13.4

Table 3-10 - Smith Creek at Shields River confluence - Alt 2 with Road Treatment A

Year	Natural Sediment Tons/Year	Fuel Treatment Sediment Tons/Year	Road Sediment Tons/Year	Total Sediment Tons/Year	% Over Natural Sediment
2007	562	0	35	597	6.2
2008	562	.9	34.0	596.6	6.2
2009	562	1.4	33.7	597.1	6.2
2010	562	.9	33.7	596.6	6.2
2011	562	.6	33.7	596.3	6.1
2012	562	.3	33.7	596.3	6.0
2013	562	.2	33.7	595.9	6.0
2014	562	0	33.7	595.7	6.0

Table 3-11 Smith Creek at Shields River Confluence -Alt 2 with Road Treatment B/C

Year	Natural Sediment Tons/Year	Fuel Treatment Sediment Tons/Year	Road Sediment Tons/Year	Total Sediment Tons/Year	% Over Natural Sediment
2007	562	0	35	597	6.2
2008	562	.9	33.7	596.6	6.2
2009	562	1.4	33.3	596.7	6.2
2010	562	.9	33.3	596.2	6.0
2011	562	.6	33.3	595.9	6.0
2012	562	.3	33.3	595.6	6.0
2013	562	.2	33.3	595.5	6.0
2014	562	0	33.3	595.3	5.9

The sediment model estimated that Smith Creek at the East Fork Smith Creek confluence sediment levels would be slightly decreased over current levels due to the pre-activity road treatments (not part of the project), which would be completed prior to project activities. In 2008 the sediment levels are projected to be 27.3% over natural and drop to 25.5% over natural by 2014. Road options B/C would further reduce sediment levels to 24.5% over natural. East Fork Smith Creek at the Smith Creek confluence sediment levels would also be slightly decreased over current levels due to the pre-activity road treatments. In 2008 the sediment levels are projected to be 14.5% over natural. Road options B/C would further reduce sediment levels to 13.4% over natural. The mainstem Smith Creek at the Shields River confluence sediment levels would also be slightly decreased over current levels due to pre-activity road treatments. In 2008 the sediment levels are projected to be 6.2% over natural. During 2009 and later sediment levels drop to 6.0% over natural by 2014. Road Treatments B /C would further reduce sediment levels to 5.9% over natural. The projected sediment effects (decreases) are too low to be measurable in Smith Creek or tributaries in terms of actual concentration or physical or biological effects. None of the treatment units are expected to create measurable sediment changes. The projected sediment effects are within Gallatin Sediment guidelines for annual (30% over natural) for the Category A streams.

Overall sediment from the proposed action (Alternative 2) for the Smith Creek Fuels Reduction Project is immeasurable and insignificant.

The Smith Creek 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 changes are immeasurable and well within the Gallatin NF sediment guidelines.

Alternative 3 – Proposed Action and Meadow Creek Burn

For Alternative 3, effects in upper Smith Creek and for East Fork Smith Creek at the Smith Creek confluence are the same as displayed with Alternative 2. With Alternative 3, the 300 acre Meadow Creek prescribed burn is assumed to be implemented in 2007 which has minor sediment impacts to Meadow Creek and to Smith Creek at the Shields River Confluence as displayed in Tables 3-12 & 3-13 below:

Table 3-12 Smith Creek at Shields River Confluence - Alt 3 with Road Treatment A

Year	Natural Sediment Tons/Year	Fuel Treatment Sediment Tons/Year	Prescribed Fire Sediment Tons/Year	Road Sediment Tons/Year	Total Sediment Tons/Year	% Over Natural Sediment
2007	562	0	0	35	597	6.2
2008	562	.9	1.4	34.0	598.3	6.5
2009	562	1.4	0.3	33.7	597.4	6.3
2010	562	.9	0.1	33.7	596.7	6.2
2011	562	.6	0	33.7	596.3	6.1
2012	562	.3	0	33.7	596.3	6.0
2013	562	.2	0	33.7	595.9	6.0
2014	562	0	0	33.7	595.7	6.0

Table 3-13 Smith Creek at Shields River confluence - Alt 3 with Road Treatment B/C

Year	Natural Sediment Tons/Year	Fuel Treatment Sediment Tons/Year	Prescribed Fire Sediment Tons/Year	Road Sediment Tons/Year	Total Sediment Tons/Year	% Over Natural Sediment
2006	562	0	0	35	597	6.2
2007	562	.9	1.4	33.7	598	6.4
2008	562	1.4	0.3	33.3	597.0	6.2
2009	562	.9	0.1	33.3	596.3	6.1
2010	562	.6	0	33.3	596.3	6.1
2011	562	.3	0	33.3	595.6	6.0
2012	562	.2	0	33.3	595.5	6.0
2013	562	0	0	33.3	595.3	5.9
2014	562	0	0	33.3	595.2	5.9

The Meadow Creek broadcast burn could result in localized erosion and soil displacement with associated delivery to stream channels (sediment). However, erosion and sediment from this proposed spring burn is anticipated to be very minor. Examination of several spring and fall broadcast burns on Gallatin NF a few months to two years after treatment during the last 13 years has documented very robust re-vegetation of grass, forbs, and shrubs. Spring burns on the Gallatin NF have re-vegetated usually 2-6 weeks after treatment. Implementation monitoring of Gallatin Canyon North burns (Karst Creek in 2005, Deer Creek in 2006) have not found any evidence of sheet or rill erosion or stream sedimentation (USFS 2005b, USFS 2006). 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 usually burn more deeply and the treated areas typically do not revegetate until the following spring. Typically spring 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. The sediment modeling, however, used conservative assumptions for sediment effects of the Meadow Creek burn and indicated a slight sediment increase (0.3% for Smith Creek with Road Treatment A) the year of treatment.

The projected sediment effects of Alternative 3 are too low to be measurable in Smith Creek or tributaries in terms of actual concentration or physical or biological effects. None of the treatments are expected to have measurable sediment changes. The projected sediment effects are within Gallatin Sediment guidelines for annual (30% over natural) for the Category A streams.

Overall sediment changes from Alternative 3 for the Smith Creek Fuels Reduction Project are immeasurable and insignificant.

The Smith Creek 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 changes are immeasurable and well within the Gallatin NF sediment guidelines.

Cumulative Effects

Alternative 1 – No Action

The R1R4 sediment modeling was run for Alternative 1 in a cumulative mode accounting for all existing roads, pre-activity road treatments, timber harvesting, and residential, and recreational developments in Smith Creek, upper Smith Creek, and East Fork Smith Creek. Timeframe for the cumulative effects analysis is 1980 to 2014. Overall sediment impacts of Alternative 1 would not change unless

sediment is increased by wildfires. Since effects are insignificant, no cumulative impacts with other sediment or nutrient impacting activities in Smith Creek would occur.

Alternatives 2 & 3–Proposed Action and Proposed Action & Meadow Creek Burn

The R1R4 sediment modeling was run for Alternatives 2 & 3 in a cumulative mode accounting for all existing roads, pre-activity road treatments, timber harvesting, and residential, and recreational developments in Smith Creek and tributaries to the confluence with the Shields River. Timeframe for the cumulative effects analysis is 1980 to 2014. Overall sediment impacts of Alternatives 2 & 3 are immeasurable and insignificant. Since effects are insignificant, no cumulative impacts with other sediment impacting activities would occur.

Applicable laws, regulation, and Forest Plan Guidance

The Smith Creek Vegetation Treatment 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 changes are immeasurable and well within the Gallatin NF sediment guidelines.

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.
State Laws:

The Gallatin Forest Plan, Forest Wide Standards 10.2 (page II-23) require that Best Management Practices (BMP's) will be used in all Forest watersheds.

The ***Montana Forestry BMP's*** are included in Appendix B, 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.

Issue 2 – <u>Fisheries:</u> Vegetation treatment (including timber harvest), maintenance of roads and construction of log landings could disturb soils and increase potential for erosion, sediment transport, and sediment deposition in streams.

Scale of Analysis: The spatial bounds for evaluating direct, indirect and cumulative effects to aquatic resources includes the Smith Creek drainage 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 or may occur up-drainage from the Smith Creek/East Fork Smith Creek confluence from 1980 through 2013 on both private and National Forest lands. Thus, the direct and indirect sediment effects analysis are cumulative in nature, and the temporal bounds for direct, indirect, and cumulative effects includes all past, present and reasonably foreseeable actions through 2013.

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 Smith Creek drainage: Smith Creek proper downstream to the National Forest boundary near its confluence with the East Fork Smith Creek, East Fork Smith Creek, four un-named tributaries to Smith Creek, and Meadow Creek.

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 streams or stream reaches 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 populations, both natural and man induced, in analysis area streams. Assessing habitat quality for aquatic biota and identifying limiting factors provides the basis from which to determine or estimate potential effects of this project. Therefore, the affected environment narrative also includes a summary of existing fish habitats and populations.

Channel Type and Existing Condition

Stream channels in the project area were characterized using the Level II classification system of Rosgen (1996). Four streams in the project area have B4 channel types (Table 3-14) Smith Creek, un-named tributary #1, un-named tributary #2, and the East Fork of Smith Creek. B4 channels are typically characterized as a series of riffles with irregular spaced scour pools. The channel bed and banks are considered relatively stable and contribute only small quantities of sediment during runoff events. B4 channels are moderately sensitive to increased streamflow and sediment from out of channel sources (Rosgen 1996). As such, low sediment increases over natural typically do not change the overall geometry of B4 channel types. Streambank erosion potential is moderate and riparian vegetation has moderate controlling influence on streambank stability. Thus, timber harvest along riparian zones of B4 channel types has moderate potential to influence bank stability. Channel 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. Excess sediment inputs to B4 channels can deposit and accumulate in the lower gradient reaches and lower velocity zones (e.g., pools) of those channels. They typically have moderate energy and moderate sediment supply with low to moderate bedload transport rates.

Table 3-14 - Management Interpretations of Channel Types (Rosgen 1996, pg 8-9)

Stream Name	Stream Type	Channel Sensitivity *	Recovery Potential**	Sediment Supply ***	Bank Erosion Potential	Vegetative Control Influence
Smith Creek	B3/B4	Low/ moderate	Excellent	Low/ moderate	Low	Moderate
Meadow Creek	A2	Very low	Excellent	Very low	Very low	Negligible
Un-named Trib #1	B4/B6	Moderate	Excellent	Moderate	Low	Moderate
Un-named Trib #1	B3/B4	Low/ moderate	Excellent	Low/ moderate	Low	Moderate
Un-named Trib #1	C3b E/4/E6 A3	Moderate Very High Very Low	Good Good Excellent	Moderate Low/Mod Very Low	Moderate Mod/High Very Low	Very High Very High Negligible
Un-named Trib #1	A4/A5	Extreme	Very Poor	Very High	Very High	Negligible
East Fork Smith Creek	B4	Moderate	Excellent	Moderate	Low	Moderate

*includes increases in streamflow magnitude and timing and/or sediment increases
**assumes natural recovery once cause of instability is corrected
***includes suspended and bedload from channel-derived sources and/or from stream adjacent slopes
****vegetation that influences width/depth stability

Smith Creek proper is a 3rd order stream flowing from the north and is the primary stream receiving flow from all other tributaries in the project area. Smith Creek is the southeastern boundary of prescribed Unit G for approximately ¼ mile. The stream channel type fluctuates between B4 (gravel dominated) and B3 (cobble dominated)

reaches depending on reach specific stream gradients. Channel and streambank stability in Smith Creek was surveyed in 1998 and again in 2004. The survey reach was in the NNW quarter of Section 6. The riparian corridor is predominately conifers, willows and alders, and understory grasses and forbs. Historic logging has occurred along some segments of the reach, which has contributed to some bank and channel instability. Cattle related impacts were considered to be minor, with some minor browsing of woody species. There is little suitable forage in the riparian zone so cattle use is limited. Some trailing and two stream crossings were observed with localized bank disturbance during a fish habitat survey in 1998, but survey notes indicate that cattle impacts for the reach as a whole were minor. Channel stability departures from natural condition were attributed to previous riparian harvest and increased sediment from roads.

Un-named tributary #1 is a small 1st order tributary to Smith Creek and flows from the north through the middle of prescribed Unit C. Un-named tributary #1 also has short intermittent B6 reaches with predominately silt substrates. The tributary was evaluated in 1998 for channel related impacts due to grazing, and an additional observational survey was completed during summer 2006. Surveys in 1998 found no evidence of cattle-related impacts. Likewise, the 2006 survey showed that the stream is heavily vegetated with conifers along most of its length. Some riparian harvest has occurred, but large woody debris (LWD) accumulations were high, and streambanks were stable. The stream is considered to be in near natural condition.

Un-named tributary #2 is also a small 1st order tributary to Smith Creek flowing from the northeast. It bisects the southern area of prescribed Unit C for approximately 600 feet near its Smith Creek confluence. Un-named Tributary #2 has intermittent B3 reaches with predominately cobble substrates. The tributary was evaluated in 1998 for channel related impacts due to grazing, and an additional observational survey was completed during summer 2006. Surveys in 1998 found no evidence of cattle related impacts. Likewise, the 2006 survey showed that stream is heavily vegetated with conifers along most of its length. Some grazing does occur in a short reach between FS Road #991 downstream to its confluence with Smith Creek. However, bank stability and channel morphology has not been impacted. Upstream of the road, LWD accumulations were high, and streambanks were stable. The stream is considered to be in near natural condition.

The East Fork of Smith Creek is a 2nd order tributary to Smith Creek flowing from the east through Sections 8, 5, 6 and 9 in the project area. The stream is the northeast boundary of prescribed Unit H in Forest Service Section 8. The stream also follows the north boundary of Unit H for approximately ¼ mile. The stream channel type is primarily a B4 (gravel dominated) channel. Depositional features (e.g., pool tailouts, channel margins) of the channel throughout its length are dominated with silt. The riparian corridor is predominately conifers upstream from its confluence with Smith Creek through Section 6. Deciduous shrubs, grasses, and forbs increase through clearcut units on private and National Forest land further up drainage. Logging has occurred along riparian reaches in Sections 5, 8, and 9, which has contributed to some

bank and channel instability and has reduced in-channel LWD frequencies throughout the clear-cut areas. Based on observational surveys and sediment core analysis (see below discussion), the main East Fork road FS #6635, and a private road constructed along the stream in Section 5, contribute significant sediment loads to the channel. Instream sediment deposits were most evident below two road culverts on FS Road #6635.

Un-named Tributary #3 is a small 1st tributary that flows along the northwest boundary of prescribed Unit B for approximately ¼ mile. The stream reach near Unit B is ephemeral with streamflows during spring snowmelt runoff and other high precipitation events. Further downstream approximately ¾ mile from its confluence with Smith Creek, the tributary has perennial (yearlong) flow. The perennial reach is not within a proposed treatment area with the exception of a trail crossing that would be used for equipment access. Throughout the perennial reach, the tributary is primarily a C3b (cobble dominated) channel type with riffles and infrequently spaced pools formed by large woody debris. C3 channels have a moderate sensitivity to changes in streamflow and sediment discharge, moderate sediment supply, and moderate streambank erosion potential (Table3-14). Riparian vegetation exerts moderate controlling influence on bank stability for C3 channel types. A short stream reach near the trail crossing in the southwest quarter of section 31 is an E4/E6 channel type that has a very high sensitivity to increased streamflow and sediment. E4/E6 channel types have a moderate in-channel sediment supply, but have high streambank erosion potential and very high riparian vegetation controlling influence (Table 3-14). Thus, land-use activities (e.g., timber harvest, cattle grazing) in riparian zones of E4/E6 channels can have a high potential to influence bank stability, channel morphology and fish habitat quality. Upstream reaches of the tributary near the northwest boundary of unit B have A3 channel types. A3 channel types have a very low sensitivity to changes in streamflow or sediment discharge associated with watershed disturbance. Un-named tributary #3 was evaluated in 1998 for channel related change due to grazing. Surveys in 1998 found no evidence of cattle related impacts. The reach surveyed was well vegetated with woody shrubs, grasses and forbs and was considered to be near natural condition.

Un-named tributary #4 is a small ephemeral tributary flowing from the west dividing prescribed units D and B. The tributary flows through the middle of unit A1. The tributary is ephemeral near its confluence with Smith Creek and is typically dry during summer months (landowner, personal communication). It has an A4/A5 channel type which is extremely sensitive to disturbance with very high bank erosion potential, and very high sediment supply (Table 3-14). Riparian vegetation exerts negligible controlling influence on channel and bank stability of A4/A5 channel types. Un-named tributary #4 was also evaluated in 1998 for channel related change due to grazing. Surveys in 1998 found no evidence of cattle related impacts. The reach surveyed was well vegetated with woody shrubs, grasses and forbs and was considered to be near natural condition.

Meadow Creek is a small 1st order tributary to Smith Creek flowing from the northeast with limited streamflow. The stream is the southeast boundary of the prescribed burn unit in section 16. The stream is higher gradient than other streams in the project area and has an A2 channel type with predominately boulder substrates with lesser amounts of cobbles and gravels. A2 channels are steep (4 to10%), 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. A2/A3 channel types have a very low sensitivity to changes in streamflow or sediment discharge associated with watershed disturbance. The stream was surveyed in 1998 to determine cattle related impacts. Field notes indicate that cattle related impacts were minor and negligible. The riparian corridor is heavily forested with the exception of a meadow in the headwater reach with suitable forage. Riparian logging has occurred in the meadow and has reduced LWD frequency in the stream channel. However, channel stability ratings were near natural condition. In 1998, when the allotment was being grazed, the stream was judged to be well within Gallatin NF channel stability and riparian filtration guidelines. The allotment has not been grazed since 2002.

Habitat Conditions

For Smith Creek and the East Fork of Smith Creek large woody debris (LWD) is a critical component for fisheries habitat. In higher gradient mountain streams like those throughout the project area, LWD creates complex and diverse habitats for all life stages of fish. LWD creates flow obstructions where pools are formed and spawning gravels are deposited in pool tail-outs. LWD also provides instream cover, which is important to both juvenile and adults. The majority of spawning habitat in all fish bearing streams in the project area occurs in association with LWD accumulations. Habitat conditions in streams throughout the analysis area are rated as good to poor. LWD is deficient throughout many reaches of Smith Creek and the East Fork of Smith Creek where riparian harvest has occurred in early 1900's through the 1980's. Timber harvest in riparian areas targeted large trees that otherwise would have been recruited to streams. Large woody debris removal projects were also common during the late 1970's and early 1980's. Thus, the primary physical habitat factors limiting fish populations in Smith Creek and the East Fork of Smith Creek are reduced habitat complexity and diversity, and a deficiency of pools and suitable spawning habitat, all a result of reduced LWD frequencies. Past timber harvest and road building also contributes elevated sediment loads to those streams. LWD frequencies have also been reduced in the upper reaches of Meadow Creek, which is inhabited by brook trout. Based on observation, there are no anthropogenic caused LWD deficiencies in un-named tributaries #1 and #3. However, low streamflows and elevated sediment concentrations limit fish populations in those streams. Extremely high levels of silt were observed in un-named tributary #1 below the FS Road 991 culvert crossing. Fine sediment (silt) is deposited below most pool tail-outs and along the channel margins.

Based on observational review, sediments are thought to be originating from the Smith Creek road.

Fine sediment concentrations (percentage of sample by weight of particles ≤ 6.3mm diameter) in spawning gravels in both Smith Creek and the East Fork of Smith Creek were measured in July 2006 using a McNeil hollow core sampler. For Smith Creek, fine sediment concentrations averaged 26.1% (n=18) with a range of 11.1% – 46.5% (Table 3-15). For the East Fork of Smith Creek, fine sediment concentrations averaged 22.9% (n=20) with a range of 18.3%-52.2% (Table 3-15). All samples were collected at sites with suitable spawning habitat. In addition to sediment core sampling results, extremely high levels of silt were visually observed in the East Fork of Smith Creek. Fine sediment (silt) is deposited below most pool tail-outs and along the channel margins. Sediment deposits exceeding 5 inches in depth were observed in many locations along the East Fork Smith Creek channel. Based on observational review, sediments are thought to be originating from the East Fork Smith Creek road.

Table 3-15 - Percent Fine Sediment From McNeil Core Sampling

Creek Name	% of core ≤ 6.3mm	% of core ≤ 2.36 mm	% of core ≤ 0.85	% of fines ≤ .85 mm
Smith Creek	26.1	15.8	9.1	33.8
East Fk Smith Creek	22.9	13.6	8.7	37.8

Fish populations

The Shields River watershed provides substantial habitat for Yellowstone cutthroat trout (YCT), which is considered a *Species of Special Concern* by the Montana Department of Fish, Wildlife, and Parks (MDFWP) and a *Sensitive Species* by the United States Forest Service (USFS). The current geographic distribution of "genetically pure" YCT encompasses less than 10% of their historic range. There are 36 remaining populations throughout their entire historic range, most of which are isolated with little potential for genetic exchange, which contributes to their decline. Unlike most isolated populations of YCT, the YCT inhabiting streams throughout the Upper Shields and Smith Creek drainages are not geographically isolated and sub-populations are relatively interconnected with few man created barriers (e.g., road culverts). Thus, YCT inhabiting the Upper Shields drainage are extremely important to conservation and recovery of the species. The MDFWP and USFS consider the Upper Shields drainage a core conservation population. Currently, the MDFWP is developing a comprehensive YCT conservation strategy for the area. Competition with non-native brook is considered one of the primary risks and causes for YCT declines in streams throughout Upper Shields and Smith Creek watersheds. Other reasons for decline include habitat degradation due to roads and timber harvest.

In recent years, Tohtz (1999), Jones and Shuler (2004), and Shepard (2004), surveyed fish populations in most tributaries to the Shields River. Findings show that YCT are distributed throughout much of the basin. However, recent follow-up surveys have revealed a dramatic increase in brook trout density with consequential declines in YCT.

In 2006, surveys in Smith Creek reveal that the fish population is predominately (87%) brook trout with few YCT remaining.

Fish populations were surveyed in Smith Creek, the East Fork of Smith Creek, un-named tributary #1 during summer 2006. Population surveys in un-named tributary #3 were conducted in 2004 and revealed low densities of YCT and brook trout. Low or ephemeral stream flows in un-named tributaries #2 and #4 preclude fish inhabitance. Low stream flows and high gradients in Meadow Creek limit fish populations throughout the National Forest reach. Electrofishing surveys in Meadow Creek on National Forest showed that brook trout were the only species, and densities were low. YCT do inhabit the lower reaches of stream near its confluence with Smith Creek (personal communication, local resident).

Forest Plan implementation guidelines, outlined in an agreement with the Madison-Gallatin Chapter of Trout Unlimited, classify streams into four different categories (Class A, B, C, and D) each with unique fisheries management and habitat goals. These classifications were recently modified in the Gallatin National Forest Travel Plan Decision (Gallatin National Forest, Travel Management Plan, Final Environmental Impact Statement, Detailed Description of the Decision 2006, pages I-11 through I-13) to include only two categories, A and B (See Table 3-16). This recent modification is more in line with Montana Department of Environmental Quality water quality laws. Category A streams are the highest value streams from a fishery standpoint, and they include streams that are inhabited by sensitive fish species. Because genetically "pure" YCT inhabit the Smith Creek drainage, including Smith Creek proper, lower reaches of Meadow Creek, and tributaries 1 and 3, Smith Creek and its fish bearing tributaries are considered Category A streams according to implementation guidelines and the GNF Travel Plan Decision. Although no YCT were found in the East Fork of Smith Creek, the entire drainage is considered to be a core conservation area and a comprehensive conservation strategy is being developed by Montana Department Fish, Wildlife and Parks. As such, habitat management objectives for all fish bearing streams in the project area follow Category A standards as outlined in the GNF Travel Plan Decision (see Standard E-4, Applicable Laws, Regulations and Forest Plan Direction below). For Category A streams, the habitat management objective is to maintain or progress toward providing habitat that is 90% or greater of its inherent habitat capability or reference condition. The fish population objectives for Category A streams, are to maintain or enhance the existing population level consistent with maintaining the integrity of the individual populations and the distribution objectives for protection of the species as a whole. Habitat management objectives and sediment standards for streams in the analysis area are displayed in Table 3-16 below.

Table 3-16 - Habitat Management Objectives and Sediment Standards

Stream Class	Habitat Management Objective	Analysis Area streams	Fine Sediment Concentrations in Spawning Gravels	Annual Sediment Yield % Over Natural
Category A Sensitive species and/or Blue Ribbon Fisheries	90% (of reference)	Smith Creek, East Fk Smith Creek, Meadow Creek, Tributaries 1,3	0-26% (%fines < 6.3mm)	30%
Category B All other streams (formerly Classes B,C,D)	75% (of reference)	Tributaries 2, 4	0-30% (% fines < 6.3mm)	50%

Biological Integrity Analysis

Aquatic macroinvertebrates are often used to describe and monitor the biological condition or productivity of stream systems primarily because macroinvertebrate communities are good indicators of localized conditions. In addition, macroinvertebrate communities integrate the effects of short and long-term environmental variations.

The primary purpose for collecting macroinvertebrate data for this project was to determine whether land use activities have caused biological impairments. More specifically, the goals of this analysis were to:

1. Assess aquatic macroinvertebrate community integrity in relation to reference condition.
2. Identify and interpret key community indicators (against reference condition standards) to observed sediment impacts.

Common responses to elevated concentrations of sediment can include decreased total abundance, decreased number of species, and a shift from a community of sediment intolerant species to a community of sediment tolerant species. For this assessment, 3 replicate samples were taken in July 2006 at 2 mainstream Smith Creek sites, the East Fork of Smith Creek, and a single sample in un-named tributary #1. The first Smith Creek site was located immediately above the East Fork Smith Creek confluence, and the second site was located further up-drainage upstream of the Bitter Creek confluence. The second site in Smith Creek was located upstream of most timber harvest and road construction activities in the Smith Creek drainage and was considered to represent undisturbed conditions. The East Fork Smith Creek samples were collected below the culvert on FS Road #991. The sample in un-named tributary #1

was also collected below FS Road #991. Stream impairment determinations were based on protocols specific to the state of Montana (Bukantis 1998; Jessup et al. 2005, Feldman 2006) using the Montana Department of Environmental Quality's newest multimetric macroinvertebrate (MMI) protocols. In addition, relative percent of sediment-intolerant macroinvertebrates (i.e., sensitive taxa that decrease with increased sediment) were used in a Fine Sediment Biotic Index (FSBI), to determine more specifically if sediment was causing impairment in those streams.

Results of the study are reported by Stagliano (2006). Results show that samples collected in un-named tributary #1 had the highest diversity index, one of the highest MMI scores and the highest percentage of FSBI sensitive taxa. The site was rated as "un-impaired". Statistical comparisons of taxa suggest that this site may have a sufficiently distinctive macroinvertebrate community to make comparisons to the mainstem Smith Creek "reference" site unreliable.

The East Fork Smith Creek site had the least variability in the field replicate samples, the highest average diversity index, the next highest average MMI scores, and the highest percentage of FSBI sensitive taxa. All three samples were rated as "unimpaired". Results also show that the East Fork Smith Creek has a significantly different macroinvertebrate community composition than the Smith Creek sites and is more closely related to the smaller un-named tributary #1 site.

All samples collected in Smith Creek near the East Fork Smith Creek confluence were also rated as "unimpaired". The 3 samples collected at this site had the next highest average diversity index, the highest average MMI scores, and the next highest average percentage FSBI sensitive taxa. One sample collected at this site had a relatively high percentage of burrowing taxa indicating possible sediment impairment.

For the upper Smith Creek site, which was thought to represent undisturbed conditions, samples had the lowest average diversity index, the lowest average MMI scores, and lowest average percentage of FSBI sensitive taxa. Two of 3 samples collected at this site were rated as "slightly impaired", and one sample was rate as "unimpaired". This anomaly can in part be explained by a high number of the riffle beetle, *Heterlimnuis*. Dominance of a particular taxa can skew both the Shannon Diverstiy Index and the MMI score.

Overall, despite 8 of 10 samples in the study indicating unimpaired macroinvertebrate communities (2 slightly impaired), the percent of sediment intolerant taxa is low compared to other Mountain Stream Reference Sites, indicating possible sediment impairment of all sites sampled (Stagliano 2006). This finding is consistent with visual observation and sediment core sample results showing high percent fines throughout lower reaches of Smith Creek and the East Fork of Smith Creek. Ironically, fine sediment accumulations were not observed in the upper Smith Creek sample site.

Methodology 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 are evaluated against treatment activities that may influence their stability.

Because potential sediment effects to trout very 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.

To estimate potential sediment effects on spawning habitat, the R1/R4 sediment yield model was used to predict and compare sediment yield increases by alternative (see water quality report). The R1/R4 sediment delivery model is a simplified approximation of complex processes that determine sediment production. Because of this, resulting values are not considered definitive or absolute; rather they are used only to evaluate the relative magnitude and direction of sediment yield change by alternative. Existing and predicted sediment yield increases are compared to measured in-stream fine sediment concentrations and standards established for Category A streams. It is important to recognize that the R1/R4 model predicts the amount of sediment delivered to channels, not instream sediment concentrations. Under equilibrium conditions, most sediment delivered naturally to a stream is flushed from the system. When sediment inputs are above a streams competence to transport them they may begin to accumulate in the system, particularly in low velocity reaches where spawning gravels are deposited. As such, predicted sediment yield is compared to existing fine sediment concentrations measured in spawning gravels (McNeil core sample results), and observed high levels of sediment deposits in depositional zones and channel margins.

Direct/Indirect 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.

Sediment standards for Smith Creek are listed in the Gallatin NF Travel Plan Standard M-1 for Water, Fisheries, and Aquatic Life**.** In watersheds with streams currently at or above fish habitat management objectives, proposals for road and trail construction, reconstruction and maintenance will be designed to not exceed annual sediment delivery levels in excess of those in Table 3-2. Sixth-code Hydrologic Unit Codes

(HUCs) are the analysis unit for sediment delivery and other habitat parameters. Within the analysis unit, sediment delivery values in Table 3-2 will serve as guidelines; however, sediment delivery values denoted in individual 7th code HUCs may temporarily exceed sediment delivery rates denoted in Table 3-2, in the following circumstances:

1. The HUC does not contain a fragmented sensitive or MIS fish population;
2. The majority of HUC's in the analysis unit remain within sediment delivery values listed in Table 3-2;
3. Other core stream habitat (e.g. pool frequency, pool quality) or biotic (e.g. macro-invertebrates, fish populations) parameters within the HUC do not indicate impairment as defined by Montana Department of Environmental Quality (MDEQ); and
4. Sediment delivery levels will return to values listed in Table 3-2 within 5 years of project completion.

Habitat management objectives are more stringent for Category A streams. The objective is to maintain or progress toward providing habitat that is 90% or greater of its inherent habitat capability or reference condition (see Standard E-4. (e.g., 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 Smith Creek Vegetation Treatment Project 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, or to inhibit progress towards that goal. It is assumed that a high level of habitat protection will result in no, or negligible affect on viability of fish populations. 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".

Alternative 1: No Action.

Direct and Indirect Effects:

With Alternative 1, no actions would be undertaken over the next few years that respond to the purpose and need of the project. No treatments such as hand piling or grapple piling would be done on the existing ground fuels. No burning would be completed. No vegetative treatments would be undertaken to treat stands or reduce fuels. There would be no fuel reduction activities along riparian corridors of streams within the project area. Thus, there would be no potential to impact riparian areas, or fish habitat.

As described in the existing condition narrative, in-stream fine sediment levels are high in Smith Creek, the East Fork of Smith Creek, and un-named tributary #1. The primary cause of sediment increases are the main Smith Creek and East Fork of Smith Creek roads near each respective stream. Under the no action alternative, the road

improvements outlined in Road Treatments B and C could possibly be accomplished if and when additional outside funds become available, but would be a very low priority to fund because they are not associated with a Forest project. Smith Creek road improvements would continue to compete with other Regional and Forest level road maintenance priorities.

Alternative 1 would result in no direct or indirect effects, beyond existing conditions, to fish populations or habitat relative to the vegetation treatment aspect of the proposal.

Alternative 2 - Proposed Action

Effects on riparian integrity and streambank stability were mitigated in the development of the project design. Stream protection measures are considered to be an integral part of the proposed action.

The underlying goal of protection measures for riparian and aquatic habitats is to follow a functional definition of riparian zone consistent with GNF Plan and FSM direction, and consider riparian vegetation in relation to stability, integrity, and meeting needs of riparian zone dependent species including fish and fish habitat. Measures included in the vegetation 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.

Numerous unit wide stream protection mitigation measures are included in the proposed action and are outlined on pp. 2-30 and 2-31 of this EA.

Considering channel sensitivity, protection measures included in the proposed action pose little threat to the physical integrity of riparian areas or streambank stability. Channels throughout the project area generally have stable stream banks with a very low to moderate sensitivity to disturbance and riparian vegetation exerts low to negligible control on channel form and bank stability. With the protection measures included in the proposed action, fuel treatments are designed to maximize the amount of large woody debris (LWD) available for recruitment to stream channels. For example, no treatment would be allowed within 15 feet of any stream, except in site specific instances where deciduous trees (aspen) are the desired future stand type. Harvest would not be allowed within 100 feet of channels with a high or extreme sensitivity to disturbance (e.g., Unit D near un-named tributary #4). Large trees leaning

toward stream channels will not be harvested. Reducing some under-story trees up to 15 feet of some streams 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. With protection measures in place, the proposed action will have *no effect* on riparian integrity or streambank stability.

Because existing in-stream fine sediment levels already exceed channel competence (see existing condition narrative), and levels approach (East Fork Smith Creek, see sediment core results) or exceed (Smith Creek, see sediment core results) in-stream sediment guidelines (see Table 3-16), it is assumed that any increase in sediment yield from this proposal would perpetuate degraded spawning habitat conditions.

In order to progress towards habitat management goals and objectives, pre-activity road treatments were scheduled and funding was obtained for implementation during summer of 2007. These road treatments will occur before any harvest related activity would begin and are designed to reduce or eliminate point source sediment inputs from roads, having immediate beneficial reductions in sediment yield to project area streams. They will also mitigate slight sediment increases associated with this proposal, and will have long term beneficial effects to fish habitat and populations. These 2007 road improvements were initially an integral component of this proposal, and were designed to meet an additional purpose and need of improving habitat conditions for Yellowstone cutthroat trout. Because the road improvements will be completed prior to this proposal, the purpose and need statement relative to YCT habitat improvement is now considered to be an objective associated with the project. The beneficial effects of this work are accounted for in the cumulative affects discussion.

Sediment yield analysis results for the proposed action are presented in the water quality section of the EA (pp 3-17 through 3-29). Sediments 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 vary according to life-stage specific habitat requirements, because different lifestages utilize different habitats. Treatments that minimize or reduce the influx of fine sediments will favor the maintenance of high quality habitats for all life stages.

Sediment effects on adult and juvenile trout can occur when sediment concentrations exceed the capacity of the channel to flush sediment, and pools fill or riffles become more embedded. Pools are areas of higher velocity during peak flows, but at low flows their depth creates a depositional environment for fine sediment. A cursory analysis of habitat and channel type data collected for streams throughout the Gallatin National Forest shows that residual pool volume and maximum pool depth decreased slightly in 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. Observations of excessive fine sediment deposits in depositional zones (e.g., pool tail-outs and channel margins) of Smith Creek, the East Fork Smith Creek, and un-named tributary # 1, which are predominately B4 channel

types, support the forest wide analysis. Reducing point source sediment inputs via road improvements would thus improve habitat conditions for adult and juvenile trout for streams in the project area.

Adverse effects to young trout (e.g., egg through fry life stages) can occur when fine sediment concentrations increase in spawning gravels. 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. Some studies (Reiser and White 1988; Hall 1986; Irving and Bhornn 1984, Stowell et al. 1983; and McNeil and Ahnell 1964) determined the most harmful particle size fraction is $\leq$ 0.84mm. For the purposes of this effects analysis, particles $\leq$6.3mm diameter are considered fine sediment. However, concentrations of smaller size fractions are also reported and used to characterize potential affects.

Based on literature review (See literature cited), survival of incubating eggs declines rapidly when spawning gravel fine sediment ($\leq$ 6.3mm dia.) concentrations exceed 26%. Existing fine sediment concentrations for Smith Creek and the East Fork Smith Creek are 26.1% and 22.9% respectively (Table 3-15). Furthermore, the relative contribution of smaller size fractions ($\leq$ 0.84 mm dia.) is high for both streams (Table 3-15) and are approaching levels that some studies found to severely limit reproduction. Reducing point source sediment inputs via road improvements completed in summer 2007 will improve spawning habitat conditions and reproductive success.

Road improvement Option B would be implemented following harvest activities as it would require money generated from merchantable timber to implement. Option B improvements are designed to further mitigate indirect sediment inputs and would have long term beneficial effects to fish habitat and populations. This work could be completed if sufficient funds are generated from the project. Likewise, road improvements outlined in Road Option C would be implemented if sufficient funds are generated from the sale. Road improvements outlined for Option C primarily address fish passage problems for culverts throughout the Shields drainage. Stewardship money generated from timber sale receipts would be used to upgrade culverts and mitigate fish passage concerns.

Alternative 3 - Proposed Action and Meadow Creek Burn

For Alternative 3, effects to fish habitat and populations in project area streams are the same as displayed for Alternative 2. For Alternative 3, sediment modeling results suggest that sediment increases from the 300 acre Meadow Creek burn are not measurable. Existing sediment yield figures are well below sediment guidelines (e.g., 6.4% over natural). To mitigate potential short-term sediment delivery increases during post-burn green-up (approximately 6 weeks), a 100 foot no ignition buffer strip along

Meadow Creek would be left for sediment filtration. Thus, anticipated sediment delivery to the channel during post-burn green-up would not be measurable. There would be no effect to fish habitat and populations.

Cumulative Effects

Alternative 1

With the selection of Alternative 1 (no action), activities described as reasonably foreseeable actions on p. 3-5 would likely proceed. These activities could include noxious weed spraying, occasional small timber sales (primarily to salvage dead and dying trees) and livestock grazing. Developments on private land would continue, including construction of additional residences. Vegetation Treatment Projects would also likely occur on additional private inholdings. Assuming road use in the Smith Creek area will continue to increase because of these and other recreational reasons, negative effects associated with the road and sediment could worsen. Sediment yield increases from timber harvest and road building that have occurred prior to this proposal are accounted for in the sediment yield analysis.

During summer 2007, several road segments that contributed chronic sediment inputs to Smith Creek, East Fork Smith Creek, and tributary streams are being treated to reduce sediment inputs. Road drainage in key road segments, road recontouring, and surfacing near streams are being implemented to address chronic sediment concerns and to address the additional objective of this project to improve fish habitat. These road treatments are expected to result in immediate and substantial reductions in sediment delivery to project area streams, with beneficial effects to trout habitat and populations.

There would be no effect from vegetative treatments because there would be none. There could be a negative effect from not being able to implement any of the additional road maintenance associated with Road Treatments B and C. Funding these treatments would be a very low priority if they are not directly associated with a Forest project. Funded pre-activity road treatments to be implemented during the summer of 2007 will have immediate beneficial effects.

Alternative 2- Proposed Action

The R1/R4 sediment model accounts for cumulative sediment yield increases from proposed vegetation treatments, and concurrent sediment reductions associated with road improvements. In addition, all existing roads, past timber harvest, and residential and recreational developments in the Smith Creek drainage to the Forest boundary were accounted for in the sediment modeling exercise.

Pre-activity road improvement work (no longer a part of this project) that is being completed during summer 2007 will substantially reduce current point source sediment inputs from roads, and based on modeled estimates, results in a continued

declining sediment trajectory, even though there is a slight increase in year 2010 in Smith Creek from harvest activities. The slight increase in 2010 is still below the 2007 modeled estimates that include the pre-activity road treatments, and declines even more by 2011. The 2007 pre-activity road improvements are expected to have immediate beneficial reductions in sediment delivery to project area streams, including Smith Creek proper, its tributaries, and the East Fork of Smith Creek. The road work is also expected to result in reduced fine sediment concentrations in spawning gravels, keeping fine sediment levels within standards, and continuing to move towards improved habitat conditions. Other core stream habitat attributes (e.g., pool frequency, pool quality) and biotic parameters (e.g., macro-invertebrates) will not directly or indirectly be affected by the proposed action because riparian harvest is limited, and mitigation measures protect those resources. Some parameters may improve with reduced sediment from road treatments. For example, fine sediment in pools and channel margins will likely be reduced, and habitat quality for macroinvertebrates will likely improve, although based on RPB survey, macroinvertebrate populations in all streams tested fully support aquatic life criteria.

Because this alternative would result in net sediment reductions in Smith Creek and its tributaries, as well as the East Fork of Smith Creek, there would be long-term beneficial effects to fish habitat and populations. In addition, for the East Fork of Smith Creek, if stewardship funds are available to implement any or all of Road Treatments B and C, then further sediment reductions and habitat improvements would be realized. Only a very limited amount of riparian harvest is proposed. Aquatic mitigation measures are an integral part of the proposal, effectively mitigating any potential for associated adverse impacts. In areas where riparian harvest is proposed, the treatment is designed to stimulate growth of deciduous trees (aspen) to more historic levels. The allochthonous (or organic) input to streams from deciduous leaves may also increase macro-invertebrate diversity.

Alternative 3 - Proposed Action and Meadow Creek Burn

For Alternative 3, cumulative effects to fish habitat and populations in project area streams are the same as displayed for Alternative 2. Because both alternatives would result in net sediment declines in project area streams, there would be a beneficial effect to fish habitat and populations associated with Alternative 3.

Applicable laws, regulations, and Forest Plan direction:

FSM, FP Standards and Guidelines (Fisheries/MA7), YCT Conservation Management Direction and Guidelines, SMZ Rules

Forest Service Manual (FSM) 2526 Riparian Area Management:

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. For the Smith Creek Vegetation Treatment Project, all alternatives were designed to comply with Forest Service Manual 2526 objectives and policy as described below:

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.

The Smith Creek Vegetation Treatment Project has numerous mitigation and design features incorporated into all alternatives to ensure that it would be consistent with the 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.

GNF Forest Plan:

Fisheries: The Gallatin National Forest Plan provides broad direction for the management of forest fishery resources and more specific direction for management of sensitive species. The Smith Creek vegetation Treatment Project has been designed and includes mitigation associated with all alternatives to insure that Forest Plan goals, objectives and standards regarding fishery resources will be adhered to. See fishery summary (pp. 3-9 & 3-10) for specifics.

GNF Travel Plan Decision:

Standard E-4. Water, Fisheries, and Aquatic Life.

Proposals for road and trail construction, reconstruction, maintenance, and other ground disturbing projects (timber sales, fuel treatment projects, mineral activities, etc.) will be designed to not exceed annual sediment delivery levels in excess of those in Table I-4 (see Table 3-16 of this report). Sixth-code Hydrologic Units (HUCs) are the analysis unit for sediment delivery (and other habitat parameters), except where a sixth code HUC artificially bisects a watershed and is therefore inadequate for analysis of impacts to aquatic habitat and aquatic organism metapopulations. In such cases, appropriate larger units will be analyzed (e.g. 5th code HUCs). Within the analysis unit, sediment delivery values in Table I-4 will serve as guidelines; however, sediment delivery values denoted in individual 7th code HUCs may only temporarily exceed sediment delivery rates denoted in Table I-4, in the following circumstances:

1. The 7th code HUC does not contain a fragmented fish population of special management designation;
2. The majority of 7th code HUCs in the analysis unit remain within sediment delivery values listed in Table I-4;
3. Other core stream habitat (e.g. pool frequency, pool quality) or biotic (e.g. macroinvertebrates, fish populations) parameters within the 7th code HUC do not indicate impairment as defined by Montana Department of Environmental Quality (MDEQ); and
4. Sediment deliver levels will retun to values listed in Table I-4 within 5 years of project completion, and thereby do not lead to stream impairment as defined by Montana Department of Environmental Quality (MDEQ).

Standard E-5: Water Fisheries, and Aquatic Life. Proposed roads and trails shall not be located in the floodplains of rivers and streams or in wetlands except where necessary to cross a stream or wetland with appropriate permits.

Standard E-6: Water, Fisheries, and Aquatic Life. Stream crossing facilities for proposed roads and trails shall allow for passage of aquatic organisms, except where passage restriction is desired to isolate genetically pure cutthroat trout populations from exposure to hybridization or competition by non-native salmonids.

Guideline E-7: Water, Fisheries, and Aquatic Life. Road materials should not be side-cast into streams or wetlands.

Trout Unlimited Settlement Agreement

The goals, policies and objectives for aquatic resources outlined in the Forest Plan have been further defined within an agreement with the Madison-Gallatin Chapter of Trout Unlimited (TU) in 1990. The intent of the Agreement was to provide more specific direction on timber harvest in riparian areas. 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." Design features and mitigation have been incorporated into the Smith Creek Project to assure that all alternatives adhere to the TU Settlement Agreement (See pp. 2-30 through 2-31).

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. Implementation of the Smith Creek Project Alternatives 2 & 3 would improve aquatic/ riparian habitat.

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. Agencies affiliated with this effort include Montana Department of Fish Wildlife and Parks; Montana Department of Environmental Quality; USDA Forest Service, Northern Region, Gallatin-Custer National Forests; Bureau of Land Management; U.S. Fish and Wildlife Service; Bureau of Reclamation; Bureau of Indian Affairs; and the Crow Tribe. This agreement establishes a framework of cooperation between the participating parties to work together for the conservation of YCT. The primary goal of the Agreement and accompanying Yellowstone Cutthroat Trout Conservation program is to ensure the persistence of the Yellowstone cutthroat trout subspecies within the historic range in Montana at levels and under conditions that provide protection and maintenance of both the intrinsic and recreational values associated with the subspecies. A commitment identified in the Agreement that is most relevant to this proposal is "modify land uses to provide the greatest degree of habitat and population protection". Habitat and populations of Yellowstone cutthroat trout would be protected with implementation of any of the alternatives.

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:

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 document those effects relative to the purpose of this order…

Implementation of either of the action alternatives (Alternative 2 or 3) would help to restore water quality and habitat degradation for fisheries by improving key roads in the project area that contribute as sediment sources.

Issue 3 – <u>Fuels:</u> Lack of treatment to the currently heavy fuel conditions in the Smith Creek WUI would not address the high potential for a catastrophic fire event that could threaten public and firefighter safety.

Scale of Analysis: The effects analysis for fuels considers the history of wildfire and fire suppression throughout the Smith Creek drainage. Also addressed is the current fuels situation in relation to human and other usage of National Forest resources in the analysis area (the Smith Creek WUI).

Affected Environment (Fuel Type and Arrangement)

Nearly all of the Smith Creek area is forested with densely populated closed tree canopy stands of lodgepole pine, Douglas-fir and sub-alpine fir/spruce. (Vegetation Structure/Diversity, pp. A-75 through A-82). Forest habitat types for the analysis area are categorized into six fire habitat type groups (FG) based on Fischer and Clayton (1983). The dominant fire habitat types consist of FG 0 (scree, rock, meadow, grass ridges); FG 4 (warm, dry Douglas fir habitats); FG 6 (moist, Douglas-fir habitats), FG 7 (cool habitats dominated with lodgepole pine), FG 8 (dry, lower sub-alpine habitats), and FG 9 (moist, lower sub-alpine habitats). Table 3-17 provides a description of the mean fire return interval and historical fire type associated with each fire habitat type group.

Table 3-17 - Fire Habitat Type Groups in Smith Creek WUI (Analysis Area)

Fire Habitat Type Group	Fire Regime (Mean Fire Interval *)	Fire Type
0	No estimate available	These habitats do not burn easily or very often. Can serve as anchor points and firebreaks in most cases.
4	5 to 20 yrs (occasionally > 20 yrs)	Variable depending on site condition and time between disturbance cycles; frequent disturbances, ground fire; less frequent disturbances ground fire to a mixed severity (fire acted as a thinning agent); fuel loadings range from 13 to 25 tons/acre.
6	42 yrs	Variable depending on site condition, stand history and successional stage; ground and mixed severity fire (fire is a thinning agent); fuel loadings average 15 tons/acre and greater.
7	50 yrs < 7600', 150 –200 yrs > 7600', 300-500 yrs	For periodic thinning ground fires. For stand-replacing fire events; fuel loadings average 15-25 tons/acre 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)

The primary concern related to the current fire risk within the Smith Creek analysis area is the vertical and horizontal arrangement of available fuel, both standing and dead woody fuels, as well as the smaller understory tree component. Years of successful fire suppression and a consequent 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 fire in the drainage has also allowed smaller, shade-tolerant trees to grow under the large, mature trees creating conditions that are referred to as 'ladder fuels'. The resulting vertical continuity of fuels could carry a fire from the ground up to the mature tree crowns.

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

The analysis area is currently experiencing mortality from mountain pine beetle and spruce budworm infestations are occurring in multiple tree species (See insect and disease Issue #5). As insects and disease move across the landscape and forested stands become infected, red needles on standing dead trees are highly volatile. As standing dead and down trees become more prevalant, the volume of surface fuel increases, resulting in the increased likelihood that a small, low intensity ground fire would become a large, uncontrollable crown fire (NEXUS modeling, Project File).

Affected Environment (Public and Fire Fighter Safety Concern)

Currently, all National Forest System Lands within the analysis area are covered under a Fire Management Plan (FMP). FMP's usually allow for a range of fire management Treatments or Appropriate Management Response (AMR) to fire. AMR to fire may include full direct suppression of any fire start to allowing fire to occur for resource benefits. The Gallatin's fire management plan delineates various geographic areas across the landscape, called Fire Management Units (FMUs), and applies specific fire management responses to them. Management responses vary from fire suppression to fire use. The analysis area falls within FMU-1 (North Suppression), which is described as full direct suppression because of the associated values at risk. These risks could include, but are not limited to wildland urban interface; municipal watersheds; developed recreation facilities; both federal and private cabin sites; etc. Rationale for direct suppression across the landscape are timber values, watershed concerns, wildland urban interface and a host of other resource concerns including public safety.

Methodology for Analysis

NEXUS and BehavePlus fire models were used for evaluating fire behavior and for modeling fuel levels of forested stands proposed for treatment within the Smith Creek Analysis Area. These 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 BehavePlus, the average rate of spread for an active crown fire and surface fire was found to be 1 to 3 miles per hour for the existing fuels

conditions. This high rate of spread would make the task of public evacuation, while also trying to dispatch firefighting resources to the fire, on the single lane roads in the area very difficult. The extreme behavior of a crown fire makes for an unsafe situation for ground firefighting forces to implement control tactics that would be effective. Using the NEXUS model, in conjunction with FVS-FFE model, results indicate that the majority of the forested stands within the Smith Creek Analysis Area currently have active crown fire potential.

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

Direct and Indirect Effects

Alternative 1 – No Action

Alternative 1 would have no effect on changing the probability of an uncontrollable crown fire from what currently exists within the Smith Creek Analysis Area. Without hazardous fuel reduction, forested areas would continue to follow their natural rates of succession, becoming denser and eventually supporting a stand replacing fire event. There would be little if any space between the crowns of individual trees. A wind-driven fire would be expected to transition quickly from the ground into the forest canopy, resulting in almost total stand replacement. Fire behavior of this kind – an independent crown fire – is the most resistant to suppression control efforts of any of the associated fire types.

Using NEXUS and BehavePlus, the average rate of spread for an active crown fire and surface fire under the current conditions was found to be 1 to 3 miles per hour. This rate of spread, and associated fire intensity, would be very difficult to control and a large, costly fire is likely to occur. As such, risks to public and firefighter safety would be high and continue to increase over time without some type of treatment.

Alternatives 2 & 3 – Proposed Action & Proposed Action & Meadow Creek Burn (Common Effects)

A variety of treatment measures to reduce or modify the volume and arrangement of fuels in Smith Creek are proposed within the project area associated with the proposed action. Treatments include thinning to increase the space between standing trees, piling and burning the remaining slash, all of which will help to reduce ladder fuels and surface fuel loadings. Burning piles and/or removing activity related fuels consisting of small diameter trees, tree tops, branches, etc. would reduce the volume of standing and down material available to support a fire. Fuel treatment objectives are to achieve a balance between leaving a moderate amount of material on the ground to provide nutrients for soil replenishment, but not so excessive as to add to an uncontrollable fire. A target range of ten to fifteen tons per acre of materials would be left on the ground, which would likely only support a readily controllable, low-intensity ground fire.

The NEXUS and BehavePlus runs created using the fuel reduction methods proposed with Alternatives 2 & 3 show a reduction in fire behavior. For modeling purposes, areas that are currently representative of Anderson's fuel model 10, pre-treatment, were run as a fuel model 8 to more accurately depict the effects of project implementation. Fire behavior was modeled using typical August weather conditions for the east side of the Gallatin National Forest (See Table 3-18). Both NEXUS and BehavePlus demonstrated a significant change in fire behavior with implementation of either Alternatives 2 or 3.

Table 3-18 - Typical August Weather Conditions

Percentile Weather for Derby Weather Station		
August	90th Percentile	97th Percentile
Temperature	83°	86°
Relative Humidity	15%	11%
Wind-speed	9 miles/hour	11 miles/hour

On a typical August day, a wildfire with the existing condition would experience rates of spread that would range from one to three miles per hour. Following implementation of the proposed treatments, rates of spread are expected to decrease to .1 to .5 mile per hour. Fire behavior was modeled on a stand or project unit basis

Modeling the effectiveness of fuel treatments using NEXUS in combination with incorporating site-specific analysis, including stand characteristic variability, shows that proposed treatments within the units meet the objective of reducing the potential for active crown fire. The model indicates that proposed units dominated by Douglas-fir go from active crown fire potential to a 'conditional' crown fire. A 'conditional' crown fire is defined as conditions for a sustained active crown fire are met, but the conditions for crown fire initiation may not be met. If a crown fire enters from adjacent stands, the fire would continue as an active crown fire due to

the crowns of the stands not being spaced far enough apart. The analysis of the proposed treatments identified in these alternatives shows a reduction of fire behavior in the treated units based on both modeling and personal knowledge. However, it is important to note that leave clumps (small untreated forested areas with project units) and other design criteria (such as not pruning lower limbs) that help meet other resource objectives may offset some of these effects. The placement of leave tree clumps, and by varying treatment intensities within and adjacent to other units helps mitigate this "offset" in the effectiveness of treatments. The effectiveness of the fuel treatments may be increased above the modeled effectiveness due to the limitations of the models.

Current stand exam data was also applied to the Forest Vegetation Simulator (FVS) in conjunction with the Fire and Fuels Extension (FFE) for the proposed treatment areas, which currently show a high likelihood of active crown fire. The proposed treatments would reduce potential fire severity to a conditional crown fire or surface fire after implementation. This means that a crown fire could still occur if the right environmental conditions were present such as extreme wind or dry conditions.

A realistic objective of fuel treatments is to reduce the likelihood of crown fire and other fire behavior that would lead to loss in value or lead to undesirable future conditions, not to guarantee elimination of crown fire (Graham, McCaffrey and Jain 2004). The proposed treatments, when fully implemented, are expected to reduce the likelihood of crown fire within the proposed units, not the entire analysis area. However, by increasing the likelihood that any fire start within the proposed units would remain small and controllable, firefighter safety would be enhanced and additional time would be provided to take measures necessary to protect the public. With implementation of Alternatives 2 or 3, fire behavior was 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. Alternatives 2 and 3 would both reduce the probability of a fire becoming an uncontrollable crown fire. The reduced potential of a crown fire would provide time for public evacuation if needed and greatly increase firefighting capabilities and firefighter safety. The proposed treatments associated with both Alternatives 2 and 3 would meet the Purpose and Need of the project.

Objectives Common to Aspen Regeneration Treatment Units

Units A1, A2, and G contain significant amounts of aspen treatments. Units B, C and D contain some aspen clones that will be treated. Treatment would reduce the volume in standing trees and down and dead fuel 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. Horizontal and vertical fuel continuity would be broken in the near term by improving the size and number of aspen stands in the corridor. In the long term, further treatment

may be needed to prevent the conifer regeneration in the aspen stands and to maintain the health of the aspen clones.

Objectives of Individual Treatment Treatment Units

Descriptions of the Silvicultural treatments proposed for each unit can be found on pp. 2-19 through 2-27 and are shown on maps M-2 through M-4.

Unit A-1: Within the unit, removal of all conifers would be the most desirable condition. However, due to mitigation developed for wildlife and visual resources, harvest activities would retain ten to fifteen percent of the existing canopy. The clumps and individual trees would be susceptible to loss from a surface fire since the lower branches would be close to the ground. Removal of the majority of the conifer canopy would greatly alter the horizontal and vertical fuel continuity within the unit as it exists today and the likelihood that a crown fire could initiate or be sustained would decrease. Segregating shorter and taller trees to distinct areas within the stand would increase the average distance from the ground to the lower tree crowns. This would reduce the probability that a ground fire would move into the crowns.

Unit A-2: Trees within this unit tend to be smaller than those found in A-1, with a much lower canopy base height. Stand density reduction would emphasize removing small and intermediate sized trees from heavily stocked areas. Increasing the spacing between trees would break-up the horizontal fuel continuity. This reduces the probability that a wildfire would carry through the crowns of individual trees. Segregating shorter and taller trees to distinct areas would increase the average distance from the ground to the lower tree crowns and reduce the probability that a ground fire would move into the crowns. Since tree crowns are somewhat smaller, spacing between trees would likely average less than Unit A-1. The clumps and individual trees would be susceptible to loss from a surface fire since the lower branches would be close to the ground.

Unit B: Thinning in this stand would break-up the horizontal fuel continuity. This reduces the probability that a wildfire would carry through the crowns of individual trees. Vertical fuel continuity would be less affected due to favoring Douglas-fir and Engelmann spruce and some passive crown fire is possible. Aspen clumps, where they are available, would act as a heat sink as described in the aspen regeneration section. High severity fire would be unlikely due to the mosaic of conifers, aspen regeneration and meadows.

Unit C: Thinning this stand would break-up the horizontal fuel continuity of fuels. Reducing the amount of fuel adjacent to the road not only reduces the likelihood of fire reaching and crossing the road but also the intensity of the fire if it does reach the road. This improves public and firefighter safety and the chances of using the road as a fuel-break. Removing all conifers for an area no

greater than five total acres at the "V" intersection in Section 6, would provide a potential safe zone for fire fighters and/or evacuated individuals. Aspen clumps, where available, will act as a heat sink as described in the aspen regeneration section. High severity fire would be unlikely due to the mosaic of conifers, aspen regeneration and meadows.

Unit D: Thinning this stand would break-up the horizontal fuel continuity of fuels. This reduces the probability that a wildfire would carry through the crowns of individual trees. Thinning to a greater distance from the values at risk would increase the time available for fire suppression and protection actions. Vertical fuel continuity would be less affected due to favoring Douglas-fir and Engelmann spruce for leave trees and some passive crown fire is possible. Aspen clumps, where available, will act as a heat sink as described in the aspen regeneration section. High severity fire would be unlikely due to the mosaic of conifers, aspen regeneration and meadows.

Units E-1 and E-2: Thinning in these stands will break-up the horizontal fuel continuity. This reduces the probability that a wildfire would carry through the crowns of individual trees. Greater spacing is necessary in Douglas-fir stands due to the larger crowns and greater susceptibility to crown fire initiation. Lodgepole pine trees killed by mountain pine beetle are generally more susceptible to fire due to dead foliage and stems and the resulting low fuel moisture. Removing these highly flammable fuels reduces not only the risk of fire spread, but of ignition as well since fires are less likely to start in fuels with higher moisture content.

Unit F: From a fuels perspective, the treatment areas in Unit F would act as a buffering/deflecting mechanism by breaking up both the vertical and horizontal fuel arrangement. Expected fire behavior outcome for this treatment type would not allow for crown fire to initiate throughout the entire proposed unit boundary. Within the boundary, individual or groups of untreated stands would still exhibit passive to active crowning with limited growth potential.

Unit G: The objective of this unit is to reduce high severity fire for both public and fire fighter safety, while enhancing aspen regeneration for wildlife and biodiversity. This would be accomplished through the removal of most conifer trees, except in areas where the ground is extremely wet. Harvest activities would retain ten to fifteen percent of the existing canopy. The remaining trees would be left individually or in clumps that could withstand prevailing wind patterns and are greater than one-hundred feet from an aspen clone. In the northern part of the unit that has a more open grown canopy, where aspen exist, all conifers within one hundred feet of the clone would be removed.

Unit H: Treatments in Unit H would be focused along the main travel corridor of the East Fork of Smith Creek Road. Smaller diameter trees, up to seven inches, within the unit would be hand-thinned to a distance between twenty and twenty-five feet between boles. Thinning in these stands would break-up the horizontal fuel continuity. Reducing the amount of fuel adjacent to the road not only reduces the likelihood of fire reaching and crossing the road but also the intensity of the fire if it does reach the road. This would improve public and firefighter safety and the chances of using the road as a fuel-break.

Fuel treatments would be designed to leave a target range of ten to fifteen tons per acre of downed material greater than three inches in diameter on the ground. The actual amount left may be less in this unit due to the lack of trees greater than three inches in diameter.

Unit I: Thinning in these stands would break-up the horizontal fuel continuity. This reduces the probability that a wildfire would carry through the crowns of individual trees. Vertical fuel continuity would be less affected due to favoring Douglas-fir and Engelmann spruce and some passive crown fire is possible. High severity fire would be less likely due to the mosaic of conifers and meadows. Due to its position on the slope, this unit would do more to protect National Forest lands from a start on private land than to protect private values at risk.

Alternative 3 (Unique Effects)

Alternative 3 would further reduce the fire risk to private land in Section 17 by implementing the 300 acre Meadow Creek prescribed burn (Unit J), which would reduce the fuel continuity adjacent to that private land (See Map M-4).

Unit J: Utilizing existing surface fire potential, smaller trees and decadent shrubs would be targeted to burn. In areas where lodgepole pine and subalpine fir dominate, passive crown fire would be expected for a short duration to mimic a mixed severity fire effect. The resulting mosaic will reduce fire intensity and resistance to control. This would improve firefighter safety and reduce the threat to private land in Section 17.

Effects for Unit J would be as follows:

1. Trees less than six feet tall; expect ninety to ninety-five percent mortality
2. Trees greater than six feet and less than thirty feet tall, expect ten to fifteen percent mortality
3. Trees greater than thirty feet tall expect five percent mortality.

The application of low intensity prescribed fire techniques would reduce the volume of standing and down material available to support a fire and would act as a thinning agent, by both reducing the number of smaller trees and increasing the canopy base height of residual trees. This reduction would greatly reduce ladder fuels within the stand, while also decreasing the likelihood that a crown fire could initiate. Utilization of these prescribed fire techniques is intended to mimic the role of natural fire within the system under a controlled setting.

Cumulative Effects

Alternative 1 – No Action

Alternative 1 would not include any type of thinning, fuel reduction, or vegetation treatments on National Forest lands. The suppression strategy would continue to be direct suppression to 'control and confine' fire, due to the popularity of the Smith Creek corridor for recreation and private land ownership patterns (FP, 1987). Since many of the stands in the drainage are heavily stocked with medium and older age class trees that are beginning to experience mountain pine beetle infestations, the incidence of tree mortality is expected to increase over time. This would lead to an increase in the accumulation of standing and downed dead fuels available to support a wildfire. There would also be an increase in the probability that, once ignited, a wildfire would have enough fuel that it would quickly escape attempts to contain it.

Defensible space treatments on private land would likely be ongoing in the foreseeable future. Managing fuels within the home ignition zone is shown to be effective at reducing the nearby sources of firebrands and combustible fuels that are commonly associated with structure ignition, however, private land treatments are extremely localized and would do little to decrease the rate of spread of a large wildfire in order to increase firefighter and public safety in the Smith Creek WUI.

Alternatives 2 & 3 – Proposed Action & Proposed Action & Meadow Creek Burn (Common Effects)

Implementation of Alternatives 2 or 3 would break up the fuel continuity on a landscape scale as well as the stand scale. The cumulative effect of all the treatments would be to not only reduce the risk of crown fire initiation and the rate of spread locally, but to impede wildfire spread across the landscape. The reduced rate of spread would increase firefighter and public safety by lessoning potential fire behavior, and in turn increasing the amount of time emergency personnel would have, if an evacuation of the Smith Creek WUI becomes necessary.

However, extreme weather conditions can produce fire behavior that will burn through the proposed treatments. Reducing the likelihood of crown fire and increasing the effectiveness of initial attack resources should enhance defensible space treatments within the home ignition zone of structures adjacent to National

Forest System lands. Together, the proposed treatments and work within the home ignition zone on private lands, would reduce the threat to the public, firefighters and private land in the Smith Creek WUI.

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 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 objectives for smoke management will be met within the constraints established by the Montana State Airshed Group's Memorandum of Understanding.

he project has also been designed to be consistent with bjectives and policy outlined in Forest Service Manual 5150 as described below:

Forest Service Manual (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.

The project creates a fuel profile that is safer for the public and firefighters. In doing so, fires will be less difficult to control and fire protection will be more cost-efficient.

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

Many resource management objectives are met with the project at the same time as meeting fuel management objectives.

Issue 4 – <u>Wildlife Habitat Diversity:</u> No action could lead to the further reduction of those habitat groups that depend on disturbance to maintain the extent of distribution, age class, and structure (grass/ wet meadow, shrub, aspen, and Douglas fir). Aspen and willow and other types of shrublands would not be represented as historic, or at all, in the long-term due to the lack of disturbance.

Scale of Analysis: The geographic analysis area for evaluating effects of this project on wildlife species and their habitat was based on known occurrence of those species and/or habitats that could be affected by the project. The analysis is focused on those species that utilize all or a portion of the area impacted by the proposed project activity or for which comprehensive analysis is actually required by NEPA. The site-specific area of influence or project area includes the lands defined by the individual vegetation treatment units as well as specific species management analysis units. Each wildlife species and their habitat was analyzed using the appropriate analysis area for that particular species. Since the Smith Creek Road #991 exists today, and improvement work will continue overtime in the established road right of way, no in-depth analysis was done for the road improvement work itself. Mitigation, as outlined on pp. 2-34 through 2-35 serve to minimize impacts to wildlife habitat and limit disturbance or displacement of individuals.

Temporal scale for the wildlife effects analysis includes road improvement work, which could begin as early as summer 2007 and the subsequent vegetation treatment implementation, which would continue for up to five full years of activity, possibly extending to the winter of 2011-2012. This period considers the direct impacts caused by the proposed action. Indirect effects of the project are expected to continue for several years after the completion of project implementation.

Affected Environment

General Landscape and Habitat Features

The Smith Creek project area is located on the west flank of the Crazy Mountain Range. The vicinity provides habitat on both private and public lands for a wide array of wildlife species including songbirds, game birds, raptors, small mammals, forest carnivores, and big game animals. The project is comprised of a variety of habitats including open grassland and meadows, aspen, riparian, lower elevation Douglas fir forest, and mixed conifer lodgepole/ spruce/ fir forest. These habitats provide for many of the species listed above, as well as more common game and non-game species. The habitat analysis is limited to those species that utilize the area impacted by the proposed project activity or for which comprehensive analysis is required.

Historically, large-scale, stand replacement wildfires were important natural events that created and maintained habitats and their associated species assemblages. The inherent variability of these processes and of the landscape on which they operate provided the evolutionary framework for native organisms. Disturbance creates habitat conditions that over the long term are beneficial to maintain a full complement of wildlife species. The Shields River Watershed Risk Assessment (USDA 2005a) made comparisons of current, historic, and fifty years into the future, finding that the existing distribution of life forms and age classes across the landscape is different from historic. The following discussion provides a summary of the findings for the Smith Creek project and adjacent Shields River drainage in context with the wildlife habitat potentially affected by the action alternatives.

Fire suppression has influenced the historic function of wildfire on the landscape, limiting whether and how much fire has an ecological role on the landscape. Conifers have invaded forage-producing openings, out competed aspen, and created multi-storied forested stands in forests that typically had a shrub and herbaceous understory. Timber harvest and associated road building has occurred on both National Forest and private lands within the project area, resulting in various age classes of regenerated forest. These activities focused on optimizing timber removal with little consideration for natural ecological disturbance patterns or processes. This single resource-minded approach created relatively homogenous habitat, not optimal for biodiversity compared to either undisturbed landscapes or landscapes with a natural fire regime.

Grasslands and Meadow

Many species of wildlife have some association with grassland and shrubland habitats. Much of the grasslands in the project area are mesic to wet and associated with seeps or riparian areas. Shrubs are not a major component in the project area. The current mix of grassland and shrubland structure is different than historic patterns. The Watershed Risk Assessment (WRA) indicated that grasslands, meadows, and shrublands were more clumped and likely provided more edge habitat historically due to the discreteness of the habitat group boundaries. In addition, the WRA approximated that the current ratio of non-forested to forested habitats is inverse to what occurred historically, i.e., there is twice as much forest (pole size and larger) than non-forested habitat groups now than what occurred historically. Consequently, the existing condition does not provide the same diversity for species that prefer a mosaic of vegetation structure provided by grassland and shrublands in relation with forested environments. The WRA concluded that fire or some other disturbance was needed to perpetuate the non-forested vegetative component.

Conifer Forest

Forested habitats are extensive over the project area. Some of the project area has been logged extensively and now supports lodgepole pine regeneration in various stages of succession. Understory species diversity and production in these even-aged stands is low, consisting of pinegrass and elk sedge, arnica, meadowrue, and bedstraw. However, these plants have value as wildlife forage. Also present are invasive plants including thistle species, houndstongue, and timothy grass, which compete with native grasses and do not provide preferred palatable forage. Some forested stands are on steep slopes, have substantial amounts of downfall, or are relatively heavily stocked with older, larger trees. These areas provide interior forest habitats.

Three habitat groups of conifer forests were identified in the WRA: Douglas fir, Subalpine fir/ spruce (often with lodgepole dominance), and whitebark forest. The warm, dry and cool, moist Douglas fir forests were lumped for the WRA. These two habitat groups provide different wildlife niches and probably respond to fire or timber harvest disturbance differently as well. Under natural fire regimes, the warm, dry Douglas fir forests exhibits an open park-like structure with a forage understory due to its propensity to underburn. The cool, moist Douglas fir types, typically with a lodgepole or mixed conifer co-dominance, probably stand replaced periodically. Currently these forest types appear to have more medium age class stands represented (62%) compared to historic (5%). Because of past timber harvest, pole and seedling/ sapling age classes are about the same percentage as they were historically and currently. The large and very large age classes, i.e., old growth or potential old growth, are also currently similar to historic. The age class that is not represented today is the shrub and herbaceous layers as the understory in the conifer sapling age classes. In addition, today there is more structure, i.e., two story and multi-storied stands are over-represented now compared to historically. The WRA concluded that, with continued fire suppression, the Douglas fir forest habitat group would continue to follow successional paths outside the natural range of variation becoming much more dense than they were historically.

Similarly, there is also more medium age class (58%) compared to historic (6%) within the spruce/ subalpine fir with lodgepole forest type. However, there is less large/ very large age classes, i.e. old growth or potential old growth, (2%) represented compared to historically (15%). Historic conditions also suggest there was about twice as much seed/ sapling age class and that 7 % was shrubland, representative of stand replacement fire(s). Pole age class is about the same between current and historic, probably due to the extensive harvest done on acquired lands. Therefore, the subalpine fir habitat group may be within the range of variation along the post-fire continuum for its natural lower frequency, higher intensity fire regime. The over-representation of medium age classes for these two forest types explains the inverse relationship of the historic to the current forest/non-forest patch dynamics discussed under grasslands.

Whitebark pine forest currently has approximately 86% medium age class that was modeled as seedling/ sapling and pole age historically. Historically there was approximately 10% of large, very large age class and about 15% shrub component. Today neither of these age classes is represented on the landscape. However, the whitebark habitat group may be within the range of variation for its natural low frequency, high intensity fire regime. There is no proposal to treat whitebark pine stands and this habitat group will not be further discussed.

Aspen

Aspen is considered a keystone species. This habitat group may occur within any of the grassland or forested types. Aspen, a deciduous tree, contributes to ecological diversity and supports a variety of plant associations. According to Campbell and Bartos (2001), Johnson (2005), and Kay (1997), aspen stands are, with the exception of riparian areas, considered the most biologically diverse ecosystem in the Intermountain West. Shepperd and others (2006) suggest that aspen serve as oases for plant and animal diversity.

Aspen stands provide important habitat for many species of wildlife (DeByle 1985b, Johnson 2005). Aspen provides forage, cover, shade, and nesting habitat for birds, small mammals, big game, and forest carnivores. Aspen provides habitat for many species of birds, some of which utilize the stand year-round while others use aspen during only a portion of the year (DeByle 1985b). Birds breeding in aspen stands include shrub or tree canopy nesters, cavity nesters, or ground nesters. Aspen trees offer more structural diversity than conifer forests (Johnson 2005). Snags provide perches for birds of prey and sites for cavity nesters. Bird communities vary with the size, age, and grazing history of aspen clones (Kay 1997).

Aspen emphasizes vegetative reproduction over sexual reproduction and occurs in clones or groups of genetically unique individuals. That aspen is dependent on a disturbance regime has been documented by many authors (Shepperd and others 2006). Aspen clones sprout suckers (individual stems called ramets) after a disturbance promotes regeneration. The mechanism that causes ramet growth is a hormonal response to apical meristem mortality (Shepperd and others 2006). Historically, fire enabled aspen to out-compete taller, shade-tolerant species and aspen has a distinct advantage with the clonal reproduction (Johnson 2005). Aspen persist if they have adequate soil moisture, sunlight, and warmth. Fire return intervals of 20 to 130 years are necessary to maintain aspen, and as fire cycles lengthen, aspen is eliminated. Grass, forbs, shrubs, or conifers replace aspen in the absence of fire (Jones and DeByle 1985).

The most valid indicator of a seral aspen community is the active replacement of the aspen overstory with more shade-tolerant conifers (Mueggler 1985b). Ripple and Larsen (in press) state that aspen decline has been observed throughout the western United States and on Yellowstone's northern range since the 1920's. They acknowledge the ongoing debate on the cause of this decline being ungulate (elk) browsing, climate fluctuations, and fire suppression. In the absence of disturbance, aspen dominated landscapes covert to other cover types, resulting in a tremendous loss of biodiversity.

Aspen occurs in the project area in relatively small, isolated clones. One exception to this is in proposed Unit A-1 and on adjacent private lands to the east and south. This area exhibits both riparian and more extensive upland aspen/conifer seral aspen communities. The relative health of the aspen is variable with some clones expressing a diversity of age and structure and other stands appearing as single storied and over-mature due to colonization by conifers. Many aspen stands are currently decadent and declining as they are invaded by conifers on the edges of grasslands, within conifer dominated stands, or where associated with riparian areas.

Some aspen is persisting along a continuum of successional stages but the extent of aspen is much less represented than historic. Conifer invasion and ungulate browsing may be contributing to the lack of regeneration and/or the ephemeral nature of the sprouts. This means that the aspen are attempting to regenerate by sending up suckers, but the suckers are dying before reaching an age after which they will survive to a mature tree. Within the project area, there are stands where spruce, lodgepole pine, and Douglas fir are either invading relatively healthy aspen stands or have completely dominated the aspen. There are also stands that appear to be browsed by livestock, moose, elk, and/or deer where aspen sprouts are browsed annually to the degree that they are not surviving. This persistent browsing activity has created a decadent, single-storied stand of over-mature aspen.

Aspen stands provide forage and shade for both domestic and wild ungulates. The young aspen sprouts themselves are nutritious forage that can contribute to a large portion of both livestock and ungulate diets, particularly in the fall. Excessive grazing generally alters forage composition and reduces production (Mueggler 1985a). In the Three Peaks Grazing Allotment, which is within the project area, the level of livestock grazing and trampling that has occurred within some aspen stands may have depleted the amount and quality of forage available.

Aspen clones in the project area, particularly in Units A1, B, D, and G of the action alternatives, are at risk of loss on the landscape from conifer encroachment, absence of rejuvenating fire, and the current level of browsing and trampling. Some multi-storied stands on the edges of meadows are relatively healthy but are experiencing minor conifer encroachment and some level of browsing. Other stands are decadent and are moving toward becoming single-storied with an over-mature canopy and

little, if any, surviving reproduction. Conifers are encroaching throughout these stands and sharing dominance with aspen. The WRA concluded that without disturbance, this habitat group would most likely continue to decline in health, vigor, and distribution. As with the grassland/ wet meadow habitat group, this habitat group would not increase over time and may not be represented at all in the long-term.

Riparian Habitat

Streamside habitats, wet meadows, seeps, and springs are important components of wildlife habitat. Riparian areas are used as foraging sites, nesting habitat, and cover. These habitats may be in areas where drainage bottoms broaden, in micro-meadows in the timber, or on otherwise dry slopes. All of these types of riparian habitat occur throughout the project area.

Riparian areas are key habitats for migratory birds as more than half of western landbird species breed exclusively or primarily in deciduous vegetation associated with water. Migratory birds are especially vulnerable to degradation of riparian habitat due to its limited distribution and extent across the landscape. Migratory bird species that utilize riparian areas may experience fewer or lower quality nesting opportunities, less cover making them susceptible to predation, diminished feeding opportunities, and general disturbance with human activity.

Within the project area, impacts of human activity in riparian areas have included introduction of non-native species, bare ground, reduced vigor of shrubs, decreased structural diversity, and altered vegetation composition. Previous harvest in riparian areas has greatly increased the accessibility of streamside habitats and wet meadow to livestock by removing overstory forest and downed trees. Riparian vegetation in these stream reaches may be dissimilar to the potential natural vegetation. However, the majority of riparian areas in the project area expressing riparian dominated vegetation are in functioning condition.

Old Growth

See old growth discussion in Appendix A of this document (pp. A-75 through A-82).

Methodology for Analysis

Site visits were made to review the areas proposed for the vegetation treatments, road upgrade work, and additional treatment activities. Suitable habitat conditions for wildlife species were assessed at this time. These field reconnaissance visits were also used to determine the existing vegetative condition within the project area and look for evidence of wildlife use and any special features (e.g. nest sites, den sites, mineral licks, wet sites, wallows, cavity trees, foraging areas, staging areas, security cover, and travel corridors) that might need protection through mitigation or that would be adversely affected by the proposal.

Aspen inventory, sensitive plant surveys, and goshawk surveys were conducted within the proposed treatment unit boundaries (located in the Project File). Geographic Information System (GIS) data were used to analyze impacts to lynx, big game, pine marten, goshawk, flammulated owl, and wolverine. Data used for these efforts are typically generated from the Timber Stand Management Record System (TSMRS) database. In addition, the analysis was partially based on outputs generated as part of the Shields River Watershed Risk Assessment (WRA) (USDA 2005a). Assumptions which framed the perspective and approach from which the model was analyzed and the conclusions and recommendations were derived were discussed in the WRA. Models and GIS exercises are no substitute for ground validation, research, or inventory and this project does not reflect a comprehensive assessment of the wildlife resource.

Direct and Indirect Effects

Alternative 1 – No Action

Alternative 1 does not meet the purpose and need relative to wildlife. This alternative would not improve wildlife habitat by modifying forest structure, maintaining meadow and aspen areas and/or by creating less dense forests.

Grassland/ Wet Meadow

Based on the WRA, grasslands, meadows, and shrublands occupied a larger percentage of the landscape and were more clumped, providing more edge habitat and associated diversity. Based on the WRA modeling, there would be a small increase in grass and shrub types in the long-term without any vegetation treatment due to some stand-replacing fires. In the short-term, non-forested habitat types would continue to decrease. There would be no benefit for those species dependent or obligate on non-forested habitat groups such as grassland, wet meadow, aspen, willow, sagebrush, and other shrublands. This alternative would continue to provide some level of seasonal or year-round nesting and foraging habitat for migratory songbirds, big game, small mammals, raptors, and forest carnivores, but not as much as the action alternatives. With no

increase in these habitat groups through disturbance, some non-forested plant communities may not be represented at all in the long-term (10-50 years).

Aspen

The aspen stands that are currently decadent and declining due to conifer invasion would not be regenerated. Aspen would continue to be under-represented due to a lack of disturbance. This habitat group would most likely continue to decline in health, vigor, and distribution. Those wildlife species dependent upon aspen habitat would also be expected to decline. As with the grassland/ wet meadow habitat group, this habitat group would not increase over time and may not be represented at all in the long-term (10-50 years).

Douglas-fir Forest

These forest types would continue to have a large percentage of the total extent represented by the medium age class compared to historic levels. Pole and seedling/ sapling and the large and very large age classes would continue to be about the same as what occurred historically. Shrub and herbaceous layers would be under-represented. There would also continue to be more structure, i.e. two story and multi-storied stands, and this age class would increase. Assuming that with continued fire suppression the Douglas-fir forest habitat group would continue to follow successional paths outside the natural range of variation, the increased structure would contribute to a lack of forage for big game, nesting habitat for snag dependent birds, foraging habitat for forest dwelling raptors, and a reduction in late seral, single story old growth.

Subalpine Fir (Lodgepole) Forest

As with the Douglas-fir forest types, these forest types would continue to have a large percentage of the total extent represented by the medium age class compared to historic levels. This would lend itself to its natural lower frequency, higher intensity fire regime and would experience stand replacement fire(s). This habitat group is not outside of its natural range of variation along the post-fire continuum. With continued fire suppression, the large and very large age classes would continue to age and would be at greater risk of stand replacement wildfire. While this would provide post-fire habitats to fire adapted species such as lynx (foraging) and woodpeckers (nesting and foraging), depending on the temporal and spatial scale of these fires across the landscape, there may be a threshold above which species do not survive or lose the ability to re-colonize within the project area. This would be especially true if wildfires burned at a higher severity due to current fuel conditions in the lower elevation habitat groups.

Alternatives 2 & 3 – Proposed Action & Proposed Action & Meadow Creek Burn (Common Effects)

Wildlife habitat diversity requires a mosaic of non-forested and forested stand structural stages over time. Many species have adapted to specific successional stages within a habitat group expressed as structural diversity, plant composition, and distribution patterns. Wildlife species distribution and numbers are related to these available habitats. These broad habitat groups offer unique attributes for wildlife and create unique assemblages of representative species across the landscape. By offering a full range of variation in habitat, including successional and seral stages, viable native species populations are maintained.

This conclusion is based on methodology used in the viability planning process (USDA 1997). This methodology identified two bases from which to approach conservation: a system or coarse filter approach and a species or fine filter approach. The coarse filter analysis assumes that a representative array of ecological communities of sufficient size, structure and distribution will contain and maintain the vast majority of native species. A general coarse filter wildlife desired condition is to maintain a diversity of habitats for a full range of wildlife in concert with other resource desired conditions and ecological processes which alter or maintain habitat structure and function. The coarse filter objective is to retain representative habitats and seral stages and, therefore, the population viability for the majority of species within the diversity of habitats that the project area provides. A fine filter analysis addresses threats to at-risk species not covered by the coarse filter analysis and may provide conservation recommendations that contribute to their viability. A general fine filter desired condition is to maintain the diversity and population viability, at an individual scale, which may not be adequately managed through the coarse filter. Population management and objectives for fine filter species are specified by Montana Department of Fish, Wildlife, and Parks; the U.S. Fish and Wildlife Service; and/or Multi-agency developed Conservation Strategies, Recovery Plans, or Management Plans.

The WRA recognized those habitat groups that depend on fire to maintain the extent of distribution, age class, and structure (grass/ wet meadow, shrub, aspen, and Douglas-fir) may be reduced in extent by succession. It projected that aspen may not be represented as historic, or at all, in the long-term due to the lack of disturbance. Specific opportunities were identified to restore those habitats of limited distribution. They included targeting treatment of Douglas-fir forests, which have historically had more frequent fire cycles, and appear to be the most departed from its natural fire regime. This would include south facing slopes to increase shrub component, stands with a high prevalence of medium age class acres, or stands with multi story structure within large, very large age class. Management within the sub-alpine fir forested types was recommended to create structural stage characteristics that are important to wildlife species. This would include treating stands that are currently medium and pole age classes, multi story structure in order to retain smaller age classes, singe story and to create replacement

(or protect existing) large, very large in the long-term. Since the potential for large stand replacement fire grows as trees mature, the possibility of current and future old growth stands being lost is high for both Douglas-fir and sub-alpine fir forest types. However, along a post-fire continuum, the current amount of the medium age class, which is above the historic range in distribution and structure, may either enable fires to burn at higher severities or possibly serve as replacement old growth if forest succession continues.

As stated above, one objective from the WRA for the wildlife resource is to move toward the historic conditions for those habitat groups that appear to be losing diversity due to lack of disturbance. These habitat groups include grass/ wet meadow (including aspen) and open-grown Douglas-fir forest. Maintaining or increasing these habitat groups, including successional and seral stages, maintains viable native species populations. Old growth forest and snag habitat would remain well distributed across the landscape within all forest types. The project purpose and need was partially based on this wildlife objective. The action alternatives both move toward meeting this objective and meet the purpose and need of improving wildlife habitat by modifying forest structure, maintaining meadow and aspen areas and opening densely forested conditions.

Alternative 2 - Proposed Action

Grassland/ Wet Meadow

Based on the prescriptions in Unit A1, B, C, D, G, and I, approximately 548 more acres would occur as a clumped mosaic of grass and shrub types providing greater diversity. This would provide better habitat for those species dependent or obligate on non-forested habitat groups such as grassland, wet meadow, aspen, willow, sagebrush, and other shrublands. It would provide seasonal or year-round nesting and foraging habitat for migratory songbirds, big game, small mammals, raptors, and forest carnivores.

Douglas-fir Forest

The medium age class of forest would be reduced, but not at levels representing historic. The vegetation treatments in the cool, moist Douglas-fir forest portions of Units B and D would decrease tree density and reduce the amount of horizontal and vertical habitat components. There would be an increase in the amount of forage available for big game, nesting habitat for snag dependent birds, foraging habitat for forest dwelling raptors, and an increase in late seral, single story old growth. The vegetation treatments proposed in Unit E1 would restore more open, park-like habitat in this warm, dry Douglas-fir forest. Other warm, dry Douglas-fir forests within this habitat group where no vegetation treatment is proposed would continue to follow successional paths outside the natural range of variation.

Subalpine Fir (Lodgepole) Forest

As with the Douglas-fir forest habitat group, the proposed vegetation treatment would reduce the medium age class structure. The prescriptions for Units B, D, E2, F, and I would move the medium age class from two storied or multi-storied to conditions with less structure and/or younger age classes. In addition, the vegetation treatment would retain clumps of larger age class habitat groups to increase the age class diversity. This is more similar to historic conditions than what would occur with no action. Without any vegetation treatment and continued fire suppression, these habitat groups are at greater risk of stand replacement wildfire, which would create less age class diversity.

Aspen

Maintaining and restoring aspen is important because of its exceeding high biodiversity (Kay 1997). A decline in aspen on the landscape could lead to significant declines in nest success for birds (Struempf and others 2001). Treatments are needed to retain aspen on seral sites and to retain a variety of age and size classes on the landscape (DeByle 1985c). Techniques such as prescribed burning, commercial harvest, removal of vegetative competition, protection of regeneration from herbivory, or mechanical root stimulation, serve to stimulate regeneration of the clone (Schier and others 2001, Shepperd 2001).

Both livestock and native herbivores modify aspen habitats by grazing understory vegetation, browsing developing aspen sprouts, and making regular use of stands for bedding and summer thermal cover. Domestic livestock browse the aspen with increasing pressure through summer and fall. This impact is greatest on shrubs and young trees less than approximately thirteen feet tall. Trampling that inevitably occurs with grazing and browsing damages vegetation and compacts soil. The combined effect of browsing, mechanical damage, and soil compaction can limit the regeneration success of treatment.

Kay (1997) states that the aspen clone will die or fail to regenerate if the new sprouts are browsed. Browsing reduces aspen growth, vigor, and numbers and can drastically reduce or eliminate sprouts (DeByle 1985a). Heavy browsing following a treatment to induce suckering can deplete aspen root reserves, jeopardize successful regeneration, and threaten stand survival (Shier and others 2001). They suggest that proposed treatments must not be initiated until browsing relief is obtained. It would be critical to manage livestock use after a physical disturbance due to the flush of sprouts and subsequent attraction to ungulates. Fencing may be required if ungulate browsing is found to be limiting the successful regeneration of aspen sprouts. This would ultimately protect regenerating aspen from browsing ungulates but would be very economically prohibitive requiring additional infrastructure maintenance and management responsibilities.

The prescription for Unit A1 also identified falling conifers within small isolated aspen stands to open them up to sunlight and hinder livestock movement and use in the stand. Research conducted by Ripple and Larsen (in press) tested the hypothesis that fallen conifers would provide refugia to aspen regeneration under levels of heavy browsing. Their findings indicated that there was a significant difference between aspen height within jackstraw sites of >0.8 m high and those subjected to ungulate browsing in the open. While this study was done on post 1988 fire debris in Yellowstone National Park, they suggest that coarse woody debris to provide barriers for cattle should be very effective and recommend this as an experimental strategy prior to investing in exclosure fences. Falling conifers within the aspen stand may serve to deter livestock grazing within the stand allowing for aspen regeneration survival and successful recruitment. Monitoring would dictate what level of management is necessary to ensure aspen ramets surviving to recruitment age. Viable Treatments include fencing from either domestic or wild ungulates, strategically falling conifers, and using adaptive management of livestock. Aspen treatments and mitigation associated with the proposed action would enhance aspen regeneration and maintain aspen stands in the project area.

Riparian Areas

The direct effects to riparian areas would be minimal due to mitigation designed for the action alternatives (See pp. 2-30 & 2-31 for mitigation and effectiveness). By buffering existing springs and other areas exhibiting riparian characteristics, and not allowing equipment use within area of influence, riparian areas would not be impacted.

Alternative 3 – Proposed Action & Meadow Creek Burn

The vegetation treatments proposed with the Meadow Creek Burn (Unit J) would restore more open, park-like Douglas-fir forest. Approximately 250 additional acres would represent a mosaic of grass and shrub types, providing greater diversity. The introduction of fire would temporarily provide post-fire habitats necessary for those species dependent or adapted to fire. The distribution and occurrence of early succession plant communities such as grassland, aspen, and willow are influenced by disturbance events such as fire. There would be an increase in the amount of forage available for big game, nesting habitat for snag dependent birds, and foraging habitat for forest dwelling raptors. This would provide better habitat for those species dependent on non-forested habitat groups such as grassland, wet meadow, aspen, willow, sagebrush, and other shrublands. It would also provide seasonal or year-round nesting and foraging habitat for migratory songbirds, big game, small mammals, raptors, and forest carnivores. The effects of this alternative would be the same as Alternative 2 except Alternative 3 would better meet the purpose and need for wildlife habitat due to the addition of Unit J.

Cumulative Effects

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

Past and current activities in both the Smith Creek and Shields River watersheds include livestock grazing (including the recent Upper Shields Grazing Allotment Revisions), approximately 1,125 acres of timber harvest on private lands and 4,275 acres of harvest on National Forest lands in the last 40+ years (much of this harvest was conducted before the Forest Service acquired these previously privately owned lands), revegetation on the majority of these acres, pre-commercial thinning activities on approximately 1900 acres of National Forest lands, changes in patterns of land ownerships on approximately 4,500 acres due to the Galt (1991-1993) and Goat Creek Land Exchanges (1997), road obliteration of approximately 25 miles of road after the Galt land exchange, hunting, and year-round recreational activities. Reasonably foreseeable actions include implementation of the recent decision for the Gallatin National Forest Travel Management Plan.

Historically, large-scale, stand replacement fires wildfires was an important natural event that created and maintained habitats and their associated species assemblages. In the short-term, fires may have caused localized extinction due to emigration or direct mortality. Depending on the spatial and temporal scale of fire severity and frequency, these areas likely re-colonized. Human development in the form of highways, roads, fences, and structures have limited both the emigration and re-colonization through the interruption of travel corridors. This is one example of why the generalized notion of returning to pre-European settlement conditions is not appropriate. If a large scale, stand replacement fire were to occur in the Smith/ Shields today, it is unlikely that it would increase the risk of extinction. However, it is unknown what role the Crazies and other equally isolated mountain ranges play in the overall viability of local or meta populations of species.

Alternative 1 – No Action

The cumulative effect of the No Action Alternative for wildlife habitat is continued succession through time, increasing habitats with limited distribution. This alternative does not provide for historic diversity created by grassland and shrubland mosaics. Similarly, decadent aspen stands would continue to decline as they are encroached upon by conifers along the edges of meadows and/or associated

with riparian areas. Aspen would continue to be less represented than historic. Without fire or other disturbance, some plant communities may not be represented at all in the long-term.

The Douglas-fir forest habitat group would continue to have an abundance of medium age class compared to historic. Understory shrub and herbaceous layers would not be represented. With successful fire suppression, and no additional disturbance, the open-grown Douglas-fir habitat group would continue to follow successional paths outside the natural range of variation. Overall this may contribute to a lack of forage for big game, nesting habitat for snag dependent birds, foraging habitat for forest dwelling raptors, and a reduction in late seral, single story old growth.

The subalpine fir habitat group would continue be within the range of variation along the post-fire continuum for its natural lower frequency, higher intensity fire regime. With continued fire suppression and no vegetation treatment, these habitat groups would continue to age and be at risk for stand replacement wildfire. Stand replacement wildfire would, however, provide post-fire habitats to fire adapted species such as lynx (foraging) and woodpeckers (nesting and foraging).

The effect of no additional disturbance, along with the past, present, and reasonably foreseeable actions (pp. 3-1 through 3-6) in the Smith Creek analysis area, would result in a loss of important wildlife habitats over time.

Alternatives 2 & 3 – Proposed Action & Proposed Action & Meadow Creek Burn (Common Effects)

The cumulative effects of implementing either Alternative 1 or 2 would move vegetative conditions closer to historic for those habitat groups that appear to be losing diversity due to lack of disturbance. These habitat groups include grass/ wet meadow, aspen, and open-grown Douglas-fir forest. Old growth forest and snag habitat would remain well distributed across the landscape within all forest types. Maintaining or increasing these habitat groups, including successional and seral stages, helps maintain viable native wildlife species populations. Subalpine fire habitat groups would undergo succession along a post-fire continuum the same as with Alternative 1.

Applicable laws, regulation, and Forest Plan Guidance

Endangered Species Act

Under Section 7 of the Endangered Species Act, each Federal agency must ensure that any action authorized, funded or carried out is not likely to jeopardize the continued existence of any threatened or endangered species. The action alternatives would have *"no effect"* on bald eagle, and is *"not likely to jeopardize"* the gray wolf. There are no plants listed as threatened or endangered in the project area. No concurrence is needed from the US Fish and Wildlife Service for "*no effect"* determinations or for 10J rule non-essential experimental species (gray wolf). The US Fish & Wildlife Service

recently removed the threatened Canada lynx from their list of species that may be present on the Gallatin Forest north of I-90. The Forest Service and US Fish and Wildlife Service jointly determined that the Crazy Mountains are not occupied by lynx. Consultation with the US Fish and Wildlife Service is not required for projects in "unoccupied" habitat. An analysis of effects on lynx was conducted for this project and included in the Environmental Assessment wildlife report; conservation measures in the LCAS (Ruediger and others 2000) and the interagency Conservation Agreement (USDA and USDI 2005, USDA and USDI 2006) were used to assess effects. Based on the analysis, all applicable standards in the LCAS would be met under all action alternatives for the project except for removal of sub merchantable material within mature forest, adversely affecting foraging habitat. The interagency Canada Lynx Conservation Agreement allows for exceptions to this standard where human health and safety would otherwise be compromised. It was determined that the purpose and need for this project relative to firefighter and public safety, for which the proposed vegetation and stewardship treatments were developed to meet, satisfies the intent of this allowed exception.

Migratory Bird Treaty Act

On January 10, 2001, President Clinton signed an Executive Order outlining responsibilities of federal agencies to protect migratory birds. On January 17, 2001, the USDA Forest Service and the USDI Fish and Wildlife Service signed a Memorandum of Understanding to complement the Executive Order. Upon review of the information regarding neotropical migratory birds in the wildlife report and project file, the proposed vegetation and stewardship treatments would not result in a loss of migratory bird habitat or be an extirpation threat to any migratory birds.

National Forest Management Act

The National Forest Management Act (NFMA) requires that Forest plans "preserve and enhance the diversity of plant and animal communities...so that it is at least as great as that which can be expected in the natural forest" (36 CFR 219.27). Furthermore, implementation regulations for the NFMA specify that, "Fish and wildlife habitat shall be managed to maintain viable populations of existing native and desired non-native vertebrate species in the planning area".

There are currently 8 terrestrial species identified as "Sensitive" that are known or suspected to occur on the Gallatin National Forest (USDA 2004). With the implementation of the action alternatives, proposed vegetation and stewardship treatments would have "no impact" on peregrine falcon, trumpeter swan, harlequin duck, and black-backed woodpecker. The determination for flammulated owl, goshawk, Townsend big-eared bat, and wolverine for the action alternatives would be "may impact individuals or habitat, but will not likely contribute to a trend toward federal listing or cause a loss of viability to the population or species".

There will be "no impact" to sensitive plants within the treatment areas due to lack of potential suitable habitat or absence of plants based on completed surveys.

Gallatin Forest Plan

Forest Plan Standard for Wildlife and Fish, page II-18, section 6.a.3 – Big game winter range will be managed for forage and cover. Winter range is not located within the project area; elk migrate out of National Forest and utilize lower elevation private lands.

Forest Plan Standard for Wildlife and Fish, page II-18, section 6.a.5 – Maintain hiding cover associated with key habitat components. Hiding cover was estimated at approximately 70-90% of the area and is not limiting. There were no areas of concern identified for big game species for this project. The vegetative structural diversity analysis indicates a 1% decrease in the pole, mature, and old growth structural classes, maintaining acceptable levels of hiding cover. Identified mitigation measures would facilitate fall migration to winter range.

Forest Plan Standard for Wildlife and Fish, page II-18, section 6.a.7 – Standards for snag and down woody material will be utilized. Snag habitat needs were considered for Townsend's big-eared bat, flammulated owl, Northern goshawk, pine marten, and migratory birds. Forest Plan standards for snag and down woody debris management would be met under both the action alternatives. Snag habitat would remain well distributed across the landscape within all forest types.

Forest Plan Standard for Wildlife and Fish, page II-18, section 6.a.8 – Emphasis will be given to the management of special and unique wildlife habitats such as wallows, licks, talus, cliffs, caves, and riparian areas. Key components such as cover, security areas, and road densities would remain unchanged with the proposed action or any of the alternatives. None of the alternatives would result in adverse modification of big game or its associated habitat. Elk population goals have been met for this EMU and are considered to be healthy and widely distributed.

Forest Plan Standard for Wildlife and Fish, page II-18, section 6.a.12 – Habitat that is essential for species identified in the Sensitive species list developed for the Northern Region will be managed to maintain these species. Sensitive species were addressed as part of the analysis for proposed vegetation treatment in the Smith Creek project area. All terrestrial sensitive species were dismissed or analyzed in detail. Mitigation measures were identified as appropriate.

Detailed analysis was completed to identify and mitigate for any adverse affects. The action alternatives meet both these wildlife standards applicable to MA 8.

Issue 5 - <u>Insect and Disease Outbreaks:</u> Without treatment, high levels of mountain pine beetle attacks (epidemics) on lodgepole pine are likely within the foreseeable future (over the next 50 years) on approximately 6,000 to 8,500 acres (based on the Shields River Watershed Risk Report (USDA 2005a)).

Scale of Analysis: The scale of this analysis will focus within the Smith Creek Timber Compartment 221 concentrating on the areas in closest proximity to the majority of homes located along Smith Creek and the East Fork of Smith Creek.

Affected Environment:

The mountain pine beetle, which attacks all western pine species, is the most aggressive, persistent, and destructive bark beetle in the United States (USDA 1994, Forest Insect & Disease Identification and Management). Normally, this insect is at low populations or endemic levels but as trees increase in size, age and density over a broad area, beetles can become epidemic. Mountain pine beetle outbreaks typically occur in mature to over-mature forests as the growth rates slow and the trees ability to defend against this insect declines. Long-term (preventative) forest management is the best strategy to keep beetle populations at endemic levels. When sufficient concentrations of pine trees exist that are suitable hosts for the mountain pine beetle, population explosions can occur. Lodgepole pine become suitable hosts for the beetle when trees are greater than 8 inches in diameter and average 80 or more years old (trees greater than 5 inches diameter) (Amman 1978, Safranyik, 1976). Susceptibility increases with diameter and basal area (Amman 1978). Thinning overstocked, mature, and over-mature lodgepole pine stands to near 80 square feet of basal area per acre can greatly reduce beetle-caused mortality (USDA 1994).

Recent aerial insect surveys (beginning in 1994 and up to 2006) show patches (less than 15 acres) of mountain pine beetle activity within timber Compartment 221 (See map in Project File). There are, however, scattered mountain pine beetle-killed trees throughout the Smith Creek drainage, including high elevation whitebark pine. This contrasts sharply to the heavy mountain pine beetle activity that occurred on the west side of the Gallatin National Forest in the late 1970s and early 1980s. The Gallatin National Forest experienced a severe attack from this insect that affected thousands of acres of lodgepole pine stands in much of the western half of the Gallatin Mountain Range and most of the Madison Mountain Range. The relatively small occurrences of beetle activity that currently exist in this area are likely due to the younger age of much of the lodgepole pine in the Crazy Mountains (90 to 110 years old in the Crazy Mountains vs. 120 to 150 years old in the Gallatin and Madison Mountains), and the mix of conifer species present, along with the isolated nature of this mountain range as compared to the large reservoir of continuous lodgepole pine present in the Gallatin and Madison Mountains.

The Douglas-fir bark beetle is the most destructive bark beetle attacking Douglas-fir in the Northern Region. Beetle populations can build up in host trees following drought,

blowdown, fire, logging, severe defoliation, or in association with root disease. Beetle populations build in down material (greater than 8 inches diameter) and then attack surrounding green trees. Douglas-fir beetles tend to favor dense stands, stands with average ages greater than 120 years, and stands with root disease or injury. Stand density reduction has been shown to be the most effective method of reducing beetle-caused mortality by reducing tree competition for moisture and exposing material to sunlight (USDA 1994, Leslie E. and Bradley, T. 2001).

Douglas-fir bark beetle activity is currently at low to moderately low levels within the project area. The 2005 and 2006 Aerial Detection Survey noted Douglas-fir mortality in small pockets (3 to 10 acres) at the lower elevations in Compartment 221. Much of the mortality in these pockets of trees (from 20 to 40% of the trees in these pockets) is likely the result of the ongoing drought common throughout much of this part of the United States. The current level of Douglas-fir beetle has been occurring for the last five to six years in and around the analysis area. In the early to middle 1980s an epidemic attack of Douglas-fir beetle occurred, leaving many larger Douglas-firs dead. Future tree mortality by this insect is likely to stay at current levels. However, if drier and warmer conditions increase and/or more wildfires occur within the area, Douglas-fir beetle numbers will likely increase.

The western balsam bark beetle is the most common beetle attacking trees in the Northern Region, accounting for a high numbers of tree mortality in subalpine fir stands. Usually, populations of this beetle maintain themselves by feeding on weakened trees including those with old age, root disease, and storm damage (USDA, 1994). During periods of drought or other environmental stresses, infestations can build and spread to less susceptible stands. The 2005 and 2006 Annual Aerial Detection Survey shows that ongoing subalpine fir mortality from the western balsam bark beetle is occurring throughout the higher elevations. However, the spread of subalpine fir mortality due to western balsam bark beetle is slow and will continue that way unless warmer and drier weather prevails.

This section will also discuss the western spruce budworm (the most noticeably damaging insect present in the analysis area). This native insect has co-evolved with Douglas-fir, spruce and true fir forests in Region 1. Budworms populations are usually cyclic, however, several forests east of the continental divide have populations that can be described as chronic, meaning that they occur over large areas with relatively short durations between outbreaks. The budworm larvae mine the buds and old needles prior to bud burst in May or June and consume new foliage as the buds flush. After 3-5 years of heavy defoliation, tree growth, branch dieback, top kill, and/or tree mortality occurs (particularly to suppressed and intermediate sized trees). Frontal systems and associated winds can carry populations from one drainage to another (USDA, 1994). Stand structure, composition, and density influence the probability, duration, and intensity of an outbreak.

The 2005 and 2006 Annual Aerial Detection Surveys show a moderate budworm outbreak (on around 600 acres of mostly private ground) throughout the lower reaches of Compartment 221. Defoliation will likely continue with possibly increases in both intensity and acres affected for the next three to five years, if the climate remains dry and warm.

Methodology for Analysis

Methods used in determining the affects insects and disease might have and will have in the Smith Creek analysis area are as follows:

1) For future forested landscape changes, the model SIMPPLLE was used extensively for tracking mountain pine beetle effects ten to forty years from today. See the description on what SIMPPLLE is in the vegetative portion of this report,
2) Other insects in the area (western spruce budworm, mountain pine beetle, balsam bark beetle and Douglas-fir beetle) and their possible effects were described, based on current conditions and possible conditions using mainly information available in the Regional insect and disease handbook,
3) Current insect conditions were determined by the yearly Regional aerial flight survey

Direct and Indirect Effects

At this time, the current and anticipated effects caused by western balsam bark beetle, and western spruce budworm are considered low to moderate. Due to the low level of potential effects from these insects, a detailed discussion of direct, indirect and cumulative effects was not included and the effects analysis was concentrated on the mountain pine beetle.

Alternative 1 – No Action

If no action is taken to reduce the stocking density of forested stands in the Smith Creek WUI within the next 10 to 20 years, there is moderate probability that a mountain pine beetle epidemic (high occurrences) will occur. Without treatment, based on information compiled in the Shields River Watershed Risk Assessment (USDA 2005a), the probability of a mountain pine beetle epidemic over the next 20-30 years would be high as more of the lodgepole pine in the area become mature and are susceptible to attack.

In order to keep populations of mountain pine beetle at or near the endemic levels (low to moderate occurrences) which currently exist in the drainage, stands of lodgepole and/or other pine species need to be less dense than what currently exists in the project area. For lodgepole stands in the project area, especially those which already contain endemic levels of beetle infestation, no action would increase the

likelihood that numerous additional trees would be killed by the mountain pine beetle in the project area in the future.

Douglas-fir beetle infestation has been occurring at similar endemic levels for the past five to six years in the analysis area. Without treatment, future tree mortality by this insect is likely to stay at current levels unless drought conditions increase and/or large wildfires occur within the area..

Alternative 2 - Proposed Action

Implementation of the Proposed Action Alternative would include irregularly thinning (to an average of 20' to 25' between boles) approximately 400 acres containing high levels of lodgepole pine in Units B, D, E2, and I. Thinning to levels of at least 80 square feet of basal area per acre considerably reduces the chance of an epidemic outbreak of mountain pine beetle occurring in the immediate project area.

The proposed action would also implement even-aged harvesting (removing most of existing conifers) by patch cutting (5 to 25 acre patches) on a total of approximately 60 acres in Unit F, a large dense lodgepole pine stand that is currently highly susceptible to mountain pine beetle attacks. Even-age patch cuts in Unit F will lessen the possibility of an insect attack getting started in this stand and greatly reduce the chances of an epidemic outbreak from starting in the immediate area.

As the lodgepole pine forests in the Smith Creek drainage continue to mature, the likelihood of an epidemic insect outbreak increases greatly as outlined in the Shields River Watershed Risk Assessment (Project File). Lodgepole pine stands attacked by the mountain pine beetle can expect mortality rates of 30% to 60% with large increases of down woody material as the dead trees decay and gradually fall over. Opening up the tree canopy and increasing the vigor of the residual lodgepole pine would reduce the likelihood of significant mountain pine beetle mortality in the project area.

In order to reduce the likelihood of a mountain pine beetle epidemic in lodgepole pine stands throughout Compartment 221, approximately 3,000 to 4,000 acres (out of a total of 9,500 acres) would need thinning over the next 10 to 20 years. Due to current watershed conditions, that many acres of treatment are not realistic or desirable. The treatments associated with the proposed action would occur at a much smaller scale (in and around private lands where residences exist).

With implementation of the proposed action, future tree mortality to Douglas-fir associated with the beetle is likely to be reduced slightly over the entire Compartment 221, but would be reduced moderately in those stands being thinned (project area). However, if drier and warmer conditions increase and/or more large wildfires occur within the area, Douglas-fir beetle numbers will likely increase in

the compartment. The treatment areas would be less affected due to the more open grown and increased vigor associated with the treated Douglas-fir stands.

Alternative 3 – Proposed Action and Meadow Creek Burn

Alternative 3 would have the same effects as Alternative 2 with the implementation of Units A through I. However, Alternative 3 also includes a 300 acre prescribed burn (Unit J) in Meadow Creek.

Timing and parameters surrounding implementation of the prescribed burn are critical to ensure that the burn remains at a low enough intensity that significant numbers of large diameter (>15" diameter) Douglas-fir within the unit are not injured by fire. These trees are the most susceptible to Douglas-fir beetle attack, as stressed trees send out a pheromone that can attract beetles for one to two miles. The Douglas-fir beetle is not as aggressive as the mountain pine beetle and the amount of mortality that would be expected would likely exist in small pockets (1/8 to 1/4 acre in size) of the larger diameter Douglas-fir.

Cumulative Effects

Alternative 1 – No Action

With Alternative 1, no vegetation treatments would occur in the analysis area on National Forest lands in the near future. Based on the small amount of potential future harvest activity likely to occur outside of this project (either by thinning or even-age harvesting where most of the forest is removed on private lands), little in the way of reducing an outbreak of mountain pine beetle at either the local or large scale is likely. Untreated private lands located in or near the project area that currently contain endemic populations of beetles, and nearby untreated public lands dominated by lodgepole pine will continue to have a moderate chance for numerous trees to be killed by mountain pine beetle into the foreseeable future.

There would not likely be any cumulative effects regarding Douglas-fir beetle infestations associated with no action unless drought conditions increase and/or large wildfires occur within the area, increasing the current infestation levels.

Alternative 2 - Proposed Action

Implementation of Alternative 2 would treat stands at the project level scale (especially those in closest proximity to private residences). Based on the fact that only small areas of additional future harvest activity are likely to occur in the drainage (either by thinning or even-age harvesting on private lands), little in the way of reducing an outbreak of mountain pine beetle or Douglas-fir beetle over the entire Smith Creek drainage is likely. However, in the project area (where the majority of the residences are located), the planned treatments would provide moderate levels of protection from mountain pine beetle and Douglas-fir beetle

epidemics for the next several years. Additional treatments on adjacent private lands would supplement the levels of protection. None of the other current or reasonably foreseeable activities would have any measurable effect on the potential for insect and disease epidemics in the Project Area.

Alternative 3 – Proposed Action and Meadow Creek Burn

Potential cumulative effects from implementation of Alternative 3 would be the same as those discussed above for Alternative 2 with the exception of those possible effects associated the Meadow Creek prescribed burn (Unit J). With implementation of the prescribed burn, a small amount of Douglas-fir beetle kill within the proximity of the burn could occur in the near future. The burn is likely to singe some Douglas-fir within the unit and could attract Douglas-fir beetles to these trees. Thinning of Douglas-fir on both private and public lands in the project area would increase the vigor of the residual Douglas-fir and make them less susceptible to beetle mortality.

Applicable laws, regulation, and Forest Plan Guidance

Gallatin Forest Plan (p.II-5), Forest Management Direction*, *Objectives*, *h. Timber: Emphasis will be placed on the harvest of lodgepole pine stands infested or the potential of infestation by the mountain pine beetle.

Both of the action alternatives (Alternatives 2 & 3) would meet the objectives described above by thinning dense stands of lodgepole and/or removing trees that are currently infested with mountain pine beetle.

Gallatin Forest Plan, Appendix A. I. Criteria for Selecting Preferred Silvicultural System: The system should develop stand conditions required to meet management area goals over the longest possible time. The system should permit enough control of competing vegetation to allow establishment of an adequate number of trees growing at acceptable rates. The system should promote stand structures, compositions and conditions that minimize damage from pest organisms, animals, wind and fire.

The majority of the project area and treatment units are located on lands that have been identified as MA8, which are suitable for timber management and have management goals of providing for productive timber stands and developing vegetative diversity. Implementation of either of the action alternatives (Alternatives 2 & 3) would be consistent with these goals.

Issue 6 – Soils: Effects of proposed vegetative treatments, in combination with existing logging roads and skid trails, could cause additional detrimental soil disturbance in the project area.

Scale of Analysis: The temporal bound of this analysis is defined by the likely period of time for soil productivity recovery. Most mountain soils have formed in environments significantly different than the present over 1000's of years. Recovery is unlikely in 100 years for soils in these kind of climatic environments (Pritchett, 1979). Though the actual recovery period may be longer, only the period of 100 years is documented so is used as the temporal bound.

The unit locations (Activity Areas) are sufficient for the spatial bounds of this analysis. Since no new system roads are proposed, soil disturbance will only occur in the cutting units, landings, and temporary roads. This is consistent with Regional Soils Guidelines and Standards (USDA Forest Service. 1999), where Activity Areas are defined as: "a land area affected by a management activity to which soil quality standards are applied. Activity areas must be feasible to monitor and include harvest units". All temporary roads, skid trails, and landings are considered to be part of an Activity Area.

Affected Environment:

Generally, the Smith – E. Fork Smith drainage has relatively fine textured soils with few rock fragments, primarily developed in glacial till derived from sandstone and shale, and moderately coarse textured soils with many fragments derived from weathered granite and glacial till. Landslide hazards are low in the area. These soils erode relatively easily and have significant potential for sedimentation. The area is heavily roaded, especially on lands purchased/traded from private landowners. These roads have poor drainage, poor maintenance, and heavy use when wet. These factors have contributed to the existing water quality problems in streams.

For soils and interpretations, see Table 3-19. This is derived from the Gallatin National Forest Soil Survey (Davis and Shovic, 1996). All data from the soil survey (Map sheets 16, 17) have been verified on the ground, with the exception of Unit J, which has no planned ground-disturbing activities.

Table 3-19 Soil Descriptions and Interpretations for the Project Area

Treatment Unit	Soil Map Units	Soils	Interpretations
A1	86-3B	Gentle slopes; weathered sandstone/shale; silty soils with few rock fragments; forested, meadows	Low landslide hazards, rutting potential on roads; erodable soils; compatible with tractor harvest
A2	86-3B	Gentle slopes; weathered sandstone/shale; silty soils with few rock fragments; forested with meadows	Low landslide hazards, rutting potential on roads; erodible soils; compatible with tractor harvest
B	86-3B	Gentle slopes; weathered sandstone/shale; silty soils with few rock fragments; forested with meadows	Low landslide hazards, rutting potential on roads; erodible soils; compatible with tractor harvest
C	86-3B	Gentle slopes; weathered sandstone/shale; silty soils with few rock fragments; forested with meadows	Low landslide hazards, rutting potential on roads; erodible soils; compatible with tractor harvest
D	86-3B	Gentle slopes; weathered sandstone/shale; silty soils with few rock fragments; forested with meadows	Low landslide hazards, rutting potential on roads; erodible soils; compatible with tractor harvest
E1	54-1C	Steep slopes; weathered granite; sandy soils with many rock fragments; open forest	Low landslide hazards, moderately erodible soils; too steep for tractor harvest
E2	53-1D	Rolling slopes; weathered granite and glacial till; sandy soils with many rock fragments; forested	Low landslide hazards; moderately erodible soils; compatible with tractor harvest
F	54-1G	Steep slopes; weathered granite with some glacial till; sandy soils with many rock fragments; forested	Low landslide hazards; moderately erodible soils; too steep for tractor harvest
G	86-3B	Gentle slopes; weathered sandstone/shale; silty soils with few rock fragments; forested with meadows	Low landslide hazards, rutting potential on roads; erodible soils; compatible with tractor harvest
H	53-1D	Rolling slopes; weathered granite and glacial till; sandy soils with many rock fragments; forested	Low landslide hazards; moderately erodible soils; compatible with tractor harvest
I	54-1G	Steep and rolling slopes; weathered granite with some glacial till; sandy soils with many rock fragments; forested	Low landslide hazards; moderately erodible soils; compatible with tractor harvest
J	71-2D	Rolling slopes; landslide debris from volcanic rocks; few wet areas; moderately-fine textured soils with many rock fragments. forested and grasslands	Low landslide hazards; moderately erodible soils; compatible with tractor harvest

Table 3-20 shows the results of the soils investigation for the activity area. These results are based on field investigation of each noted unit (June 20, 2006, Nov 21, 2006, and Jun 4, 2007). Note that mitigation is prescribed in all units having ground-disturbing activities. The Gallatin National Forest Soil Protection Best Management Practices (Gallatin BMP) are specified for all units. The applicable practices are specified in Appendix B. Additional restorative mitigation (in this case addition of coarse woody debris) is specified where units have been previously harvested and have a cumulative predicted detrimental disturbance of over 15%. This is designed to mitigate the previous disturbance.

Table 3-20 Proposed Harvest Method & Past Detrimental Soil Disturbance by Unit

Unit	Acres	Approx Length of Old Skid Trails (miles) *	Proposed Harvest Method	Detrimental Disturbance from Previous Harvest (%)	Disturbance from Proposal (%)	Total Detrimental Disturbance (%)	Restoration Proposed (Addition of Coarse Woody Debris (CWD))	Regional Standard Met? (With Restoration)
A1	52	0.3	Ground-based; winter	36	3.5	39.5 (less effects of restoration)	Yes	Yes
A2	15		Hand-thinning	Yes	0		No	Yes
B	165	2.7	Ground-based; winter	17	3.5	20.5 (less effects of restoration)	Yes	Yes
C	112		Hand-thinning	Yes	0		No	Yes
D	125	0.9	Ground-based; winter	26	3.5	29.5 (less effects of restoration)	Yes	Yes
E1	34		Helicopter	0	0.3	0.3	No	Yes
E2	50		Helicopter	0	0.5	0.5	No	Yes
F	143		Helicopter	0	0.5	0.5	No	Yes
G	28	0.1	Ground-based; winter	10	3.5	13.5 (less effects of restoration)	Yes	Yes
H	103		Hand-thinning	Yes	0			Yes
I	66	0.1	Ground-based; winter	22	3.5	28.5 (less effects of restoration)	Yes	Yes
J	300	0	Prescribed Burn	0	0	0	No	Yes

* Miles of skid roads estimated to be candidates for restoration.

Field investigation shows that in all areas noted as previously harvested, harvest consisted of a "high-grading" or removal of the best trees, probably in the 1960's and 1970's. Skid trails, piles of soil, temporary roads, landings, and depressions where topsoil is absent are common. The Region One Soil Quality Monitoring Protocol (authorized May 25, 2007, Regional Forester, 2550) was used to determine extent of previous detrimental disturbance (See Table 3-20). Because this is 30-40 year old harvesting, vegetative recovery has occurred in many areas and evidence of disturbance has been obscured. The primary visible indicators of disturbance consist of rutting and/or soil compaction.

There are a number of excavated skid roads in Units A, B, D & G. Length estimates shown in Table 3-20 are from a combination of aerial photo interpretation and ground investigation. Some of these roads are restoration opportunities.

Units E1, E2, and F would be harvested using helicopter methods. Helicopter landings to accommodate these units would consist of approximately three acres of detrimentally disturbed ground, or 1.3 percent (3 acres divided by 227 acres times100%), well below Regional standards. This proportion is distributed over all three helicopter units. Existing landings would be used where available.

Winter logging has been shown to produce 0 to 7% (average 3.5%) detrimental disturbance (Philipek, 1985; Dumroese, et. al, 2006) when completed properly. Use of the Soil Quality Best Management Practices (Appendix B) is recommended to properly complete winter logging operations. Specifications for winter practices are similar to those used in the literature (Ibid).

Methodology for Analysis

Soil characterization, status and extent of previous harvest, predicted impacts of project management, potential restoration, and effects by alternative were developed using the following methods.

- Soil characterization and interpretations are derived from the Gallatin National Forest Soil Survey (Davis and Shovic, 1996). Data from the soil survey (Map sheets 16, 17) has been verified in the field.

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- Results of soils investigation of the Activity Areas are based on field investigation of each noted unit (June 20, 2006, Nov 21, 2006, and Jun 4, 2007). All units have been reviewed in the field with the exception of Unit J, which has no planned ground-disturbing activities.

- The Region One Soil Quality Monitoring Protocol (authorized May 25, 2007, Regional Forester, 2550) was used to determine extent of previous detrimental disturbance. Only visible indicators such as rutting or soil compression were used. There are several old excavated skid roads in some of the units. Road

lengths and disturbance were estimated from a combination of aerial photo interpretation and field investigation.

- Winter logging effects and restoration recommendations are based on literature.

- Restoration specifications are based on review of indirect and direct effects of various restoration methods.

- Northern Region Soil Quality Standards (USDA, Forest Service, 1999) are the context for effects analysis for soil quality.

  "Design new activities that do not create detrimental soil conditions on more than 15 percent of an activity area. In areas where less than 15 percent detrimental soil conditions exist from prior activities, the cumulative detrimental effect of the current activity following project implementation and restoration must not exceed 15 percent. In areas where more than 15 percent detrimental soil conditions exist from prior activities, the cumulative detrimental effects from project implementation and restoration should not exceed the conditions prior to the planned activity and should move toward a net improvement in soil quality."

Direct and Indirect Effects

Alternative 1 – No Action

Alternative 1 does not specify any ground-disturbing activities, therefore would have no direct or indirect effect on soil quality or productivity.

Alternative 2: Proposed Action

Alternative 2 specifies a mixture of ground-based harvest, hand-thinning, and helicopter harvest (See Table 3-20 for specific information).

The indicator used in disclosing the direct effects is adherence to the Soil Quality Standards. These standards specify no more than 15% total detrimental disturbance in any unit. This only applies to areas having no previous harvest. Table 3-20 contains the ratings for the Units described below.

Units E1, E2, and F would be harvested using helicopter methods. Existing landings may be used, so these estimates are maximums. For each helicopter unit, a one acre disturbance for landings is estimated. This totals (for all units) three acres of detrimentally disturbed ground, or 1.3 percent (3 acres divided by 227 acres times 100%), which is well below Regional standards.

Units A1, B, D, G, and I would be harvested using ground-based methods in winter conditions over frozen ground or 8" of snow. Effects are likely to be a small increase in soil disturbance (3.5% average), within Regional soil standards. No new permanent or temporary roads are specified.

Units A2, C, and H are scheduled for hand-thinning, with no machine access. Therefore, there would be no significant increase in soil disturbance in these units.

All units having no previous harvest (Units E1, E2, F) as well as those units that are scheduled for hand-thinning only (A2, C, and H) would meet the Regional Soil Quality Standards (Table 3-24), if the Soil Protection BMP's are used.

This Alternative is consistent with the Soil Quality standards, and the Forest Plan in terms of protecting soil quality and productivity.

Alternative 3: Alternative 2 plus Meadow Creek Burn

This alternative would have the same effects to soils as those described in Alternative 2 with the exception of an additional prescribed burn (Unit J), which is 300 acres located near Meadow Creek.

Literature shows that prescribed fire often causes little change in soils. This is because of low heating levels and the retention of most ground cover (Debano, et. al, 1998, page 181). Reviews of past prescribed burns on the Gallatin support this conclusion (Story, 2006).

Cumulative Effects

Alternative 1 – No Action

Because this alternative does not specify any ground-disturbing activities, there would be no cumulative effects on soil quality or productivity.

Alternative 2 - Proposed Action

The indicator used in disclosing cumulative effects is adherence to the Soil Quality Standards. These standards specify no more than 15% total detrimental disturbance from the proposed action in areas having previous harvest. Furthermore, previous detrimental disturbance should be mitigated by restoration within the Activity Area. Table 3-20 has the analysis results by Unit.

Units A1, B, D, G, and I: Previous harvest has occurred in these units and disturbance exceeded soil quality guidelines (See Table 3-20). Any additional disturbance will increase this to some extent. Regional standards recommend a reduction in total disturbance if a new action is planned. Though current proposed disturbance is less than Regional standards (winter logging has an average of 3.5%,

which is less than the 15% standard), total cumulative disturbance is higher than 15%, indicating a potential cumulative effect of a net reduction in soil quality (Table 3-20).

Mitigation/restoration is planned in all of these units. The proposal is to pull back coarse woody debris (CWD) on old skid roads within these units. The skid roads are remnants of poor logging practices in the 1970's when this land was privately owned. Only skid roads having no current ATV designation as trails are proposed for this restoration. These areas have been mapped and verified on the ground by the soil scientist. Enough debris should be added to provide about 5 tons per acre (Graham, et.al., 1994), over the entire skid road. Debris should be placed to maximize barriers to ATV access. At an average of 30 feet wide over a distance of 4.1 miles of skid roads, the area to be treated equates to about 15 acres. This restoration work can be completed by hand in the summer/fall or by using mechanized equipment over snow or frozen ground.

This type of restoration work would have the following effects:

1. The addition of coarse woody debris would be beneficial for restoration of soil productivity. Addition of debris would increase the organic fraction of the soil after decay, and is a recommended activity for protection of soil productivity (Graham, et. al, 1994).

2. There is potential for increased ATV use in the area post-harvest, and the placement of woody debris would deter ATV use of these old trails. Increased ATV use could be a source of additional soil disturbance. Because there is high potential for increased weed infestation in portions of the Project Area (Units B and G), keeping soils undisturbed would also prevent the spread of weeds on these skid roads.

In summary, all previously harvested units that are scheduled for mechanical treatments with this proposal (Units A1, B, D, G, and I) have restoration practices specified (Table 3-20). There is a total of 4.1 miles of skid trail restoration scheduled within these units. This restoration proposal would qualitatively reduce the detrimental effects of previous harvest. This method of restoration has been shown to be effective in Region 1. However, there are no data to estimate quantitative measures of reduction.

The remaining units have either not been previously harvested (E1, E2, F), or have no mechanized treatments planned with this entry (A2, C, and H). Therefore, there would be no significant cumulative effects to soil quality or productivity associated with these units.

The Regional Soil Standards should be met for all units associated with Alternative 2 if the Soil Protection BMPs are used and the specified restoration practices are carried out. Therefore, there would be no cumulative effects to soil quality or productivity. Alternative 2 is consistent with the Soil Quality Standards as applied to cumulative effects and to the Forest Plan in terms of protecting soil productivity.

Alternative 3: Alternative 2 plus Meadow Creek Burn

Cumulative effects for Alternative 3 would be the same as for Alternative 2, with the exception of an additional 300 acre prescribed burn.

No cumulative effects for the prescribed burn (Unit J) are anticipated. Literature shows that prescribed fire often causes little change in soils. This is because of low heating levels and the retention of most ground cover (Debano, et. al, 1998, page 181). In addition, all these soils have developed under a continuous, repeating cycle of fire. Reviews of past prescribed burns on the Gallatin support this conclusion (Story, 2006).

Applicable laws, regulation, and Forest Plan Guidance

Forest Plan Standards and Direction (USDA, Forest Service, 1987)

Soil and site productivity issues relate to the Forest Plan as follows:

Soil and Water Quality Maintenance: All practices will be designed or modified as necessary to maintain land productivity (p.II-24).

Timber Production: Provide a sustained yield of timber products and improve the productivity of timber growing lands (p.II-1). Site prep. and debris disposal methods will be prescribed which maintain an adequate nutrient pool for long-term site productivity through the retention of topsoil and soil organisms.

Regional Standards

Regional standards for protection of long term soil productivity are applied (USDA, Forest Service, 1999). These are dated 11/12/1999 and are titled: FSM 2500 - Watershed and Air Management R-1 Supplement 2500-99-1, Chapter 2550 - Soil Management (USDA Forest Service. 1999).