Environmental Assessment

United States Department of Agriculture

Forest Service

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Haacke-Claremont Vegetation Management

Stevensville Ranger District
Bitterroot National Forest
Ravalli County, Montana

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For Information, Contact Dan Ritter, District Ranger
Stevensville Ranger District
88 Main Street
Stevensville, MT 59870
(406) 777-5461

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SUMMARY

Haacke-Claremont Vegetation Management
Stevensville Ranger District, Bitterroot National Forest, Montana

The Bitterroot National Forest proposes to treat fuels and harvest timber using a combination of commercial and non-commercial tree thinning and prescribed fire. The project area is located in Haacke and Claremont Creek watersheds in the Sapphire Mountains, east of Stevensville, Montana. The project area is within the Stevensville Ranger District, Bitterroot National Forest, Montana. This action is needed to:

1. Reduce fuel loading throughout Haacke and Claremont Creeks, especially along the National Forest and private land boundary
2. Reduce tree densities in both young, regenerated timber stands and mature stands to improve forest growth, and
3. Provide forest products, jobs, and income to the local economy.

The Forest Service evaluated the following alternatives:

	Alternative 1 No Action	**Alternative 2**	**Alternative 3**
Commercial forest thinning of predominantly ponderosa pine and Douglas-fir stands using tractor or skyline harvesting followed by hand piling, pile burning, and underburning (acres)	0	671	735
Non-commercial thinning of young forest stands followed by hand piling, pile burning, and underburning (acres)	0	447	447
Prescribed burning, with limited slashing of small trees (≤ 10” dbh) (acres)	0	281	281
Road Construction (miles) Temporary Road Construction (miles) Temporary Road Reconstruction (miles)	0 0 0	0 0 0	0 1.2 0.11

Road Construction

No new permanent road construction is planned in any of the proposed alternatives for the Haacke-Claremont Vegetation Management project.

Alternative 3 would require the construction of approximately 1.2 miles of temporary road to access the lower portion of unit 14. An existing skid trail in unit 2 which is currently closed to motorized use would also be temporarily re-opened for use as a temporary road in this alternative. This temporary road is approximately 600 feet in length. The temporary roads would be closed and rehabilitated following their use by restoring the natural contour of the slope.

Road maintenance on existing roads would occur in conjunction with the harvest operations and would be completed either by the Forest Service or included as a requirement in the timber sale contract prior to hauling logs. Maintenance will consist of cutting brush, small trees, and other vegetation that is encroaching into the road prism. Ditches and cross drains will be cleaned and restored to fully functioning condition. The road surface will be improved to allow adequate drainage.

Hauling of logs would occur within the project area, down Forest Road 428 (Ambrose Creek Road) to County Road 1100.

The following site-specific Forest Plan Amendments are proposed as part of Alternatives 2 and 3:

Forest Plan Amendment – Elk Habitat Effectiveness

A site-specific Forest Plan Amendment is proposed to adjust elk habitat effectiveness standards in the Bitterroot Forest Land and Resource Management Plan (standard #14 on page II-21) to current levels in the Haacke-Claremont project area. The reason for this amendment is that the small size of the 3rd order watersheds in this project area unreasonably limits the amount of roads that can be present on the ground. In order to meet the standards nearly all roads would need to be closed which conflicts with the Forest Plan management objective to provide roaded, dispersed recreation. The elk habitat effectiveness standards were designed to manage elk habitat at optimum levels. The current elk populations in the Haacke-Claremont area are above Montana Fish, Wildife, and Parks objectives.

Forest Plan Amendment – Coarse Woody Material

A site-specific Forest Plan Amendment is proposed to adjust coarse woody material standards in the Bitterroot Forest Land and Resource Management Plan. The site-specific coarse woody material standard to be applied for the Haacke-Claremont project on all affected lands would read:

In areas where harvest and prescribed burning occur, coarse woody material (material greater than 3 inches in diameter) will be left from designated leave trees, both standing and down, and from breakage of limbs and broken tops that will occur during harvest, at or above the minimum levels identified in the following table. Material will be well distributed across all acres.

PROPOSED COARSE WOODY MATERIAL STANDARD BY FIRE GROUP

Fire Group (FG)	Coarse Woody Material
Warm, Dry Ponderosa Pine and Douglas-fir (FG-2 & 4)	5-10 tons/acre
Cool, Dry or Moist Douglas-fir (FG-5, 6)	10-20 tons/acre
Cool SitesUsually Dominated by Lodgepole Pine (FG-7) Dry, Lower Subalpine (FG-7) Moist, Lower Subalpine (FG-9)	8-24 tons/acre

This proposed site-specific standard is intended to apply the best available research and information to this project's coarse woody material design in support of the Plan's and project's goals and objectives. The proposed ecologically based standard would replace the various management area standards in the 1987 Forest Plan (f.(4) at FP p. III-6; f.(3) at FP p. III-12; j.(2) at FP p. III-13; and f.(4) at FP p. III-19).

Forest Plan Amendment – Thermal Cover

A site specific Forest Plan Amendment is proposed to adjust winter range thermal cover standards in the Bitterroot Forest Land and Resource Management Plan (Record of Decision page 8) to read:

"Existing thermal cover will be maintained within the Haacke-Claremont treatment units to the extent it does not conflict with meeting the project's objectives."

The purpose of this site-specific amendment is to recognize and address the conflicting nature of the Forest Plan's fire protection goals with the overlapping winter range thermal cover standard defined in the Forest Plan. This site-specific amendment is needed to meet the fuel reduction Purpose and Need on the Haacke-Claremont project. Existing thermal cover (which currently does not meet the Forest Plan standard) will be slightly reduced because treatments will reduce the crown closure below 70%.

The proposed Forest Plan Amendments for elk habitat effectiveness, coarse woody material, and thermal cover are not considered a significant change to the Bitterroot Forest Plan (FSM 1926.51). These changes are consistent with the multiple use goals and objectives for long term land and resource management for Management Areas 1, 2 and 3a. Resource analysis of these amendments is contained in this document in the fuels, wildlife, and soils sections of this document. No adjustments of management area boundaries or management prescriptions are proposed.

Decision To Be Made

Based upon the effects of the alternatives, the responsible official will decide whether to:

- Authorize one of the action alternatives;
- Authorize one of the action alternatives with modifications; or
- Deny the authorization by selecting the No Action Alternative.

Summary of Environmental Effects

The following table provides a summary of the effects of Alternatives 1, 2 and 3 on each resource area. Alternatives 2 and 3 are summarized together and differences between these two action alternatives identified.

Resource Area	Alternative 1 - No Action	Alternatives 2 and 3
Vegetation and Silviculture	▪ Forest density in the proposed units would continue to increase, resulting in thick, brushy stands with higher potential fire severity. ▪ Elevated levels of tree mortality would continue to occur ▪ Young dense regeneration would slow in growth due to competition and moisture stress becoming more susceptible to insects and wildfire. ▪ No forest products would be offered for sale	▪ Implementation of this project would alter forest conditions by reducing the density of trees and creating scattered openings. ▪ Openings would range in size from less than one acre to a maximum of 12 acres and would regenerate with young tree seedlings, shrubs, and grasses. ▪ The mix of tree species would be altered with a greater percentage of ponderosa pine and western larch and less Douglas-fir and subalpine fir. ▪ Changes in tree species, size and density would be more similar to what historically existed, would allow for increased tree growth and vigor, and would be more resilient to disturbance. ▪ Prescribed fire would change the composition and vigor of understory species and favor species better adapted to fire. ▪ Since Alternative 3 treats more acres than Alternative 2, more acres would meet the desired vegetation conditions.
Fire and Fuels	Fire history on the Bitterroot National Forest suggests that the Haacke-Claremont project area will eventually burn in a wildfire. The analysis area is currently densely forested with pole to mature tree sizes with appreciable ladder fuels. Current fuel and fire models suggest that because the area is more densely forested than historic conditions, fires will likely be larger and of a higher severity than would have been expected in the past. • Does not decrease the potential for destructive crown fires because we are not increasing canopy base height, reducing ladder fuels or reducing the amount of surface fuels. • Fire suppression capability would not be increased, because fireline intensities and flame lengths would be such that mechanized equipment and indirect firefighting tactics would be needed for control. • Firefighter safety would not be improved because of fireline intensities, flame length, crown fire potential. • Does not reduce the potential for major smoke impacts due to wildland fires.	▪ The combination of mechanical treatments together with prescribed fire will reduce the amount of surface fuels, ladder fuels, and biomass in the treated areas. ▪ Canopy continuity will be reduced in the treated areas and result in a mosaic of forest and fuel conditions across the project area. ▪ Generally treated stands have lower fireline intensities than untreated stands allowing for increased fire suppression capability and greater firefighter safety. ▪ Treating these stands should reduce the potential for extreme fire behavior and create conditions more favorable for the reintroduction of prescribed fire consistent with historic disturbance regimes. ▪ Prescribed fire under conditions suitable for good air dispersal allows the reintroduction of fire while still meeting the Montana Idaho air quality standards. ▪ A greater number of acres are treated in Alternative 3 resulting in greater fuel reduction.

Resource Area	Alternative 1 - No Action	Alternatives 2 and 3
Wildlife	In the short term the no action alternative would not affect wildlife species in the project area. However, vegetation changes that would occur over time would benefit some wildlife species and adversely affect others. Some notable changes include: ▪ Existing population levels of black-backed woodpeckers would likely increase as the number of trees killed by recent mountain pine beetle attacks rises. ▪ Habitat quality for flammulated owls would gradually decline as Douglas-fir and grand fir continue to fill in the sub-canopy layer under mature and older ponderosa pine. ▪ Some existing nesting habitat for goshawks would improve as trees become larger and canopies fill in. Other existing nesting habitat, would become less suitable as understories become denser and reduce the open flight lanes that goshawks prefer. ▪ Habitat quality would continue to improve for American marten at both lower and upper elevations as forests continue to mature, crown closures increase and coarse woody debris accumulates. ▪ Elk forage will decline and elk thermal and hiding cover will increase In the longer term, increased mortality due to pathogens, and/or a large scale, moderate to severe fire could significantly alter wildlife habitat. In areas burned at moderate to high intensity, some of the changes to wildlife would include: ▪ abundant, if temporary, habitat for black-backed woodpeckers. ▪ marginal or unsuitable habitat for flammulated owls and post-fledging habitat for goshawks ▪ unsuitable habitat for marten	The following wildlife species are present in the project area and potential impacts to these species analyzed. The Biological Assessment and Biological Evaluation completed for this project determined that Alternative 2 or 3 would: ▪ Not likely to Jeopordize the Continued Existence of the Species or Result in the Destruction or Adverse Modification of Proposed Critical Habitat of Gray Wolves (Experimental Nonessential Species) ▪ May impact individuals or their habitat but would not likely contribute to a trend towards Federal listing of loss of viability to populations or species for the following Sensitive Species: Black-backed woodpeckers, flammulated owls, northern goshawks, Townsend's big-eared bats. ▪ May impact individuals or their habitat but would not likely contribute to a trend towards Federal listing of loss of viability to populations or species for the following MIS species: elk, pileated woodpeckers, and pine marten. ▪ Implementation of alternatives 2 or 3 would require a Forest Plan Amendment to allow a reduction in thermal cover in winter range and a reduced level of Effective Elk Habitat (EHE) ▪ No old growth habitat would be treated with either Alternative. These alternatives would help move treated stands towards mature or old growth conditions by reducing the risk of stand-replacing fire. ▪ Effects on wildlife are very similar for both Alternative 2 and 3.

Resource Area	Alternative 1 - No Action	Alternatives 2 and 3
Threatened, Endangered and Sensitive Plant Species, and Invasive Plants	▪ Although the No Action alternative is not likely to adversely impact any potentially suitable sensitive plant habitat there is a possibility that a large-scale, natural fire event may result in the creation of more bare soil, invasive plant spread and negative impacts on suitable sensitive plant habitat. ▪ The trade-off with the proposed activities is that of reducing fuels and burning under controlled conditions where some of the native plant community will be left intact to help compete with weeds versus risking a potentially severe natural fire event in the drier summer months. High severity fires are more conducive to weed spread than low severity fires, especially in Douglas-fir habitats. The more vegetation consumed in a fire on sites previously infested with knapweed, the higher the probability of spotted knapweed spreading into newly opened areas in its immediate vicinity	▪ No sensitive plant species were found in the Haacke-Claremont project area. ▪ Potentially suitable habitat does exist for some species in almost all of the proposed units. ▪ The greatest threat to sensitive plants and native plant diversity would be from the spread of invasive plants. All action alternatives that involve timber harvest to open the forest canopy and/or under burning on lower elevation south or west facing slopes have the potential for spreading invasive plants - particularly spotted knapweed *(Centaurea biebersteinii*). ▪ Timber harvest or prescribed fire alone would be less impactive than the combination of both on spotted knapweed spread, particularly in Douglas-fir habitats. Underburning post-harvest further increases the potential to open the canopy as well as create more bare soil. ▪ Mitigation measures included in the project (revegetation, erosion control, cleaning equipment, seeding with certified weed-free seed) will help reduce the spread of invasive plants. ▪ The environmental effects between Alternative 2 and Alternative 3 are similar except that there would be more ground disturbance in Alternative 3 and so there is more potential for the spread of invasive plants.
Fish and Aquatic Habitats	▪ The impact on fisheries and aquatic habitat of implementing or not implementing any part of the proposed action would be minimal.	▪ The size of the areas proposed for treatment relative to the watershed areas is small and the intensity of treatments within the units proposed would not perceptibly affect the fisheries or aquatic habitat. ▪ There are no fish bearing streams in the project area. ▪ Bull trout (*Salvelinus confluentus*), a species federally listed as threatened, are known to inhabit the Burnt Fork, downstream of the project area. ▪ Westslope cutthroat trout (WSCT), listed as a Sensitive Species by the Regional Forester and a management indicator species for fisheries changes in the Bitterroot Forest Plan, inhabit the private reaches of Haake and Claremont Creeks, as well Ambrose and Burnt Fork Creeks. ▪ The most concern related to aquatic habitat and this project is the potential effect of hauling logs and increased traffic on Ambrose road (Rd. 428), which closely parallels Ambrose Creek for

		approximately two miles. A Biological Assessment for bull trout was completed as part of this project. Implementation of alternative 2 or 3, as designed, should have No Effect on bulltrout. The Biological Evaluation for WSCT for both action alternatives is "may impact individuals or habitat, but will not likely contribute to a trend towards federal listing or loss of viability to the population or species". This determination is based on the potential for minor negative short term impacts to a section of Ambrose Creek, and the lack of long term negative effects. Protection afforded to the streams by incorporating RHCAs into project design would offset potential harmful effects.
Resource Area	**Alternative 1 - No Action**	**Alternatives 2 and 3**
Water	▪ Without ongoing forest management, fuels are likely to increase and stands would become more susceptible to high-intensity wildfires. Watershed effects associated with these types of fires can be severe. While there is no guarantee that the implementation of this alternative will cause an intense wildfire, a no-action approach may increase the probability of this type of event. Robichaud et al (in press) note that high severity wildfire increases erosion and runoff rates to a much greater level than low severity fire. Under the current fire-suppression policy, fuels would likely continue to increase in all levels of the stands, adding to the risk of high-intensity wildfire. During high-intensity wildfires, soil heating is intense and most organic material in the upper horizons is burned off. These soils often end up in a water-repellent (hydrophobic) condition that severely increases erosion rates. Post-fire monitoring of the 2000 fires on the Bitterroot National Forest, directly east of the analysis area, suggests that debris flows, gully rejuvenation, and channel adjustments would be common (Hyde, in press) after large fires that occur under extreme weather conditions. Watershed "sponge & filter" functions are often significantly degraded, resulting in heavy sediment delivery to streams, channel adjustments, and higher-than-normal mortality in local aquatic organism	▪ The project is consistent with Montana Impaired Waters (303(d)) programs. Neither Haacke nor Claremont Creeks are on the 2006 MTDEQ 303(d) list or past lists. North Burnt Fork Creek (downstream of the analysis area) is currently on the MTDEQ 303(d) list as partially supporting cold water fisheries and aquatic life. Currently sediment is not listed as a pollutant in Ambrose Creek, but the on-going TMDL assessment on the lower Bitterroot River basin may produce updated information on this stream. ▪ Analysis considering the design and size of this proposed action suggests it is very unlikely that either Alternative 2 or Alternative 3 would produce even minor sediment in the Haacke and Claremont Creek watersheds, and neither alternative is likely to negatively affect water quality. Conversely, the management activities proposed produce moderate benefits to the watershed, mainly through the reduction of fuels and potential fire intensity on the treated areas. ▪ The majority of treatments are partial cuts and leave stocked stands, with nearly-continuous ground cover to limit sediment travel. Some openings will be created but are generally less than 2 acres in size. ▪ Specific log yarding methods are prescribed for each unit, tailoring the method to the slope and terrain. ▪ Wet sites and stream channels would be excluded from ground-

	populations.	disturbing activities and protected by RHCA stream buffers. ▪ Timber sale contract clauses would be used to enforce BMPs that further limit resource damage to soils and remaining vegetation.
Resource Area	**Alternative 1 - No Action**	**Alternatives 2 and 3**
Soils	▪ The No Action Alternative would not lead to direct detrimental soil disturbances in the project area. ▪ The current soil erosion and mass wasting regimes would not be altered. ▪ Over time, standing trees (dead and alive) would shed needles and fine branches that would accumulate on the soil surface. Eventually, trees would fall to the ground, providing coarse wood for decomposition into the soil. ▪ Microorganisms would continue to populate the soils, contributing towards site productivity through nutrient cycling and development of soil structure aggregates in areas of poorly developed mineral soils. ▪ Natural and human caused wildfires would likely continue to affect the project area and cause consumption of the protective layer of litter and duff on the soil surface. Long-term effects on soil health and productivity are likely to be relatively small from future fires that are within the historic range of variability. Fire severity exceeding the historic range could have detrimental effects on soil productivity and health through the oxidation and loss of soil organic matter and associated soil biota, as well as through accelerated rates of erosion	Due to the high coarse fragment content of these soils, compaction is much less of a concern than the displacement of shallow organic and mineral soil horizons that may occur during ground-based logging operations and in skyline corridors. The proposed activities in treatment units were designed to minimize increases in soil disturbance that could lead to losses in soil productivity. This goal would be achieved by implementing the mitigations described in the Environmental Assessment, incorporating Montana Best Management Practices (BMPs), and following the Soil and Water Conservation Practices. These design features and management practices would minimize the extent of compaction, rutting, puddling, and displacement. Field review of past harvest activities in all activity units did not identify legacy detrimental soil disturbance. Furthermore, the soil analysis of proposed activities for this project indicates that all proposed alternatives would meet the R1 soil quality guidelines for direct, indirect, and cumulative detrimental soil disturbance. Detrimental soil disturbance would cumulatively be less than 15 percent in all proposed treatment units. ▪ The potential for soil erosion and mass soil movement is low due to parent materials (talus) and the high coarse fragment content of soils. ▪ Maintaining organic matter and ground cover on at least 85 percent of the site, as prescribed in the action alternatives, will ensure nutrient cycling and availability will not be altered, help maintain soil microbial populations, and protect the soil from erosion. Organic matter would be reduced after prescribed burning but re-growth of vegetation and annual needle drop would provide groundcover and leaf and litter material necessary for soil organic matter development. Localized losses may occur at landings or where severe fire occurs. Site specific

		mitigation measures will be implemented in activity areas to maintain surface organics (duff) and soil organic matter essential for soil productivity. ▪ Required Coarse Woody Material will be maintained at levels that provide for future soil productivity. A site specific Forest Plan Amendment ensures current and future levels of coarse woody material are adequate to promote soil development. ▪ The effects of implementing Alternative 2 or Alternative 3 are very similar. More acres are treated in Alternative 3 resulting in more soil disturbance.
Resource Area	**Alternative 1 - No Action**	**Alternatives 2 and 3**
Heritage	▪ Failure to reduce fuels could contribute to a greater long-term risk to cultural resources within and around the Haacke-Claremont project area from severe wildfires and related erosion, flood events and invasive plant establishment. Wildfire also increases the risk of site looting and vandalism due to exposure through erosion and lack of vegetative cover.	▪ Activities proposed in Alternatives 2 and 3 have the potential to adversely affect two cultural sites. Mitigation measures to protect these two sites are included in the Environmental Assessment. ▪ Reduction of accumulated fuels will have the long term beneficial effect of reducing the threat of wildfire damage to cultural resources in the Haacke-Claremont project area. ▪ More open timber stands will also benefit cultural resources in the project area by returning the cultural site settings to their historic appearance.
Recreation	▪ The No Action Alternative would have no effect on current recreation use in the area. Travel management would not be changed for any roads or trails as a result of this project.	▪ Harvest and burning activities would result in more open forest conditions creating the potential for offroad access into areas where it currently doesn't exist and it is not allowed. Mitigation measures are proposed that would limit illegal off road use. ▪ Vehicle traffic from log hauling, contractors associated with the project, and Forest Service personnel would increase during project implementation. Better road conditions may attract more recreational use in the area but is not likely to significantly change the use level in the area. ▪ Opening the forest canopy through commercial harvest, noncommercial thinning, and prescribed fire should provide a positive viewing element to the landscape when completed. The treatment areas will have an average of 50% canopy cover with dispersed openings, leave areas, and irregular unit boundaries that will provide visual variety across the landscape.

I. INTRODUCTION

DOCUMENT STRUCTURE

The Forest Service has prepared this Environmental Assessment in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This Environmental Assessment discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed action and alternatives. The document is organized into six parts:

I. *Introduction:* This chapter includes information on the history of the project proposal, the purpose of and need for the project, and the agency's proposal for achieving that purpose and need. This section also details how the Forest Service informed the public of the proposal and how the public responded.
II. *Alternatives, including the Proposed Action:* This chapter provides a more detailed description of the agency's proposed action as well as alternative methods for achieving the stated purpose. These alternatives were developed based on significant issues raised by the public and other agencies. This discussion also includes possible mitigation measures. Finally, this section provides a summary table of the environmental consequences associated with each alternative.
III. *Environmental Consequences:* This chapter describes the environmental effects of implementing the proposed action and other alternatives. This analysis is organized by resource area. Within each section, the affected environment is described first, followed by the effects of the No Action Alternative that provides a baseline for evaluation and comparison of the other alternatives that follow.
IV. *Agencies and Persons Consulted:* This chapter provides a list of preparers and agencies consulted during the development of the environmental assessment.
V. *Literature Cited:* A list of literature citations that were used in the analysis.
VI. *Appendices:* The appendices provide more detailed information to support the analyses presented in the environmental assessment.

Additional documentation, including more detailed analyses of project-area resources, may be found in the project planning record located at the Stevensville Ranger District Office in Stevensville, Montana.

BACKGROUND

The Haacke-Claremont project area has a history of commercial forest harvest. Most of the recorded harvesting occurred in the 1970s and 1980s. A variety of silvicultural harvest methods were implemented including clearcuts, shelterwoods, seed trees, thinning, and sanitation/salvage. Little harvesting has occurred in the last 20 years. A network of roads constructed to support the timber harvest has been maintained on the landscape. The area has provided opportunities for dispersed, motorized recreation, firewood cutting, and hunting for many years.

The forest in this area is comprised of dense stands of ponderosa pine, Douglas-fir, lodgpole pine, and sub-alpine fir with the species composition varying depending on elevation and aspect. Minor amounts of western larch and aspen also exist. Forested areas that were harvested in past decades are now stands of young trees. Fire suppression, continued forest growth, and tree mortality have allowed fuels to accumulate and ladder fuels to build in the understory.

Private land along the western boundary of the analysis area is largely undeveloped (in terms of housing or other buildings). The forests have been thinned and are being managed for elk habitat in cooperation with Montana Fish, Wildlife, and Parks. Roads have been constructed, reconstructed, or used to support private land management activities.

PURPOSE AND NEED FOR ACTION

The purpose of the Haacke Claremont project is to;

- Reduce fuel loading throughout Haacke and Claremont Creeks, especially along the National Forest and private land boundary,
- Reduce tree densities in both young, regenerated timber stands and mature stands to improve forest growth
- Provide forest products, jobs, and income to the local economy.

These actions are needed because forest land in Haacke and Claremont Creeks are comprised of dense stands of ponderosa pine, Douglas-fir, and lodgepole pine with an unacceptable risk of high severity wildland fire, and high susceptibility to tree mortality by fire, root disease, or insects.

A fire in these drainages could burn over a substantial portion of each drainage. Fuel reduction treatments such as tree thinning and prescribed fire would help to modify extreme fire behavior, lessen the severity of a wildland fire, and provide a better chance of controlling or extinguishing the fire before it develops into a high intensity fire with undesirable effects on soils, water, and wildlife habitat.

The high number of trees per acre in these timber stands create competitive stress between trees as they compete for growing space, water, nutrients, and sunlight. Competitive stress and poor tree vigor provides opportunity for root disease to become established and spread; and for insects such as Douglas-fir beetle and mountain pine beetle to expand their populations beyond endemic levels. This disease and insect caused mortality adds to the fuel load and makes fire suppression activities more difficult. Tree thinning reduces the competitive stress on trees by providing them more growing space and reducing the competition for water, nutrients, and sunshine. The reduced stress, in turn, creates forests that are more resilient to disturbance such as root disease, insects, or low severity fire.

Haacke and Claremont Creeks have a history of timber management. A network of forest roads was constructed to support commercial timber harvest activities that occurred in the 1970s and 1980s. These old timber harvests contributed wood products to the local economy providing jobs and income to loggers and other forest workers. The old harvest units have successfully regenerated to dense stands of young trees. The development of these young forests has progressed to the point where trees are competing for growing space and moisture. Tree thinning in these young timber stands would improve the tree spacing, giving them more growing space and reducing competitive stress. The remaining trees would be able to grow larger, faster and be more resilient to disturbance such as root disease, insects, and low severity fire. Improved forest growth would help to provide options for additional wood products in the future supporting jobs and income to the local economy from this portion of the Bitterroot National Forest.

These actions respond to the goals and objectives outlined in the Bitterroot Forest Plan (1987), and helps move the project area towards desired conditions described in that plan. The Haacke-Claremont project is within Management Area 1 (93 acres), Management Area 2 (889 acres) and

Management Area 3a (2,149 acres). The following Forest Plan goals and objectives (Chapter II & Appendix M) apply to the Haacke-Claremont project:

- Provide sawtimber and other wood products to help sustain a viable local economy
- Provide an economically efficient timber sale program
- Maintain forest stands so that pest caused losses are reduced to acceptable levels
- Convert high-risk or insect and disease infested stands to young, healthy stands
- Design fire management programs that are consistent with other resource goals
- Prescribe fire to maintain healthy, dynamic ecosystems that meet land management objectives.
- Emphasize fire ecology implications when applying prescribed fire. Integrate an understanding of the role that fire plays in regulating stand structure into the development of silvicultural prescriptions.
- Coordinate with state Air Quality Bureaus to prevent significant deterioration of air quality.
- Fire pre-suppression programs are cost-effective and responsive to the Forest Plan

The Burnt Fork Ecosystem Analysis at the Watershed Scale (EAWS) provides reference conditions and recommendations for the Burnt Fork Watershed, including the Haacke and Claremont drainages (Bitterroot North Zone Interdisciplinary Team. 2004).

PROPOSED ACTION

The action proposed by the Forest Service to meet the purpose and need includes the following management activities. This proposed action is similar to what was sent out to the public for scoping except that some boundary changes were made to units based on information received during the scoping process.

- Commercial forest thinning of predominantly ponderosa pine and Douglas-fir stands using tractor and / or skyline harvesting (approximately 671 acres) followed by hand piling, pile burning, and underburning. Scattered openings generally less than two acres in size will be created in the thinning units and a few larger openings (up to 12 acres in size) will also be created where patches of decadent lodgepole exist.
- Non-commercial thinning of young forest stands (approximately 447 acres) followed by hand piling, pile burning, and underburning.
- Prescribed burning, with limited slashing of small trees ($\leq$ 10” dbh) (approximately 281 acres)

Road Construction

No new permanent road construction is planned in any of the proposed alternatives for the Haacke-Claremont Vegetation Management project. No changes in travel management status are proposed as part of this project.

Road maintenance on existing roads would occur in conjunction with the harvest operations and would be completed either by the Forest Service or included as a requirement in the timber sale contract prior to hauling logs. Maintenance will consist of cutting brush, small trees, and other vegetation that is encroaching into the road prism. Ditches and cross drains will be cleaned and restored to fully functioning condition. The road surface will be improved to allow adequate drainage.

Forest Plan Amendment – Elk Habitat Effectiveness

A site-specific Forest Plan Amendment is proposed to adjust the road density standards in the Bitterroot Forest Land and Resource Management Plan to current levels in the Haacke-Claremont project area. The reason for this amendment is that the small size of the 3rd order watersheds in this project area unreasonably limits the amount of roads that can be present on the ground. In order to meet the standards, many roads would need to be decommissioned which conflicts with the management objective to provide roaded, dispersed recreation. The elk habitat effectiveness standards were designed to manage elk habitat at optimum levels. The current elk populations in the Haacke-Claremont area are above Montana Fish, Wildlife, and Parks objectives.

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A site-specific Forest Plan Amendment is proposed to adjust coarse woody material standards in the Bitterroot Forest Land and Resource Management Plan. The site-specific coarse woody material standard to be applied for the Haacke Claremont project on all affected lands would read:

In areas where harvest and prescribed burning occur, coarse woody material (material greater than 3 inches in diameter) will be left from designated leave trees, both standing and down, and from breakage of limbs and broken tops that will occur during harvest, at or above the minimum levels identified in the following table. Material will be well distributed across all acres.

Proposed Coarse Woody Material Standard by Fire Group

Fire Group (FG)	Coarse Woody Material
Warm, Dry Ponderosa Pine and Douglas-fir (FG-2 & 4)	5-10 tons/acre
Cool, Dry or Moist Douglas-fir (FG-5, 6)	10-20 tons/acre
Cool SitesUsually Dominated by Lodgepole Pine (FG-7) Dry, Lower Subalpine (FG-7) Moist, Lower Subalpine (FG-9)	8-24 tons/acre

This proposed site-specific standard is intended to apply the best available research and information to this project's coarse woody material design in support of the Plan's and project's goals and objectives. The proposed ecologically based standard would replace the various management area standards in the 1987 Forest Plan (f.(4) at FP p. III-6; f.(3) at FP p. III-12; j.(2) at FP p. III-13; and f.(4) at FP p. III-19).

Forest Plan Amendment – Thermal Cover

A site specific Forest Plan Amendment is proposed to adjust winter range thermal cover standards in the Bitterroot Forest Land and Resource Management Plan (Record of Decision page 8) to read:

"Existing thermal cover will be maintained within the Haacke-Claremont treatment units to the extent it does not conflict with meeting the project's objectives."

The purpose of this site-specific amendment is to recognize and address the conflicting nature of the Forest Plan's fire protection goals with the overlapping winter range thermal cover standard defined in the Forest Plan. This site-specific amendment is needed to meet the fuel reduction Purpose and Need on the Haacke-Claremont project. Existing thermal cover (which currently does not meet the Forest Plan standard) will be slightly reduced because treatments will reduce the crown closure below 70%.

The proposed Forest Plan Amendments for elk habitat effectiveness, coarse woody material, and thermal cover are not considered a significant change to the Bitterroot Forest Plan (FSM 1926.51). These changes are consistent with the multiple use goals and objectives for long term land and resource management for Management Areas 1, 2 and 3a. Resource analysis of these amendments is addressed in the fuels, wildlife, and soils sections of this document.

DECISION FRAMEWORK

Given the purpose and need, the deciding official reviews the proposed action and the other alternatives in order to make the following decisions:

- What is the location and amount of forest land in Haacke and Claremont Creeks that should be thinned using commercial logging methods?
- What is the location and amount of forest land in Haacke and Claremont Creeks that should be thinned using non-commercial methods?
- What is the location and amount of forest land that should have prescribed fire applied to reduce ladder fuels and total fuel load?
- What is the location and amount of road construction, reconstruction, or maintenance required to support management activities?

PUBLIC INVOLVEMENT

The proposal was first listed in the April 2006 Schedule of Proposed Actions for the Stevensville District, Bitterroot National Forest. The proposal was provided to the public and other agencies for comment during scoping August 15 through September 14, 2007. In addition, as part of the public involvement process, the agency sent a letter and map that described the proposed action to a locally developed mailing list. A news release was issued on August 10, 2007 for publication in local newspapers. The news release was published in the Bitterroot Star on August 22, 2007. A legal advertisement was published in the Ravalli Republic, the newspaper of record, on August 15, 2007.

Using the comments from the public and other agencies, the interdisciplinary team developed a list of issues to address and developed alternatives to evaluate and consider. Note that Alternative 2 is similar to the proposed action that was described for public scoping, however minor changes in unit sizes and shapes were made to ensure that the proposal was feasible to implement.

ISSUES

The Forest Service separated the issues into two groups: significant and non-significant issues. Significant issues were defined as those directly or indirectly caused by implementing the proposed action. Non-significant issues were identified as those:

- Outside the scope of the proposed action;
- Already decided by law, regulation, Forest Plan, or other higher level decision;
- Irrelevant to the decision to be made;
- Conjectural and not supported by scientific or factual evidence.

The Council on Environmental Quality (CEQ) NEPA regulations require this delineation in Sec. 1501.7, "…identify and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review (Sec. 1506.3)…" A list of non-significant issues and reasons regarding their categorization as non-significant may be found at Section E in the project record.

Project scoping identified the following three significant issues for this project:

Roads

The Haacke-Claremont project area has an existing network of roads that were constructed to support past timber harvest. Public use on some of the roads is restricted either yearlong or seasonally to reduce soil erosion or maintain wildlife security. The existing roads do not appear to be adversely affecting watershed conditions; however, open road densities are higher than desirable for optimum elk security.

The issue is whether or not more roads (permanent or temporary) should be constructed in the Haacke-Claremont project area. The alternatives will evaluate the cumulative effects of the roads and evaluate whether or not to construct additional temporary roads. The alternatives do not consider additional road closures or restrictions because motorized, dispersed recreation is an important goal of the Forest Plan in this area. Motorized recreation planning is currently ongoing on a Forest-wide basis, and any potential travel or access changes would be discussed and analyzed in that project.

Wildlife Habitat

The Haacke-Claremont project area provides habitat for a variety of terrestrial wildlife species, including deer, elk, pine marten, pileated woodpeckers, black-backed woodpeckers, and flammulated owls. The alternatives will evaluate the effects of management actions on these species and their habitat. The issue is to what degree management actions will adversely affect habitat for these species.

Fuels:

The forested areas of the Haacke-Claremont project area are uncharacteristically dense. The lack of timber harvest over the last 20 years and successful fire exclusion over several decades has allowed the stands to become thick with trees and ladder fuels. It is estimated that two fire cycles have been missed in this area. Current stand conditions would promote high severity, crown fires rather than non-lethal or mixed lethal ground fires throughout much of the drainage. The public issue is whether or not the proposed stand treatments would positively affect fire behavior.

There is also a concern that wildfire may be more difficult to control on lands that are logged since tree removal opens the forest canopy increasing the amount of wind that enters the stand and drying flammable fuels more rapidly. Logging can also increase the amount of flammable fine fuels left on the ground.

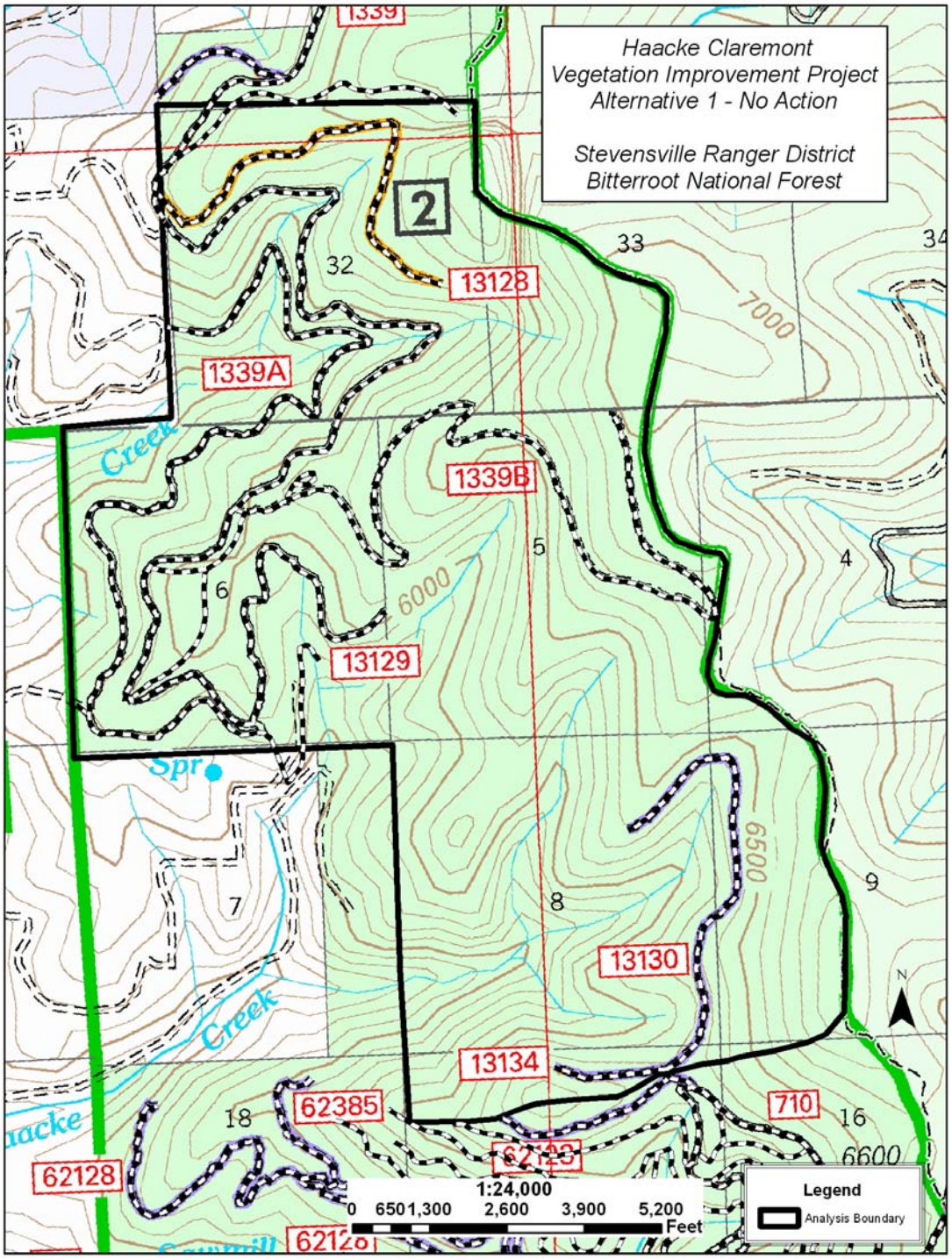
II. ALTERNATIVES, INCLUDING THE PROPOSED ACTION

This chapter describes and compares the alternatives considered for the Haacke-Claremont Vegetation Management project. It includes a description and map of each alternative considered. This section also presents the alternatives in comparative form, sharply defining the differences between each alternative and providing a clear basis for choice among options by the decision maker and the public. Some of the information used to compare the alternatives is based upon the design of the alternative (i.e., differences in unit size or miles of road construction) and some of the information is based upon the environmental, social and economic effects of implementing each alternative (i.e., the amount of erosion or cost resulting from potential road construction).

ALTERNATIVE 1: NO ACTION

Under the No Action Alternative, current management would not change within the project area. No fuels or vegetation management activities would be implemented at this time to accomplish project goals or move the project area towards desired conditions. Activities authorized by previous decisions and included in active contracts would continue to completion. Routine road maintenance activities such as surface grading, culvert cleaning, or road side brushing would continue as needed to keep the roads in usable and safe condition. Recreational activities currently enjoyed by the public would continue.

The following map displays the Haacke-Claremont project area, Bitterroot National Forest boundaries, the existing road system, topographic features, and streams.



Alternative 1 -- No Action

ALTERNATIVE 2

Alternative 2 is similar to the Proposed Action that was described for public scoping. The only differences are that treatment units 12 and 14 were reduced in size. Unit 12 is a prescribed fire treatment area that was changed to ensure that the boundaries were defensible. Unit 14 was reduced in size to eliminate the need for additional road access. Alternative 2 was designed to meet the purpose and need for the project and includes the following management activities:

- Commercial forest thinning of predominantly ponderosa pine and Douglas-fir stands using tractor or skyline harvesting (approximately 671 acres) followed by hand piling, pile burning, and underburning. Scattered openings generally less than two acres in size will be created in the thinning units and a few larger openings (up to 12 acres in size) will also be created where patches of decadent lodgepole exist.
- Non-commercial thinning of young forest stands (approximately 447 acres) followed by hand piling, pile burning, and underburning.
- Prescribed burning, with limited slashing of small trees (≤ 10” dbh) (approximately 281 acres)

Road Construction

No new road construction (permanent or temporary) is planned in Alternative 2 for the Haacke-Claremont Vegetation Management project. No changes in travel management status are proposed as part of this project.

Road maintenance on existing roads would occur in conjunction with the harvest operations and would be completed either by the Forest Service or included as a requirement in the timber sale contract prior to hauling logs. Maintenance will consist of cutting brush, small trees, and other vegetation that is encroaching into the road prism. Ditches and cross drains will be cleaned and restored to fully functioning condition. The road surface will be improved to allow adequate drainage.

Hauling of logs would occur within the project area, down Forest Road 428 (Ambrose Creek Road) to County Road 1100.

Forest Plan Amendment – Elk Habitat Effectivess

A site-specific Forest Plan Amendment is proposed to adjust elk habitat effectiveness standards in the Bitterroot Forest Land and Resource Management Plan (standard #14 on page II-21) to current levels in the Haacke-Claremont project area. The reason for this amendment is that the small size of the 3rd order watersheds in this project area unreasonably limits the amount of roads that can be present on the ground. In order to meet the standards, nearly all roads would need to be closed which conflicts with the Forest Plan management objective to provided roaded, dispersed recreation. The elk habitat effectiveness standards were designed to manage elk habitat at optimum levels. The current elk populations in the Haacke-Claremont area are above Montana Fish, Wildlife, and Parks objectives.

Forest Plan Amendment – Coarse Woody Material

A site-specific Forest Plan Amendment is proposed to adjust coarse woody material standards in the Bitterroot Forest Land and Resource Management Plan. The site-specific coarse woody

material standard to be applied for the Haacke Claremont project on all affected lands would read:

In areas where harvest and prescribed burning occur, coarse woody material (material greater than 3 inches in diameter) will be left from designated leave trees, both standing and down, and from breakage of limbs and broken tops that will occur during harvest, at or above the minimum levels identified in the following table. Material will be well distributed across all acres.

Proposed Coarse Woody Material Standard by Fire Group

Fire Group (FG)	Coarse Woody Material
Warm, Dry Ponderosa Pine and Douglas-fir (FG-2 & 4)	5-10 tons/acre
Cool, Dry or Moist Douglas-fir (FG-5, 6)	10-20 tons/acre
Cool SitesUsually Dominated by Lodgepole Pine (FG-7) Dry, Lower Subalpine (FG-7) Moist, Lower Subalpine (FG-9)	8-24 tons/acre

This proposed site-specific standard is intended to apply the best available research and information to this project's coarse woody material design in support of the Plan's and project's goals and objectives. The proposed ecologically based standard would replace the various management area standards in the 1987 Forest Plan (f.(4) at FP p. III-6; f.(3) at FP p. III-12; j.(2) at FP p. III-13; and f.(4) at FP p. III-19).

Forest Plan Amendment – Thermal Cover

A site specific Forest Plan Amendment is proposed to adjust winter range thermal cover standards in the Bitterroot Forest Land and Resource Management Plan (Record of Decision page 8) to read:

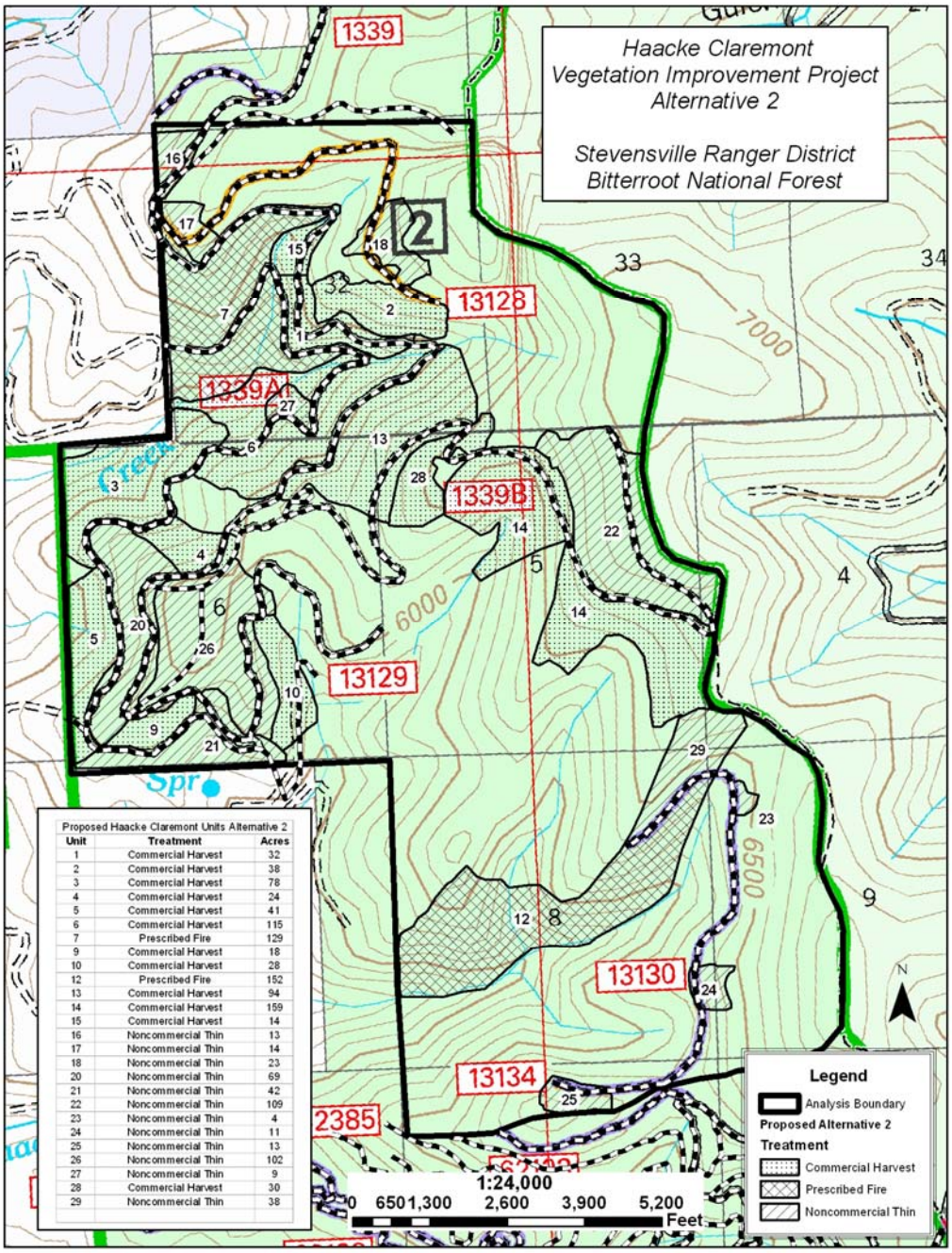
"Existing thermal cover will be maintained within the Haacke-Claremont treatment units to the extent it does not conflict with meeting the project's objectives."

The purpose of this site-specific amendment is to recognize and address the conflicting nature of the Forest Plan's fire protection goals with the overlapping winter range thermal cover standard defined in the Forest Plan. This site-specific amendment is needed to meet the fuel reduction Purpose and Need on the Haacke-Claremont project. Existing thermal cover (which currently does not meet the Forest Plan standard) will be slightly reduced because treatments will reduce the crown closure below 70%.

The proposed Forest Plan Amendments for elk habitat effectiveness, coarse woody material, and thermal cover are not considered a significant change to the Bitterroot Forest Plan (FSM 1926.51). These changes are consistent with the multiple use goals and objectives for long term

land and resource management for Management Areas 1, 2 and 3a. Resource analysis of these amendments is addressed in the fuels, wildlife, and soils sections of this document.

The following map displays the location of proposed treatment units for Alternative 2, the proposed treatment, and estimated acreage of each unit.



Proposed Haacke Claremont Units Alternative 2		
Unit	Treatment	Acres
1	Commercial Harvest	32
2	Commercial Harvest	38
3	Commercial Harvest	78
4	Commercial Harvest	24
5	Commercial Harvest	41
6	Commercial Harvest	115
7	Prescribed Fire	129
9	Commercial Harvest	18
10	Commercial Harvest	28
12	Prescribed Fire	152
13	Commercial Harvest	94
14	Commercial Harvest	159
15	Commercial Harvest	14
16	Noncommercial Thin	13
17	Noncommercial Thin	14
18	Noncommercial Thin	23
20	Noncommercial Thin	69
21	Noncommercial Thin	42
22	Noncommercial Thin	109
23	Noncommercial Thin	4
24	Noncommercial Thin	11
25	Noncommercial Thin	13
26	Noncommercial Thin	102
27	Noncommercial Thin	9
28	Commercial Harvest	30
29	Noncommercial Thin	38

Alternative 2

ALTERNATIVE 3

Alternative 3 increases the size of unit 14 from 159 acres to 223 acres and includes approximately 1.2 miles of temporary road that would be used to commercially harvest and remove trees from the lower portion of this unit. The temporary road would be closed and rehabilitated following its use by restoring the natural contour of the slope. The larger unit size would thin more acres to meet management objectives.

Alternative 3 was designed to meet the purpose and need for the project and includes the following management activities:

- Commercial forest thinning of predominantly ponderosa pine and Douglas-fir stands using tractor or skyline harvesting (approximately 735 acres) followed by hand piling, pile burning, and underburning. Scattered openings generally less than two acres in size will be created in the thinning units and a few larger openings (up to 12 acres in size) will also be created where patches of decadent lodgepole exist.
- Non-commercial thinning of young forest stands (approximately 447 acres) followed by hand piling, pile burning, and underburning.
- Prescribed burning, with limited slashing of small trees ($\leq$ 10” dbh) (approximately 281 acres)

Road Construction

Approximately 1.2 miles of temporary road construction would be required to access the lower portion of unit 14. An existing skid trail in unit 2 which is currently closed to motorized use would be temporarily re-opened for use as a temporary road in this alternative. This temporary road is approximately 600 feet in length. The temporary roads would be closed and rehabilitated following their use by restoring the natural contour of the slope.

Road maintenance on existing roads would occur in conjunction with the harvest operations and would be completed either by the Forest Service or included as a requirement in the timber sale contract prior to hauling logs. Maintenance will consist of cutting brush, small trees, and other vegetation that is encroaching into the road prism. Ditches and cross drains will be cleaned and restored to fully functioning condition. The road surface will be improved to allow adequate drainage.

Hauling of logs would occur within the project area, down Forest Road 428 (Ambrose Creek Road) to County Road 1100.

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A site-specific Forest Plan Amendment is proposed to adjust coarse woody material standards in the Bitterroot Forest Land and Resource Management Plan. The site-specific coarse woody material standard to be applied for the Haacke Claremont project on all affected lands would read:

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Proposed Coarse Woody Material Standard by Fire Group

Fire Group (FG)	Coarse Woody Material
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This proposed site-specific standard is intended to apply the best available research and information to this project's coarse woody material design in support of the Plan's and project's goals and objectives. The proposed ecologically based standard would replace the various management area standards in the 1987 Forest Plan (f.(4) at FP p. III-6; f.(3) at FP p. III-12; j.(2) at FP p. III-13; and f.(4) at FP p. III-19).

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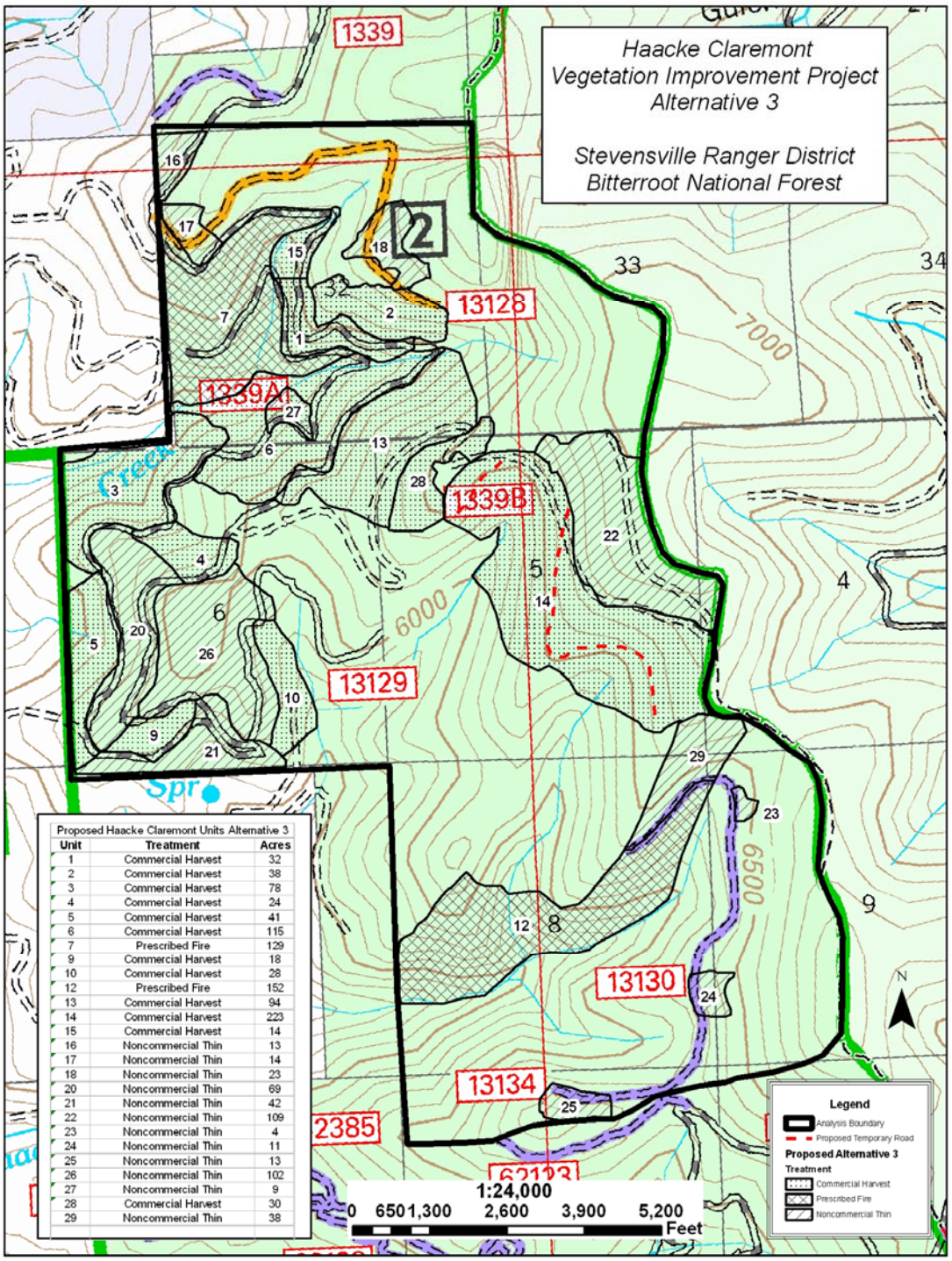
The following map displays the location of proposed treatment units for Alternative 3, the proposed treatment, and estimated acreage of each unit.



Proposed Haacke Claremont Units Alternative 3		
Unit	Treatment	Acres
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2	Commercial Harvest	38
3	Commercial Harvest	78
4	Commercial Harvest	24
5	Commercial Harvest	41
6	Commercial Harvest	115
7	Prescribed Fire	129
9	Commercial Harvest	18
10	Commercial Harvest	28
12	Prescribed Fire	152
13	Commercial Harvest	94
14	Commercial Harvest	223
15	Commercial Harvest	14
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24	Noncommercial Thin	11
25	Noncommercial Thin	13
26	Noncommercial Thin	102
27	Noncommercial Thin	9
28	Commercial Harvest	30
29	Noncommercial Thin	38

Alternative 3

MANAGEMENT REQUIREMENTS

The Bitterroot Forest applies commonly accepted management practices to reduce environmental effects of projects. Specific practices to be applied to the action alternatives described for the Haacke-Claremont project include the following:

Best Management Practices (BMPs): Best Management Practices designed to protect soil and water and comply with requirements of the Clean Water Act are incorporated into all management actions. BMPs pertinent to the proposed commercial thinning operation would be enforced through timber sale contract clauses and Timber Sale Administrator oversight. A list of required Best Management Practices is included in Appendix A.

Riparian Habitat Conservation Areas: Riparian Habitat Conservation Area (RHCA) buffers are required by the 1996 Inland Native Fish Strategy (INFISH) Forest Plan Amendment. Please see the fisheries report for further discussion of RHCA use in this project.

Presale Road Maintenance: Road maintenance on existing roads in the project area will be completed by the Forest Service or included as a requirement in the timber sale contract prior to hauling logs. Maintenance will consist of cutting brush, small trees, and other vegetation that is encroaching into the road prism. Ditches and cross drains will be cleaned and restored to fully functioning condition. The road surface will be improved to allow adequate drainage. Ambrose Creek road is currently graveled and would receive maintenance as needed during the project.

Presale Weed Management: Prior to commencing commercial logging operations, existing roads will be surveyed for invasive plants and spot treated with the appropriate herbicide to eradicate or suppress the amount of invasive plants in the road prism. This requirement is authorized by the Forest-wide Noxious Weed Treatment Project (Bitterroot National Forest 2003).

MITIGATION COMMON TO ALL ACTION ALTERNATIVES

In response to public comments on the proposal, mitigation measures were developed to ease some of the potential impacts the various alternatives may cause. The mitigation measures may be applied to any of the action alternatives.

Sensitive Plants

- If new landings, tracked line machine pads, or temporary road locations are identified, a botanist must survey prior to construction.
- Individual hand piles will generally not exceed 50 ft^2 (pile size approximately 6 to 8 ft in diameter).
- Disturbed sites (including skid trails and landings) will be evaluated and the timber sale administrator (TSA) and /or resource specialists will determine erosion control and revegetation needs. Topography, presence and condition of adjacent vegetation, and amount of disturbance will be used to determine need and treatment. Appropriate erosion control may include contouring, seeding, fertilizing, planting of shrubs, mulch and/or scattering of slash.

Soils

Mitigation measures designed to protect the soil resource have been summarized here for the following listed activities. All other soil protection measures not discussed here are covered by Soil and Water Conservation Practices (SWCPs) and Montana Best Management Practices (BMPs), which are included in Appendix A.

Ground-based yarding[1]

- Historic skid trails will be utilized to the extent feasible in the ground based units.
- Harvest activities will discourage future illegal off road vehicles (OHV) use by placing slash at the beginning of the skid trails. Access to skid trails from landings will be closed by placing slash from the landing on the rehabilitated skid trail.
- Ground based yarding in this project will occur when soils are dry (soil moisture is near or below the permanent wilting point) or during adequate winter conditions.
- When possible, do not yard larger diameter (>15 inches) unmerchantable material in units where Coarse Woody Material is below standards.

Skyline yarding

- Feller/buncher operations will be monitored closely by the sale administrator and soil scientist to ensure soil quality guidelines are not exceeded. The feller/buncher operation will cease immediately if detrimental soil disturbance approaches R1 soil quality guidelines. Monitoring of feller buncher operations on private land and on the Flathead NF estimated detrimental soil effects between 2 and 8 percent. Through careful sale administration it is anticipated that this operation would be within 3 percent or less on this project.
- Harvest activities on skyline units with swing trails will discourage future illegal OHV use by placing slash at the beginning of the trails. Access to skid trails from landings will be closed by placing slash from the landing on the rehabilitated skid trail.
- Where possible, do not yard larger diameter (>15 inches) unmerchantable material in units where CWM is below standards.

Maintenance Burning and Prescribed Fire

- Upon completion of commercial harvest and prescribed fire activities, the following levels of coarse woody material shall be left. This material will include the combination of standing dead as well as down woody fuels.

Fire Group	CWM
2 and/or **4** = Warm, Dry Ponderosa Pine and Douglas-fir Habitat Types	5 to 10 tons/acre
5 and/or **6** = Cool, Dry and Moist Douglas-fir Habitat Types	10 to 20 tons/acre
7, 8, and/or **9** = Cool Lodgepole Pine and Lower Subalpine Fir Habitat Types	8 to 24 tons/acre

- Upon completion of maintenance burning or other prescribed fire activities, at least 70 percent ground cover is necessary to prevent detrimental accelerated erosion and loss in soil productivity. In those cases where ground cover is less than 70 percent prior to burning,

[1] If a contractor chooses to yard during the winter they would be required to comply with winter standard operating procedures and mitigation measures to assure the appropriate combination of snow depth and frozen soil conditions under the wheels or tracks/treads of equipment are met at all times.

consumption and loss of ground cover should not exceed 15 percent. Ground cover includes duff, organic soil horizons, basal area of vegetation, fine woody material, coarse woody material, and surface coarse fragments. Prescribe fire prescriptions will be designed to meet these soil protection requirements.

- CWM requirements must also be considered where prescribed fire is used. CWM larger than 15 inches in diameter will not be *intentionally* ignited by crews during hand lighting operations. It is understood that once the fire is lit by hand crews, the fire may burn into large CWM and combust various pieces.
- Allow time for nutrients to leach from slash prior to burning. The slash will be left through one winter after cutting to allow for initial decomposition and nutrient leaching.

Heritage Resources

- Site 24RA554, a surviving segment of the historic Bitterroot Direct road, is located in or adjacent to Units 5, 9, and 20. The segment will be flagged prior to implementation. No heavy equipment or skidding should occur on or across the road track. The Heritage specialist will monitor project activities in this area.
- Site 24RA0285 is surrounded by, but outside, two commercial harvest units. A 100-foot buffer zone will be established around the site perimeter, pending concurrence by representatives of the Confederated Salish and Kootenai Tribes. The Heritage specialist will monitor project activities in the vicinity.
- If previously unknown cultural resources are encountered during implementation of the project, activities in the area of the discovery will be halted and the Forest's Heritage program manager will be notified immediately. Activities will not be resumed until adequate protective measures are developed and specified in the field, and the required SHPO and tribal consultation regarding the new discovery has been completed.

Water Resources

No specific water resource mitigation measures would be needed for this project as proposed. Project design, BMP use and landscape characteristics would limit impacts to the lowest practicable amount. Refer to BMP list Appendix A for specific conservation practices.

Recreation

- Mitigations to reduce potential illegal OHV use are included in the soil section above.

Scenery

- Mark boundaries and trees as subtly as possible; paint trees above stump height away from view from roads and trails to the extent practical.
- In Unit 14 a 150 foot buffer will be maintained along Trail 313 to reduce visual impacts to the trail users.

Vegetation

- Noncommercial thinning units that contain large numbers of ponderosa pine or lodgepole pine will have a restricted operating season allowing cutting between the months of July 1

thru December 31. Where limbs and tops exceed three inches in diameter they will be bucked in four-foot lengths and scattered to allow time for larger boles to dry out and not become host sites the following year for Ips beetles.

- The cutting of ponderosa pine greater than 12 inches at stump diameter will have their stumps treated with Sporax® within 24 hours of cutting to prevent the spread of annosus spores.

Fuels

- Whole tree yarding, or yarding tree tops attached, is required to reduce the amount of surface fuels in units proposed for commercial harvest. Yarding operations should be designed to minimize damage to residual trees.

Fisheries

- Commercial harvest will not occur within Riparian Habitat Conservation Areas (RHCAs). The widths and preliminary locations of RHCAs are included in Section III – Fish and Aquatic Habitats.
- Hand ignition of fire will be allowed within RHCAS, but not in wetlands. Fire will be allowed back into wetlands. Helicopter ignition will not occur in RHCAs.
- Noncommercial tree thinning could occur up to the stream or wetland edge. When thinning is proposed within 100 feet of streams the sites will be reviewed by the fisheries biologist or hydrologist prior to implementation to determine trees that are needed for bank stability, shade, or future large wood.

Wildlife

The following number of snags will be retained if they exist in the unit prior to treatment. Irregular distribution and small clumps are acceptable. Snags retained will include some from the largest diameter size class available within that unit.

Fire Group (FG)	Snags (average trees per acre)
Warm, Dry Ponderosa Pine and Douglas-fir (FG-2 & 4)	2-5
Cool, Dry or Moist Douglas-fir (FG-5, 6)	4-12
Cool SitesUsually Dominated by Lodgepole Pine (FG-7) Dry, Lower Subalpine (FG-7) Moist, Lower Subalpine (FG-9)	10-15

- Sufficient numbers of large trees will be included in the thinning guidelines to provide a source for large snags and coarse woody material into the future.

COMPARISON OF ALTERNATIVES

The summary at the beginning of this document provides a comparison of alternatives. Refer to the summary section for differences between number of acres proposed for treatment, temporary road construction, and environmental effects.

III. ENVIRONMENTAL CONSEQUENCES

This section summarizes the physical, biological, social and economic environments of the affected project area and the potential changes to those environments due to implementation of the alternatives. It also presents the scientific and analytical basis for comparison of alternatives presented in the chart above.

VEGETATION AND SILVICULTURE

Analysis Area

The analysis area resides in the Bitterroot Valley Section M332B of the Middle Rocky Mountain Steppe-Coniferous Forest-Alpine meadow Province M332 of the Temperate Steppe Division M330 of the Dry Domain 300 (McNab and Avers, 1994). Elevation ranges from 5000 to 6800 feet.

Analysis Methods

Detailed stand exams or walk through exams were completed in October of 2007 for all units designated for commercial treatment. Information for National Forest System Lands on habitat types, forest cover types, forest structural stages and past harvest activity are based on existing data bases (Timber Stand Management Record System), stand exam information, regeneration exams, historical records, and aerial photo interpretation. Maps of forest cover types, habitat types and past harvest activity are filed in the project file (PF#M- Maps and Photos). Information from field surveys were used to evaluate most of the stands. Survey information is located in the Haacke project record and/or the individual stand files located at the Stevensville Ranger District office. A detailed description of the silvicultural diagnostic and prescription process is included in the Vegetation and Silviculture Specialist Report in the project file.

Affected Environment

Vegetation is described relative to the process that shaped its evolution and in terms of its attributes, composition, and structure. Describing trends and the wide range of vegetation conditions that resulted from historical processes helps provide the context to evaluate current conditions. Understanding ecological processes and how management activities may have affected them, helps to define desired stand conditions.

Existing Condition by Vegetation Response Units and Forest Composition

Vegetation Response Unit

The vegetation response unit (VRU) is suggested as the basic environmental stratification for relating repeatable landscapes to predictable ecological processes (USDA, 1999). The Region 1 habitat groups (Pfister,1977) are the foundation for this classification. The VRU is intended to be an aggregation of land having similar biological capabilities and potentials for management with similar natural disturbance processes (USDA, 1999). The combination of climatic, geophysical and soil factors form the habitat types that are indicative of the ecosystem. Each habitat type represents a relatively narrow segment of environmental variation and delineates a certain potential for vegetative development which is defined as the "potential natural vegetation" for a site. Habitat types are assigned to Fire Groups, which are based on the response of the tree species to fire and the roles, these trees species take during sucsessional stages (Fischer and Bradley, 1987). The interaction of these processes creates a mosaic across the landscape. With that interaction, vegetation directly or indirectly affects other aspects of the environment such as wildlife populations, biological diversity, insect pest populations, fire potential and fire behavior. The following table identifies VRU's within the Haacke-Claremont analysis area based on regional habitat groupings.

VEGETATION RESPONSE UNITS (VRUS) WITHIN THE HAACKE-CLAREMONT ANALYSIS AREA.

Habitat Group	Climate Modifier (Region 1 Groupings)	Vegetation Response Unit	Primary Fire Group Code	Acres	Percent of Analysis Area
HG 1	Warm and Dry	VRU 1	2, 4	11	0.3%
HG 2	Moderately Warm and Dry	VRU 2	4, 6	1501	48%
HG 7	Cool and Moist	VRU 7	9	437	14%
HG 9	Cool and Moderately Dry	VRU 9	7, 8	996	32%
-	Non-Forest Scree	N/A	-	171	5%

Disturbance, which can have a strong influence on individual species, natural communities and ecosystems, can be attributed to both natural and human causes (Landres, et al 1999). Fires historically burned in a range of sizes, intensities, and intervals throughout the Haacke-Claremont project area and resulted in a mix of stand ages, structures, and species. Insects, forest pathogens, and other disturbances also changed vegetation through time. This diversity of vegetation across the landscape was desirable because it helped create forest conditions that were more resilient to disturbance since not all size and age classes were subject to the same disturbance processes.

Vegetation Response Unit 1 is a mix of forested and nonforest sites, characterized as a warm, dry setting. Where tree cover is present, it is composed of large ponderosa pine in open park-like stands of grassy understories and occasional shrubs. The density and distribution of Douglas-fir understory and co-dominant trees varies directly with the degree that fire has been excluded. Western larch and lodgepole are largely absent on most sites due to high temperatures and lack of moisture.

A natural fire interval of 5 to 25 years maintained these grassy open areas. These non-lethal, nonuniform burns regularly interrupted succession of Douglas-fir and largely determined the stand composition. During fire-free periods dense thickets of Douglas-fir develop beneath the

overstory. The overstory can become susceptible to crown fires due to the buildup of ladder fuels. Although rare, this condition can result in severe stand replacing fires. Fuel loadings on representative habitat types of Fire Group 2 and 4 ranges from 5-9 tons per acre and are composed of herbaceous material, tree litter and some large woody fuels (Fischer and Bradley, 1987). Approximately 0.3% of the analysis area is in VRU 1.Since this makes up a relatively small portion of the analysis area, for the rest of the analysis is will be lumped with VRU 2 since they are so similar.

Vegetation Response Unit 2 is characterized as moderately warm and dry but is a transitional setting that includes warm, dry grasslands and moderately cool, dry upland sites. The dry, lower elevations are composed of mixed Douglas-fir and ponderosa pine in well to over stocked stands that are being encroached by Douglas-fir regeneration. Many units are heavily overstocked with Douglas-fir ladder fuels. Also, much of the Douglas-fir has severe mistletoe issues causing increased mortality in many units.

On the higher moist sites, ponderosa pine is less evident and a mix of Douglas-fir and lodgepole pine with lesser amounts of western larch make up the vegetation composition. Ponderosa pine seems to be more prevalent on southern and western aspects. Lodgepole pine is found in distributed pure pockets across the VRU. These dry sites are mostly within the Douglas-fir habitat series.

Habitat types within this VRU are primarily in fire group 6 and some in fire group 4. Prior to intensive fire suppression, fire was an important agent in controlling density and species composition in this VRU (USDA, 1999). A nonlethal, low severity fire is representative of the warm dry sites with an anticipated fire interval between 5 and 25 years. Much more typical of this VRU is a mixed severity fire. On the cooler and more moist sites a nonuniform mixed severity fire with a fire interval of 15 to 45 years were common (Fischer and Bradley, 1987). This played a major role in maintaining the seral component of conifers. Mixed lethal, mosaic fires typically occurred at mid to upper elevations and northerly aspects. These fires killed trees in patches and created multiple age classes (USDA,1999). After a long enough fire-free interval, stand replacement fires can occur in the moist settings of this VRU under varying forest conditions approximately 150-400+ years (Arno et al., 1995). These lethal fires likely occurred in overstocked stands containing heavy fuels due to long fire free intervals. A dense understory creates a fuel ladder carrying fire into the crowns and throughout the stand. Many of these fires were patchy and not expansive creating pockets of pure lodgepole pine. Because fire has been absent from this landscape for such a long period of time a much larger proportion of the project area is predisposed to high severity fires. Fuel loadings on representative habitat types of Fire Group 4 and 6 averaged 11-12 tons per acre (Fischer and Bradley, 1987). Approximately 13 percent of the analysis area is in VRU 2.

Vegetation Response Unit 7 occurs in the moist lower subalpine forest setting and is common on northwest to east facing slopes, riparian and poorly drained subalpine sites. This VRU occupies a broad subalpine zone that is bordered by subalpine fir and lodgepole pine on cooler and drier elevations found in VRU 9. Douglas-fir, lodgepole pine, Engelmann spuce, and small amounts of western larch often form the overstory with a dense understory of subalpine fir and some spruce.

Most habitat types in VRU 7 are in fire group 9 (Fischer and Bradley, 1987). Fire plays an important role in the development of species composition in this VRU. Fires typically are nonuniform; relatively infrequent which is mostly low severity or stand replacing with periodic mixed severity fires (Fischer and Bradley, 1987). Fire intervals are estimated at greater than 120

years for most sites (Fischer and Bradley, 1987). Additional research demonstrates that nonuniform, infrequent stand replacement fires were the most common, occurring within a mosaic on low severity and mixed severity fires (USDA, 1999). Within the lodgepole pine/Douglas-fir mix cover type a 100+ year fire interval was found (Arno, 1980). Nonuniform mixed severity fires were less prevalent, but occurred on a frequency of 38-120 years in lodgepole pine/Douglas-fir cover types (Losensky, 1993). These types of fires resulted in large canopy gaps and mosaic conditions that included patches of even-aged stands, with surviving groups and individual trees.

Downed dead woody fuel averages about 25 tons per acre but could be much higher (Fischer and Bradley, 1987). This VRU comprises 14 percent of the analysis area.

Vegetation Response Unit 9 is typified by cool and moderately dry conditions characterized by a short growing season with early summer frosts. Lodgepole pine is the seral dominant in most stands, with western larch and Douglas-fir occurring as scattered overstory relics. Englemann spruce and subalpine fir occur as minor stand components, particularly where stand replacement fires have been absent. Whitebark pine may occur as a minor seral species.

Within the analysis area 94 percent of habitat types are within fire group 8. There is one habitat type that is in fire group 7. These dry lower subalpine habitat types, subalpine fir/beargrass, are composed of mixed species that include lodgepole pine. Research by Arno (1985) reported that 40 to 67 percent of mature stands in subalpine fir/beargrass habitat showed evidence of periodic underburns, particularly in upper elevations of lodgepole pine cover type (Barrett, 1982). Barrett (1982) found that fires originating at high elevations in these habitat types and fire group tended to be small and to burn with low severity. Stand replacing fires generally average 100 years with some mixed severity burns occurring 50-130 years (Fischer and Bradley, 1987).

The averaged downed woody loading is approximately 18 tons per acre but extreme fuel loads have been documented at 150 tons per acre (Fischer and Bradley, 1987). Approximately 32 percent of the analysis area is within VRU 9.

Forest Composition

The 2004 Burnt Fork Ecosystem Analysis at the Watershed Scale (EWAS) compiled reference conditions, comparing 2004 and 1937 forest cover types and size class. Haacke-Claremont is within that larger analysis area. This analysis indicated that species composition had changed from a predominance of seral species, ponderosa pine and lodgepole pine, to dominance by climax fir species, Douglas-fir and subalpine fir. In 1937 45 percent of the area was dominated by seedling/sapling and pole size stands. Currently, 37 percent of the EWAS area is dominated by the smaller size classes with 51 percent in mature, larger sized trees. This increase in mature size classes is attributable in part to fire exclusion since the turn of the century. Fire exclusion has allowed stands to mature without fire influences that would create younger stands.

Historic vegetation research by Losensky (1993) indicates the following percent area by cover type for Ravalli County around 1930: Douglas-fir cover type occurred in 9 percent, lodgepole pine 7 percent, ponderosa pine 18 percent, and a mix of western larch/Douglas-fir at 0.7 percent.

The existing condition information is taken from the Forest Service Activity Tracking System (FACTS). Douglas-fir is the dominant cover type within the analysis area. It accounts for 54 percent of the forested land. Lodgepole pine and ponderosa make up the difference with 29 and 11 percent. Approximately 20 percent of the area is in the seedling/sapling structural stage, 26

percent in the pole stage and 47 percent in the sawtimber structural stage accounting for 93 percent of the analysis area. The remaining 7 percent of the analysis area consists of non-stocked areas (PF-#M-Maps and Photos). The continued fire free interval has changed the understory. This change has produced a decline in the availability, palatability and abundance of many forage species. Shrubs and grasses such as Scouler willow, western serviceberry, blue huckleberry, common snowberry, elksedge, pinegrass, and blue bunch wheatgrass become typically older and decadent due to lack of rejuvenation through top kill caused by fire (USDA 1999), (Fischer and Bradley, 1987).

Many of the non-commercial stands cut in the late 1970's and early 1980's are heavily stocked averaging 1000+ trees per acre. Douglas–fir and lodgepole pine are competing with the planted ponderosa pine. Many of these stands have high numbers of insect and disease related pests contributed to high stocking densities.

The stands we see today are a product of succession in the absence of disturbance. Densities and species composition differ significantly from historical conditions, as does the extent and continuity of this forest type across the landscape. The result has been a gradual trend toward the potential natural vegetation (the habitat type that would exist if no disturbance ever occurred). Higher densities of shade tolerant species are more prevalent, especially in the understory.

Desired (Preferred) Stand Conditions

The purpose and need for the project is focused specifically on: 1) reducing fuel loads throughout Haacke and Claremont Creeks, 2) reducing tree densities in both young, regenerated timber stands and mature stands 3) providing forest products, jobs, and income to the local economy. The following conditions are described as options for Silviculturists to consider in prescribing treatments to shift the landscape within this vegetation response unit towards a more desirable and sustainable condition. The landscape attributes are achievable under average conditions and are based on applied research, scientific findings from the Interior Columbia Basin Ecosystem Management Project (ICBEMP), and local forest conditions. The desired stand conditions are formulated with those objectives in mind. The desired stand conditions are as follows:

Vegetation Response Unit 2:

- Desired forest structures reflecting the product of frequent low to moderate severity ground fires.
- Mosaic of stand conditions such as stocking, age class, and species composition relative to historic range of seral and climax tree species.
- Nonuniform, relatively open community of late seral ponderosa pine, western larch, and Douglas-fir sustained through prescribed fire and timber harvest at frequencies consistent with natural fire returns.
- Species composition of approximately 70 - 85% ponderosa pine and 15 - 30% Douglas-fir
- Stand density relatively low, between 40 – 80 square feet of basal area per acre.
- Within the response unit strive to maintain 15-25% early seral, 15-35% mid seral, 10-30% mature, and 20-35% late seral based on ICBEMP scientific findings (USDA, 1996)
- Create small openings (2-5 ac) within an irregularly shaped, treatment area (20-200 ac); to emulate variation that occurs from mixed severity fires.

- Maintain the health, vigor, stocking, species, and age class diversity of vegetation.
- Average fuel loading generally ranging from 5-15 tons per acre

Vegetation Response Unit 7:

- Desired forest structures would reflect conditions of both mixed severity fires and infrequent stand replacement fires.
- Maintain historic fire frequency using prescribed fire or prescribed natural fire. Promote the development of fire-adapted species.
- Generally, stand density moderate in treated stands between 80 – 140 square feet of basal area per acre
- Species mixture should include 70 - 90% Douglas-fir and lodgepole pine and 10 - 30% other species
- A variety of successional stages relative to historic ranges of seral and climax species.
- Within this response unit strive to maintain 15-25%early seral, 20-40% mid seral, 15-30% mature, and 15-45% late seral based on ICBEMP scientific findings (USDA, 1996)
- Relic overstory would be left in aggregated or dispersed fashion wherever possible.
- Average fuel loading generally ranging from 10-30 tons per acre

Vegetation Response Unit 9:

- Desired forest structures would reflect a mosaic of stand conditions similar to conditions created naturally by nonlethal and mixed severity fires and low to moderately extensive stand replacement fires.
- Generally, stand density moderate in treated stands between 80 – 140 square feet of basal area per acre
- A mix of even and multi-aged stands of Douglas-fir and/or lodgepole pine with stocking ranging from fairly open to dense with a mix of even-aged stands of lodgepole
- A variety of successional stages based on ICBEMP findings (USDA, 1996) indicates 20-40% in early seral stage, 40-60% in mid seral stages, and 15-20% in mature stage across the vegetation response unit.
- Desirable to create small openings <5-10 acres to mimic past occurrence of mixed severity fires.
- Utilize prescribed fire where possible to maintain sustainable fuel conditions.
- Average fuel loading generally ranging from 10-30 tons per acre.

Noncommercial Thinning:

- Minimize excess, damaged and diseased trees,
- Maintain or improve stand and tree vigor to reduce insect and disease vulnerability by reducing stocking levels,
- Maintain stocking levels between 150-300 trees per acre,
- Increase growth of remaining trees to provide a commercially valuable wood product,
- Reintroduce fire into the older and larger diameter ponderosa pine,
- Retain residual overstory trees for structural diversity

It is also important to ensure that potential treatments will result in a healthy and sustainable condition in the forest and ecosystem. The desired conditions should be within the range of

natural variability – that which we might expect under natural disturbance and succession regimes. The desired future condition includes structures, composition and processes that would have been present historically. It is desirable to return fire to the ecosystem and allow it to play its natural role. Performing mechanical treatments in advance of prescribed fire allows fire to be reintroduced into the project area without causing high levels of tree mortality. Prescribed fire will reduce the vulnerability of the forest to possible severe and undesirable effects from future fire, insects or disease. It creates a forest more resilient in the face of inevitable change and future uncertainties, providing for a wide variety of possible future resource and management needs. Harvesting would be designed to maintain the larger diameter trees which are better able to survive after fire . Discussions related to the natural historic fire regime and the fire ecology of the affected stands is found in the Fire and Fuels section of this document.

Disturbance

Ecological processes and disturbances directly affect the diversity of plant and animal communities within an area over space and time. The better we understand this interrelationship, the better we will be able to plan our actions to maintain healthy, properly functioning ecosystems into the future. Ecological processes and disturbances include nutrient and biomass cycling, forest succession, weather events, insects, pathogens, fire and human influences (i.e. timber harvest).

The primary disturbances, or factors of change, influencing vegetation in Haacke-Claremont include, fire, insects, pathogens and timber harvest.

Fire

Fire was historically the dominant agent of change and filled a very important role in Rocky Mountain ecosystems. Fires are natural modifiers of the vegetation, sometimes killing all trees and above-ground parts of vegetation (high intensity, lethal fire), sometimes killing only smaller trees or no trees at all and only burning understory grasses and shrubs (low intensity, non-lethal fire). Fire releases nutrients to soils and streams. Fires affect the amount of dead, woody material and snags on a site. Fires affect soil moisture and stream-flows because of the change in amount of precipitation available. Sometimes fires consume forest floor organic soil layers and are followed with hard rains before soil conditions recover. This can cause the watershed-forming processes of erosion, altering hill-slopes and stream channels.

The historical frequency and intensity of fires was highly variable across the Bitterroot landscape, depending upon such factors as elevation, aspect, vegetation and fuel conditions, terrain, and weather. Most fires were lightning-caused. However fires set by indigenous people living in this area before white settlement played a significant role particularly in the lower elevation forest types (Arno 1976, Barrett 1981). In some of the drier ponderosa pine forest types, low intensity fires might burn through the stand every 6 to 7 years (Arno 1976). Generally, as you move into the moister and cooler forest types, intervals between fires increase and the more severe, lethal fire becomes more common.

Several studies have found a marked decrease in the number of fires occurring in the Bitterroot Mountains since around 1920 and a corresponding increase in fire intensity (Arno 1976, McCune 1983, Brown et al 1993). Possible reasons for this change are increased fuel loadings, weather and successful fire suppression, especially on lower intensity fires. Suppression of fire and its exclusion from these ecosystems during the 20th century is probably the factor affecting the largest proportion of vegetation across the Bitterroot landscape.

Insects and Pathogens

Susceptibility of forest stands from forest pests and diseases depends on a variety of factors such as species composition, size class, age, stocking, and environmental stress caused by drought. Most insect and diseases are endemic and vital to the ecosystem. Stands outside historical conditions are at a higher risk for insect and disease related issues resulting in epidemic levels not sustainable in a functioning ecosystem.

In this section, those insects and pathogens that are of most concern and have had the most obvious influence on the forest within the Haacke-Claremont Project area include: dwarf mistletoe and bark beetles.

Dwarf mistletoe

Dwarf mistletoe (Arceuthobium douglasii) is a small, leafless, parasitic plant that extracts water and nutrients from live conifer trees. These plants are native components of the forest and have co-evolved with their host species for millions of years. The effects of dwarf mistletoes on individual trees are generally quite gradual; therefore, the effects on ecosystem functions will be rather gradual as well.

Dwarf mistletoe species are generally host specific, occurring on one principal species. The major tree species impacted in the Haacke-Claremont Project area is Douglas-fir. There is some occurrence of mistletoe on lodgepole pine as well. The mistletoe plant causes brooms, stem cankers, stem and branch swelling on infected trees resulting in decreased height and diameter growth, reduction in seed and cone crops, and direct tree mortality or predisposition to other pathogens of insects (Hawksworth and Wiens, 1996).

Dwarf mistletoe spread rate is fastest in multi-storied stands where mistletoe seeds from infected overstory trees “rain down” on susceptible understory trees. Seedlings and saplings growing under a heavily infected overstory will be killed at an accelerated rate. They will often die before reaching cone-bearing age. Brooms can contribute to development of ladder fuels leading to intense fire behavior (Hawksworth and Wiens, 1996).

Most of the Douglas-fir in the stands within the Haacke-Claremont Project area is infected with dwarf mistletoe, with severity rating of 4 and 6. Huge witches brooms are common on these trees. The level of mistletoe infection in the younger Douglas-fir trees varies across the project area, from very low levels in some stands to very high levels in others. Where heavily infected Douglas-fir overstory exists, the infection level in the adjacent and understory trees is also high, and would be expected to continue to increase as long as the source of infection exist. Presumably, the effect of dwarf mistletoe adds to the fuel generation rates and increases vulnerability of the forest to severe fire damage (Arno, 1976). Alexander and Hawksworth (1975) have analyzed an interrelationship between fire exclusion and increased infections. They have also analyzed using prescribed fire to control the parasite.

Mountain Pine Beetle

Mountain pine beetle (MPB; Dendroctonus ponderosae Hopkins) is the most aggressive, persistent and destructive bark beetle in the United States. All western species of pine, native and introduced are susceptible. It will bore into the tree and feed on the inner bark, often killing the tree. Populations can build up to very high levels (epidemic) and cause large-scale mortality when forest conditions are at favorable, “high risk” conditions (Amman et al. 1977). This

situation most typically occurs in lodgepole pine when the trees are mature (average stand age >80 years), with average stand diameter >8' dbh and elevations less than 6000' (Amman et al., 1977). Events such as long term drought and other agents of stress such as high stocking levels and over mature stands that are not real vigorous can put stands at high risk.

Looking at past aerial detection maps from 2003 to 2005, MPB activity has been increasing within the analysis area having the potential to be epidemic. In 2003, there were no points or polygons with MPB activity. Compared to 2005, MPB within the analysis had numerous polygons with MPB hits averaging 10+ faders per polygon. Currently, within several units there are several pockets of mortality in lodge pine pole. Several stands have multiple beetle kill accumulations from past outbreaks. These same units have over 80 tons of downed fuels due to MPB mortality in lodgepole pine. The majority of lodgepole pine within the analysis area averages 110 years of age and is densely overstocked. Basal area averages 180-200ft^2. Most of the lodgepole pine is not real vigorous, and they have very low crown ratios, fewer than 30 percent.

Douglas-fir Bark Beetle

Douglas-fir bark beetle (DFB; Dendroctonous pseudotsugae Hopkins) is an aggressive beetle that often times causes tree mortality. It generally attacks Douglas-fir greater than 14"dbh in mature, dense stands. It can and will attack trees smaller than this when DFB populations are very high (Negron et al., 1999). Douglas-fir bark beetle populations can be triggered by other events such as wildfire, windstorms, and other climatic stressors such as drought.

Within the analysis area, Douglas-fir is found mixed with lodgepole pine, western larch, and ponderosa pine. Aerial detection flights in 2003 had three polygons within the analysis area averaging 17 fader trees per polygon. Also, the 2005 aerial detection map had a tremendous increase in the number of fader trees, averaging 5-10 trees with a high of 80 faders in one polygon. Walkthrough surveys conducted in the analysis area in 2007 noted DFB activity had decreased. Much of the mortality is 2-3 years old and new attacks from this year were limited. Unlike other areas of the Bitterroot National Forest, the analysis area appears to have endemic levels of DFB activity. During field reviews, many of the tree crowns that were red in 2005 and 2006 were less evident in 2007. Many of the large diameter Douglas-fir that died to DFB and are close to road have been harvested for firewood.

The Douglas-fir beetle has consistently been associated with fire-injured Douglas-fir, often attacking larger trees with moderate to high levels of basal bole injury (Furniss 1965; Rasmussen and others 1996; Weatherby and others 2001) and light to moderate levels of crown injury (Cunningham and others 2005; Peterson and Arbaugh 1986; Ryan and Amman 1994; Weatherby and others 2001). Additionally many coniferous species have life history traits and characteristics that enhance their resistance to injury from fire, thereby increasing post-fire survival rates (Hood and Bentz 2007). Larger Douglas-fir does have the capability to tolerate fire due to its thick insulating bark that develops with age that protects the inner cambium (Fowler and Sieg 2004). However, mortality following fire, not only depends on tree species, but also on type and degree of fire caused injuries, initial tree vigor, type and intensity of fire and post-fire environment (Ryan and Amman 1996).

To predict DFB impacts from prescribed burning and post-fire management after a wildfire, models have been developed to help facilitate these issues. Models developed by Hood and Bentz (2007) predict Douglas-fir mortality and beetle attacks within 4 years post-fire in areas

dominated by Douglas-fir in the Northern Rocky mountains. These models are intended to be a part of the planning process in Douglas-fir forests and managers should augment their decision criteria with information on many factors, including location of population centers of DFB, tree physiological factors, overall stand health, and management objectives (Hood and Bentz 2007).

Annosus root disease

This root disease is widely distributed in North America, and harvesting practices have increased its incidence and impacts (Rippy et al 2005). The disease is spread by the fungus *Heterobasidion annosum* ((FR.) Bref.). Its primary mode of spread is by airborne spores landing on fresh cut stumps. The spores germinate and colonize the wood if conditions are favorable (Lockman 2006). The disease can also be spread across root contacts if the neighboring tree is a susceptible species (Lockman 2006). This root disease often occurs in stands with other root diseases and thus all the root diseases are treated as a complex with the management recommendation of promoting root disease tolerant species. Ponderosa pine is the main host for the p-type annosum.

Stem Diseases

Western gall rust (Endrocronatrium harknessii (Moore) Hirat) is present in some lodgepole pine in the analysis area. It produces a gall, which affects form, growth rates and outright mortality in individual trees. Some saplings and larger trees have flared target cankers called hip cankers. The only practical means of control is to thin out infected trees during stand treatments.

Western Spruce Budworm

Western spruce budworm (Choristoneura occidentalis Freeman) is an insect native to this area, and normally exists at endemic levels in the forest landscape. The larvae consume buds and foliage of Douglas-fir, subalpine fir and spruce. Cones and seeds are also destroyed. Tree growth can be reduced after several years of heavy defoliation. After four to five years, branch dieback, top kill and tree mortality can occur.

Good budworm habitat consists of dense, multiple layers of host species. The upper canopy provides a good food source and refuge from predation, while the lower canopy intercepts budworm spinning from the upper layers and provides sanctuary from predators on the forest floor. The dense stand structure may also favor budworm survival by limiting the diversity of bird predators (Langelier et al., 1986) and reducing efficiency of some insect parasites.

Western spruce budworm has co-evolved with the forests of the Northern Rockies, and regular population fluctuations have always occurred. High population levels of the budworm would periodically occur, largely influenced by climatic conditions. Though climate may influence the probability of an outbreak, stand conditions will determine the duration and intensity. Several studies have found that the intensity and duration of budworm have increased over the past 50-100 years (McCune, 1982; Stipe, 1982; Blais, 1983; Carlson et al., 1983, and Anderson et al. 1987). It is probable that this change has come about largely because of past partial cutting and fire suppression practices, which has changed stand structures and species composition at the stand and landscape level (Schmidt, 1985; Wulf and Gates, 1987). Spruce budworm now has far more area of desirable dense, multi-canopied Douglas-fir forest available.

Currently there are no known infestations of western spruce budworm in the stands within the analysis area. However, many of the stands are of a structure and composition favorable to budworm activity and would be considered highly susceptible to infestation.

Timber Harvest

In the analysis area there was no commercial harvest before 1971. Roads were developed in the northern part of the analysis for the 1973 for the Haacke Slocum sale. No real developed roads existed prior to 1971 as interpreted from aerial photos of 1930, 1964 and 1971. However, in the southern part outside of the analysis area there were roads established in the 1960's. Since 1973 there has been approximately 888 acres harvested within the analysis area. Past harvest treatments include 223 acres of intermediate harvest (commercial thin and salvage), 109 acres of clear cutting, 100 acres of seed tree harvest, and 456 acres of shelterwood harvest. Much of this material was ground skidded or cabled yarded.

Environmental Consequences

This section describes the direct, indirect, and cumulative effects of the no action alternative and the two action alternatives.

Effects Common to All Alternatives

There are no specific effects common to all three alternatives with respect to the forested vegetation resource. To a certain extent insect and disease activity would continue with all alternatives, but at different intensities and scale depending on the alternative. Forest succession would continue, although at what stage would depend on which alternative is chosen.

Effects Common to Action Alternatives

All action alternatives propose some level of timber removal, altering forest structure and composition. Alternative 2 and 3 are essentially the same except that Alternative 3 treats 64 more acres and includes the construction of 1.2 miles temporary road and reconstruction of 0.11 miles of temporary road. For both action alternatives there would be an effect on forest composition, structure, succession, and disturbance ecology.

A mosaic of structure and composition would be maintained on the landscape due to the layout of treatments. Succession would be moved back to an earlier successional stage in units with patch cuts, mainly in pure lodgepole pine. Relic overstory would be left in aggregated or dispersed fashion wherever possible in these patch cuts. These patch areas would essentially be dominated by a new, young age class.

Later successional stages would be maintained in the commercial thin units. The objective is to improve the existing stand by reducing the number of stems without any effort directed at regeneration (Smith 1962). The use of prescribed fire is recommended as a tool for periodic reduction in fuels as well as restoring and maintaining vegetative composition and structure. For example, in VRU 2 prescribed fire used in combination with thinning prepares the site for maintaining ponderosa pine and western larch as seral species.

Proposed treatments for both alternatives would affect insects and pathogens. By decreasing forest density and competition, the remaining trees would have greater resources of light, water, and nutrients available to them. If a tree is healthy and vigorous it has a better defense against

insects and pathogens. Also, proposed treatments focus on removing infested or diseased trees. It is neither possible nor desirable to completely remove insects and pathogens from the ecosystem.

Application of Sporax® in stands proposed for commercial thinning where ponderosa pine (>14 inches in diameter) exist. Ponderosa pine trees are the main host for this p-type annosum and since this is the main tree species we want to retain on site, annosus root disease becomes a management concern of the area. Once this root disease has been established there is no economically feasible procedure for directly suppressing it. Preventing the introduction of the disease is the most efficient and economical method of reducing the impact from annosus root disease (Lockman 2006). The management option to prevent the spread of annosus root disease would be to treat fresh cut stumps of ponderosa pine with a borate compound. This would prevent the germination of annosus spores that land on these stumps (Lockman 2006) and as well as wound prevention, greatly reducing the infection of annosus root disease (Rippy et al 2005). Applying a borate compound to fresh cut ponderosa pine stumps would greatly reduce the potential negative impacts of annosus root disease. *Sporax*® (a borate compound - borax) is the only registered and labeled product available for forestry uses, and is a specified mitigation measure for this project. The Forest Service has completed a risk assessment of the use of *Sporax*® or borax (USDA Forest Service 2006g). The agent of toxicologic concern is boron, and exposures as well as toxicity information, are expressed as boron equivalents (USDA Forest Service 2006g). Boron occurs naturally in the environment, and exposure is unavoidable. Except for the most extreme exposure scenario considered in the risk assessment - i.e., the direct consumption of Sporax® from a tree stump by a child – the use of *Sporax*® will not substantially contribute to boron exposures in humans (USDA Forest Service 2006g). Health effects evaluations by the Forest Service have taken into consideration the potential for both worker and public exposure from this application. This information has been used in formulating protective measures to reduce the risk to forest workers and to the public (USDA Forest Service 2006g). Refer to the Borax Pesticide Fact Sheet (Information Ventures, Inc. 1995) and the *Sporax*® Material Safety Data Sheet and Label from Wilbur Ellis (1996) for guidance on the safe handling and use of borax. The use of *Sporax*® in Forest Service programs will not typically or substantially contribute to concentrations of boron in water or soil (USDA Forest Service 2006g). In addition, using *Sporax*® to prevent the spread of annosus root disease does not present a significant risk to wildlife species under most conditions of normal use, even under the highest application rate (USDA Forest Service 2006g). Results from exposure scenarios indicate that aquatic animals and plants are not at risk (USDA Forest Service 2006g). Other mitigation measures such as riparian and wetland buffers would greatly limit any accidental spillage of large quantities of *Sporax*® into aquatic habitats.

Within the analysis area there are no stands classified as old growth that are proposed for commercial treatment. Members of the public have indicated that they view individual large, old, live trees and large, old, dead trees as old growth. These same trees are a component of old growth habitat but do not constitute old growth as defined in the Forest Plan (USDA Forest Service, 1987, p. II-20). For purposes of this analysis, as required by the Forest Plan, old growth classification is based on stand-wide structure and characteristics.

Alternative 1 (No Action)

Alternative 1 is the no action alternative. Under this alternative no treatments would occur in the project area; no acres would be harvested or prescribed burn. In the short term the forested

resource would appear unchanged. However, natural processes would continue and over time there are effects and implications of implementing this alternative.

Direct and Indirect Effects

There would be no direct effects to vegetation in the short term since there would be no timber removal, commercial or noncommercial, and no prescribed fire. Indirect effects of this alternative would continue over time. The area would continue to change with natural forces determining stand conditions. The composition in the units would change in direct relation to future disturbances. Ecosystem processes would continue but would likely be very different from historical conditions. The potential natural vegetation in the analysis area is Douglas-fir and subalpine fir. Although this is the theoretical climax forest, it is not what historically existed in this area since periodic fire maintained a different species mix and structure in these forested stands. Eventually these stands would be burned by wildfire.

While insects and pathogens are an inherent part of the forest, changes in composition, stand densities and structure would create additional concerns that relate to ecosystem resiliency and maintaining biological function. Dense multi-storied stands are susceptible to and capable of supporting populations of western spruce budworm. These same stand structures can be conducive to infection by dwarf mistletoe. Areas that contain older decadent lodgepole pine stands will experience bark beetle mortality due to physiological age and overstocking. The increased mortality, decadence and higher stand densities will be accompanied by dense, continuous fuels. This increased fire hazard presents conditions resulting in increased fire intensity and a change from surface to crown fuels (Monnig and Byler 1992).

The multistoried stands of Douglas-fir are under stress from overstocking and heavy dwarf mistletoe infection. This creates the opportunity for Douglas-fir beetle, currently within the analysis area, to take advantage of the low vigor in these trees thus, populations would increase over time.

Past regeneration units would not be thinned. Many of these forest plantations contain high densities of young trees as a result of successful regeneration. These areas are too dense to achieve their optimal growth rate and size. Without treatment they may grow at a suppressed state and be at risk to mountain pine beetle and/or being replaced by wildfire. This would represent a loss in investment that was made to regenerate these units. This would push back the next viable timber rotation in these units, causing economic loss.

In absence of fire, shade-intolerant species such as Douglas-fir and subalpine fir would increase. Continuous, multiple vegetation layers of Douglas-fir with interconnecting crowns would continue to develop and increase the fire hazard. Stand structure over time would become denser. Ponderosa pine would decrease and eventually be replaced by shade-intolerant species. Native shrubs, grasses, and forbs that are adapted to fire would decline. These factors would continue to interact, creating conditions that would increase high susceptibility to fire. Low-severity fires would be less likely due to the buildup of ladder fuels and downed woody material. Canopy gaps will occur due to mortality of individual and group tree mortality.

When fire does return to this landscape, most likely it will be a high severity fire. The fires of 2000 burned in many of these same vegetative conditions with a result of 70-100 percent mortality. A lack of seed, severe seedbed conditions, and competition from grasses and shrubs make it extremely difficult for regeneration. Invasive plants already present in the stand would increase relative to native species.

Alternatives 2 & 3

Alternative 2 and 3 are identical with respect to vegetation except for unit 14. In alternative 3 the size of unit 14 increases from 159 acres to 223 acres and includes approximately 1.2 miles of temporary road used for timber removal on the lower portion of the unit. Therefore, they will be analyzed together in this section. Treatments would occur in all proposed units including prescribed burning. Sporax application would be similar in both alternatives with some additional application in Alternative 3 where more acres are treated.

Direct and Indirect Effects

The action alternatives include combinations of treatment to change composition and/or structure through thinning and prescribed fire. There would be clear changes to forest composition, structure and successional stages of treated areas under these alternatives. Trees per acre and basal area would be reduced on all treatment units opening up stands and moving them towards a desired future condition. Species composition would move more towards a greater proportion of early seral species, and where openings are created, natural regeneration would occur.

Noncommercial thinning (approximately 447 acres; units 16-27 and 29), in predominately ponderosa pine and lodgepole pine plantations. These plantations have high densities of naturally regenerated species including Douglas-fir and lodgepole pine mixed within successful artificial regeneration. Thinning these stands will reduce competition for water, nutrients and light, and increase growth and vigor on residual stems. Thinning in the early stem exclusion stage can effectively reduce stocking and redistribute growing space to the desirable species in the unit. Due to high stem density these sites are experiencing high levels of competition and are susceptible to mountain pine beetle and stand destroying wildfire (Graham et al., 1999). Trees growing within 12-18 ft. of saplings designated as crop trees will be slashed and lopped by chainsaws leaving approximately 150-200 trees per acre. Crop trees are defined as those that are the most vigorous, dominant and best formed.

As a consequence many of these stands would remain even-aged even though there is a scattered overstory of ponderosa pine and Douglas-fir. Many of the standing overstory Douglas-fir have severe mistletoe infections. In areas where the understory is predominantly Douglas-fir, these highly infected trees would be girdled and left as snags as part of the thinning treatment. Where the Douglas-fir understory is infected, many of these trees would be removed creating openings within these young stands.

Within these thinning units, stand density would be reduced by 30-60 percent. Treatments are designed to reduce wildfire hazard over the long term by rendering stands more resilient to natural fire occurrence and ecosystem processes. By reducing crown bulk density and changing species composition to more fire-adapted species, anticipated fire behavior will be more manageable in thinned stands in the long term. More open stand conditions are less prone to rapidly spreading crown fires than very dense canopies (Graham et al., 2004). Long term fire hazard and tree mortality from insects and diseases will be lowered as a result of this treatment. However, for at least the next few years there is high risk associated with fire in these stands due to the amount of coarse woody material being generated and height of the lower canopy level. The fine fuels associated with slashing will break down over a couple of winters reducing the fire risk. If fuel accumulations are determined to be unacceptable with these units, hand piling and burning piles or underburning will be completed in those areas.

Treatment of all areas that require slashing or bole scattering would be allowed from July 1 through December 31. This will allow time for larger boles to dry out and not become host sites the following year for pine engraver beetles (Ips pini (Say)). This is applicable to stems being cut that are 3 inches or greater.

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

Prescribed burning will be conducted on approximately 281 acres in units 7 and 12. It is important that fire be restored and maintained as a process of change on the landscape. The use of prescribed fire is desirable as a tool for periodic reduction in fuels as well as restoring and maintaining vegetation composition. Slashing material less than 7”dbh and/or the removal of duff or slash from residual trees will be needed to protect residual trees from being killed by fire. Slashing in advance of burning would be done to minimize the anticipated radiant heat that could damage overstory trees. Generally, duff accumulations around large ponderosa pine trees is generally very high, anything over 12”, there is a mortality risk to individual trees during prescribed burns. It is generally not the intensity of the prescribed burn, but the heat held within the duff that smolders that causes mortality (per discussion with M. Harrington 10/2007).

The extent of duff reduction, mineral soil exposure, overstory crown scorch, and tree mortality that results from prescribed burning is dependent upon the resource objective, and the burning prescription which is covered in the silvicultural prescription. Prescribed burning will create sites favorable for the establishment of natural regeneration even though the intent is not for regeneration. To maintain open stand conditions, prescribed burning should be implemented every 5-10 years to ensure fire dependent processes are continued.

It is important to maintain downed woody material (>3”) at a level that would provide a source of nutrients and organic matter to support the growth of vegetation over time. Graham et al (1994) recommended between 5 and 30 tons depending on habitat type. This material would include the contribution of standing dead as well as down woody fuels. These recommendations are designed to ensure the replacement of nutrients and organic matter over the next 100 years or more. This is particularly important on sites with light fuels and thin duff.

Commercial Thinning will be conducted on approximately 671 acres in alternative 2 and 735 acres in alternative 3. Both of these alternatives would thin the live residual overstory from below to remove excess trees, maintain a desired stocking level and open up growing space while maintaining a large overstory component. Without the temporary road in alternative 3, vegetation below this road would not be harvested. Less area would meet the desired condition because only part of the stand would be treated.

Within VRU 2 stocking levels would vary with the site capabilities and would average 60 ft^2 BA. Stocking would be maintained somewhere between 40 and 80 ft^2 BA. The classical (BD*q*) approach to structural regulation of stands involves residual basal area, diameter of the largest reserve trees, and the ratio between the numbers of trees in successive diameter classes (Fielder, 1995). According to Fielder (1995) residual basal area is probably one of the most important factors because it sets the stage for capturing the site’s potential, allocating space for

regeneration and ensuring structural sustainability. The target 60 ft^2 was chosen based onsite capability and research done by Fielder and others.

It would be desirable to create small openings (2-5 acres) within treatment units. These openings would create an element of edge that would be beneficial to some wildlife species. Openings support the grass, forbs, and shrubs that are largely absent under canopy cover.

Overall, it is expected that there would be a balanced mix of shade intolerant species (PP and WL) and mid tolerant species (DF). Following treatment, trees within the units would be spaced apart from each other and contain a mix of diameter classes. The long term goal of this treatment is to maintain a range of age classes, create areas for regeneration, and adjust for mortality and accretion by allowing trees to move into different size classes. These intermediate treatments are very useful in modifying species composition to favor ponderosa pine over Douglas-fir and have been used with success in other areas on the Bitterroot. Treatments would leave fewer trees, reduce ladder fuels, and break up crown continuity. It could be inferred that canopy bulk density would be reduced with treatment. The residual trees would be larger, have thicker bark and higher crown heights making them more fire resistant. These benefits coupled together would result in reduced potential for crown fire occurrence and less severe effects (Pollet and Omi, 2002).

Within VRU 7 and 9 of the analysis area, VRU 9 makes up the majority of the area. Stocking levels would promote resiliency and good tree vigor and average 80-140ft^2 BA. Stocking level would vary with the site capabilities but would not likely be reduced below 80ft^2 BA. Stocking will be reduced approximately 30-60 percent. Intermediate treatments like thinning are a viable option in these VRU's where stand replacement is not the desired end result. Thinning from below removes excess trees and opens up the growing space while maintaining a large overstory component. Target stands would be composed of lodgepole, spruce and subalpine fir in cool, moist areas and Douglas-fir, western larch and lodgepole pine in the lower to mid elevations. Merchantable trees would be removed that are generally of poor vigor and/or competing with larger quality trees. In the process of reducing stand density, smaller trees would be removed more heavily from the understory than the overstory.

Except in areas where openings are created, the proposed treatments would leave fewer, larger trees; reduce ladder fuels, and break up crown continuity. Reduced canopy bulk density, larger trees with thicker bark (depending on species), and higher crown heights would help improve the chances of tree survival from subsequent fires and reduce the potential for crown fire occurrence (Pollet and Omi, 2002).

Where patches of decadent lodgepole exist, that component would be removed to help secure regeneration. Lodgepole pine is a short-lived seral species and is not resilient to stand opening from disturbance. The lodgepole component on these sites is often infected with mistletoe, or infested by mountain pine beetle. It is also highly susceptible to blowdown. Since lodgepole requires extensive levels of light to regenerate, openings will be created where lodgepole exists to allow natural reforestation.

<u>Prescribed fire in conjunction with mechanical treatments (all commercial units).</u>

Prescribed fire is recommended as a tool for periodic reduction in fuels as well as maintaining vegetative composition and structure in all VRU's. Performing mechanical treatments in

advance of prescribed fire allows fire to be reintroduced into the project area without causing high levels of tree mortality.

Within VRU 2 units there is a need to prepare the sites for maintaining ponderosa pine and western larch as a seral species. Especially in units 5, 3 and 6 where there is an overstory of these species but a lack of their seedlings other than Douglas-fir. Within unit 5, prescribed fire would be applied primarily by jackpot burning initially to minimize impacts to the residual overstory from mistletoe witchs brooms. These brooms have increased the fuels to unacceptable levels. Maintenance burning should follow every 5-10 years to maintain desired conditions.

Fuel loading reductions would reduce fire hazard. Existing surface fuel loading and activity fuels would be reduced though consumption or removal to acceptable levels through yarding and/or prescribed fire. Reducing surface fuel amounts through prescribed fire and mechanical means reduces the risk that the overstory would ignite in a wildfire (Graham et al., 2004). Understory density and ladder fuels would be reduced through slashing where necessary to facilitate underburning and protect individual trees from scorch. Mechanical thinning and fuel treatments have been shown to reduce fire severity and crown scorch (Pollet and Omi, 2002).

Cumulative Effects

Past, present and reasonably foreseeable actions within the Haacke-Claremont analysis area were considered and analyzed to determine the potential for cumulative effects. Past harvest activities are listed by sale name where known. The information is based primarily on historic timber sale records and the Forest Service Activity Tracking System (FACTS) database.

Past Activities:

Past timber sales that have occurred within the last 34 years within the analysis area are listed in the table below by the amount of acres affected by various silvicultural systems or treatments. The FACTS database shows a total of 888 acres harvested between 1973 and 1998.

PAST TIMBER HARVESTS

Year	Acres	Forested Vegetation Cumulative Effect	Sale Name
1973	267	Clear-cut, Shelterwood, Sanitation	Haacke-Slocum
1974	95	Shelterwood	Haacke-Slocum
1981	4	Sanitation	Haacke Sawmill
1983	23	Sanitation	Haacke Sawmill
1984	361	Clear-cut, Shelterwood, Sanitation	Haacke Sawmill
1987	61	Clear-cut, Shelterwood, Commercial Thin	Haackensack
1988	47	Clear-cut,	Ambrose
1989	6	Clear-cut	Unknown
1993	4	Sanitation	Ambrose Mistletoe
1997	10	Commercial Thin	Unknown
1998	10	Commercial Thin	Unknown

Some of these sites are either intact forest canopies where intermediate operations have occurred including commercial thinning, sanitation, and salvage. These treatments combined with the action alternatives serve to increase growing space, vigor and reduce the levels of disease and fuel loading within the landscape. Alternative 2 would accomplish this commercially on 671

acres, a reduced amount of acres compared to alternative 3. Alternative 1 would not accomplish this.

Where shelterwood, clearcut, and seed tree silvicultural systems have occurred within the analysis area, these activities served to break up landscape homogeneity by adding disturbance to the system. This served to increase age class and species diversity by establishing young, shade intolerant stands. These sites are occupied by young, healthy seedling to sapling sized stands at present. These activities have been the primary mechanism on the landscape that has enabled the reestablishment of young, healthy, vigorous stands and are a primary contributor to the age class, size class and species diversity within the landscape. Where regeneration harvest has occurred, these sites have been regenerated within desired species and stocking levels from locally adapted seed. The action alternatives reduce fuels and establish healthy, more vigorous stands. Combined with past treatments, these alternatives increase productivity, vigor and resilience at a greater scale on the landscape. Alternative 1 does not accomplish this.

Planting

This activity has occurred throughout the analysis area most often after regeneration harvest where natural regeneration was not sufficient or of undesirable species. Stands were planted with the intention of at least one precommercial thinning entry. The action alternatives do not prescribe planting except in a portion of unit 3 which re-establishes lost shade intolerant species on an appropriate site. Overall, these regenerating stands would add to the representation of young stands across the landscape. Alternative 1 would favors establishment of shade tolerant species, but provide no assurance of regeneration. They would result in further loss of crucial shade intolerant conifer species within the landscape.

Private Land Harvest

The Burnt Fork Ranch which borders the analysis area has harvested an undisclosed amount of acres in 2000. It is not known what type of harvest has occurred, other than visually it looks like a seed tree cut within ponderosa pine. It will likely add to the percentage of stands in the early, open seral vegetation classes on the landscape. The cumulative effect of the action alternatives is to add to the mosaic pattern on the landscape of stand structures, as well as add to fire and insect resiliency. Alternative 1 does not accomplish this.

Reasonably Foreseeable Actions:

Timber Harvest by the State of Montana

The State is early stages of planning a timber harvest in approximately three years in section 30 which is adjacent to the northwest corner of the Haacke-Claremont analysis area. The plan is to harvest 200 acres of timber in three blocks which would include 80 acres of improvement harvest, 20 acres of commercial thinning, and 100 acres of sanitation harvest to cleanup dead and dying mistletoe. The cumulative effect is to add a mosaic pattern to the landscape of stand structure, as well as add to the fire resiliency of the area.

Noncommercial Thinning Under Contract

A noncommercial unit is under contract within the analysis area and will be treated in 2008. Thinning favors the most healthy individuals and desirable species for a given site. This would result in a cumulative benefit when considered in the context of the landscape with noncommercial thinning activities that are foreseeable within the analysis area. Under Alternative 1 stands would remain highly susceptible to mountain pine beetle attack and their ability to support stand-replacing wildfires would continue to increase over time. Combined with action alternative creates a pattern in the landscape which is more resilient to fire, insects and pathogens.

Consistency With Laws, Regulations And The Forest Plan

Requirements for project or activity planning are established in the Forest Service Directives System. Required project level NFMA consistency findings are described in Forest Service Manual (FSM) 1900, Chapter 1920, Section 1921.12-Vegetation Management Requirements from the National Forest Management Act and in the Forest Service Handbook (FSH) 1909.12, Chapter 20, Section 29-Application of Plan to Project. Forest Service Handbook 1909.12, Chapter 60, Section 61 describes Vegetation Management Requirements at the Project Level.

FSM 1921.12 -- National Forest Management Act Vegetation Management Requirements:

1921.12a-Timber Management Requirements

The minimum specific management requirements for projects or activities that must be met in carrying out projects and activities for the National Forest System (NFS) are set forth in this section. Under 16 U.S.C. 1604 (g) (3) (E), a Responsible Official may authorize site-specific projects and activities to harvest timber on NFS lands only where:

1. Soil, slope, or other watershed conditions will not be irreversibly damaged. Response: Refer to the soils and watershed sections.

2. There is assurance that the lands can be adequately restocked within five years after final regeneration harvest (FSM 1921.12g). Response: Stands within that area that have had regeneration harvests from the 1970's and 1980's have been certified. Larger sized openings created with this project are in lodepole pine where an abundance of natural regeneration is anticipated.

3. Streams, streambanks, shorelines, lakes, wetlands, and other bodies of water are protected from detrimental changes in water temperatures, blockages of water courses, and deposits of sediment where harvests are likely to seriously and adversely affect water conditions or fish habitat. Response: Refer to the soils and watershed sections.

4. The harvesting system to be used is not selected primarily because it will give the greatest dollar return or the greatest unit output of timber. Response: The harvesting systems utilized in Haacke-Claremont were selected based on site specific resource needs and not selected primarily to give the greatest dollar return or the greatest output of timber.

A Responsible Official may authorize projects and activities on NFS lands using cutting methods, such as clearcutting, seed tree cutting, shelterwood cutting, and other cuts designed to regenerate an even-aged stand of timber, only where:

1. For clearcutting, it is the optimum method; or where seed tree, shelterwood, and other cuts are determined to be appropriate to meeting the objectives and requirements of the relevant plan (16 U.S.C. 1604 (g)(3)(F)(i)). **Response:** Where large patches of saw-timber sized, older (generally greater than 110 years-old) lodgepole pine exists, it will be cut and removed creating an opening within the thinning units. These openings will range from less than one acre up to 12 acres in size. Where other species occur in these lodgeple pine areas, they will be retained if they are healthy and windfirm. The lodgepole is riddled with dwarf-mistletoe and are starting to show signs of mountain pine beetle activity and mortality. Thinning these areas is not recommended since the residual trees are likely not healthy enough to survive after the stand is opened up. Cutting of these patches meet the purpose and need of this project and Forest Plan goals.

2. The interdisciplinary review has been completed and the potential environmental, biological, aesthetic, engineering, and economic impacts have been assessed on each advertised sale area and the cutting methods are consistent with the multiple use of the general area (16 U.S.C. 1604 (g)(3)(F)(ii)). **Response:** Refer to other sections of this analysis.

3. Cut blocks, patches, or strips are shaped and blended to the extent practicable with the natural terrain (16 U.S.C. 1604 (g) (3) (F) (iii)). **Response:** Small patch openings will be blended and feathered to avoid straight edges.

4. Cuts are carried out according to the maximum size limit requirements for areas to be cut during one harvest operation (FSM 1921.12e). **Response:** The small openings are well under the 40 acre limit with the largest opening proposed at 12 acres.

5. Timber cuts are carried out in a manner consistent with the protection of soil, watershed, fish, wildlife, recreation, esthetic resources, cultural and historic resources, and the regeneration of timber resources. **Response:** Refer to the other sections of this analysis.

6. Stands of trees are harvested according to requirements for culmination of mean annual increment of growth (16 U.S.C. 1604 (m); FSM 1921.12f; FSH 1909.12, chi. 61.3). **Response:** This project proposes primarily thinning although some openings are proposed up to 12 acres in size. These openings are proposed where decadent (infested with bark beetles, disease, and declining growth) patches of lodgepole exist. Lodgepole is a short-lived species and these areas are generally 110 years or older and have culminated in growth.

<u>Suitability For Timber Production:</u>

As a pre-cursor to the silvicultural diagnosis process, stand examinations are conducted to determine existing stand conditions, and a determination of suitability (in regards to management of the stand for timber production) is made for each stand. Stands proposed for harvest treatment

in Haacke-Claremont were examined for suitability in accordance with 36 CFR 219.12(a)(2)(D)(ii). Units were found to be suitable for timber management based upon the following:

- Meet the definition of forestland as described in 36 CFR 219.16.
- Technological feasibility exists to ensure soil productivity and watershed protection. All sites considered for treatment will use established harvesting and site preparation methods. In combination with resource protection standards in the Forest Plan, applicable Best Management Practices and INFISH, will be sufficient to protect soil and water resource values.
- None of the stands considered for harvest have been withdrawn from timber production as specified in 36 CFR 219.12(2)(A)(B).

Consistency with the Bitterroot National Forest Plan

The Bitterroot National Forest Plan of September 1987 sets out basic management direction and guides all natural resource management activities. Forest plan objectives and goals are given on pages II-2-7 and Management Areas (MAs) are listed between pages III-3-80 (See the Forest Plan for further detail). Goals and objectives directly applicable to vegetation include:

- Provide saw-timber and other wood products to sustain a viable economy, including firewood for personal and commercial use.
- Provide an economically efficient sale program.
- Maintain forest stands so that pest caused losses are reduced to acceptable levels.
- Maintain vegetative diversity on land where timber production is a goal of management.
- Convert high-risk or insect and disease infected stands to young healthy stands.
- Provide optimal habitat on elk winter range.
- Provide for resource protection and fire use necessary to protect, maintain, and enhance resource values.

This particular proposal area contains a combination of 3 of the 18 Management Areas (MAs) allocated in the Forest Plan. Proposed activities will be consistent with MA goals. Commercial timber harvest is proposed only in areas defined as suitable for timber management under the Bitterroot Forest Plan. Except where site-specific Forest Plan Amendments are proposed, all treatments are designed to meet Forest Plan Standards and Guidelines.

FIRE AND FUELS

Introduction

Wildfire has always been an important ecological process in the Haacke-Claremont area. In 1880 a large fire burned part of the northern end of the project area and in 1885 another fire burned part of the southern end. Numerous other fires have burned along the Sapphire range, including the recent Cooney Ridge, Gold 1 and Wyman Fires. For the past 100 years, numerous smaller fires, mostly started by lightning but some human caused, have started within the area but have been suppressed.

Fires historically burned in a range of sizes, intensities, and intervals throughout the area, helping to define the vegetation within that area. These fires varied in size from a fraction of an acre to over 10,000 acres. Through time fire created a mosaic of burn patterns across the landscape and these patterns in turn affected future fire activity. Areas that didn't burn, burned at low intensity, or burned so hot the total stand was consumed. Inside a fire perimeter, fire intensities can vary greatly. Generally, fires are oriented from drainage bottoms to ridge tops and spread laterally until they encounter a past fire scar, natural barrier, or a fire-ending weather event. As a result, areas across the landscape were in various stages of recovery following past fire events. This essentially created holes in the continuity of fuels across the landscape, reducing the potential of a large fire burning across the entire area. Fires over 1,000 acres would be the exception rather than the rule because there was not enough continuous areas of unburned fuels.

Today, following almost 100 years of fire suppression, we are losing the mosaic pattern of past burns. Most areas that would have burned during the past 100 years have not burned and areas that burned during the last century are now entering the successional stages that are more susceptible to fire. As a result, continuous fuel beds across the landscape are starting to develop, setting the stage for uncharacteristically large fires that exhibit more high intensity stand replacement fire than occurred historically.

Existing Conditions

Fire Regime

Most stands in the Haacke-Claremont area have been fire-free since before the turn of the century. During the intervening period dense stands of Douglas-fir have developed, occupying most sites and crowding out seral species. Changes in vegetation will result in altered fire behavior and a corresponding change in fire regime.

Fire return intervals of the units in the project area fall mostly into natural Fire Regime Group I, Fire Regime Group III, and Fire Regime Groups IV. The natural Fire Regime is a general classification of the role fire would play across the landscape in the absence of modern human intervention, but including the influence of aboriginal burning (Agee 1993, Brown 1995). The natural (historical) fire regimes for the project area are classified by the number of years between fires (fire frequency) combined with the severity of the fire on the dominant over story vegetation. Fire Regime Groups I, III, IV and V are defined as:

- **Fire Regime Group I**- 0-35 year fire frequency and low (surface fires are most Common) to mixed severity (less than 75% of the dominant overstory vegetation replaced).

- **Fire Regime Group III**- 35-100+ year frequency and mixed severity (less than 75% of the dominant overstory vegetation replaced).
- **Fire Regime Group IV**- 35-200 year frequency and replacement severity.
- **Fire Regime Group V**- 200+ year frequency and any severity.

The Fire Regimes in the project area coincide with Vegetation Response Unit (VRU) 2, VRU 7 and VRU 9. VRUs can be defined as the basic environmental stratification for relating repeatable landscape patterns to predictable ecological processes (Vegetative Response Unit Characterization and Target Landscape Prescriptions-USDA-FS, 1999). VRUs are describd in detail in the silvicultural section of this document. The following table describes the vegetation and fire regimes for the planning area (3,170 acres) that encompasses the proposed project.

VRU and Fire Regime for the Haacke-Claremont Planning Area

VRU	Percent of project area	VRU Description	Fire Regime
VRU1, nonforest	6%	Warm, dry	I
VRU 2	48%	Moderately warm, and dry	I, III
VRU 7	14%	Cool and moist	IV
VRU 9	32%	Cool and moderately dry	IV

With the advent of fire suppression, the role of fire has diminished. Notable changes due to reduced fire activity include: an increase in fuel loadings and biomass, less recycling of available nutrients, higher insect and disease levels; and a lack of suitable seedbed and conditions for continued successful regeneration of fire adapted species like ponderosa pine, larch and lodgepole pine.

Fuel Conditions

Fuel composition varies depending on the aspect, elevation, vegetation, and history of the area. In general, timbered stands throughout the treatment areas have a wide range of fuel loadings at different amounts. Fuel loadings vary from 1-2 tons to the acre in openpark like areas to 35 or more tons to the acre in areas affected by insect and disease. Talus slopes, roads, and past logged areas reduce the fuel continuity. Ladder fuels are common throughout the area, especially where the overstory is more open, ranging from sparse to very dense thus allowing for isolated torching and crown fire to develop within most of the timbered stands throughout the project area.

The exclusion of fire has altered the existing fuels both live and dead within the proposed treatment areas including: increased stand density, altered species composition, increased fuel loading both in size and distribution, decreased crown base height, and increased canopy bulk density.

Existing vegetative conditions are altered from those that would have historically occured under natural Fire Regimes. Fire Regime condition class (FRCC) has been developed to classify the amount or degree of departure from the historical fire regimes. These are broken into three condition classes for each Fire Regime: FRCC 1 (low departure), FRCC 2 (moderate departure), and FRCC 3 (high departure).

- **Condition Class 1**- current conditions of the fire regime are within the historical range of variability; the risk of losing key ecosystem components is low; vegetation attributes (species composition and structure) are intact and functioning within their historical range.

- **Condition Class 2**- fire regimes have been moderately altered from their historical range; there is a moderate risk of losing key ecosystem components; fire frequencies have increased or decreased by one or more intervals from their historic range; vegetation and fuel attributes have been moderately altered, resulting in potential changes to one or more of the following: fire size, intensity and severity, and landscape patterns.

- **Condition Class 3**- fire regimes have been drastically altered from their historical range; the risk of losing key ecosystem components is high; vegetation has been substantially altered from their historical range; fire frequencies have departed from historical frequencies by multiple return intervals, resulting in dramatic changes to one or more of the following: fire size, intensity, severity, and landscape patterns.

The following table depicts the Treatment Areas, VRU, Historical Fire Type, Fire Return Interval and Condition Class. The condition class is based on the most recent fire occurrence, severity, number of missed fire return intervals, stand density relative to historic condition, and presence of exotic species. Treatment areas may be assigned more than one category to accurately portray the variability within these units

VRU, Fire Regime, and Condition Class for Haacke-Claremont Proposed Units

Units Affected	VRU	Historical Fire Type	Fire Return Interval (years)	Fire Group	Condition Class
3, 21	2	Low to Mixed Severity	15 - 45	2, 4	3
1, 2, 5, 6, 7, 9, 10, 12, 13, 14, 17, 18, 20, 26, 27, 28, 29	2	Low to Mixed Severity	15 – 45	2, 4	2
1, 4, 22, 23, 26, 27	7	Stand Replacing with Mosaic of Low & Mixed Severity	120+	9	1
12, 13, 14, 22, 28	9	Primarily Stand Replacing with some Mixed & Low Severity	100+	7, 8	1

Approximately 48% of the proposed planning area is classified as VRU 2, 14% is classified as VRU 7 and 32% is classified as VRU 9. This means that 48% of the project area would have had

periodic low to moderate severity fire 2-6 times since 1900 under the historic fire regime. Approximately 14% of the project area should have a low severity or stand replacement fire soon and lands classified as VRU 9 (32% of the area) would still typically be within its historical range of variably according to the historical fire regime.

Units with a condition class of 1 are still within the range of historic conditions. The majority of units proposed for treatment have a condition class of 2, which means they have been moderately altered from historic conditions. The juxtaposition of these units across the landscape is important since it affects how fire behaves across the landscape. Stands with a condition class of 1 could have a severe fire if the adjacent stand creates conditions that cause a crown fire moving into it.

Without reoccurring fire on the landscape, the end result is a change in fire regime from a primarily low to moderate severity fire regime to a fire of higher severity. The current altered fire regime would be best described as low frequency, with a greater proportion of high intensity, stand replacing fire.

Fuel Models.

In order to quantify the effects of a wildfire a fuel model is selected to use as input to the fire spread model (Rothermel 1972). A fuel model (FM) is defined as a set of fuelbed inputs needed for a particular fire behavior or fire effects model. (Scott and Burgan 2005). A fuel model is chosen by the primary carrier of the fire (e.g. grass, brush, timber litter, slash) and its fuel characteristics (e.g. fuel loading, surface area to volume ratio, fuel depth, etc). Rothermel (1983) has a detailed discussion on fuel models and how they are used to predict the spread and intensity of forest and range fires.

Fuels models contained within the project area, as described by Anderson (1982), Scott and Burgan (2005) which are defined below.

- **Fuel Model 2 (Timber, grass and understory).** Fire spread is primarily through the fine fuels, such as grass and pine needles. The stand is open where larger pine and Douglas fir cover one to two thirds of the area. Surface fuel loading, less than 3 inches in diameter, averages 4 tons per acre. Surface fuel bed depth is 1.0 feet.

- **Fuel Model 8 (Timber, closed timber litter).** A typical stand includes a closed canopy of short-needled conifers, such as Douglas fir. The compact litter layer consists of needles, leaves and occasional twigs. Surface fuel loading, less than 3 inches in diameter, averages 5 tons per acre. Surface fuel bed depth is .2 feet.

- **Fuel Model 10 (Timber, litter and understory).** Fuels in this model include greater quantities of dead and down material three inches and greater. Any forest type may be considered if heavy down material are present, such as those caused by insects, disease, wind throw, or over maturity. Surface fuel loading, less than 3 inches in diameter, averages 12 tons per acre. Surface fuel bed depth is 1.0 feet.

- **Fuel Model 11 (logging slash).** Fuels in this group are a result of timber or vegetation manipulation. Fires are fairly active in the slash and herbaceous material intermixed with the slash. Spacing of the light fuel loading, shading from overstory, or the ageing of the fine

fuels contribute to limiting the fire potential. Surface fuel loadings less than 3 inches are less that 12 tons per acre. Greater than 3 inch material is represented by not more than 10 pieces, 4 inches in diameter, along o 50-foot transect. Surface fuel depth 1 foot or less. Flame length and rate or spread varies with amount of and age of fine fuels.

- **Fuel Model TU1 (light load, dry climate timber-shrub).** TU1 is similar to fuel model 8, but with a slightly higher spread rate and flame length. This is a dynamic fuel model which means it takes into account the herbaceous fuels shift between live and dead according to moisture levels.

Due to the size, shape and variability across the landscape more than one fuel model may be selected for the treatment units thus allowing for more accurate calculations of potential fire behavior and effects. The following table displays major fuel models present per unit. Fuel loadings varied across the units. Fuel loadings listed are derived from on-the-ground fuel transects, visual observation, and photo interpretation. Some may be higher or lower depending on exact plot location.

EXISTING FUEL MODELS

Treatment Unit	Fuel Model 2	Fuel Model 8	Fuel Model 10	Fuel Model 11	Fuel Model TU1	Fuel loading (tons)
Unit 1	x			x	x	2-20
Unit 2	x	x		x		2-40
Unit 3	x	x	x			8-80+
Unit 4		x	x			12-80
Unit 5	x	x	x	x	x	10-100+
Unit 6			x			5-80
Unit 7	x			x	x	4-50
Unit 9	x					4-50
Unit 10		x	x	x	x	4-50
Unit 12	x	x		x	x	2-30
Unit 13	x		x			5-60
Unit 14	x	x	x			4-80
Unit 15			x			2-40
Unit 16	x			x		8-40
Unit 17	x			x	x	8-40
Unit 18				x	x	4-40
Unit 20	x			x	x	4-40
Unit 21	x	x		x	x	4-40
Unit 22	x			x	x	4-40
Unit 23	x			x		4-40
Unit 24	x			x		4-40
Unit 25	x			x		4-40
Unit 26	x	x	x	x		4-40
Unit 27	x			x		4-35
Unit 28		x	x			4-50
Unit 29		x		x		8-60

Brown (2003) recommended a desired fuel loading of 5 to 10 tons per acre on VRU2 lands, and 10 to 30 tons per acre on VRU7 and VRU9 lands. This desired range provided sufficient coarse wood for site productivity and wildlife but also allowed for safer fire suppression, with less resistance-to-control, and less detrimental soil heating. The above table indicates that fuel loading varies across the proposed treatment units and that portions of almost all units have fuel loading far in excess of 30 tons per acre. Prescribed burning will reduce fuel loading and can change the fuel model from FM 10 or 11, which is less desirable, to FM 8 or 2 which generally results in less severe fire behavior.

Fire Behavior

Fire behavior is strongly influenced by fuel structure, composition and wind events. Low and mixed severity fires historically created a mosaic of forest conditions across the landscape and these patterns in turn affected future fire activity. Fire suppression and harvest activities have changed the structure and composition by increasing the accumulation of fire intolerant vegetation and the amount of dense forest canopies. Forest structure across the landscape is more homogenous and continuous both horizontally and vertically. This increases the potential for crown fires. From a fire management viewpoint, any decision to manipulate vegetation in this area should consider breaking up continuity of stands and associated heavy fuel loadings. This could help reduce the frequency and size of stand replacement fires.

Within the project area, normal fire season runs from May through September. During fire season, gradual drying of forest fuels occurs throughout the summer. July and August is the peak time of year for thunderstorm development, where southwest flows bring moisture from the southwest into the Bitterroot Range bringing various amounts of rain and lightning fires. Recent history has showed lightning occurring into early October. Weather variables and fuel moistures change frequently and are the primary factors that affect fire behavior. Winds tend to come down the valley from the south, south west and west.

Canopy base height, canopy bulk density, and canopy continuity are key characteristics of forest structure that affect the initiation and propagation of crown fire (Albini 1976, Rothermel 1991). Canopy base height is important because it affects crown fire initiation. Continuity of canopies is more difficult to quantify, but clearly patchiness of the canopy will reduce the spread of fire within the canopy stratum. Forest treatments that target height to live crown and bulk density can be implemented to reduce the probability of crown fire (Graham, 2004). Canopy bulk density varies considerably within stands and units but can reach maximum values of 0.4 kg-3. Thinning to reduce canopy bulk density to less than 0.10 kg/m3 is generally recommended to minimize crown fire hazard (Agee 1996, 1998b, Graham and others 1999), and for the most part below this point, active crown fire is difficult to achieve (Scott and Reinardt 2001).

Environmental Consequences

Direct and Indirect Effects of Alternative 1. -- No Action

- Fire suppression capability would not be increased, because fireline intensities and flame lengths would be such that mechanized equipment and indirect firefighting tactics would be needed for control.

- Firefighter safety would not be improved because of fireline intensities, flame length, crown fire potential.
- Future wildland fires would not exhibit higher rates of spread but would increase in intensity and severity because of the accumulation of surface fuels, ladder fuels and canopy bulk density.
- Private property protection, adjacent to and near the project area, would not be improved because fireline intensities and flame lengths would be such that mechanized equipment and indirect firefighting tactics would be needed for control.
- Cost of fire suppression would not be reduced because the difficulty of suppression operations would require a larger firefighting organization.
- Fire suppression strategies (control) would be increasingly difficult to attain over time because the use of prescribed fire alone to manage fuel accumulations would generate undesirable fire effects.
- Does not reduce the potential for major smoke impacts due to wildland fires.
- Not consistent with National Fire Plan, Healthy Forest Initiative, Forest Plan and the Forest Land and Resource Management Plan because we are not reducing the accumulation of hazardous fuels.
- Does not decrease the potential for destructive crown fires because we are not increasing canopy base height, reducing ladder fuels and reducing the amount of surface fuels.

Cumulative Effects of No Action

Fuels will continue to build, increasing the probability of large fires that will be difficult to control and increase the risk to firefighter safety. The chance of these fires spreading into the local valleys and interface will increase. The opportunities to manage the ecosystem with prescribed fire will decrease as fuels increase. Providing a cost-effective fire protection and fuels management program that is compatible with the role of fire in forest ecosystems and responsive to resource management objectives will become more difficult to achieve.

Direct And Indirect Effects Of Fuel Treatments Alternatives 2 And 3

The purpose of the proposed actions are to reduce the density of forest canopies, break up the homogenous and continuous horizontal and vertical structures and to reduce the accumulation of fire intolerant vegetation in order to maintain the stands in a low to moderate severity fire regime.

Although fire suppression within and adjacent to our continually growing urban-interface communities is a necessity to protect life and property, there is an urgent need to reintroduce planned fire back into these areas. With proper planning and implementation, fire can be used as an important tool to bring ecological health back into these areas while limiting the possibility of an unwanted wildfire event

Treatment Summary

Units 7 and 12

The proposed action is to apply prescribed fire to all or parts of these units. Slashing of small understory trees, lopping and scattering slash, or piling slash may occur prior to the application of fire. All burning would be done under favorable air dispersion conditions..

Units 1, 2. 3, 4, 5, 6, 9, 10, 13, 14, 15, 28

Commercial harvest (thinning with various sized openings) is proposed for these units. Whole tree yarding or yarding with tops attatched will remove branchwood and tops associated with the commercial thin. This slash will be burned at a later date. Prescribed fire would be applied to these units through a combination of jackpot burning, broadcast burning and/ or pile burning. This would occur either in the spring or fall of the year when conditions allow burning safely, within the direction provided in this analysis, and when acceptable smoke dispersion quidelines can be met. Slashing of small understory trees, lopping and scattering slash, or piling slash may occur prior to the application of fire.

Units 16, 17, 18, 20, 21, 22, 23, 24, 25, 26, 27, 29

The proposed action is to noncommercially thin all or portions of the unit. Cut trees may be hand piled or left on site depending on stand conditions, size of material, risk of insect attack, or location of the unit.

All or parts of these units will eventually be prescribed burned. This future treatment is not a part of this proposal but is part of the management of these units to reduce fuel loading and restire historic vegetation conditions. Prescribed fire would be applied when weather and fuel conditions allow for protection of the residual trees and smoke dispersion regulations can be met.

Implementation of these two alternatives would:

- Increase fire suppression capability within the project area
- Provide for greater firefighter safety
- Reduce the risk of a fire moving from National Forest lands to private property
- Reduce the potential for extreme fire behavior by:
    - Reducing fuel loadings
    - Reducing ladder fuels (increasing canopy base height)
    - Breaking up the continuity of fuels
    - Reducing tree densities (canopy bulk density)
    - Reducing tree species susceptible to fire mortality
    - Increasing fire resilient species
    - Reducing susceptibility to insects
- Manage tree species composition, structure and density to improve tree vigor and resilience to disturbance
- Create vegetative conditions favorable for the reintroduction of prescribed fire in designated treatment areas consistent with historic disturbance regimes

- Apply prescribed fire at optimum times to meet intended objectives and meet the Montana Idaho air quality constraints and standards.

Fuel reduction from harvest and thinning activities will provide better opportunities for fire control and management of the stand structure with prescribed fire. In general, well timbered stands within the project area could not be easily burned without some kind of prior mechanical treatment except under conditions that would make it very difficult and expensive to meet resource objectives since the risk of escape would be high and the outcome would be uncertain. Over arching resource objectives, including wildlife habitat, timber and visual resources, make a "burn only" option unlikely to succeed under existing stand conditions.

Breaking up the fuel continuity of stands will help reduce the frequency and size of stand replacement fires and provide for firefighter safety through increased control capabilities. These action alternatives will improve the level of suppression capability in this area. The fire risk is likely to increase during harvest and post treatment activities. This risk is associated with personnel activities, equipment, and accumulation of fuels during and after harvest. These are acceptable trade-offs in the short term to reduce the fire hazards in the long term. There is also the risk of fire escape during prescribed fire activities. All vegetation and fuel treatments considered will, over time, reduce fuel hazards by reducing fuel loads, ladder fuels, and stand density.

Although fire suppression within and adjacent to our continually growing urban-interface communities is a necessity to protect life and property, there is an urgent need to reintroduce planned fire back into these areas. With proper planning and implementation, fire can be used as an important tool to bring ecological health back into these areas while limiting the possibility of an unwanted wildfire event

Stand density thinning and crown opening would occur in stands that have high stand density, and more continuous crown density than is desirable from a fuel management perspective. Many of these stands also have higher density than would occur within historic fire regimes. Reducing stand density would decrease ladder fuels and help modify fire behavior allowing an increased chance of successful initial attack were a fire to occur in this area. The probability that extreme fire behavior would occur will be reduced (Graham, McCaffrey, Jain, 2004).

Yarding tree tops would be required to remove the excess biomass from the site. This would allow for greater opportunities to utilize prescribed fire because reduction in logging slash will help reduce fire intensity. It also may provide the opportunity for greater utilization such as Fuels for Schools program or small roundwood sales.

Reduction of ladder fuels through harvest and slashing would break up the continuity from the surface fuels to the canopy fuels, and reduce the likelihood of crown fire ignition. Aerial fuels separated from surface fuels by large gaps tend to be more difficult to ignite, thus requiring higher intensity surface fires, surface fires of longer duration, or ignition from spotting to ignite the crowns, and of course wind.

Surface fuel reduction would occur through hand piling, piling slash at log landings, or underburning. Reducing the amount, depth and continuity of surface fuels (especially those less than 3 inches in diameter), reduces the likelihood that overstory canopies would ignite during a wildfire. This would modify fire behavior so wildfires can be suppressed more easily. (Graham, McCaffrey, Jain, 2004).

A Forest Plan Amendment is proposed for retention of coarse woody material. Material left on site would vary by fire group and are within the levels suggested by Brown et al. (2003) for managing sites for reduced fire behavior, better resistance to control, and acceptable levels of soil heating.

A relative light surface fire can be used to remove Douglas-fir understories, reducing competition for moisture and nutriments. Where such fires burn hot enough to create openings in the stand or to bare mineral soil in existing openings, ponderosa pine, larch and other species regeneration may become established. Increased sunlight to the forest floor would also stimulate growth of other understory vegetation.

The proposed treatments would reduce the amount of shading on surface fuels, increase the wind speeds to the forest floor, reduce the relative humidity at the forest floor, increase the fuel temperature, and reduce fuel moisture. These factors may increase the probability of ignition over current conditions and, in some instances, surface rates of fire spread will increase. However, by reducing ladder fuels surface fires have a lower potential for progressing into crown fires, and by reducing crown bulk density, there is a lower potential that individually torched trees will progress into a crown fire. Lower overall fireline intensity and lower fire severity would increase opportunities for safe fire management actions (Van Wagner 1977, Rothermel 1983, 1991).

Cumulative Effects for Alternatives 2 and 3

Past, ongoing and reasonable foreseen projects would affect the geographic area in a variety of ways. Timber sales, prescribed fires and fuel reduction projects would all serve to reduce fuel loadings and disrupt fuel continuity of large fuels. Fine fuels would be expected to increase to certain degree, but since they provide less resistance to control, are considered more favorable for fire suppression objectives than heavy loads of large fuels.Private land holdings have done some reduction of large fuels in the immediate area and there is an increase of fine fuels up to the forest boundary. Continuing fire suppression has and will continue to allow fuels to increase in amount and continuity.

The effects from wildfire versus prescribed fire can vary drastically depending on the timing of the burn. Both fulfill the role of restoring fire as an ecological process back into the landscape. At the current time, prescribed fire is preferred over allowing a wildfire to burn across this area. . Some areas have been protected from fire long enough that a wildfire would likely burn with uncharacteristic intensity (outside the typical disturbance regime) and result in conditions that meet some objectives but not others . The management objectives for most of this area include other human values like recreation and forest products; protection of the watershed, fisheries and wildlife. There is also a need to protect human values such as home sites.

Smoke Management and Air Quality

Air quality in the Bitterroot valley is of primary concern. The Clean Air Act specifically outlines the requirements for air resource management. A smoke management program developed between Montana fire fighting organizations in cooperation with state environmental quality agencies allows burning only under specific parameters of time, place, and weather conditions. It’s purpose is to keep smoke at an acceptable level and away from population concentrations.

Under these parameters, areas can be burned only when current weather situations meet prescribed conditions.

In the Haacke-Claremont drainage, prevailing winds usually come from the southwest or west. During the evening, and especially in the fall, most of the smoke from prescribed burns flows down the drainages settling into the Missoula and Bitterroot valleys. At elevations less than 5000 feet, fall burning has a very narrow "window of opportunity" due to its impact on air quality in the Bitterroot valley. This effect could be minimized by burning in the spring when air dispersal is more favorable due to the frontal passage associated with springtime ventilation in the northwest. In addition, completing burning early in the afternoon allows smoke and heat time to dissipate before the diurnal wind changes occur.

A burn plan will be prepared and approved prior to any prescribed burning. Prescribed fires will be planned and scheduled to burn under conditions that produce a strong convection column with smoke dispersal directed away from valley areas or other smoke sensitive areas.

Prescribed burning is preferred over allowing a wildfire to burn across this area. Accumulations of dead and living fuels resulting from years of intensive fire protection has the potential to lead to wildfires that results in more serious air pollution than those resulting from a program of prescribed burning with smoke management.

Consistency With The Forest Plan

The Forest Land and Resource Management Plan, Appendix M, directs prescribed fire and the application of fire to ensure healthy, dynamic ecosystems while meeting resource management objectives. The proposed action is consistent with Management Area goals and Fire Management direction.

WILDLIFE

Affected Environment & Effects to Wildlife

Wildlife Species Analyzed and Summary of Effect Determinations

Species considered in this analysis include federally listed proposed, threatened, and endangered species, Forest Service sensitive species, and Forest Plan management indicator species (MIS) (USDA Forest Service 1987). The table below provides a list of all species in these categories known or suspected of occurring on the Forest, status, habitat preference, whether the habitat or species are present in the analysis area, and whether the habitat or species will be impacted by proposed treatments. The following species and their habitats were dropped from further analysis because the analysis area is outside the range of the species' distribution and will not be impacted by the project: yellow-billed cuckoo**,** bald eagle, fisher, North American wolverine, northern bog lemming, American peregrine falcon, western toad, Coeur d'Alene salamander northern leopard frog. Rationale and documentation for dropping these species from further analysis is located in the project file (PF#J-Wildlife1&2).

Wildlife Species Analyzed and Summary of Effect Determinations

Species considered in this analysis include federally listed proposed, threatened, and endangered species(PF#J-Wildlife1), Forest Service sensitive species and Forest Plan management indicator species (MIS) (USDA Forest Service 1987) (PF#J-Wildlife2). The table below provides a list of all species in these categories known or suspected of occurring on the Forest, status, habitat preference, whether the habitat or species are present in the analysis area, and whether the habitat or species will be impacted by proposed treatments.

Wildlife Species Considered in the Haacke-Claremont Analysis Area

SPECIES	STATUS	HABITAT PREFERENCE	HABITAT OR SPECIES PRESENT IN ANALYSIS AREA	HABITAT OR SPECIES IMPACTED BY PROPOSED TREATMENTS/ SUMMARY DETERMINATION*
Gray Wolf	Experimental Nonessential	Forests in western Montana	Y	Y, NLJ
Yellow-billed cuckoo (western population)	Candiadate	Riparian areas with cottonwoods and willows	N	N, NE
Bald Eagle	Sensitive	Nesting trees/platforms near large rivers or lakes; available fish and water bird species prey.	N	N, NI
Fisher	Sensitive	Moist coniferous forested types (including mature and old growth spruce/fir), riparian/forest ecotones	N	N, NI
North American	Sensitive	Large areas of unroaded security habitat; secure denning habitat, ungulate carrion in	N	N, NI

Wolverine		winter.		
Northern Bog Lemming	Sensitive	Wet riparian sedge meadows, bogs, fens.	N	N, NI
Townsend's Big-Eared Bat	Sensitive	Roosts in caves, mines, rocks and buildings. Forages over tree canopy, over riparian areas or water.	Y	N, MIIH
American Peregrine Falcon	Sensitive	Cliff nesting (ledges); aerial foraging over open areas for small to medium-sized bird species prey.	N	N, NI
Black-backed Woodpecker	Sensitive	Burned or insect-killed forests.	Y	Y, MIIH
Flammulated Owl	Sensitive	Mature and old growth ponderosa pine with open understory, with abundant moth species prey.	Y, seasonal migrant	Y, MIIH
Northern Goshawk	Sensitive	Mature forests with large trees, relatively closed canopies, and open understories for nesting, diverse habitat conditions for foraging.	Y	Y, MIIH
Western (Boreal) Toad	Sensitive	Terrestrial habitat generalist; breeds in ponds, slow streams	N	N, NI
Coeur d'Alene Salamander	Sensitive	Spray zones near waterfalls or seeps in fractured bedrock.	N	N, NI
Northern Leopard Frog	Sensitive	Non-forested ponds.	N	N, NI
Pine Marten	Old Growth MIS	Mature and older lodgepole, subalpine fir and spruce forests with abundant down logs.	Y	Y, MIIH
Pileated Woodpecker	Old Growth MIS	Mature and older lower to mid-elevation conifer forests or cottonwood gallery forests with large snags and down logs.	Y	Y, MIIH
Elk	Commonly Hunted MIS	Habitat generalist. Winter range in lower elevation conifer/shrub/grasslands.	Y	Y, MIIH

*** Definitions of Summary Determination Abbreviations**: For TES species: NE = No effect, NLJ = Not likely to jeopardize, NLAA = Not likely to adversely affect, LAA = Likely to adversely affect, BE = Beneficial effect. For Sensitive Species: NI = no impact; MIIH = may impact individuals or habitat, but will not likely result in a trend toward federal listing or reduced viability for the population or species; WIVH = will impact individuals or habitat with a consequence that the action may contribute towards federal listing or result in reduced viability for the population of species; or BI = beneficial impact.

THREATENDED (T) – Any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.
CANDIDATE (C) – Those taxa for which the Service has sufficient information on biological status and threats to propose to list them as threatened or endangered. We encourage their consideration in environmental planning and partnerships, however, none of the substantive or procedural provisions of the Act apply to candidate species.
EXPERIMENTAL NONESSENTIAL POPULATION (XN) – A population of a listed species reintroduced into a specific more flexible management under the Act

Regulatory Framework

The regulatory framework providing direction for the protection and management of wildlife and habitat for the Haacke-Claremont project comes from the following principal sources.

Endangered Species Act of 1973 (as amended)

Section 7 of the Endangered Species Act (ESA) directs that actions authorized, funded, or carried out by federal agencies do not jeopardize the continued existence of any threatened or endangered (T & E) species, or result in the adverse modification of habitat designated as critical to these species. The Bitterroot National Forest consults with the US Fish and Wildlife Service (USFWS) as required concerning the effects of projects on T & E species. In accordance with the requirements of the ESA, a stand-alone Biological Assessment (BA) has been prepared (PF#Wildlife1) for this project that addresses the direct, indirect, and cumulative effects of the selected alternative on threatened and endangered wildlife species, species habitat, individuals, and populations.

National Forest Management Act of 1976

The National Forest Management Act (NFMA) provides for balanced consideration of all resources. It requires the Forest Service to plan for a diversity of plant and animal communities. Under its regulations the Forest Service is to manage for viable populations of native and desired non-native species, and to maintain and improve habitat of management indicator species.

Forest Plan

The Bitterroot Forest Plan of 1987, in compliance with NFMA, establishes Forest-wide management direction, goals, objectives, standards and guidelines for the management of wildlife species and habitats on the Forest. Direction covers old growth habitat, management indicator species, sensitive species, and threatened and endangered species.

The Bitterroot Forest Plan requires that habitat be provided to support viable populations of native and desirable non-native wildlife, and to maintain habitat for the recovery of threatened and endangered species (USDA Forest Service, 1987:II-3). Habitat needs of sensitive species and protection of threatened and endangered species is to be considered in all project planning (USDA Forest Service, 1987:II-21). Sensitive species are designated by each Region of the Forest Service according to the occurrence of the species and its habitat within Regional boundaries. Forests are then required to prevent declines in sensitive species populations that might lead to listing under ESA (FSM 2670.32 (4). Region 1 sensitive species for the Bitterroot National Forest that could be affected by the proposed action are evaluated in this document.

The Record of Decision (1987) for this plan requires retention of 25 percent of the big game winter range in thermal cover. Other Forest Plan standards related to maintenance of wildlife populations include standards for the amount and distribution of old growth habitat by management area, retention of snags, maintenance of elk populations and habitat, and management of elk habitat effectiveness through the Travel Management process (USDA, Forest Service, 1987).

The Haacke-Claremont analysis area includes proposed vegetation treatments in management areas (MAs) 1, 2, and 3a. The goals and standards for each of these management areas can be found in the Forest Plan on pages III-4 to III-31.

Species Further Evaluated for Effects

Gray Wolf (*Canis lupis*) (Non-Essential-Experimental)

Effects Analysis Methods

There is no evidence that gray wolves occurred in the project area in recent decades prior to the U.S. Fish and Wildlife Service's reintroduction efforts near the Salmon River (see below) in January 1995. The analysis of potential impacts looks at potential for temporary disturbance for the proposed action.

Affected Environment

The Haacke-Claremont area is in the vicinity of two wolf pack territories (USFWS 2006). http://www.fws.gov/mountain-prairie/species/mammals/wolf/annualrpt06/index.htm The Sapphire pack contains an estimated 14 wolves and the Skalkaho pack has an undetermined number of wolves (PF#J-Wildlife1).

The Bitterroot NF, including the Haacke-Claremont project area is within the boundaries of the Central Idaho Experimental Population Area (CIEPA) for gray wolves. The CIEPA includes all of Idaho south of I-90 and north of I-84 and I-86 and west of I-15, and all of western Montana south of I-90 and west of I-15. Any wolves within this area are treated as a proposed species under Section 10 (j) of the Endangered Species Act. Therefore, the Forest is only required to consult with the Fish and Wildlife Service if an action "is likely to jeopardize the continued existence" of the species. Wolves are classified as a habitat generalist. The entire project area is currently suitable habitat for wolves from the standpoint of the vegetation.

The Reintroduction of Gray Wolves to Yellowstone National Park and Central Idaho Final Environmental Impact Statement (USDI FWS 1994) shows the entire Bitterroot Forest within the boundaries of the Central Idaho Non-essential Experimental Population Area. A non-essential experimental population is defined as an introduced population, not essential to survival of the gray wolf in the wild. The Selected Alternative, for which the ROD was signed in early July 1994, programs the reintroduction and recovery process for the Central Idaho area in great detail.

Under the conditions for management of the non-essential experimental population published in the Federal Register November 22, 1994, the only land management restriction in the recovery area would be to:

> "…control intrusive human disturbances around active wolf den sites. Such temporary restrictions on human access, when five or fewer breeding pairs are established in an experimental area, may be required between April 1 and June 30, within one mile of active wolf dens or rendezvous sites and would only apply to public lands…. When six or more breeding pairs are established in an experimental population area, no land-use restrictions may

be employed outside of national parks or national wildlife refuges..." (USDI FWS 1994).

As of 09/15/2001 the recovery goal of thirty breeding pairs of Wolves has been met, therefore because there are six or more breeding pairs in the experimental population area, no land-use restrictions may be employed outside of national parks or national wildlife refuges (Mack, 2001). Estimates of wolf numbers at the end of 2006 were 739 wolves in the Central Idaho Recovery Area (CID). In 2006, a minimum estimate of 76 wolves in 16 packs was verified in the Montana portion of the CID (http://www.fws.gov/mountain-prairie/species/mammals/wolf/annualrpt06/index.htm, 2006). The Rocky Mountain Wolf Recovery 2006 Annual Report states that there were total minimum estimate of 1,300 wolves in the tri-state area (http://westerngraywolf.fws.gov/annualrpt04/index.htm, 2006). Of approximately 173 packs (groups of 2 or more wolves), 86 packs met the definition of "breeding pair," defined as an adult male and female raising 2 or more pups until December 31. This made 2006 the seventh year in which 30 or more breeding pairs were documented and well distributed within the 3-state area. Biological recovery criteria have been met for removing NRM wolves from the Endangered Species list (http://www.fws.gov/mountain-prairie/species/mammals/wolf/annualrpt06/index.htm, 2006). On March 29 2007 DOI prposed designating the Northern Rocky Mountain Population of Gray Wolf as a Distinct Population Segment and removing this Distinct Population Segment from the Federal List of Endangered and Threatened Wildlife (50 CFR Part 17 RIN 1018–AU53).

Environmental Effects

Direct & Indirect Effects

Alternative 1

The No Action alternative would not affect gray wolf habitat or populations in the short term. This alternative would not affect the availability of prey for wolves because it would not change existing habitat conditions. It would not change the potential for human disturbance because it would not affect existing open road densities.

Effects Common to Alternatives 2 and 3

Vegetation treatments proposed in these alternatives could result in minor changes to population numbers of deer and elk in the project area because they would result in increased forage production and reduced hiding cover. See elk analysis for more information.

Proposed activities have the potential to displace individual wolves from using a den or rendezvous site if one or both were to occur in the analysis area. The proposed action is consistent under the conditions for management of the non-essential experimental population published in the Federal Register November 22, 1994. The only land management restriction in the recovery area would "control intrusive human disturbances around active wolf den sites. Such temporary restrictions on human access, when five or fewer breeding pairs are established in an experimental area, may be required between April 1 and June 30, within one mile of active wolf dens or rendezvous sites and would only apply to public lands..."(USDI, 1994). "When six or more breeding pairs are established in an experimental population area, no land-use restrictions may be employed outside of national parks or national wildlife refuges..." (USDI,

1994). There are 86 breeding pairs within the tri-state area, which includes Idaho, Montana, and Wyoming.

Although there is potential for displacement of individual wolves, the potential is considered to be low. Ample habitat is available for wolves to disperse to with territories ranging in size from 300 to 400 square miles.

Cumulative Effects

Geographic Boundaries

The defined effects area for wolves is the Haacke-Claremont analysis area. Because of the localized nature of effects associated with the proposed action this analysis area is appropriate to analyze any incremental effects from the actions of this project on wolves in conjunction with past, present, and ongoing actions.

Other Actions & Trends

Wolves were not present in the Haacke-Claremont analysis area during much of the period of management activities. Statewide bounties were placed on gray wolves from 1883 to 1915 with approximately 80,730 wolves killed during that period. Wolves were exterminated from most of Montana with the last known wolf shot in Lincoln in 1961. With wolf territories estimated at 300 to 400 square miles, the potential effects of proposed treatments, along with past and foreseeable future management actions will have a negligible effect on wolves or their habitat. Gray wolves are currently proposed as recovered in the Northern Rocky Mountains including the Bitterroot National Forest (50 CFR Part 17 RIN 1018–AU53).

Determination

Alternative 1

Implementation of this alternative will have No Effect on wolves or their habitat.

Alternatives 2 and 3 Wolves within this area are treated as a proposed species under Section 10 (j) of the Endangered Species Act. As a result, the effects call for either of these alternatives is **Not Likely to Jeopardize the Continued Existence of the Species or Result in Destruction or Adverse Modification of Proposed Critical Habitat.** This effects call does not require consultation with the U.S. Fish and Wildlife Service.

Determination Rationale:

- The proposed action would not disturb known den and rendezvous sites
- The results of the project may potentially benefit prey species such as big game
- There is ample habitat available for wolves to disperse within and adjacent to the project area.

Black-backed Woodpecker (*Picoides arcticus*) (Sensitive)

Effects Analysis Method

The analysis for black-backed woodpecker for the Haacke-Claremont project focuses on two evaluation criteria:

- Impacts to snags in high quality habitat (moderate or severe fire areas burned within the last six years)
- Impacts to snags in secondary habitat (patches of insect and disease infestations). Further explanation of these evaluation criteria and why they were selected, including a look at contradicting information in the literature, follows.

Black-backed woodpeckers' preference for recently burned forest has led to its listing as sensitive. Most research on black-backed woodpeckers indicates that they are dependant upon fires, particularly in the Northern Rockies (Hutto 1995, Caton 1996, Hitchcock 1996, Murphy and Lehnhausen 1998, Saab and Dudley 1998, Hejl and McFadzen 2000). Post-burn area studies in Oregon, Montana, Idaho, and South Dakota consistently report that wood-boring beetles that occur in abundance (2 to 8 years) following a fire are an important food source for the woodpecker. Hutto (1995) stated the black-backed appears nearly restricted to post-burns, and Murphy and Lehnhausen (1998) postulated that local populations increase in number in post-burned areas and decrease in unburned areas. Preferred nesting habitat is characterized by high snag densities (Hejl and McFadzen, 2000).

Black-backed woodpeckers however, are also found in unburned forests and in areas of insect outbreaks (Bock and Lynch 1970, Apfelbaum and Haney 1981, Harris 1982, Goggans et al. 1989), but they likely occur at lower densities and viability may not be maintained over time without sufficient post-fire habitat. For example, home ranges for black-backed woodpeckers in beetle-killed forests were estimated to be 1,000 acres, compared to an estimated territory size of 56 acres/pair in post fire habitat (Powell 2000). Some studies indicate that black-backed woodpeckers forage primarily on wood-borers, which may explain this difference in suitability between beetle outbreaks and post-fire habitat. Wood borers are much less abundant than bark beetles in areas of bark beetle outbreaks (Powell 2000). However, insect outbreak studies (without fire) suggest the species is attracted to other insects such as bark beetles when these insects provide an abundant prey base (summarized in Samson 2006). Arnett (et al. 1997a and 1997b) found similar densities of black-backed woodpeckers in mountain-pine beetle killed areas, as in post-burns, further suggesting the species is not “restricted” to post-burns. Hoyt and Hannon (2002) noted that few studies have considered all habitats in proportion to availability nor considered the difficulty in comparing bird densities observed in open post-fire habitats versus bird densities observed in closed canopy and structurally complex, live forests.

For these reasons, the Haacke-Claremont analysis looks at both post fire snag habitat and insect and disease snag habitat in our analysis of potential effects of proposed activities.

Affected Environment

The Haacke-Claremont project area has not experienced any moderate or high severity fire in many years. As a result, the area currently does not offer post burn habitat that could support large numbers of black-backed woodpeckers. Recent mortality due to a variety of insect and disease pathogens has affected scattered pockets of trees within the project area. Recent snags in these areas support populations of various beetles that could provide a food source for smaller numbers of black-backed woodpeckers. Many individual woodpeckers of several species were detected during wildlife habitat surveys in the project area, but we did not observe any black-backed woodpeckers

Mountain pine beetle activity has been increasing within the analysis area having the potential to be epidemic. Currently, within several units there are several pockets of mortality in lodge pine pole. Several stands have multiple beetle kill accumulations from past outbreaks. These same units have over 80 tons of downed fuels due to MPB mortality in lodgepole pine. The majority of lodgepole pine within the analysis area averages 110 years of age and is densely overstocked

Within the analysis area, Douglas-fir is found mixed with lodgepole pine, western larch, and ponderosa pine. Walkthrough surveys conducted in the analysis area in 2007 noted Douglas-fir beetle (DFB) activity had decreased. Much of the mortality is 2-3 years old and new attacks from this year were limited. Unlike other areas of the Bitterroot NF, the analysis area appears to have endemic levels of DFB activity.

Environmental Effects

Direct and Indirect Effects

Alternative 1

This alternative would not reduce existing snag numbers, and would therefore not affect the amount of secondary habitat available for black-backed woodpeckers in the short term. Existing population levels of black-backed woodpeckers would likely increase because the number of trees killed by recent mountain pine beetle attacks appears to be rising. Sometime in the future, the high fire risk caused by dense stands with closed canopies and high fuel loadings would result in increased mortality due to pathogens, and/or a large scale, moderate to severe fire that would create abundant, if temporary, habitat for black-backed woodpeckers. The large numbers of snags and abundant beetle populations created by these conditions would likely attract and support a large population of black-backed woodpeckers for several years.

Alternative 2

This alternative would not affect any high quality habitat for black-backed woodpeckers because there are no recent moderate or severe burns within the project area. Treatments included in this alternative would reduce the habitat quality of currently suitable secondary habitat where trees have been killed by insects or diseases. Most of these reductions would occur within the 672 acres of commercial thin units. Although the snag retention guidelines would retain sufficient snags in these units for most woodpecker species, removing some or most of the existing snags would result in poor quality habitat for black-backed woodpeckers. This species seems to prefer high snag densities, and is rarely found in burned areas that have been partially salvaged (Hejl

and McFadzen 2000). Units designated as prescribed burn or non-commercial thinning would have little effect on the number of snags within those units. These types of units contain little existing suitable habitat for black-backed woodpeckers.

Overall, this alternative could cause a small reduction in the number of black-backed woodpeckers the project area is capable of supporting in the short term. In the long term, this alternative would reduce the risk of a large, high to moderate intensity fire or a beetle epidemic, either of which could provide a large amount of suitable habitat and could potentially attract large numbers of black-backed woodpeckers for several years.

Alternative 3

This alternative would not affect any high quality habitat for black-backed woodpeckers because there are no recent moderate or severe burns within the project area. Treatments included in this alternative would reduce the habitat quality of currently suitable secondary habitat where trees have been killed by insects or diseases. Most of these reductions would occur within the 735 acres of commercial thin units. Although the snag retention guidelines would retain sufficient snags in these units for most woodpecker species, removing some or most of the existing snags would result in poor quality habitat for black-backed woodpeckers. This species seems to prefer high snag densities, and is rarely found in burned areas that have been partially salvaged (Hejl and McFadzen 2000). Units designated as prescribed or maintenance burn, small tree thinning and slashing would have little effect on the number of snags within those units. These types of units contain little existing suitable habitat for black-backed woodpeckers.

Overall, this alternative could cause a small reduction in the number of black-backed woodpeckers the project area is capable of supporting in the short term. In the long term, this alternative would reduce the risk of a large, high to moderate intensity fire or a beetle epidemic, either of which could provide a large amount of suitable habitat and could potentially attract large numbers of black-backed woodpeckers for several years.

Cumulative Effects

Geographic Boundaries

The defined effects area for black-backed woodpecker is the Haacke-Claremont project area. This analysis area is appropriate to analyze any incremental effects from the actions of this project on this woodpecker in conjunction with past, present, ongoing and reasonably foreseeable future actions. An assessment of information available at the Forest and Regional level is also considered to provide additional context. Any incremental effects of the three alternatives considered in this analysis would not be detectable at a scale larger than the analysis area.

Other Actions

Although past harvest may have reduced habitat for black-backed woodpeckers in salvage-logged areas until the mid to late 80’s, snags have been managed for on the landscape in recent years. Fire suppression may have impacted black-backed woodpecker habitat (Canton 1996). Suppression has reduced the size of fires in the past but has also created stand conditions that may favor uncharacteristically large fires today. The Bitterroot National Forest has been a pioneer nationally in wildfire use since 1972. In 2005 alone, approximately 40 fires burned approximately 28,700 acres on the Bitterroot National Forest. Since 1997, the Forest has had an

average of 17 wild fire use fires each year burning an average of over 6,000 acres annually (2006 Forest Plan Monitoring Report, PF-K Forest Plan8). Between 2001 and 2005, approximately 78,000 acres burned on the Bitterroot National Forest. Of these 14% were prescribed burns, 46% were wildfires and 40% were wildfire use fires. These fires provide suitable habitat for this species.

Habitat modeling based on FIA data estimates that the Bitterroot National Forest contains sufficient post-fire habitat to support between 2,898 and 4,490 pairs of BBWO (Samson, 2005), although the portion of this habitat burned in 2000 is quickly losing its suitability. This habitat is well-distributed across the Forest as a result of the widespread fires in 2000 and 2003, plus smaller amounts of fire in 2005 and other years. At the Regional scale, habitat modeling estimates that there is enough suitable post-fire habitat to support at least 3,719 to 6,405 pairs of BBWO (Samson, 2005). Areas of insect outbreaks offer additional potential habitat, and BBWO have been documented using this habitat in Montana, Idaho, and Oregon. Median dispersal distance for BBWOs is estimated to be about 65 miles, although BBWOs are known to travel farther than this during irruptions. This dispersal distance indicates that BBWOs across the entire Region belong to a single, well connected population. Although no population estimates are available, the large amount of apparently suitable habitat well distributed across USFS Region 1 combined with the interconnectedness of the population indicates that short-term viability of BBWOs across the Region is not an issue (Samson, 2005).

Determination

Alternative 1
Implementation of this alternative would have **no impact** on black-backed woodpeckers or their habitat.

Alternative 2 and Alternative 3: Implementation of Alternative 2 and 3 **may impact individual black-backed woodpeckers or their habitat, but would not likely contribute to a trend towards Federal listing or loss of viability to population or species.**

Rationale for Determination

- There are no measurable or guaranteed impacts with implementation of Alternative 1.
- Treatments would not affect high quality habitat, but would reduce suitable acres of secondary habitat.
- Treatments would not preclude fires, but would reduce the risk of fires or insect epidemics.
- There is a large amount of available habitat Forest-wide (see cumulative effects).
- There is low-density use by black-backed woodpecker in insect and disease outbreaks.
- Snags will be retained as follows:

Fire Group	Snags (average trees per acre)
2, 4	2-5
5, 6	4-12
7, 8, 9	10-15

Flammulated Owl (*Otus flammeolus*) (Sensitive)

Effects Analysis Method

The analysis for flammulated owl focuses on the effects to suitable habitat within the three watersheds in which the project area is located. Suitable habitat is defined for flammulated owls in the Haacke-Claremont project as habitat that may currently have the habitat components necessary to meet the needs of flammulated owls. Suitable habitat includes ponderosa pine or ponderosa pine – Douglas fir that is classified as sawtimber or older seral stages. The forest structure is characterized by large trees, large snags and relatively open understories.

Potentially suitable habitat was mapped through a query of the R1 VMap data base.
For each alternative four evaluation criteria were used to predict impacts to flammulated owls. These are:

- stand structure of suitable habitat (density),
- tree species composition of suitable habitat (restoring ponderosa pine),
- large snag density within suitable habitat; and

These criteria for analyzing effects to flammulated owls were selected for the following reasons.

Stand Structure (density)

Flammulated owls evolved in an ecosystem primarily shaped by frequent, low severity fires. Fire suppression has resulted in conversion of many pine forests to shade-tolerant fir forests and high tree densities in smaller diameter classes. Overall “fire suppression may be resulting in sub optimal habitat for flammulated owls” (Linkhart 2001, page 168).

Based on current literature, flammulated owls are dependent on mature to old growth ponderosa pine/Douglas-fir forests at lower elevations in the Rocky Mountains. They are found in mature open park-like stands with some understory shrubs and small trees (McCallum 1994). In general, flammulated owls nest in relatively large trees in relatively open areas. They are not typically associated with burned areas or extensive beetle-killed trees, probably due to the lack of physical and biological components needed to support both the owls and the insects they prey on.

Composition of forests within favored areas where flammulated owls foraged repeatedly suggests the importance of old ponderosa pine or ponderosa pine and Douglas-fir in the foraging behavior of the owl. Old ponderosa pine forests (whether pure or mixed with other species) typically form open stands with well-developed grass or shrub understories, as long as frequent fires are allowed to limit invasion of shade-tolerant conifers. These understories support arthropods (insects for food) in a forest layer that is used extensively by fledged owlets and molting adults in late summer (Reynolds and Linkhart 1992).

The associated prey for flammulated owls in the early spring are primarily noctuid (night flying) moths and in the summer crickets, grasshoppers, moths and beetles (McCallum, 1994). The openness of these stands also provides space for hawking flying insects between crowns and for hover-gleaning them from outer needle bunches (Reynolds and Linkhart 1987).

Reynolds and Linkhart (1992) reported that males sang from hidden positions next to tree trunks or in dense clumps of foliage and that ponderosa pine and Douglas-fir were the only species used as song trees, the trees had a mean age of 289 years. Security cover is provided by regenerating Douglas-fir thickets and large-diameter, veteran trees with heavy branching. These features are utilized by both foraging and roosting owls for cover from predators (van Woudenberg 1999, including extensive internal citations). Each alternative was assessed by how it would affect the stand structure in potential or suitable habitat favored by flammulated owls.

Composition (restoring ponderosa pine)

Ponderosa pine is an important habitat component of flammulated owls. Ponderosa pine was found by some researchers to be the preferred nest tree (McCallum 1994 IN van Woudenberg 1999). Wright (1996) found that flammulated owl occurrences were correlated with the number of ponderosa pine trees > 15” and live basal area (IN Samson 2005, p. 55). Each alternative was assessed by how it would affect ponderosa pine composition in potential or suitable habitat.

Snag Density

Flammulated owls depend on woodpeckers to create nesting cavities, usually in large dead trees. Reynolds and Linkhart (1992) state that in reports where forests surrounding nests were described or photographed, all nests were in, or adjacent to, mature or old growth stands (Hanna 1941, Bull and Anderson 1978, Canning et al. 1978, Hasenyager et al. 1979, Cannings 1982, Bloom 1983, Reynolds and Linkhart 1984, 1987, Fix 1986, Goggans 1985, Hayward 1986, Howie and Ritcey 1987, McCallum and Ghelback 1988). However, Hasenyager et al. (1979) and Bloom (1983) reported nests in forests that had been partially cut but contained large, residual trees, and Winter (1974) found the owl in second-growth forests, although they did not report nesting in this age-class (Reynolds and Linkhart 1987). Each alternative was assessed by how it would affect large snag densities.

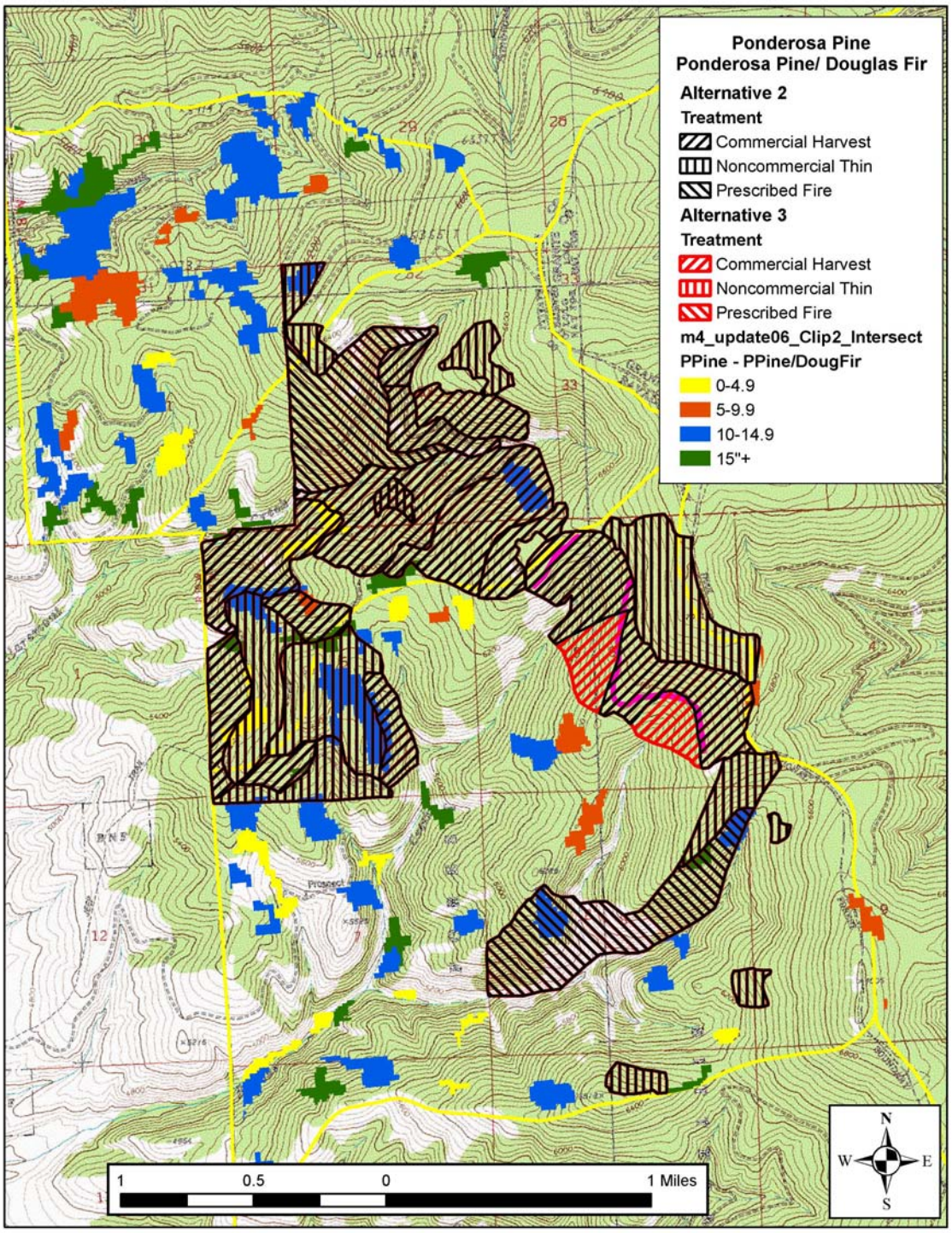
Affected Environment

The Forest does not have population estimates for flammulated owls within the Haacke-Claremont project area. As part of the field work for this project surveys were conducted for flammulated owl in 2007 along all roads within the project area in habitats that offer potential habitat. These surveys did not detect any flammulated owls.

The project area contains approximately 105 acres of potentially suitable habitat, meaning that it may currently have the habitat components necessary to meet the needs of flammulated owls. Much of the potentially suitable habitat is of lower quality because it contains relatively young trees and very few large snags (see below table).

Ponderosa Pine and Ponderosa pine/Douglas fir Stands in the Analysis Area

DBH (inches)	Acres
0-4.9	72
5-9.9	72
10-14.9	340
15+	105
Total	589


Ponderosa Pine
Ponderosa Pine/ Douglas Fir
Alternative 2
Treatment
Commercial Harvest
Noncommercial Thin
Prescribed Fire
Alternative 3
Treatment
Commercial Harvest
Noncommercial Thin
Prescribed Fire
m4_update06_Clip2_Intersect
PPine - PPine/DougFir
0-4.9
5-9.9
10-14.9
15"+
1
0.5
0
1 Miles
N
W
E
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Environmental Effects

Direct and Indirect Effects

Alternative 1

The No Action Alternative would not change existing habitat quality for flammulated owls in the short term, because existing habitat conditions would be unchanged. Over time, habitat quality for flammulated owls would gradually decline as Douglas-fir and grand fir continued to fill in the sub-canopy layer under mature and older ponderosa pine. The open stand structure that attracts flammulated owl prey items and allows the owls to forage would become less common. As forests continue to mature, snag numbers would increase as a result of mortality due to insects and disease, and coarse woody material would accumulate. In the longer term, increasing tree densities and fuel loadings would increase the probability of a large, intense fire. A large fire would create marginal or unsuitable habitat for flammulated owls in areas that burned with moderate or high intensities.

Alternatives 2 and 3

Within potential flammulated owl habitat proposed treatments under alternatives 2 and 3 are identical. All treatments would favor retention and recruitment of ponderosa pine. Non-commercial thinning treatments (57 acres) would improve flammulated owl foraging habitat in the short term by increasing the spacing between trees in densely stocked stands. Thinning would also move these units closer to desired habitat conditions for flammulated owls in the long term by increasing the ratio of ponderosa pine in the stands, accelerating growth rates of remaining trees, and moving the units towards the desirable open stand structure.

Commercial thinning (47 acres) would not change the amount of suitable habitat for flammulated owls within the project area, but it would alter the habitat quality in some suitable habitat by reducing the number of snags available as potential nesting sites. Snag retention guidelines would ensure that sufficient numbers of snags remained in these units to provide nesting habitat for woodpeckers. The number of abandoned woodpecker cavities available for use by nesting flammulated owls would probably decline somewhat from existing levels, but would likely remain more than adequate to provide for the nesting needs of flammulated owls.

At the same time, treatments in many of these harvest units, plus treatments in the 18 acres of prescribed burn treatment would open up dense thickets of sapling, pole and small sawtimber-sized Douglas-fir, grand fir and ponderosa pine, which are currently not suitable nesting or foraging habitat for flammulated owls. In these cases, treatments would result in better foraging habitat for flammulated owls in the short term, and better potential nesting habitat over the long term. Most of the acres in the thinning units are currently classified as unsuitable habitat for flammulated owls due to past harvest. The treatments would convert these units to suitable habitat for flammulated owls in the long term, so would increase the amount of suitable habitat for this species across the project area.

Overall, the effects of the treatments in this alternative would be positive for flammulated owls both in the short and long terms, because they would move vegetative conditions towards the open, mature ponderosa pine stands that flammulated owls are adapted to and appear to prefer.

Treatments in Ponderosa Pine Dominated Stands

Treatment Type	DBH (inches)	Acres
Commercial Harvest	0-4.9	13
	5-9.9	3
	10-14.9	22
	15+	8
Commercial Harvest Total		47
Noncommercial Thin	1	7
	0-4.9	7
	5-9.9	0
	10-14.9	43
	15+	6
Noncommercial Thin Total		57
Prescribed Fire	10-14.9	15
	15+	3
Prescribed Fire Total		18
Total		122

Cumulative Effects

Geographic Boundaries and Time Period

The defined effects area for flammulated owl is the Haacke-Claremont analysis area. This analysis area is appropriate to analyze any incremental effects from the actions of this project on flammulated owls in conjunction with past, present, ongoing and reasonably foreseeable future actions. An assessment of the habitat and population viability at the Forest and Regional levels is also considered to provide additional context.

To determine the cumulative effects area for flammulated owls the size of their home ranges was considered. With a home range size of between 22 and 58 acres (Samson 2005, p. 52) it is reasonable to assess effects within the 105 acres of suitable habitat in the Haacke-Claremont analysis area. Theoretically, between 2 and 4 home ranges could fit within the potentially suitable habitat in the Haacke-Claremont area. The overall low quality of the habitat and the fact that flammulated owl surveys have failed to locate any owls Haacke-Claremont area implies that the flammulated owls are likely absent from the area. Incremental effects of proposed activities of this project to home ranges outside the analysis area would not be measurable. The Forest level consideration is used to provide a broader context for the more localized effects analyzed.

For Alternative 1, the status quo on unmanaged lands continues for several decades. Long-term (several decades) indirect effects could occur if a high severity fire burns an extensive portion of the project area in the future. The result would be to move more Douglas-fir/ponderosa pine cover types into early seral condition reducing habitat suitability for several decades, depending upon severity.

For Alternative 2 & 3,

- Improvement in stand structure of potential and suitable habitat (reduced forest density) – would improve habitat for approximately 25 – 50 years or until the next fire disturbance or vegetative management occurred.
- Composition of potential and suitable habitat (protecting ponderosa pine) – where ponderosa pine already exist the protection of those trees by removal of competition and fuel reduction activities would effect flammulated habitat for approximately 25 – 50 years or until the next fire disturbance or vegetative management.
- Temporary disturbance in suitable habitat -- during periods of active management temporary displacement could occur within that locality for the duration of the activity. Flammulated owls appear to return to stands after disturbances, such as selective timber harvest (van Woudenberg 1992 IN van Woudenberg 1999) and spring and summer grazing (Christie 1994 IN van Woudenberg 1999 p. 20). Prescribed burning could reduce insects for a short period of time until the vegetation re-sprouts (1-2 years). There is suitable habitat available within the analysis area (6,556 acres) and outside the analysis area to displace to.

Other Actions

Flammulated owls may be vulnerable to the repeated action of fire suppression which modifies forest structure, and composition (Groves et al. 1997; Wright et al. 1997; Linkhart 2001; and Wonudenberg 2003 IN Samson 2005). Fire suppression in coniferous forests that have been dominated or co-dominated historically by ponderosa pine has resulted in dominance by shade-tolerant species. In many lower to mid elevation areas across the Forest, encroachment by Douglas-fir (and grand fir in some places) has changed the composition and structure of stands by out-competing the shade-intolerant species such as ponderosa pine, resulting in stands with closed canopies and high stem densities that do not meet the habitat characteristics selected by flammulated owls (McCallum 1994). Understory development is reduced and the high stocking density can result in slow, stagnated growth (Harrington and Sackett 1992 IN van Woudenberg 1999). The structure of these stands and the high risk of tree mortality prior to maturity, due to insect and disease exacerbate the lack of nest-tree regeneration.

As well, the reduction or loss of the ponderosa pine component as a preferred nest tree (McCallum 1994 IN van Woudenberg 1999) may have long-term consequences for the abundance of breeding owls by reducing the abundance of suitable cavity trees for nesting (van Woudenberg 1999). As explained by van Woudenber (1999, p. 18) flammulated owl productivity in dense, single species Douglas-fir stands is reduced overall for a number of reasons. First, poor or absent understory development will result in reduced food availability. Second, even if the limited food supply could support a few nesting owls, breeding would be constrained by the lack of suitable cavities available in stable snags. Third, the moister, cooler microclimate will inhibit rather than enhance what insect activity is present, particularly after precipitation. Finally, the increase in coarse woody material that tends to accumulate at increased rates of bark beetle activity, disease, and overall mortality may enhance cover for rodents and increase prey opportunities for the Barred Owl, which is a likely predator of flammulated owls. Additionally, dense stands may result in uncharacteristically severe fires that results in large areas of stand replacing disturbance where, historically, low severity or mixed severity fires occurred. This would not only reduce suitable habitat but could remove the ponderosa pine seed source,

hampering natural regeneration of ponderosa pine, as was observed in the high and moderate severity burns in 2000 on the Bitterroot National Forest (USDA 2000). The loss of snags appropriate for nest cavities through harvest or firewood cutting is a past repeated impact. Several timber sales have been completed in the same geographic area over the past several decades.

Snag retention guidelines, in place since the 1980's have reduced the loss of potential nesting snags in harvest units. Monitoring of recent vegetation management activities (PF#K-wildlife1, wildlife2) indicates prescriptions for snag retention have consistently been met. Samson (2005, p. 60), states that timber management in the Northern Region in 2004 amounted in total to 0.0009% of the landscape. Level of timber management in preceding years was an insignificant influence on the landscape in comparison to suppression of fire. Samson states that Gallant et al. (2003) concluded the same in the Greater Yellowstone ecosystem.

Stand replacing fire could eliminate large areas of potential habitat as seen in the assessment of post fire conditions (USDA 2000 p. 4.4 Wildlife – 8).

Trends

The largest significant legacy effect to flammulated owl habitat across the Forest and in the Haacke-Claremont area is fire suppression (Sampson 2005; Gallant et. al 2003). The existing trend is for flammulated owl habitat to continue to change structurally and in composition from historic conditions. Loss of habitat continues to occur with large moderate to high intensity fires.

Should high severity fire not occur in the project area in the future or only burn a very small portion, the cumulative effect of Alternative 1, No Action, would likely be a continuation of the status quo. The current trend of flammulated owl habitat structure and composition changing, reducing habitat quality, will continue. If high severity fire burns an extensive portion of flammulated owl potential or suitable habitat then a trend of reduced habitat would continue for the flammulated owl (USDA 2000, p. 4.4-Wildlife-8).

As noted in the direct and indirect effects for Alternative 2 and 3, with the exception of temporary displacement and reduction in potential nest sites, the trend after the treatments proposed here are implemented will be toward improving quality flammulated owl habitat. It would move stands toward historic structure (density) and composition (increasing ponderosa pine component) where appropriate, improving habitat structure for the owl in potential and suitable habitat.

Broader Context

The Montana Natural Heritage Program classifies the flammulated owl as a G4 S3B species (MNHP, 2006). This means that at the global scale, the species is considered to be uncommon but not rare (although it may be rare in parts of its range), and usually widespread. It is apparently not vulnerable in most of its range, but there is possibly cause for long-term concern. At the state scale, the breeding population is considered to be potentially at risk because of limited and potentially declining numbers, extent and/or habitat, even though it may be abundant in some areas.

The flammulated owl is perhaps the most common raptor of the montane pine forests of the western United States and Mexico (McCallum, 1994). The Bitterroot National Forest is near the northeast edge of the known range of this species. As of 1998, flammulated owls were considered to have a widespread presence in Missoula and Ravalli counties (Wright 1996 and http://nhp.nris.state.mt.us/mbd/).

At a Forest wide scale, habitat modeling based on FIA data estimates that the Bitterroot National Forest contains 11,144 acres of flammulated owl habitat more than the amount estimated as necessary to maintain a minimum viable population. Another way to say this is that there is an estimated 337% of the habitat necessary to maintain a minimum viable population of flammulated owls on the Forest. Neither action alternative is expected to eliminate any suitable habitat, and both would improve habitat conditions in the future. For these reasons, impacts to suitable flammulated owl habitat would not impact species viability.

The number of flammulated owl detections on the Bitterroot National Forest on unburned transects has remained fairly consistent from 2000 to 2004. In high and mixed severity fires that burned through areas known to support concentrations of flammulated owls in 2000, about half the number of flammulated owls were detected in 2001. Flammulated owl detections on burned transects have continued to decline, with very few owls found in burned areas in 2005 (2005 Monitoring report, (PF#K-Forest Plan8)

A standardized Regional survey effort in 2005 found that flammulated owls were well-distributed in suitable habitat west of the Continental Divide, but were rather restricted in distribution east of the Divide. On the Bitterroot National Forest, flammulated owls were detected on 14 of the 30 completed transects, and on 42 of the 281 sample points (Cilimburg, 2006). These surveys showed that flammulated owls are well-distributed in suitable habitat on the southern half of the Forest, which was heavily sampled. They were only detected on a few transects on the north half of the Forest, but this area was not heavily sampled. Wright (1996) found a similar distribution pattern for flammulated owls on the Bitterroot National Forest during field work for her Master's thesis in 1994 and 1995. The Region 1 Wildlife Ecologist has looked at viability for this species and has determined that habitat is well distributed and abundant for the flammulated owl in the Northern Region, and that short-term viability of the species in the Northern Region is not an issue (Samson 2005).

Determination

Alternative 1

Implementation of this alternative would have no impact on flammulated owls or their habitat.

Alternative 2 and Alternative 3

Implementation of Alternative 2 and 3 may impact individual flammulated owls or their habitat, but would not likely contribute to a trend towards Federal listing or loss of viability to population or species.

Rationale for Determination

- There are no measurable or guaranteed impacts with implementation of Alternative 1.
- Alternatives 2 and 3 incorporated the needs of flammulated owl into the project design and mitigations. No loss of habitat is expected.

- The minimal amount of disturbance, in light of the well distributed and excess habitat will not affect species viability.

Northern Goshawk (*Accipiter gentilis*) (Sensitive)

Effects Analysis Method

The analysis area for goshawks is the three watersheds in which the project area is located. Analysis of goshawk habitat is often based on known nest locations with the nest stand serving as the center of the sampling unit. No goshawk were detected during calling surveys of the project area during July 2007 and no goshawk are known to nest in the three watersheds in which the project is located. This analysis for goshawks focuses on impacts to habitat structure within suitable nesting habitat – effects to large trees and canopy closure and foraging area – understory stand density. Suitable nesting habitat for goshawks in the Haacke-Claremont project area was defined as habitat that may currently have the habitat components necessary to meet the nesting needs of goshawks. Suitable nesting habitat includes forested stands dominated by ponderosa pine, Douglas-fir or lodgepole pine in larger size classes (e.g., greater than 10” DBH) with canopy cover greater than 60%. The forest structure in typical nest stands is characterized by large trees, high canopy closures and relatively open understories (Hayward and Escano, 1989; Reynolds, et al. 1992; Squires and Reynolds 1997; McGrath, et al. 2003; Squires and Kennedy 2006. Habitat was modeled using R1-VMap.

Suitable foraging habitat was defined as forested cover with trees greater than 10” DBH and all canopy cover classes and shrub/grass dominated areas. Areas with small trees (less than 10” DBH) and high canopy cover (greater than 60%) were considered not suitable for foraging due to the dense conditions present in these stands.

Affected Environment

Population

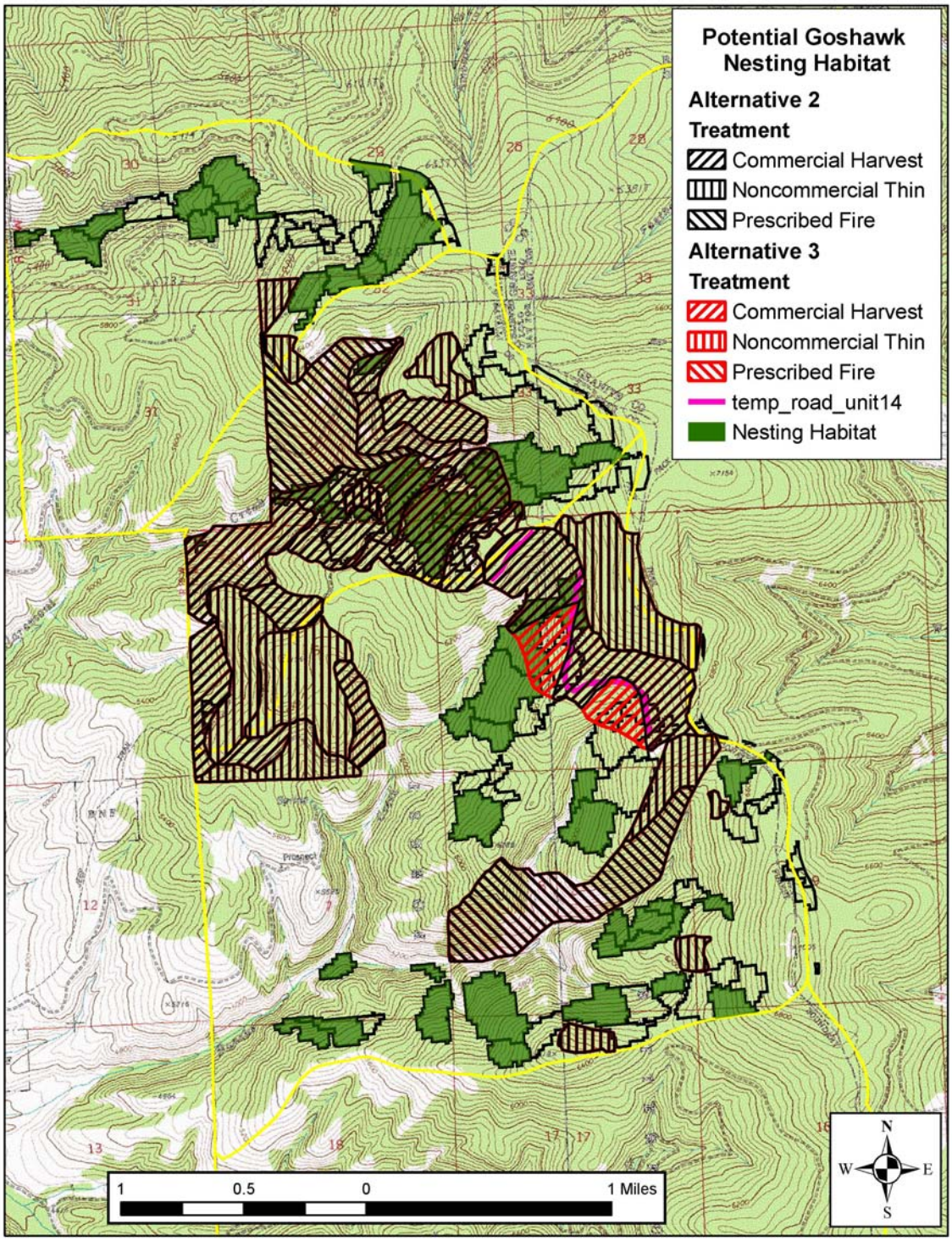
Habitat modeling based on Forest Inventory and Analysis (FIA) data estimates that the Bitterroot National Forest contains sufficient suitable nesting habitat to support a minimum of 340 goshawk nests, which would provide nesting habitat for at least 57 to 170 goshawk pairs. Modeling also estimates that there is enough suitable post-fledging habitat to support a minimum of from 68 to 135 goshawk pairs, and enough suitable foraging habitat to support a minimum of 87 goshawk pairs (Samson, 2005). Therefore, a conservative estimate is that the Forest contains enough suitable habitat to support all the life stages of at least 57 goshawk pairs. This habitat is well-distributed across the Forest.

The Bitterroot National Forest maintains an active program of monitoring Accipiter nests. As of October 2005 a total of 88 northern goshawk nests were identified across the Bitterroot NF, in 33 different territories. Of the known nests, 47 have been active at least one year since they were located, and 10 have been active more than one year. The Forest has documented at least 115 juvenile goshawks fledged from these nests (USDA, unpublished). In 2006, at least six additional goshawk nests were found across the Forest, including one in a new territory.

Habitat

Goshawk nesting and foraging habitat

Watershed		Nesting Habitat		Foraging Habitat	
Name	**Area (acres)**	**(acres)**	**(%)**	**(acres)**	**(%)**
07a106-1	1,242	110	9	860	69
07a107-1	2,791	315	11	1,328	48
07a107-2	1,119	129	12	636	57
Total	5232	554	11	2,824	54


Potential Goshawk Nesting Habitat
Alternative 2
Treatment
Commercial Harvest
Noncommercial Thin
Prescribed Fire
Alternative 3
Treatment
Commercial Harvest
Noncommercial Thin
Prescribed Fire
temp_road_unit14
Nesting Habitat
1
0.5
0
1 Miles
N
W
E
S

Environmental Effects

Effects Common to All Action Alternatives

None of the proposed treatments in either of the action alternatives would include adverse management activities within known goshawk nesting areas. Adverse management activities are defined as activities that could adversely modify goshawk behavior, reproductive effort or habitat (Reynolds et al. 1992, p. 22 and 87), including reducing the overstory canopy or disturbing active nests during the nesting season. Preferred treatments for maintaining stand structure in nest areas include thinning unwanted understory trees, with non-uniform spacing using prescribed fire and/or hand-operated tools (Reynolds et al. 1992, p. 22). Such treatments may occur within the nest areas around known nests if they do not reduce the overstory canopy. Incidental disturbance of foraging goshawks could occur, but would have little impact to goshawks.

Alternative 1

The No Action Alternative would not change existing habitat quality for goshawks in the short term, because existing habitat conditions would be unchanged. Over time, some existing nesting habitat would improve as trees become larger and canopies fill in. Other existing nesting habitat, would become less suitable as understories become denser and reduce the open flight lanes that goshawks prefer. Many stands that currently are characterized by immature trees and fairly open canopies could become suitable goshawk nesting habitat as the trees grow larger and canopies fill in. Habitat available for post-fledging habitat would become more mature and generally less diverse as trees continue to grow, although some stands might become too thick in the understory for goshawks to maneuver through. Foraging habitat would also tend to become more mature but less diverse across the area. The prey base of species associated with mature forested conditions, such as red squirrels, would increase, but the diversity of prey species that goshawks seem to depend on would decline.

As forests continue to mature, snag numbers would increase as a result of mortality due to insects and disease, and coarse woody material would accumulate. The closed canopies in some mature nesting areas would become more open as larger trees succumbed to pathogens. In the longer term, increasing tree densities and fuel loadings would increase the probability of a large, intense fire. A large fire would create marginal or unsuitable nesting and post-fledging habitat for goshawks in areas that burned with moderate or high intensities. Portions of these areas, especially those near the edge of remaining green stands would provide good foraging habitat for goshawks hunting for woodpeckers and other species associated with post-fire habitats.

Alternative 2

Stand Structure of Nesting Areas

This alternative is estimated to reduce potentially suitable goshawk nesting habitat within the project area by about 122 acres where commercial thinning is proposed in potential nesting habitat. Commercial thinning would create stand conditions that are too open to provide the closed canopies that goshawks prefer. The other treatment types would leave structure suitable for goshawk nesting habitat if it currently exists. The prescribed burning and non-commercial thinning treatments would improve existing goshawk nesting and foraging habitat and facilitate

development of future goshawk nesting habitat by thinning out the conifer understory and increasing the vigor and growth rates of the overstory trees.

In areas that are currently densely stocked with conifers, reducing stocking levels would benefit goshawks by opening up flight lines and making foraging easier for juvenile goshawks. In areas that are not currently densely stocked with conifers, further reducing stocking levels might make it more difficult for juvenile goshawks to approach their prey undetected. Changes in forest structure would result in increased populations of some goshawk prey species, and decreased populations of others.

Stand Structure of Foraging Areas
All units included in this alternative are likely within the foraging range of at least one goshawk pair. Alternative 2 would treat approximately 1,147 acres within the foraging habitat in the project area. Treatments within these foraging areas would consist of about 427 acres of commercial thinning, 440 acres of non-commercial thinning, and 279 acres of prescribed burning.
Proposed treatments would generally retain a forest structure composed of the most mature live trees available in each unit, as well as snags and logs within the historic range for the site. These conditions should provide suitable foraging habitat for goshawks, although changes in forest structure may alter the abundance of prey species in some areas. The treatments would tend to increase the diversity of habitats across the area, which could benefit goshawks by increasing the diversity of the prey base. Three major goshawk prey items are red squirrels, snowshoe hares and grouse. In mixed conifer stands, numbers of red squirrels increased after a mechanical fuels reduction treatment, but numbers of snowshoe hares decreased (Bull 1999). In Oregon, the number of red squirrels remained constant or increased following a thinning treatment (Bull, et al. 2005). Blue grouse benefit from open canopies (Reynolds, et al. 1992). Thinning dense stands may benefit goshawks by increasing the populations of some prey species, and by making it easier for goshawks to successfully capture those species.

The 440 acres of non-commercial thinning would benefit goshawks by providing foraging opportunities that do not currently exist. Trees in the plantation thinning units are generally spaced too tightly to allow goshawks to maneuver between them. In addition, these stands probably support low numbers of only a few prey species, since the dense canopies shade out most of the forage plants used by a variety of wildlife species. After thinning, goshawks would be able to forage in these stands due to the more open flight lines that thinning would produce. The abundance and diversity of prey species within the plantations would also increase.

Alternative 3

Stand Structure of Nesting Areas
This alternative is estimated to reduce potentially suitable goshawk nesting habitat within the project area by about 140 acres where commercial thinning is proposed in nesting habitat. Effects of treatments would be as described under alternative 2.

Stand Structure of Foraging Areas
Alternative 3 would treat approximately 1,190 acres within the foraging habitat in the project area. Treatments within these foraging areas would consist of about 470 acres of commercial

thinning, 440 acres of non-commercial thinning, and 279 acres of prescribed burning. Effects of treatments would be as described under alternative 2.

Cumulative Effects

Geographic Boundaries and Time Period

The defined effects area for goshawks is the Haacke-Claremont project area. This analysis area is appropriate to analyze any incremental effects from the actions of this project on goshawks in conjunction with past, present, ongoing and reasonably foreseeable future actions. An assessment of information available at the Forest level is also considered to provide additional context.

Given an average spacing of about two miles between nest areas, it seems unlikely that the Haacke-Claremont area could contain more than two goshawk territories. Incremental effects of proposed activities of this project to nesting territories outside this defined cumulative effects analysis area would not be measurable. The Forest level consideration is used to provide a broader context for the more localized effects analysis.

For Alternative 1, the status quo on unmanaged lands continues for several decades. Long-term (several decades) indirect effects could occur if a high severity fire burns an extensive portion of the project area in the future. The result would be to move more mature or old growth habitat into early seral condition reducing habitat suitability for several decades to over 100 years, depending on severity.

For Alternatives 2 & 3:

- The incremental reduction in canopy closure due to treatments in a number of units would have a minor detrimental effect on the availability of goshawk nesting habitat. The loss of canopy cover, due to treatment, and secondarily to pathogens, will be a long lasting effect. Where reduction in density and competition increases canopy growth, return of sufficient canopy cover for goshawks may be hastened. It still may require 25 – 50 years or more.
- Reduction in understory canopy will improve habitat for some prey species and reduce it for others. In some units it may actually improve or create foraging habitat for goshawks by opening flight lines (Reynolds 1998, Ch. 4, p.3). These effects would occur for approximately 25 – 50 years until the site re-vegetated, or fire or other vegetative management occurred.
- It is possible that management activities could disturb individual goshawks that are in or near units during implementation, even if the unit is not within an active nest territory. Such disturbance would be minor and temporary, and goshawks could easily avoid the disturbance by flying to other portions of their large territories.

Other Actions

Past fire suppression activities may have increased goshawk nesting habitat in the Haacke-Claremont project area in the last several decades. Douglas-fir has increased in numbers and matured in the absence of frequent fires that may have favored more fire adapted species. This has resulted in numerous mature Douglas-fir trees that potentially could be used for nesting. In

some areas, where the encroachment of Douglas-fir has altered what was once open habitat, fire suppression may have negatively impacted flight lanes used for foraging.

Changes in forest composition and structure have also likely altered the prey species available to goshawks in the area. With fire suppression activities continuing in the future some of these stands of currently suitable goshawk habitat will become unsuitable in time. The loss could be due to stand densities that don't allow open flight or to loss through fire.

The structure, function and quality of both nesting and foraging habitat has been impacted by timber harvests in the Haacke-Claremont area. In the cumulative effects area clearcuts, shelterwoods, seed tree cuts and sanitation salvage occurred in the area. These management practices may not have left sufficient canopy cover for the dense canopy preference of goshawks, and they decreased the number of snags and the amount of down wood available to support goshawk prey. Since 1987 reduction in cover still occurred but snag and downed woody debris standards were implemented. Timber management has been suspected of affecting goshawks at least at local levels (USFWS 1998, Ch. 4, p.5). Reduction and fragmentation of habitat of mature forest may favor early successional competitors and predators such as red-tailed hawks and great horned owls (USFWS 1998, Ch. 4 p.8). Nestling and juvenile goshawks are incapable of or inexperienced at predator avoidance. Predation, therefore, is likely to be a more important mortality factor for these age classes than in adults (USFWS 1998).

Trends & Broader Context

The Montana Natural Heritage Program ranks the northern goshawk as a G5 S3 species (MNHP, 2006). This means that across its range the species is considered common, widespread and abundant (although it may be rare in parts of its range). It is not vulnerable in most of its range. In Montana, the species is considered potentially at risk because of limited and potentially declining numbers, extent and /or habitat, even though it may be abundant in some areas.

As explained above under Affected Environment, Population, a conservative estimate is that the Forest contains enough suitable habitat to support all the life stages of at least 57 goshawk pairs and that this habitat is well-distributed across the Bitterroot National Forest. At a Forest wide scale, habitat modeling based on FIA data estimates that there is 347,917 acres of goshawk habitat more than what is necessary to maintain a minimum viable population. Another way to say this is that the Forest has an estimated 1,254% of the habitat necessary to maintain a minimum viable population of goshawks on the Forest. Alternatives 2 and 3 would reduce the amount of suitable nesting habitat within the Haacke-Claremont project area, but these areas would still provide suitable goshawk foraging habitat. Because the potential effects of the alternatives are so limited, in the context of the apparently adequate and excess habitat Forest wide, the predicted impacts to potential goshawk habitat would not likely influence population or species viability.

At the Regional scale, habitat modeling estimates that there is enough suitable habitat to support at least 1266 pairs of goshawks (Samson, 2005). Median dispersal distance for goshawks is estimated to be about 167 miles, which indicates that goshawks across the entire Region belong to a single, well connected population. Although no population estimates are available, the large amount of apparently suitable habitat well distributed across the Region combined with the

interconnectedness of the population indicates that short-term viability of goshawks across the Region is not an issue (Samson, 2005).

Since goshawks are well distributed across the Forest, are reasonably abundant given their large territory size, and produce good numbers of fledglings, we are confident that the goshawk population across the Forest is doing well and that it contributes positively to the viability of goshawk populations in western Montana.

Determination

Alternative 1 (No Action)
Implementation of this alternative would have **no impact** on goshawks or their habitat.

Alternative 2 and Alternative 3
Implementation of Alternative 2 and 3 **may impact individual goshawks or their habitat, but would not likely contribute to a trend towards Federal listing or loss of viability to population or species.**

Rationale for Determination

- There are no measurable or guaranteed impacts with implementation of Alternative 1.
- Some loss of potential nesting habitat would occur, but all of the area would still be suitable habitat for forging.
- The minimal amount of disturbance, in light of the well distributed and excess habitat will not affect species viability.
- There are no known goshawk nesting areas affected.

Townsend's Big-Eared Bat (*Plecotus townsendii*) (Sensitive)

Effects Analysis Methods

Since there are no known primary habitats (caves or mines) for Townsend's big-eared bats within the analysis area, potential effects to snags, as temporary refugia, is assessed for each alternative. See also section on effects to snags.

Affected Environment

The Bitterroot National Forest is within the range of the Townsend's big-eared bat. Hoffman et al. (1969) reported specimens collected northeast of Florence, at the Curlew Mine near Victor, in Hamilton, and at Lake Como. The vocalizations of a big-eared bat were recorded at Lake Como in August, 2006 (K. Dubois, pers. comm.).

Townsend's big-eared bats forage near a wide variety of vegetation types, from juniper/pine to high elevation mixed conifer forests (Barbour and Davis 1969). Caves and abandoned mines are used for maternity roosts and hibernacula (Foresman 2001). Females form maternity colonies in spring and summer, where they bear and raise young in colonies of from 20 – 180 females (Pearson, et al. 1952). Males are more solitary and may venture further out into the forest to forage, and occasionally roost in tree cavities or behind loose bark. This species sometimes

roosts in buildings in late summer. Caves or mine tunnels are essential to western big-eared bat nursery colonies and hibernating colonies. There are no known caves or tunnels within the analysis area that would be suitable for a nursery or hibernating colony.

Environmental Effects

Direct and Indirect Effects

Alternative 1

Implementation of this alternative would have **no impact** on Townsend's big-eared bats or suitable habitat because it does not include any treatments.

Alternative 2

This alternative would not affect any mines, caves or tunnels that could provide important habitat for a Townsend's big-eared bat maternal colony or hibernacula because none of these structures exist within the project area. This alternative would potentially reduce the existing snag densities on 672 acres of commercial thin units. The prescribed burns could also reduce existing snag densities to some extent, but these actions would also create some new snags. Units prescribed for non-commercial thinning would not reduce existing snag numbers.

Snag retention guidelines in the harvest units would assure that numerous snags would be retained in those units. The analysis area also contains large numbers of snags that are not within proposed units. Snags inside and outside of proposed units would provide more than adequate numbers of snags to provide roosting opportunities for individual males. See also section on effects to snags.

Alternative 3

Effects of Alternative 3 to western big-eared bats would be similar to Alternative 2, but snag numbers would be reduced on 735 acres of commercial thinning units.

Cumulative Effects

Geographic Boundaries

The defined effects area for big-eared bats is the Haacke-Claremont analysis area. This analysis area is appropriate to analyze any incremental effects from the actions of this project on big-eared bats in conjunction with past, present, ongoing and reasonably foreseeable future actions. The state-wide status is also looked at for a broader context.

Broader Context

The Montana Natural Heritage Program ranks western big-eared bat as a G4 S2 species (MNHP, 2006). This means that across its range the species is considered uncommon but not rare (although it may be rare in parts of its range), and usually widespread. It is apparently not vulnerable across most of its range, but there is possibly cause for long term concern. In Montana, the species is considered at risk because of very limited and potentially declining numbers, extent and /or habitat, making it vulnerable to extirpation in the state.

Determination

Alternative 1 (No Action)
Implementation of this alternative would have **no impact** on Townsend's big-eared bats or their habitat.

Alternative 2 and 3
Implementation of Alternative 2 **may impact individual Townsend's big-eared bats or their habitat, but would not likely contribute to a trend towards Federal listing or loss of viability to population or species.**

Rationale for Determination
- Some snags will be removed which could potentially be used as a temporary refugia by individual bats. There would be no effects to any caves or mines suitable for maternity colonies or hibernacula because none are known to occur within the project area.

Elk (*Cervus elaphus*) MIS

Effects Analysis Methods

For each alternative two Forest Plan standards were evaluated:
- Habitat including thermal cover
- Habitat effectiveness

A third evaluation criteria was also used to predict impacts to elk,
- Security

Elk habitat was classified and mapped through a query of the Wildlife Oracle database, which contains habitat determinations based on a combination of data from the Timber Stand Management Record System (TSMRS), air photo interpretation and walk through exams by experienced wildlife personnel.

Elk Habitat Effectiveness (EHE) was determined using the Forest's transportation system database to determine open road density within each third order drainage, and then converting that to EHE using the model described in Lyon (1983). Elk security was calculated by using GIS to overlay the transportation system database with the area that provides cover, based on the R1-VMap.

Affected Environment

Population
Elk are an important big game species within the analysis area. Elk population status was identified in the Forest Plan as an indicator of commonly hunted ungulate species and the status of their habitat. Land management activities, particularly timber harvest and associated roads affect elk habitat quality, potential elk use of habitat, and elk mortality from hunting. The Forest

Plan objective is to provide sufficient habitat to maintain the current level of big-game hunting … opportunities (FP II-5, II-7).

The project area is located in Hunt District 204 which is part of the Rock Creek Elk Management Unit (EMU). Elk observed during post-season aerial trend surveys have increased since 1983, with the greatest percent increase occurring in HD 204 (MTFWP 2004). Numbers of elk observed during post-season aerial trend surveys have ranged from 2,149 to 3,672 in the EMU during 1998-2007 (MTFWP 2004, 2007). In 2007 elk population size was approximately 1,068 animals in HD 204 and 3,672 in the Rock Creek EMU.

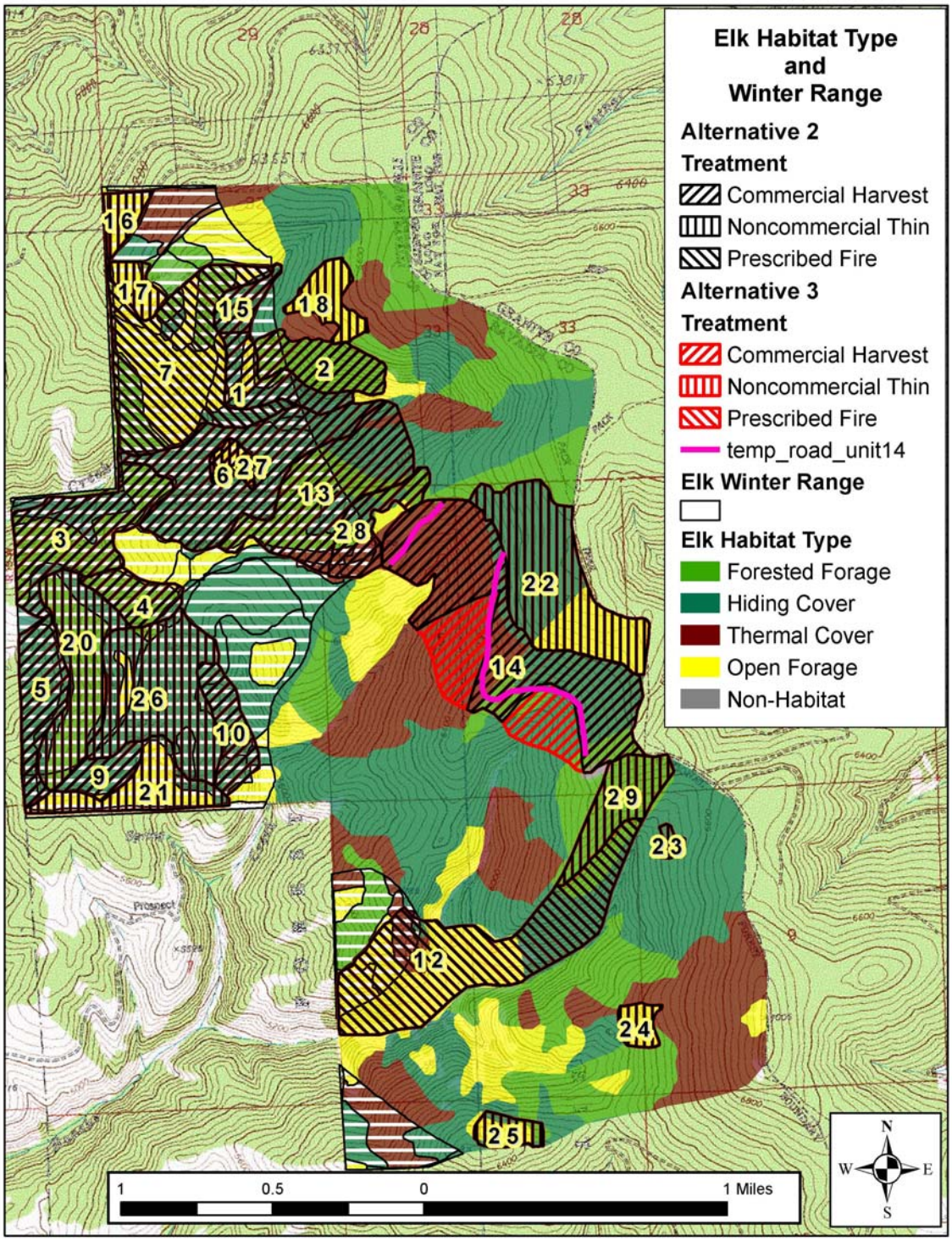
Lack of public access to private land in HD 204 has resulted in a large increase in elk numbers occupying private lands during the general season over the past 5-10 years. The percentage of elk in this EMU not available to hunters because of the limited access to private land ranges from 20 to 40 % among years, largely dependent on weather. Elk congregate on lands closed to hunting during the hunting season (MTFWP 2004).

Habitat Including Thermal Cover

The below table displays the existing elk habitat percentages within the entire analysis area, and separately within the portion of the area identified as elk winter range, based on data contained in the Wildlife Oracle database and displayed on the Haacke-Claremont elk habitat map (Figure below).

Existing Elk Habitat Percentages within the Analysis Area and within the Winter Range Portion of the Analysis Area.

Habitat Category	Existing Condition (acres)	Existing Proportion	"Optimum" Habitat Proportions (USDA 1978)
Analysis Area			
Forested Forage	694	22%	40%
Hiding Cover	1,338	43%	25%
Open Forage	556	18%	20%
Thermal Cover	551	18%	15%
Non-habitat	3	<1%	
Total	3,141		
Winter Range			
Forested Forage	275	26%	40%
Hiding Cover	517	48%	20%
Open Forage	217	20%	20%
Thermal Cover	30	3%	20%
Total	1,072		



The existing condition includes more hiding cover and thermal cover and less forested forage and open forage than recommended in USDA (1978). The high amounts of hiding cover combined with forested forage and thermal cover have probably helped to reduce elk mortality due to hunting by reducing sight distances in the heavily roaded portions of the project area. At the same time, the shading caused by the canopies in these stands limits elk forage productivity, which may in turn contribute to winter mortality and reduce calf survival. The Bitterroot Forest

Plan Record of Decision requires management of winter range vegetation to provide 25 percent of the winter range area in thermal cover as defined in Guides for Elk Habitat Objectives (USDA 1978). The purpose of the 1987 Forest Plan Record of Decision thermal cover requirement was to provide habitat that at that time was believed to be necessary to meet the Forest Plan goals and objectives of maintaining the State's population goals for elk. Recent research, however has questioned the necessity of thermal cover for survival of wintering elk (Cook, et al. 1998). The researchers found "no significant, positive effect of thermal cover on the condition of elk during any of the six experiments. In contrast, dense cover provided a costly energetic environment, resulting in significantly greater over-winter mass loss, fat catabolism, and (in one winter) mortality." Whether thermal cover is necessary for individual elk survival or elk population viability seems open to question. Although public lands (USFS, BLM and DNRC) make up approximately 50% of the Rock Creek EMU approximately 70% of winter range occurs on private lands.

Thermal cover was analyzed for big game winter range within the analysis area. This area does not necessarily correspond to a defined elk herd unit, but does include winter range that is used by elk. The Forest Plan defines thermal cover as forested stands that average at least 40 feet tall with canopy closure of more than 70 percent (USDA Forest Service, 1978). Currently, approximately 30 acres of currently suitable thermal cover occur within the 1,072 acres of elk winter range within the analysis area. This means currently about 3% of the winter range area within the project boundary qualifies as thermal cover. This amount of thermal cover does meet the optimal thermal cover percentage referenced in Guides for Elk Habitat Objectives (USDA 19787) and the 25% standard set in the Bitterroot Forest Plan Record of Decision.

Elk Habitat Effectiveness

The Forest Plan standard for elk habitat effectiveness (EHE) is to manage roads through the Travel Plan process to attain or maintain 50 percent or higher EHE in currently roaded drainages (those where more than 25% of the potential road system was in place in 1987), and 60 percent or higher EHE in drainages where less than 25% of the roads had been built (USDA 1987, p. II-21). EHEs of 50% and 60% equate to 2 miles and 1 mile of road per square mile, respectively (Lyon, 1983).This standard supports the Forest Plan objectives of maintaining habitat to support viable populations of wildlife species, and cooperating with the state of Montana to maintain the current level of big game hunting opportunities (USDA 1987, p. II-5). The EHE model described by Lyon (1983) was the best information available at the time the Plan was implemented. Subsequently, an additional model developed by Hillis, et al. (1991) has been used in Bitterroot National Forest project planning to maintain elk security during hunting season when elk are most vulnerable. See the following elk security section for details of how this model has been used in addition to EHE to achieve the Forest Plan objective.

EHE percentages were calculated for the Haacke-Claremont project area using GIS and updated road status data contained in the infrastructure database (INFRA). The table below displays the existing EHE percentages by third order drainage in the Haacke-Claremont area, and compares those to the current Forest Plan standard. For this analysis, roads that are closed to public use all year are counted as closed roads, even though we know that some level of unauthorized OHV use occurs on some of those roads. Roads that are closed seasonally are considered open roads for the purposes of this EHE analysis because small herds of elk are present within the roaded part of the project area year-round, and never migrate to higher elevation summer ranges.

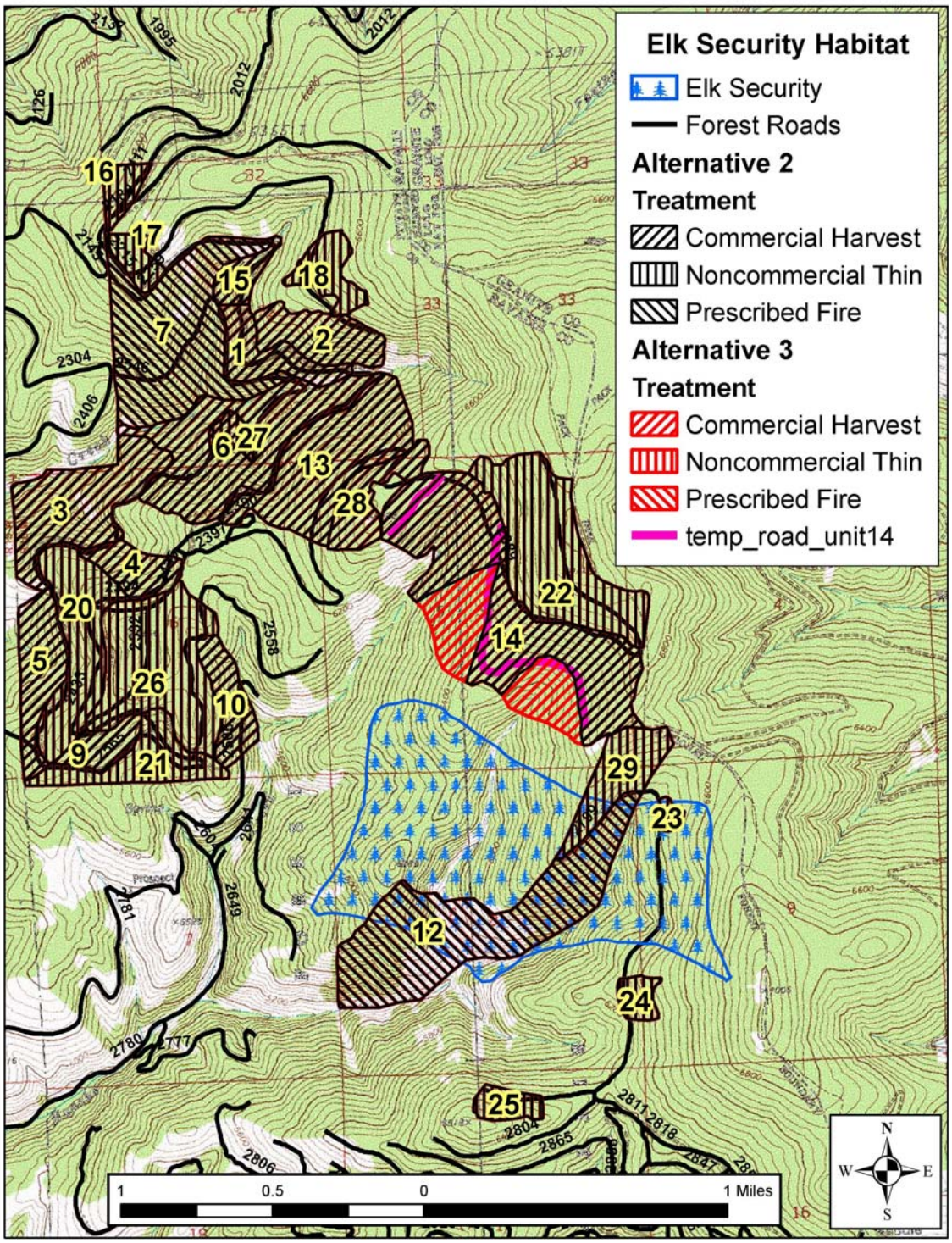
Vehicle traffic on those roads thus reduces the effectiveness of elk habitat throughout the year. Elk Habitat Effectiveness standards are met in one third order drainage within the project area and are not met in two third order drainages.

Existing Elk Habitat Effectiveness Percentages by Third Order Drainage Compared to Forest Plan Standards

Third Order Drainage	Existing Open Rd. Density (miles / square mile)	Existing EHE %	FP Minimum EHE
07a106-1	3.8	32	50
07a107-1	1.7	53	50
07a107-2	3.0	40	50

Elk Security

Elk security areas have been mapped using the criteria from Hillis et al. (1991). Security areas are defined as non-linear polygons of cover that are greater than 250 acres and more than one half mile from a road open to motorized use during the rifle hunting season. Adequate elk security exists when at least 30 percent of an elk herd unit qualifies as security area (Hillis et al, 1991). Elk security percentage across the lands administered by the Bitterroot National Forest within HD 204 is currently 35%, which is above the recommended level. One 470 acre elk security area exists within the project area (see figure) which constitutes approximately 15 percent of the area overall. The density and distribution of existing roads within the analysis area precludes the existence of any other security areas.


Elk Security Habitat
Elk Security
Forest Roads
Alternative 2
Treatment
Commercial Harvest
Noncommercial Thin
Prescribed Fire
Alternative 3
Treatment
Commercial Harvest
Noncommercial Thin
Prescribed Fire
temp_road_unit14
1
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Environmental Effects

Direct and Indirect Effects

Existing Elk Habitat Percentages within the Analysis Area and within the Winter Range Portion of the Analysis Area.

Habitat Category	Existing Condition	Alternative 2	Alternative 3	
Analysis Area				
	Existing	Alternative 2	Alternative 3	**"Optimum" Habitat Proportions (USDA 1978)**
Forested Forage	22%	37%	39%	40%
Hiding Cover	42%	30%	29%	25%
Open Forage	18%	18%	18%	20%
Thermal Cover	18%	15%	14%	15%
Non-habitat	<1%	<1%	<1%	
Winter Range				
Forested Forage	27%	50%	50%	40%
Hiding Cover	48%	26%	26%	20%
Open Forage	20%	21%	21%	20%
Thermal Cover	3%	1%	1%	20%
Non-habitat	2%	2%	2%	

Alternative 1

Population

Alternative 1 would not affect elk populations in the short term. Elk populations might eventually decline to some extent due to reduced forage productivity resulting from increasingly dense conifer canopies.

Habitat Including Thermal Cover

The No Action alternative would not change existing elk habitat percentages in the short term, including the existing percentage of thermal cover in elk winter range. In the absence of disturbance, forested stands would continue to become denser and taller. Thermal cover and hiding cover percentages are likely to increase over time, resulting in reduced vulnerability to hunting mortality. Open forage and forested forage percentages are likely to decrease, resulting in further reduced forage productivity. Continued insect and disease activity would slowly reduce the amount of thermal cover as these pathogens tend to affect older, less vigorous trees that form the overstory layer. The area would continue to be at risk of a large, high intensity fire which could dramatically reduce the amounts of cover, but dramatically increase the level of forage productivity.

Elk Habitat Effectiveness

Alternative 1 would not implement any road use restrictions. EHE ratings for two of the three third order drainages wholly or partially within the project area would continue to not meet Forest Plan minimum standards.

Elk Security

Alternative 1 would not change the existing elk security area percentage in the short term because it would not change existing road use restrictions or alter existing cover areas. The area would continue to be at risk of a large, high intensity fire which could reduce the elk security area percentage in the longer term.

Alternative 2

Population

This alternative would increase elk vulnerability to hunting mortality by increasing sight distances in many of the treatment units in the short term (10-15 years). Hunters would be able to detect and shoot at elk from longer distances within the units. Increased hunting mortality might reduce the number of elk within the project area to some extent. On the other hand, increased forage production resulting from reduction of overstory canopies in some units would lead to more elk surviving the winter in better condition. This in turn would improve birth rates and calf survival, which would tend to increase elk numbers. Overall, it is likely that there would be little discernable change in elk numbers within the project area as a result of implementing this alternative. Changes to elk populations resulting from implementation of this alternative would be difficult to quantify because elk populations are also affected by hunting regulations, predation levels and weather, among other factors. Currently elk numbers exceed the state goals. See cumulative effects section for more information.

Habitat Including Thermal Cover

The proposed treatments will reduce conifer encroachment and invigorate herbaceous production in winter and summer ranges. Elk will experience beneficial effects from the increased forage availability anticipated following application of these treatments. Treatments included in this alternative would reduce the thermal cover percentage from 18% to 15% across the entire area and from 3% to 1% within the winter range. Commercial harvest units Units 13 and 28 contain 16.5 acres of thermal cover. Unit 12 contains 7 acres of thermal cover within winter range which would be underburned in a prescribed burn treatment. This treatment will leave the structure of these 7 acres such that they still serve as thermal cover.

In general, this alternative would reduce hiding cover percentages and increase the amount of forested forage**.** Forested forage percentages would be nearer the levels considered “optimal” in USDA (1978), with an accompanying increase in forage productivity. Recent research (Cook, et al. 1998) indicates that higher levels of forested forage may be more beneficial to elk than high amounts of thermal cover. Hiding cover percentages would still exceed “optimal” levels (USDA 1978) across the project area and within winter range. Although elk might be more vulnerable to hunting mortality in some areas, adequate hiding cover would remain to allow elk to escape much of the hunting pressure.

Elk Habitat Effectiveness

Alternative 2 proposes no change to existing road use in the project area therefore no change to EHE would result from implementation of this alternative. The EHE standard of 50% would continue to not be met in 2 of the 3 watersheds within the project area.

Security
This alternative would not construct any new roads in areas that are now considered security areas. The 98 acres of prescribed fire and 15 acres of non-commercial thinning in the 470 acre security area will not compromise the ability of the area to serve as security habitat. These treatments will increase forage without substantially altering the overstory. Overall the amount of security habitat will remain unchanged at 470 acres within the project area.

Alternative 3

Population
The effects to elk populations within the project area and across the larger scale represented by hunting districts would be very similar to those described under Alternative 2. Overall, it is likely that there would be little discernable change in elk numbers within the project area as a result of implementing Alternative 3. Changes to elk populations could also occur due to hunting regulations, predation levels and weather, among other factors.

Habitat Including Thermal Cover
This alternative would also reduce the thermal cover percentage from 18% to 14% across the entire area and from 3% to 1% within the winter range. In general, the effects of this alternative are similar to alternative 2 except an additional 22 acres of hiding cover and 35 acres of thermal cover would be converted to forested forage outside of winter range.

Elk Habitat Effectiveness
The effects of changes to elk habitat effectiveness under Alternative 3 would be the same as those described under Alternative 2.

Security
This alternative includes approximately 1.2 miles of temporary road construction in unit 14 and 0.11 mile of temporary road reconstruction in unit 2. The temporary road in unit 14 will end 0.20 miles from the perimeter of the security area. The temporary roads would be closed and rehabilitated following project completion. As a result the temporary road would have no effect on the ability of the area to provide security habitat for elk beyond the time the road is in use for project implementation. Overall, treatments and resulting effects to elk security percentage under Alternative 3 would be the same as those described under Alternative 2.

Cumulative Effects

The defined cumulative effects area for elk is the Haacke-Claremont project area plus the portion of the HD 204 that lies within the national forest boundaries. This analysis area is appropriate to analyze any incremental effects from the actions of this project on elk in conjunction with past, present, ongoing and reasonably foreseeable future actions because it approximates the area of the elk herd unit. An assessment of information available at the Forest level is also considered to provide additional context. The cumulative effects of the site-specific Forest Plan Amendment for this project are also analyzed at the Forest level.

Population Trends and Broader Context

The Montana Natural Heritage Program classifies elk as a G5 S5 species (MNHP, 2006). This means that at both the global and state scales, elk are considered to be common, widespread, and abundant, and not vulnerable in most of their range.

The Haacke-Claremont area is located within the boundary of Hunting District (HD) 204. In 2007, the HD 204 elk count was 1,068, about 71% over the Montana Department of Fish, Wildlife and Park's (FWP) objective of 625. The elk count in the Rock Creek Elk Management Unit in 2007 was 3,672, about 47% over FWP's objective of 2,500 (Montana Fish, Wildlife and Parks, 2004). Elk trend counts for the entire Bitterroot drainage have generally been increasing since 1967, when the count was 1613. FWP counted a new record high of 8,169 elk in the Bitterroot in spring 2005. The 2006 count showed a total of 7,787 elk. While the 2006 count shows a 3% decline from the record number in 2005, FWP feels that this is well within the normal variation in year to year valley-wide counts, rather than an indication of a reduction in elk numbers (Montana Fish, Wildlife and Parks, unpublished).

Habitat Including Thermal Cover

FWP data show that elk numbers throughout the Bitterroot have increased dramatically even though the amount of thermal cover available in elk winter range across the Forest is less than the 25% required by the Forest Plan standard, indicating that this standard is not necessary to maintain elk populations. Additionally, since the Forest Plan was implemented it has become apparent that many portions of winter ranges in the Bitterroot historically did not produce or sustain large amounts of forest structure that meets thermal cover definitions.

Within the project area elk habitat on both winter and summer ranges has been heavily influenced by past harvest activity (see silviculture section). The past decades of fire suppression have led to more thermal cover than would typically occur in a fire adapted ecosystem, especially in the low elevation forests that were formerly visited regularly by low severity fires. Fire exclusion in these same areas resulted in less available forage for big game animals. Timber harvest has resulted in local increases in forage and reductions of thermal cover. Historic low intensity fires burned over much more of habitat type group, or VRU, 1 and 2 than timber harvest operations have affected in the last several decades, resulting in much more thermal cover today in these habitat types than occurred historically. State and private land thermal cover has been discounted as a factor in maintaining elk use of winter ranges for two reasons. Since most State and private lands are at low elevation, they are not likely to produce a stand of trees with 70 percent crown cover, and where thermal cover could exist, the landowner has no real incentive to maintain it as cover for elk.

The fires of 2000 and the ensuing Douglas-fir beetle epidemic on the south half of the Forest dramatically reduced thermal cover on winter ranges across much of the Forest. However, forage productivity apparently increased dramatically on both summer and winter ranges as grasses, forbs and shrubs responded to increased moisture and sunlight made available by the reduced conifer canopy. The number of elk counted in the burned elk herd units in the 2001 spring trend count was comparable to record numbers counted in 2000 (Montana Fish, Wildlife and Parks, unpublished), despite the loss of cover caused by the fires prior to the 2000 hunting season. The fact that elk populations have continued to grow across the Forest despite these reductions in

thermal cover seems to support the theory that abundant forage is more important to winter elk survival than thermal cover.

Timber sale projects listed as reasonably foreseeable actions (refer to silviculture section) have the potential to reduce thermal cover on winter ranges. Whatever management activities are implemented in the future must comply with the Forest Plan ROD standard and will not be allowed to reduce thermal cover without a site specific amendment. None of the other activities listed will have an effect on winter range thermal cover.

Thermal Cover Analysis of the Forest Plan Amendment

A site specific Forest Plan Amendment is proposed to adjust winter range thermal cover standards in the Bitterroot Forest Land and Resource Management Plan (Record of Decision page 8) to read:

"Existing thermal cover will be maintained within the Haacke-Claremont treatment units to the extent it does not conflict with meeting the project's objectives."

The direct effect of Alternatives 2 and 3 is that 16 acres of thermal cover within winter range will be reduced through commercial thinning treatments. The open grown ponderosa pine and mixed Douglas-fir/ponderosa pine stands on the warm-dry and moderately warm-dry slopes probably never supported enough trees to qualify as thermal cover, and certainly in historic landscapes, thermal cover did not occupy 25 percent of this elk winter range.

Research conducted since the Forest Plan was signed has questioned the necessity of thermal cover for survival of wintering elk (Cook, et al. 1998). Researchers found "no significant, positive effect of thermal cover on the condition of elk during any of the six experiments. In contrast, dense cover provided a costly energetic environment, resulting in significantly greater over-winter mass loss, fat catabolism, and (in one winter) mortality." Wintering elk survived and retained body weight better in open areas than in thermal cover. For this reason, whether thermal cover is necessary for individual elk survival or elk population viability seems open to question. For example, in the Middle East Fork, elk numbers are above State goals, in spite of less than 25% thermal cover on the north side of the river. See also above discussion about the fires of 2000.

This means that it is doubtful that the reduction in 16 acres of thermal cover will have a quantifiable effect on observed elk population numbers in the Haacke-Claremont Project Area. The reduction in thermal cover is not expected to impact the Forest's ability to meet the State's elk objectives. The State's elk objectives in most herd units across the Forest will continue to be met or exceeded.

Cumulative Effects

Since the Forest Plan was signed, it has become apparent that many portions of winter ranges in the Bitterroot are incapable of producing and/or sustaining the high canopy closures that provide thermal cover. The vegetative communities on these warm, dry sites were typically dominated by grasses, forbs, shrubs, and relatively open grown ponderosa pine and Douglas-fir/ponderosa pine stands that rarely supported enough trees to qualify as thermal cover. Certainly, in historic landscapes, thermal cover did not occupy 25 percent of elk winter ranges in the Bitterroot

drainage. On the other hand, the moister north-facing slopes and riparian areas have retained and provide thermal cover. Most of the thermal cover in winter range that has been identified in the Haacke-Claremont Project Area is on north slopes. About 3% of the winter range area is currently classified as thermal cover.

As stated in the thermal cover analysis above, research has cast doubt on the necessity for thermal cover as a major component of elk winter range. The generally upward trend of elk numbers seen on winter ranges in the Hunting District 204 and across the Forest indicates that the recent downward trend in thermal cover acres across the Forest, and on adjacent private lands, resulting from fires, timber harvest, bark beetle attacks, and thinning to create defensible space around structures in the wildland-urban interface, may have had a beneficial effect on the health of the elk herd, presumably due to increased forage production.

In most hunting districts in the Bitterroot, the 2004 Elk Management Plan (Montana Fish, Wildlife and Parks, 2004) objective is to stabilize or reduce the number of elk on winter ranges. Therefore, the slight reduction in thermal cover resulting from management actions with the Haacke-Claremont project will have negligible effect on thermal cover from a Forest-wide perspective, and will not likely have a measurable effect on the elk population in Hunt District 204 or the Bitterroot Valley. Therefore, this amendment will contribute toward meeting the Forest Plan objective to cooperate with the State of Montana to maintain hunting opportunity and elk population goals. Elk numbers are so high in the Bitterroot drainage and across the range of elk in Montana and the rest of western North America that there is no question or concern for elk viability.

Since the establishment of the Forest Plan in 1987, similar amendments of the thermal cover standard for the Bitterroot National Forest have been made for the Burned Area Recovery (2001) and Middle East Fork (2006) projects. Currently the Trapper Bunkhouse project (2008) is also proposing the same. Together with this amendment, the cumulative effects of amending the thermal cover standard will have an imperceptible effect when considered at the Forest scale because the change in thermal cover is not expected to adversely affect the ability to produce elk in this project Area, and the Forest objective and goals are expected to continue to be met.

Elk Habitat Effectiveness Analysis of the Forest Plan Amendment

The Forest proposes to adopt a site-specific Forest Plan Amendment for Elk Habitat Effectiveness that adjusts EHE standards to the current levels in the Haacke-Claremont project area.

Since the Forest Plan standard for elk habitat effectiveness was implemented in 1987, many, but not all, of the third order drainages on the Forest have been brought into compliance with the standard. There are two drainages in the Haacke-Claremont analysis area that are currently out of compliance. In spite of not meeting the Forest Plan standard for elk habitat effectiveness in every third order drainage, the Forest Plan objective of maintaining the current (1987) level of big-game hunting opportunities has been achieved. The number of hunters as well as the numbers of elk has continued to increase, and the general hunting season has remained at five weeks.

No ongoing or reasonably foreseeable future projects will have a detrimental effect on EHE in any of the third order drainages within the Project Area. The Forest has added an elk security analysis (Hillis et al. 1991) to its environmental analysis protocol that has proven to be a better

tool than EHE analysis for achieving the Forest Plan objective to maintain elk populations and hunting season opportunities in cooperation with the Montana Department of Fish, Wildlife and Parks. In summary, the proposed actions, in combination with past and reasonably foreseeable actions in this analysis area, are not expected to cumulatively degrade the habitat effectiveness for elk.

Determinations

Alternative 1 (No Action)
Implementation of this alternative would have **no impact** on elk or their habitat.

Alternative 2 and Alternative 3
Implementation of Alternative 2 and 3 **may impact individual elk or their habitat, but would not likely contribute to a trend towards Federal listing or loss of viability to population or species.**

Rationale for Determination

- There are no measurable or guaranteed impacts with implementation of Alternative 1.
- Forest-wide, the predicted impacts to elk habitat would not likely influence population or species viability.
- Population survey and harvest information from the Montana Fish, Wildlife and Parks indicate a thriving elk population in the Sapphire range and in western Montana.
- If elk occupy an area where treatment occurs, there is other suitable habitat in the Haacke-Claremont project area to displace to.

Pine Marten (*Martes americana*) (MIS)

Effects Analysis Methods

Pine marten (often referred to as American marten) are listed in the Bitterroot Forest Plan (1987) as a management indicator species for mature and old growth forests. The analysis for pine marten focuses on the suitable habitat within the Haacke-Claremont Analysis area. Suitable habitat is defined as habitat that may currently have the habitat components necessary to meet the needs of marten. Suitable habitat typically includes habitat type groups, or VRU, 3, 4, 7, 8 and 9 in older seral stages, and usually contains old growth, mature, saw timber, or multi storied structural components. Marten habitat was classified and mapped through a query of the Wildlife Oracle database, which contains habitat determinations based on a combination of TSMRS data, air photo interpretation and walk through exams by experienced wildlife personnel. We also used outputs from the Northern Region Vegetation Mapping Project (R1-VMap) to validate the general pattern of project-wide marten habitat ratings contained in the Wildlife Database.

For each alternative three evaluation criteria were used to predict impacts to pine marten. These are:

- Habitat suitability index - which includes consideration of structural stage, forest canopy closure, and large woody debris
- Effects to riparian corridors
- Temporary disturbance in suitable habitat

We have selected these three criteria for analyzing effects to pine marten for the following reasons.

Habitat Suitability Index

Marten use predominantly cooler, moister, habitat types and not habitat type groups 1 or 2 (Appendix B). Much of marten preferred habitat resembles mature and old growth habitat. Dead woody debris is an essential component of this habitat (Strickland and Douglas 1987; Witmer 1998, p. 14 and 16). Resting and denning tend to occur in structures associated with late-successional conifer forests, whereas prey can be distributed among a variety of successional stages. Because the types of forests that contain resting and denning sites may be more limiting, these habitats are used as an evaluation criteria in this analysis. Buskirk and Powell (1994) hypothesized that tree species composition is less important to marten than aspects of forest structure that affect prey abundance and vulnerability and provide denning and resting sites. Such forest structures can be characterized by a diversity of tree sizes and shapes; light gaps and associated understory vegetation; snags; fallen trees and limbs; and limbs close to the ground. A summary of old growth habitat and associated wildlife species in the Northern Rocky Mountains (USDA 1990, p.34) cited research suggesting that at least 50% of female marten home range should be maintained in mature or old growth forest. Forest structure should have three components important for marten: structure that leads to high diversity of dense prey populations, structure that leads to high vulnerability of prey, and structure that provides natal and maternal dens and resting sites.

Most studies have reported that marten prefer forests with continuous cover (Claar et al. 1999; Koehler and Hornocker 1977). Late-successional Douglas-fir forests of the Pacific Northwest are characterized by multiple layers of cover that create closed-canopy conditions (Franklin and Spies 1991). Koehler and Hornocker (1977) found that fires in the Selway-Bitterroot Wilderness in Idaho affected marten cover and food sources. The vegetation mosaic created by the fires of 1910, including stringers and patches of retained large trees, provided arrangement and quantities of marten food and cover, a combination of overhead cover from live trees and coarse woody material that provided den sites and subnivean (beneath the snow) travel lanes and hunting areas. Forests with greater than 30 percent canopy closure provided winter cover and foraging areas. Strickland and Douglas (1987) found marten did not use recent burns because habitat changes reduced prey populations and overhead cover. The same is not true in areas where beetle killed trees occur on the landscape, because beetles typically kill only a portion of the trees in a stand, and most areas that retained well over 30 percent canopy cover were used by pine marten.

***Effects to Riparian Corridor*s**

Riparian stringers of late successional stage vegetation provide important connectors. Marten use forested riparian areas extensively for foraging, resting, and as travel corridors (Claar et al. 1999; Witmer 1998, p. 15).

Temporary Disturbance
The potential for activities in the different alternatives to disturb marten was also assessed.

Affected Environment

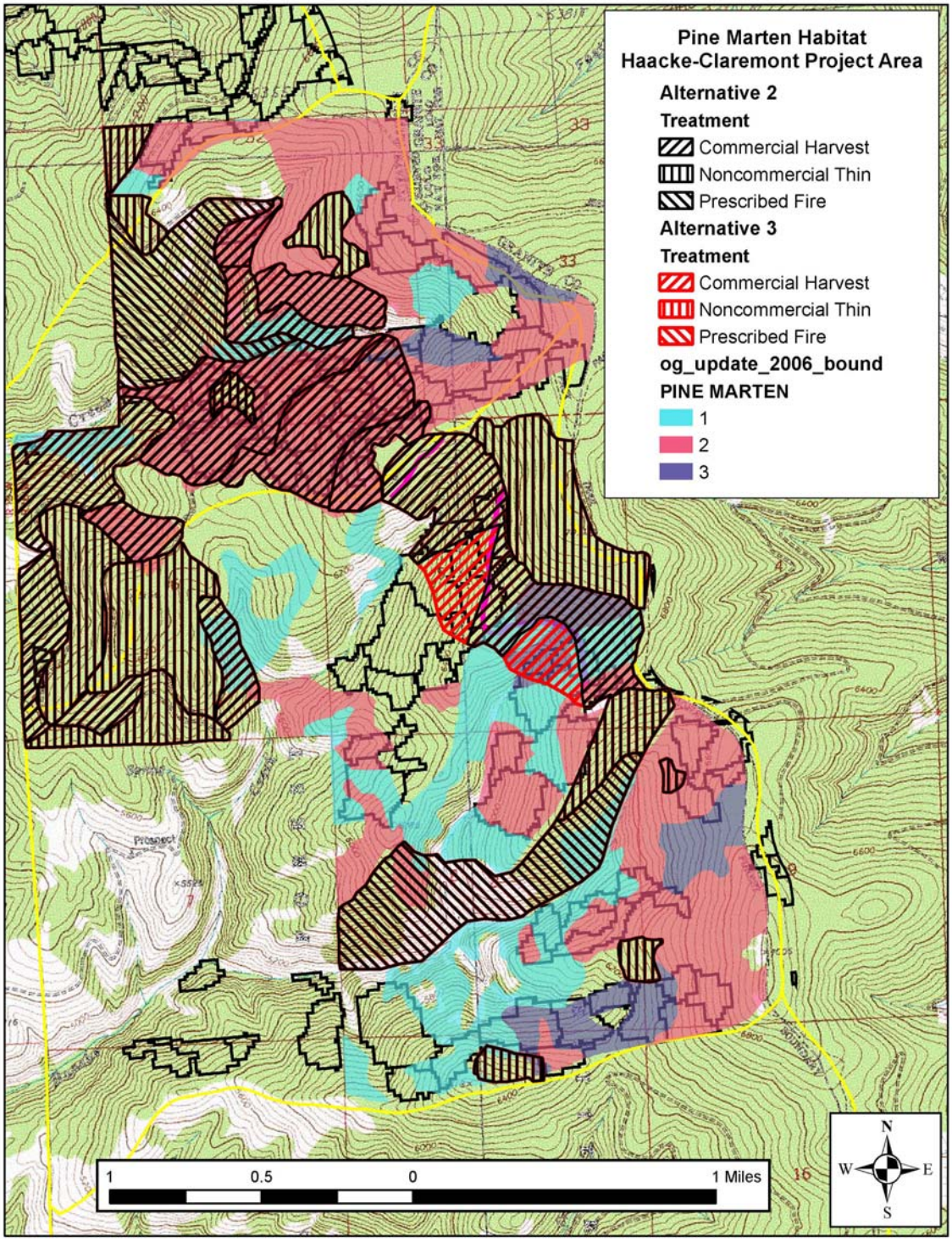
The Forest does not have population estimates for marten within the Haacke-Claremont project area. It is assumed that marten occupy suitable habitat within the area, since they appear to be widely distributed in similar habitat throughout the Sapphire Mountains.

There are approximately 2,031 acres of suitable marten habitat within the Haacke-Claremont project area, or 52% of the area. However, 89% of this habitat is rated marginal or suboptimal meaning that this area may not currently have the habitat components necessary to meet the needs of marten. The marten Habitat Suitability Index rating for the Haacke-Claremont area is currently 28%, based on existing data in the Wildlife Oracle database. An HSI rating of 28% indicates that overall, the project area provides poor to fair marten habitat. However, habitat quality varies considerably across the project area. Marten habitat quality in many of the lower elevation areas is marginal to poor. This is partly because these warm dry habitat types historically supported forest structures that were too open to provide high quality marten habitat, and partly because these areas have been harvested and/or thinned more than once in the past. They now support fairly open stands of pole to immature ponderosa pine mixed with Douglas-fir, with little course woody debris on the ground. These stands do not provide the closed canopies or structural complexity that martens prefer. However, many of the riparian areas that bisect lower elevation areas have much higher crown closures and much more coarse woody material than the adjacent uplands, and thus provide stringers of good to excellent marten habitat that serve as linkage zones to allow marten to move through areas of low quality habitat. Haacke and Claremont Creeks provide narrow zones of good marten habitat in their upper reaches, but marten habitat declines to only fair in their lower reaches on the Forest. The lower one mile of Haacke Creek is quite open, and provides only marginal marten habitat. Marten habitat quality in many of the mid to upper elevation stands is generally good, except in those areas that have been harvested in the recent past. Marten habitat quality at these elevations is generally better on cooler aspects. Stands at these elevations tend to support higher crown closures and also contain abundant course woody debris. Many of these stands support mature or older forest structures.

Outputs from R1-VMap were used to validate the general distribution of marten habitat quality across the project area indicated by the Wildlife Oracle database. R1-VMap confirmed that the lower elevations making up the western half of the project area are generally rated as poor marten habitat except for some stringers of better habitat along the larger creeks. R1-VMap also confirmed that mid to upper elevation areas are generally fair to good marten habitat, with most of the highest quality habitat on north aspects and in creek bottoms.

Marten habitat quality in the Haacke-Claremont area has declined somewhat over the past five years due to scattered mortality of Douglas-fir, grand fir and subalpine fir killed by bark beetles, dwarf mistletoe or root disease. Mortality of overstory trees reduces the crown closure, which is an important habitat feature for marten. This loss of overstory canopy may have reduced marten

habitat quality somewhat in some stands where insect or mistletoe mortality was most pronounced, but has not turned any stands into unsuitable habitat for marten.



Environmental Effects

Direct and Indirect Effects
Alternative 1

Habitat Suitability Index and Riparian Corridors
The No Action Alternative would not change existing habitat quality for marten, either in forested uplands or in riparian corridors. In the short term, habitat quality would continue to improve at both lower and upper elevations as forests continue to mature, crown closures increase and coarse woody material accumulates. In the longer term, increasing tree densities and fuel loadings would increase the probability of a large, intense fire. A large fire would create unsuitable habitat for marten in areas that burned with moderate or high intensities.

Temporary Disturbance
This alternative would not create any temporary disturbance to marten.

Alternative 2

Habitat Suitability Index and Riparian Corridors
In the short term, Alternative 2 would reduce the overall marten HSI from the existing 28% to 17%. Reductions in habitat quality would be most pronounced in the 430 acres of commercial thinning. Most of these acres are currently poor to fair marten habitat. Treatments in these units would result in unsuitable marten habitat because the proposed leave tree spacing would produce low crown closures, and subsequent fuel treatments would reduce the amount of course woody debris to levels below those preferred by marten. Reductions in habitat quality would occur but would generally be less pronounced in the 44 acres of prescribed burning and the 15 acres of small tree thinning because a higher proportion of the existing canopy and course woody debris would be retained. However, since most of these acres are currently poor marten habitat, even relatively small reductions in overstory canopy and/or course woody debris could make them unsuitable for marten.

This alternative includes one unit (Unit 3) which contains a riparian area that is currently classified as low quality marten habitat. The treatment would remove dead and dying trees surrounding the riparian area, which would open up the canopy to the point that the stand would no longer qualify as marten habitat. RHCA stream buffers would retain trees along the stream to maintain the corridor as marten habitat.

Average marten territory size would likely increase because the proposed treatments would reduce habitat quality within some territories. As a result, the project area's carrying capacity for marten would be less than the existing condition. The reduction in carrying capacity is not quantifiable, but is likely to be small.

In the long term, this alternative would reduce the risk of a large, high-intensity fire that could drastically reduce the amount of suitable marten habitat in large portions of the project area. It

would also reduce the potential for loss of overstory trees to pathogens, which would help to retain the continuous canopies that marten prefer. This alternative would help move treated stands towards old growth conditions in the long term by reducing high stocking densities that result in slow-growing, stunted trees that are at high risk of stand-replacing fire. However, most of the units would result in stands dominated by ponderosa pine, which develops less desirable old growth conditions for marten than more shade tolerant tree species such as Douglas-fir or subapline fir.

Temporary Disturbance

Mechanical treatments proposed in this alternative would disturb marten if any were present within the unit while the treatments were occurring. Marten would probably leave the immediate area of the activity. Since treatments are proposed on 44% of the project area, and activities would only occur on a small number of acres at any one time, there would be abundant amounts of suitable habitat for marten to disperse to.

Alternative 3

Habitat Suitability Index and Riparian Corridors

This alternative would reduce the overall marten HSI from the existing 28% to 17%. Reductions in habitat quality would be most pronounced in the 460 acres of commercial thinning in marten habitat. Most of these acres are currently poor to fair marten habitat. Treatments in these units would result in unsuitable marten habitat because the proposed leave tree spacing would produce low crown closures, and subsequent fuel treatments would reduce the amount of course woody debris to levels below those preferred by marten. Reductions in habitat quality would occur but would generally be less pronounced in the 44 acres of prescribed burning and 15 acres of small tree thinning because a higher percentage of the existing canopy and course woody debris would be retained. However, since most of these acres are currently poor marten habitat, even relatively small reductions in overstory canopy and/or course woody debris could make them unsuitable for marten. This alternative includes the same treatment in unit 3 that is included in Alternative 2. Effects to marten from implementation of treatments in this units would be the same as those described under Alternative 2. The long term effects of this alternative would be similar to those described for Alternative 2.

Temporary Disturbance

Mechanical treatments proposed in this alternative would disturb marten if any were present within the unit while the treatments were occurring. Marten would probably leave the immediate area of the activity. Since treatments are proposed on 46% of the project area, and activities would only occur on a small number of acres at any one time, there would be abundant amounts of suitable habitat for marten to disperse to.

Cumulative Effects

On a Forest wide basis there was 4% sawtimber sized DF in 1938-1942 compared to 26% currently (Samson 2005, p. 58). Marten habitat includes dense mature Douglas-fir, so theoretically marten habitat may be more extensive today then during the early 1900's into the 1940's. The build up of fuels, however, due to fire suppression suggests if a fire occurs in the area it could be uncharacteristically severe in size and intensity. If this occurred it could reduce large areas of marten habitat, as occurred in 2000 on the Bitterroot National Forest (USDA 2000

– Post fire assessment p. 4.4 Wildlife-8). The natural fire regime would have had mixed severity and smaller stand replacing fires that created a mosaic of mature forest for denning sites, with islands of unburned forest within burned areas that may have increased populations of voles or other prey. This was the pattern observed in the Selway Bitterroot Wilderness as a remnant of the 1910 fires (Koehler and Hornocker 1977). Past timber management has reduced mature canopy cover, downed woody debris and snags across the landscape, all of which are important to marten. Forestry practices changed in the 1980's to retain downed woody debris and snags in units. Marten may be vulnerable to fragmentation of habitat (Hargis 1999). Martens in one study were nearly absent from landscapes having greater than 25% nonforest cover (both natural openings and openings created by harvest) (Hargis 1999).

Trends & Broader Context

At a Forest wide scale it is estimated that we have approximately 393,400 more acres of marten habitat than is necessary to maintain a minimum viable population (Samson 2006). Another way to say this is that we have an estimated 2,374% of the habitat necessary to maintain a minimum viable population of marten on the Forest. Alternatives 2 and 3 would potentially reduce the amount of suitable marten habitat by 2,725 acres and 2,704 acres, respectively. These reductions would amount to about 0.7% of the 410,700 acres of habitat on the Forest.

Forest biologists have rated the suitability of the marten habitat across the Forest. Considering all the area rated, the Habitat Suitability Index for marten was calculated at 0.32. This index tells us that on average, marten habitat on the Bitterroot Forest (at least the 190,000 acres rated for suitability) is about 1/3 as good as the best marten habitat. This implies that marten are likely to occur in low densities in suitable habitat throughout the Forest. However, marten populations are likely to be robust in the corridors of high quality habitat that exist along many of the larger streams draining the Bitterroot Mountains.

The Bitterroot National Forest has been monitoring marten populations by searching transects for marten tracks since 1988 (2006 Forest Plan Monitoring Report (PF#-ForestPlan 8)). The Forest surveyed nearly 750 miles of transects between 1988 and 1996. In that period, an average of one marten track every 6.7 miles was observed. Variation between transects was high, ranging from one track every four miles to one track every eleven miles. It would appear that our population is much less dense than a Canadian population, where Thompson, et al. (1989) found nearly three tracks per mile of transect surveyed. The 1988-1996 data established a base line population index with which to compare more recent information. Each Ranger District has established permanent pine marten monitoring routes. These were established in developed areas, areas to be developed, and areas where no development is scheduled. Nine marten transects were completed in 2004 (the most recent surveys). The average number of miles surveyed per marten track in 2004 was considerably lower than the average from 1988 to 1996. Put another way, a lot more marten tracks were seen in 2004 than in previous years. This apparent increase could mean that marten numbers have increased dramatically, but could also be a result of other sampling or environmental variables, not the least of which is the effect of pelt price on trapping activity. During years of abundant food supply, population densities of marten increase, which could be another factor (USDA 1990, p. 34). Pine marten tracks have been detected on all the established monitoring routes indicating pine marten are well distributed across the forest (2006 Forest Plan Monitoring Report (PF#K-ForestPlan08). This distribution of habitat should allow individual martens to interchange between habitat patches (USDA 1990, p. 34). Fish, Wildlife, and Parks

trapping records and National Heritage Program ratings also seem to support wide distribution of this species.

Coarse Woody Material Analysis of the Forest Plan Amendment

A site-specific Forest Plan Amendment is proposed to adjust coarse woody material standards in the Bitterroot Forest Land and Resource Management Plan. The site-specific coarse woody material standard to be applied for the Haacke-Claremont project on all affected lands would read:

In areas where harvest and prescribed burning occur, coarse woody material (material greater than 3 inches in diameter) will be left from designated leave trees, both standing and down, and from breakage of limbs and broken tops that will occur during harvest, at or above the minimum levels identified in the following table. Material will be well distributed across all acres.

PROPOSED COARSE WOODY MATERIAL STANDARD BY FIRE GROUP

Fire Group (FG)	Coarse Woody Material
Warm, Dry Ponderosa Pine and Douglas-fir (FG-2 & 4)	5-10 tons/acre
Cool, Dry or Moist Douglas-fir (FG-5, 6)	10-20 tons/acre
Cool SitesUsually Dominated by Lodgepole Pine (FG-7) Dry, Lower Subalpine (FG-7) Moist, Lower Subalpine (FG-9)	8-24 tons/acre

This Forest Plan Amendment is needed because more recent research has been published since the Forest Plan was approved in 1987. Graham et al., 1994 and Brown et al. 2001 suggest a range of CWM by habitat type and/or VRU. The suggested range provides adequate CWD for soil productivity and other resource benefits without creating conditions that would lead to unacceptable fire intensity.

Direct and Indirect Effects

All harvest prescriptions for the Haacke-Claremont project would cut only a portion of the existing trees. Yarding will be either whole tree or leave tops attached. Coarse woody material (CWM) (material greater than 3 inches in diameter) will be left from designated leave trees, both standing and down, and from breakage of limbs and broken tops that will occur during harvest. The amounts listed for each Fire Group (see table above) will maintain future soil productivity.

The proposed fuel treatments are anticipated to leave slash on the ground through the winter and into late summer/fall before prescribed burning will be completed. This will provide opportunity for the nutrients in the slash to be leached into the soil.

Cumulative Effects

Since the establishment of the Forest Plan in 1987, two other Forest Plan amendments regarding CWM have been made for the Burned Area Recovery (2001) and Middle East Fork (2006)

projects. An identical amendment is currently proposed as part of the Trapper Bunkhouse project (2008). Burned Area Recovery treatments comprised approximately 0.6 percent of the Bitterroot National Forest, the Middle East Fork Project amendment 0.3 percent of the Forest, and the Trappaer Bunkhouse project 0.3 percent of the Forest. These projects, in combination with the Haacke-Claremont project, cumulatively amount to approximately 1.3 percent of the Forest. The CWM amendment for this project will not have appreciable cumulative effects at the site or Forest scale.

Cumulatively, by implementing this site-specific standard for CWM, the Haacke-Claremont Project Area is expected to have appropriate levels of CWM by fire group, over time, fully supporting the Forest goals and objectives.

Determination

Alternative 1 (No Action*)*
Implementation of this alternative would have **no impact** on marten or their habitat.

Alternative 2 and Alternative 3

Implementation of Alternative 2 and 3 **may impact individual marten or their habitat, but would not likely contribute to a trend towards Federal listing or loss of viability to population or species.**

Rationale for Determination

- There are no measurable or guaranteed impacts with implementation of Alternative 1.
- Because the potential effects of Alternative 2 and Alternative 3 are so limited, in the context of the apparently adequate and excess habitat Forest wide, the predicted impacts to potential marten habitat would not likely influence population or species viability.
- Alternative 2 and 3 would adhere to downed woody debris and snag mitigations which would retain adequate amounts of large woody debris and snags for marten for travel, resting, hiding cover, prey habitat, hunting and denning.
- Forest monitoring information indicates marten are present and appear to be well distributed (USFS 2006) Trapping information from the Montana Fish, Wildlife and Parks also indicate a thriving marten population in western Montana.
- If marten occupy an area where treatment occurs, there is other suitable habitat in the Haacke-Claremont project area to displace to.

Pileated Woodpecker (*Dryocopus pileatus*) (MIS)

Effects Analysis Methods

The analysis for the pileated woodpecker focuses on the suitable habitat within the Haacke-Claremont analysis area. Suitable habitat is defined for the Haacke-Claremont project as habitat that **may** currently have the habitat components necessary to meet the needs of pileated woodpeckers. Suitable habitat typically includes habitat type groups, or VRU 1, 2 and 3 in older seral stages, and usually contains old growth, mature, saw timber, or multi storied structural components. Suitable habitat is typically limited to elevations below 6200' on the Bitterroot National Forest.

Suitable habitat was mapped through a query of the Wildlife Oracle database, which contains habitat determinations based on a combination of TSMRS data, air photo interpretation and walk through exams by experienced wildlife personnel. Outputs from the Northern Region Vegetation Mapping Project (R1-VMap) were also used to validate the project-wide pileated woodpecker habitat ratings contained in the Wildlife Database.
For each alternative the following evaluation criteria was used to predict impacts to pileated woodpecker. These are:

- Habitat Suitability Index (HSI), which includes consideration of:
    - o Structural stage
    - o Availability of large snags for nesting
    - o Snags and coarse woody material for foraging.
    - o Elevation

We have selected this criterion for analyzing effects to pileated woodpecker for the following reasons:

Habitat Suitability Index

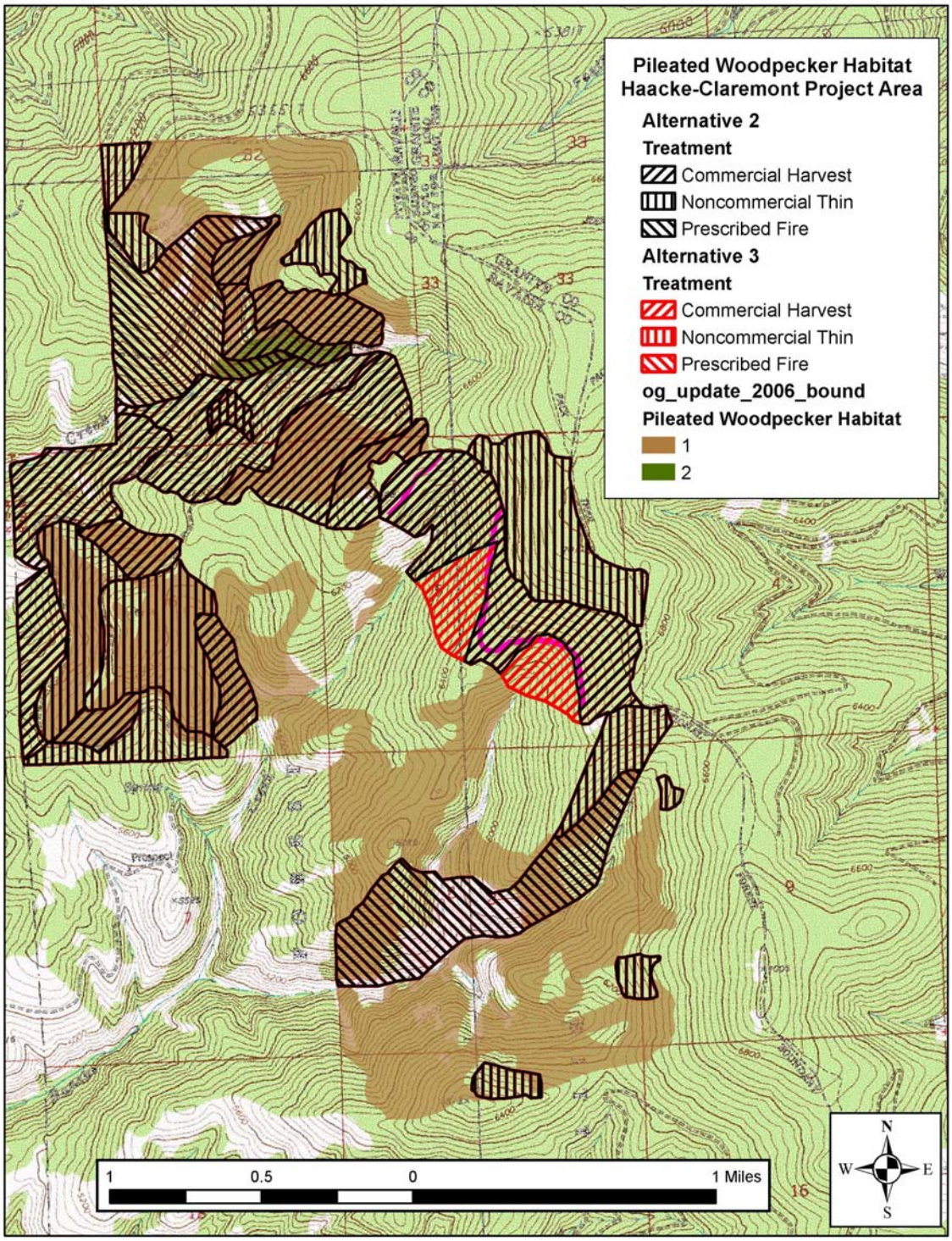
The pileated woodpecker inhabits mature and older forests of cottonwood, ponderosa pine and Douglas-fir at low to moderate elevations (Bull and Jackson, 1995). Dead trees large enough to accommodate a nest cavity are important for pileated woodpecker habitat (Terres 1980). The pileated woodpecker is most often associated with mature forests (Coner et al. 1979, Conner 1980, Shackelford and Conner 1997) although the presence of large trees for nesting is reported to be more important than forest age (Kirk and Naylor 1996, Giese and Cuthbert 2003). The pileated woodpecker may be able to do well in young and fragmented forests with abundant remnant (older) structure (Mellon et al. 1992). However some studies have showed pileated woodpeckers responded negatively to forest fragmentation, though whether older structure was retained in those studies is not clear (PF#K-wildlife3). The pileated woodpecker is reported to nest in areas with as little as 10% cover (Bonar 2001), although a Montana study indicated that they prefer nest stands with relatively high basal areas (100 – 125 square feet per acre) and relatively closed canopies for nesting (McClelland 1977). Nest snags are typically greater than 21 inches diameter at breast height and the cavity is usually more than 40 feet above the ground (Bull and Jackson 1995). Preferred nest tree species are western larch (which currently occurs only as planted saplings in the Haacke-Claremont area), ponderosa pine and black cottonwood. Other species such as Douglas-fir, grand fir and western white pine are rarely used for nesting (McClelland and McClelland 1999). Nest trees were similar in size to roost trees and both were typically snags (81% and 78% respectively) and with broken tops (McClelland and McClelland

1999), indicating they contained decay. Hutto (1995) reported habitat use by the pileated woodpecker similar to McClelland and McClelland (1999) in the Northern Rocky Mountains, i.e., mature cottonwood bottoms, ponderosa pine, and larch stands, but also reported use of mixed conifer and cedar-hemlock. Altered fire regimes are known to effect species composition, favoring shade tolerant species like Douglas-fir and inhibiting shade intolerant species like western larch and ponderosa pine. Researchers have stated that if altered fire regimes reduce the abundance of large, old western larch, they are likely to impact the pileated woodpecker as well (Smith 2000, p. 49). Western larch is present in the project area and it is reasonable to assume that if fire regimes reduce the abundance of large, old ponderosa pine, it may impact the woodpecker's habitat as well. Pileated woodpeckers on the Forest frequently forage on several tree species not preferred for nesting, particularly Douglas-fir. Carpenter ants are very important for pileated woodpecker habitat (Bull and Jackson 1995). Pileated woodpeckers often feed on ants, other insects, and larvae in dead down woody material and standing snags. In winter, the pileated woodpecker excavates relatively sound wood around the base of a snag or tree in search of carpenter ants.

Affected Environment

The Forest does not have population estimates for pileated woodpeckers within the Haacke-Claremont area. In 2007 we found three pileated woodpecker foraging sites in the project area. We did not hear their distinctive calls and did not have any visual observations. We conclude that pileated woodpeckers may occur in the area in very low densities. There are approximately 1,138 acres, or 36% of the analysis area of low quality habitat, meaning that it may currently have the some of the habitat components necessary to meet the needs of pileated woodpeckers. The pileated woodpecker Habitat Suitability Index rating for the Haacke-Claremont area is currently 7% based on existing data in the Wildlife Oracle database. An HSI rating of 7% indicates that overall, the project area provides marginal pileated woodpecker habitat. However, habitat quality varies considerably across the project area. Pileated woodpecker habitat quality in many of the lower elevation areas is marginal to poor, because these areas have been harvested and/or thinned more than once in the past. They now support fairly open stands of pole to immature ponderosa pine mixed with Douglas-fir. These stands generally contain very few snags large enough for this species to nest in, and few smaller snags or course woody debris to provide foraging habitat. However, many of the smaller riparian areas that bisect lower elevation areas contain scattered larger snags and live trees that could provide nesting habitat. They also provide more small snags and coarse woody material than the adjacent uplands, and thus provide stringers of fair to good habitat that could allow these birds to utilize the scattered foraging habitat that exists in this area.

Pileated woodpecker habitat quality in many of the mid elevation stands is generally marginal. Many stands in this elevation zone provide abundant foraging habitat in the form of coarse woody material and trees recently killed by bark beetles or mistletoe. Many stands above 6200 feet contain little suitable nesting habitat, but may provide some foraging habitat.


Pileated Woodpecker Habitat
Haacke-Claremont Project Area
Alternative 2
Treatment
Commercial Harvest
Noncommercial Thin
Prescribed Fire
Alternative 3
Treatment
Commercial Harvest
Noncommercial Thin
Prescribed Fire
og_update_2006_bound
Pileated Woodpecker Habitat
1
2
1
0.5
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Environmental Effects

Direct and Indirect Effects

Alternative 1

The No Action Alternative would not change existing habitat quality for pileated woodpeckers. In the short term, habitat quality would continue to improve at both lower and upper elevations as forests continue to mature, snag numbers increase as a result of mortality due to insects and disease, and coarse woody material accumulates. In the longer term, increasing tree densities and fuel loadings would increase the probability of a large, intense fire. A large fire would create unsuitable habitat for pileated woodpeckers in areas that burned with moderate or high intensities. Pileated woodpeckers are not strongly associated with recently burned landscapes as many woodpecker species are (Hutto, 1995), and do not commonly nest in areas of recent stand replacing fire (Smith, 2000).

Alternative 2 and 3

Alternatives 2 and 3 would not effect the overall pileated woodpecker HSI rating of 7%. Changes in habitat quality would be most pronounced in the 225 acres of commercial thinning in marginal or poor pileated woodpecker habitat. Habitat in these units would still be suitable for pileated woodpeckers, but habitat quality would improve because the treatments would reduce the number of small diameter trees while retaining the larger diameter trees and snags available for foraging and for nesting. These treatments would however, reduce the current amount of small snags and course woody debris available for foraging. Snag retention guidelines and coarse woody material guidelines would ensure that some foraging habitat would remain. An overstory of mature Ponderosa pine, western larch, and Douglas fir would remain and be favored by reduced competition in the understory. Changes to habitat quality would also result from the 96 acres of prescribed fire: more of the canopy comprised of large trees would generally be retained and coarse woody material would be reduced. An Oregon study showed that pileated woodpeckers foraged significantly less in units that had been burned using prescribed fire, because these units contained less dead wood habitat for ants, the primary prey species of pileated woodpeckers (Bull, et al. 2005). As a result, the project area's carrying capacity for pileated woodpeckers would be less in the short-term than the existing condition. The reduction in carrying capacity is not quantifiable, but is likely to be small.

In the long term, this alternative would reduce the risk of a large, high-intensity fire that could drastically reduce the amount of suitable pileated woodpecker habitat in large portions of the project area. This alternative would help move treated stands towards mature or old growth conditions in the long term by reducing high stocking densities that result in slow-growing, stunted trees that are at high risk of stand-replacing fire. Most of the treatments would favor stands dominated by ponderosa pine, which develops more desirable old growth conditions for pileated woodpeckers than shade tolerant tree species such as Douglas-fir or subalpine fir.

Cumulative Effects

Geographic Boundaries and Time Period

The defined effects area for pileated woodpecker is the Haack-Claremont project area. This analysis area is appropriate to analyze any incremental effects from the actions of this project on pileated woodpeckers in conjunction with past, present, ongoing and reasonably foreseeable future actions. An assessment of the habitat and population viability at the Forest level is also considered to provide additional context. To determine the cumulative effects area for pileated woodpecker the size of their territory was considered. Territory size reported in the literature varies considerably. Estimated territory size from studies in western coniferous forests include ranges of 500 – 1000 acres in western Montana (McClelland 1979) and 320 – 600 acres in northeastern Oregon (Bull and Meslow 1977), and means of 543 acres in northeastern Oregon (Bull and Meslow 1988), 1006 acres in northeastern Oregon (Bull and Holthausen 1993) and 3361 acres in Alberta (Bonar 2001). Assuming that the estimate from the Montana study is most pertinent to our area and that territory size for pileated woodpeckers in western Montana ranges from 500 to 1000 acres, it is reasonable to assess effects within the 1,138 acres of habitat in the analysis area. Incremental effects of proposed activities of this project to nesting territories outside the analysis area would not be measurable. The Forest level consideration is used to provide a broader context for the more localized effects analyzed.

Alternative 1

The current habitat status continues for several decades, meaning more snags will be available for nesting and more downed wood available for foraging. If a large-scale fire and severe fire occurred in the area it could reduce the amount of pileated woodpecker habitat for up to 100 years, until trees grew to a size suitable for nesting.

Alternative 2 & 3

Reduction in potential nest trees – In general, snag numbers are at an unprecedented level across the Bitterroot National Forest (USDA 2000, p. 4.4 Wildlife—8, 9). Douglas-fir snags, in particular, are available in the analysis area and throughout the south end of the Bitterroot National Forest due to Douglas-fir bark beetle mortality. Prescriptions are designed to favor retention of ponderosa pine trees and snags, which are preferred over Douglas-fir for nesting. Pileated woodpeckers are known to nest in 10% cover if suitable nest trees are available (Bonar 2001), but appear to prefer nest trees in areas that provide relatively high basal areas (100 – 125 square feet per acre) and relatively closed canopies for nesting (McClelland 1977). The effect of a reduction in the number of snags (which would predominantly be Douglas-fir) is assumed to be only a temporary impact, as other appropriate nest trees are available.

- Nest tree preference (restoring ponderosa pine) – Where ponderosa pine already exists the protection of those trees by removal of competition and fuel reduction activities would improve pileated woodpecker habitat for approximately 25 – 50 years or until the next fire disturbance or vegetative management occurs.

- Downed woody debris- foraging habitat – The amount of downed woody debris left after treatments is expected to be of sufficient quantity for foraging pileated woodpeckers. If

charring of the wood reduces ant use, and therefore foraging habitat, the effect would last until new downed woody material was available.

Determination

Alternative 1 (No Action)

Implementation of this alternative would have **no impact** on pileated woodpeckers or their habitat.

Alternative 2 and Alternative 3

Implementation of Alternative 2 and 3 **may impact individual pileated woodpeckers or their habitat, but would not likely contribute to a trend towards Federal listing or loss of viability to population or species.**

Rationale for Determination

- There are no measurable or guaranteed impacts with implementation of Alternative 1.
- Alternative 2 and 3 incorporate the needs of pileated woodpecker into the project design and mitigations. Snags will be retained consistent with the historic range for that habitat type.
- Ponderosa pine where appropriate, will be favored for retention for pileated woodpecker nesting. Alternative 2 and 3 will protect ponderosa pine reducing the current trend of loss.

Snags

Effects Analysis Method

The analysis of effects to snag habitat in the Haacke-Claremont analysis area focuses on the availability of this habitat across the analysis area, and in specific treatment units. The effects of implementing this alternative on some species associated or dependent on snag habitat occurs elsewhere in this Specialists report (marten, pileated woodpecker) and the Biological Evaluation for Sensitive Species (flammulated owl, northern goshawk, black-backed woodpecker).

We reviewed the scientific literature applicable to snags in the Northern Rocky Mountains to determine an appropriate number of snags to retain for wildlife habitat within treatment units while meeting the fuel reduction objectives for the Haacke-Claremont Project. This review included the Northern Region Protocol for Snag Management (Snag Protocol Team for the USDA Forest Service Northern Region, 2000), Abundance and Characteristics of Snags in Western Montana Forests (Harris, 1999), Old-Growth Forest Types of the Northern Region (Green et al. 1992, errata 2005), and the Interior Columbia Basin Ecosystem Management Project FEIS (2000, Appendix 12, p. 12-4). The following table shows the number or range of snags found in the various habitat type groups and the minimum range proposed for this project.

Snags per Acre by Habitat Type as Cited in the Literature and the Standard for This Project

Literature	Warm & Dry Habitat Types	Moderately Warm & Dry Habitat Types	Moderately Cool & Dry Habitat Types	Cool & Moist, Wet, or Cool & Moderately Dry Habitat Types
Harris	≈ 2.92	≈ 6.66	≈ 9.45	≈ 14.58 to 17.47
Green, et al.	0 to 22 with an average of 6 >9”dbh	0 to 22 with an average of 6 >9”dbh	2 to 37 with an average of 7 >9”dbh	0 to 92 with an average of 15 >9”dbh
ICBEMP FEIS Butte RAC Snags >21”	0.4 – 3.4	0.4 – 3.4	0.4 – 3.4	3.0 – 6.9
USDA 2000	1 to 2	4	6 to 12	6 to 12
Haacke-Claremont Minimum Snag Requirements	2 to 5	2 to 5	4 to 12	10 to 15

Affected Environment

The Haacke-Claremont area has not been affected by any large recent fires and it is currently still on the edge of the Douglas-fir bark beetle epidemic that has affected the southern half of the Forest in recent years. For these reasons there are not large concentrations of snags in the project area as are found throughout much of the Bitterroot National Forest. Though not at epidemic levels, the Douglas-fir bark beetle has created pockets of recently killed snags in some areas within the Haacke-Claremont area where larger Douglas-fir comprised a high percentage of the trees. Douglas-fir dwarf mistletoe seems especially virulent in some areas, and has also created numerous recent snags. Fir engraver beetle, western pine beetle and other insects and diseases are present at endemic levels, and continue to create small pockets of snags scattered across the landscape. Large ponderosa pine snags are relatively uncommon. Many of the lower elevation stands in the area contain very few large snags. These areas were clearcut in the early part of the 20th century. They are well stocked with healthy, vigorous trees, but lack the decay and decadence that provides habitat for cavity excavators.

The Bitterroot Forest Plan states, "All snags that do not present an unacceptable safety risk will be retained.” The purpose of the 1987 Forest Plan snag standard is to retain some vertical structure in the regenerated forest (Forest Plan Five Year Review 1994, p. 22, p. 70), in support of the wildlife goals and objectives, while providing a safe working environment. In contrast to some regeneration management practices prior to 1987 where no vertical structure was maintained at all, the standard intended that when conducting clearcuts, seedtree, and shelterwood harvests, some snags would be retained as vertical structure and biodiversity (Forest Plan Five Year Review 1994, p. 16, Appendix – Detailed Reports p. 2). In the Forest Plan Five Year Review it states that “In order to meet the intent of the Forest Plan to retain some large

vertical woody structure, about two trees per acre are needed…" (p. 22). In old growth habitat the Forest Plan has as criteria to consider "snags, generally 1.5 per acres greater than 6 inches dbh and .5 per acre greater than 20 inches" (II-20).

It is clear that the Forest Plan considered and permits salvage of dead or dying trees (FP Record of Decision, 1987). Fuel treatment is discussed in several areas of the Forest Plan (II-7, II-8, II, 28, III-7, III-13, III-20, III-28, III-34, III-38, III-63). The Forest Plan FEIS even specifically discussed the concern of stand replacing fires following mortality from insect epidemics and due to fire suppression (Volume I, p. III-33, IV-22). Salvage is also discussed in multiple areas of the Forest Plan and Record of Decision, further supporting that the removal of snags, beyond what is necessary for safety, was not only intended but was programmed (FP p. II-20(6), II-20(2), II-22(2), III-8, III-14, III-21, III-29, III-35).

Environmental Effects

Direct and Indirect Effects

Alternative 1

This alternative would not reduce the number of existing snags within the project area because it does not include any vegetative treatments. In the short term, snag numbers would tend to slowly increase as additional trees died as a result of endemic levels of insect and disease activity. At the same time, some existing snags would fall due to a combination of the progression of decay in their roots and butts, strong winds and snow loads. Snags near open roads would continue to be vulnerable to removal by firewood cutters. Overall, the number and distribution of snags would probably not change dramatically from the existing condition. In the long term, the existing dense canopies and high fuel loads that are common throughout the project area would continue to increase the risk of a large, intense fire that could kill most or all of the trees over a large portion of the project area. If such a fire occurred, it would dramatically increase the number of snags within the burned area. A large concentration of snags would provide abundant habitat for snag dependent wildlife species.

Alternative 2

This alternative would retain all existing snags on about 1,771 acres , or about 56% of the project area because no treatments are proposed for those acres. Some snags would be felled and removed from up to 1,117 acres, or about 35% of the project area. Treatments that would cut and remove snags include 671 acres of commercial thinning units and 446 acres of small tree thinning units. Most of the snags that would be cut would come from several units that contain high numbers of snags that were recently killed by pathogens. Prescribed burning which is proposed for an additional 282 acres, or 9% of the project area would not cut or remove snags. The burning treatments would likely reduce the numbers of existing snags because some of them would catch on fire and burn. These treatments would also create some new snags in areas where small concentrations of fuel occur near the boles or under the crowns of green trees.

Guidelines for snag and woody debris retention specified would be followed during harvest operations. These guidelines are designed to assure that the number, size and species of snags

that are left on site are within the historic ranges for a given habitat type, if such snags are currently available within the unit. Ponderosa pine would generally be favored for snag retention, where available and appropriate for the site. Larger snags would generally be favored over smaller snags for retention. Monitoring of recent vegetation management activities on the Bitterroot National Forest indicates that snag retention guidelines have consistently been met or exceeded (USDA, unpublished).

Portions of the 56% of the project area that are not within a harvest unit contain snag numbers than are on the high end of the historic range. Combined with leaving snag numbers within the historic range in the harvest units, the number of snags across the area following implementation of this alternative would be within the historic range. It is reasonable to assume that leaving historic levels of snags for a given habitat type would provide adequate snag habitat to sustain the wildlife species associated or dependent on snags that occur in those habitat types.

Alternative 3

The effects of implementing this alternative to some wildlife species associated with or dependent on snag habitat is disclosed later in this Section.

This alternative would retain all existing snags on about 1,708 acres or about 63% of the project area because no treatments are proposed for those acres. Some snags would be felled and removed from up to 1,180 acres, or about 37% of the project area. Treatments that would cut and remove snags include 734 acres of commercial thinning units and possibly 446 acres of small tree thinning units. Most of the snags that would be cut would come from several units that contain high numbers of snags that were recently killed by pathogens. Prescribed burning which is proposed for an additional 282 acres, or 9% of the project area would not cut or remove snags. The burning treatments would likely reduce the numbers of existing snags because some of them would catch on fire and burn. These treatments would also create some new snags in areas where small concentrations of fuel occur near the boles or under the crowns of green trees.

Guidelines for snag and woody debris retention would be followed during harvest operations. These guidelines are designed to assure that the number, size and species of snags that are left on site are within the historic ranges for a given habitat type, if such snags are currently available within the unit. Ponderosa pine would generally be favored for snag retention, where available and appropriate for the site. Larger snags would generally be favored over smaller snags for retention. It is reasonable to assume that leaving historic levels of snags for a given habitat type would provide adequate snag habitat to sustain the wildlife species associated or dependent on snags that occur in those habitat types. Monitoring of recent vegetation management activities on the Bitterroot National Forest indicates that snag retention guidelines have consistently been met or exceeded (USDA, unpublished).

Combined with leaving snag numbers within the historic range in the harvest units, the number of snags across the area following implementation of this alternative would be within the historic range. It is reasonable to assume that leaving historic levels of snags for a given habitat type would provide adequate snag habitat to sustain the wildlife species associated or dependent on snags that occur in those habitat types.

Cumulative Effects

Geographic Boundaries and Time Period

The defined cumulative effects area for snags is the Haacke-Claremont project area. This analysis area is appropriate to analyze any incremental effects from the actions of this project on snags in conjunction with past, present, ongoing and reasonably foreseeable future actions. An assessment of information available at the Forest level is also considered to provide additional context.

The effects of the reduction of snags in Alternative 2 and 3 would be an effect until other trees die. Given the current beetle epidemic, that has not reached the project area, but has been active in the southern portion of the Forest for several years, that may be a very short period of time, or it could be decades.

Other Actions

Approximately 888 acres of past harvest have occurred within the Haacke-Claremont analysis area since 1973. Few or no snags were left on about 78 of these acres (clear cuts with no reserve trees). Snag levels have been managed for in harvest units that have occurred in the project area since 1987.

In the Haacke-Claremont project, commercial timber harvest has been prescribed for up to approximately 671 acres in Alternative 2 and 734 acres in Alternative 3. Some of the merchantable trees proposed for harvest are dead or dying. In commercial harvest units, if the number of standing dead trees exceeds the historic range for snags, harvest will reduce snag numbers from current levels to approximately the number of snags present in historic forests, by habitat type.

The effects of continued firewood cutting would remove additional snags along open roads within the analysis area. This would reduce the number of potential nesting trees for cavity nesters as well as potential roosting and foraging habitat. Negligible cumulative impacts are expected for two reasons: the abundance of snags across the Forest, which is discussed above, and the small portion of the Forest available to firewood cutting. Management areas 1, 2, 3a, and 3c (the “roaded” portion of the Forest) comprise about 484,000 acres of Forest land. About 334,600 acres (70%) of that area are beyond 100 meters from a road, regardless of road status as open, closed or seasonally closed. Nearly 80 percent of the Forest outside Wilderness and Roadless areas is beyond 100 meters from a road that is open, even seasonally.

None of the Forest Service’s other ongoing or future activities will have a significant effect on snags because either they do not affect snags, or snag management guidelines would require retention of an appropriate number of snags be retained after the activity.

Trends and Broader Context

Snags are probably more abundant now on the Bitterroot National Forest than at any time since the Forest was created. The fires of 2000 burned across approximately 307,000 acres of the Forest, creating millions of new snags. About 46 percent of this area burned with moderate or high severity where the majority of trees were killed and turned into snags. In the 54 percent of

the area that burned with low severity, up to about 40 percent of the trees were killed either as individuals or small groups. The fires resulted in a large "pulse" of snags analogous to similar pulses created by large fires prior to active fire suppression. While the fires of 2000 may have been characteristic for some areas across the landscape other areas across the landscape had higher levels of stand replacing fires (in warm dry habitat types) than historically would have been expected. This resulted in a higher mortality in large ponderosa pine – generally a fire resistant species – than is characteristic for that fire regime. Several fires in 2003 burned approximately 19,700 acres on the north end of the Forest and created an additional but smaller pulse of snags. In 2005, fires burned approximately 22,570 acres on the Forest and adjacent private land. Most of the fires in 2005 were in the Wilderness or in Roadless areas on the Darby and West Fork Ranger Districts, and were allowed to burn with minimal suppression efforts. In 2006, the Gash Creek fire on the Stevensville District burned over 8,000 acres, both inside and outside the Selway-Bitterroot Wilderness. Suppression efforts were limited to the non-wilderness portion of the fire. Numerous other small fires were allowed to burn within wilderness areas on the West Fork District, creating additional snag habitat.

The vast majority of the snags created by these fires will be left on the landscape until they naturally fall and become downed woody material. The Forest only salvaged dead and dying trees from about 4% of the area burned in 2000, and from about 0.6% of the area burned in 2003. Most of the acres that burned in 2005 were in Wilderness or Roadless areas, and will not be harvested. Approximately 235 acres of salvage logging has been proposed within the non-wilderness portion of the 8,000 acre Gash Creek fire of 2006 (about 3% of the total acres burned), but all snags will remain within the Wilderness. Within areas burned during 2000 that were salvaged, monitoring indicates that numbers of snags left following harvest averaged much higher than the number required under snag retention guidelines (PF#K-wildlife1 and wildlife2). On the landscape scale, the Forest is allowing natural disturbance processes to shape the ecosystem by retaining most of the biological diversity created by fires.

A second major source of current snags on the Bitterroot National Forest is the Douglas-fir bark beetle epidemic which started before the fires of 2000. In 2002, Douglas-fir bark beetle populations soared to the highest infestation level ever recorded on the Bitterroot National Forest with approximately 29,000 acres infested on the southern half of the Forest. The epidemic has continued through 2006 and has created large Douglas-fir snag habitat on over 30,000 acres of the Forest outside Wilderness, and about 20,000 acres of Wilderness lands. Less than 1,000 acres of beetle killed trees have been harvested, and snags approximating historic numbers have been retained in the harvest units as well.

Estimates of snag numbers derived from FIA data show that snags were abundant and well distributed across the Forest even before the wildfires of 2000 and beyond. Table 3.7.6 shows estimated average snag numbers per acre for forested lands within several different scales across the Forest. Estimates of snag numbers are displayed separately for snags with diameter at breast height (DBH) between 10.0" and 19.9" (suitable size for most woodpecker species to excavate nest cavities) and DBH greater than 20" (large enough for pileated woodpeckers to excavate nest cavities in).

These estimates of snag numbers are very conservative; they do not include data from plots where fire, insect mortality or harvest activities have occurred since 2000.

	10.0” – 19.9” DBH			> 20.0” DBH		
	90% CI Lower Bound	**Estimate of Snags/Acre**	**90% CI Upper Bound**	**90% CI Lower Bound**	**Estimate of Snags/Acre**	**90% CI Upper Bound**
Entire BNF	6.7	8.7	10	0.6	0.9	1.2
MA 1	1.0	3.8	7.3	0	0.4	1.1
MA 2	0	1.4	3.8	0.1	1.5	3.4
MA 3a	1.3	4.7	8.6	0	0.7	1.5

With the abundance of snags available now and snag management guidelines in place to assure a continuing supply, every indication is that snag dependent species will have sufficient snag habitat to retain viability on the Forest (see also the cumulative effects of the implementing these alternatives on some snag associated or dependent species (marten, pileated woodpecker, flammulated owl, and black-backed woodpecker)). Therefore, the relatively minor effect of this proposal on snags is imperceptible and inconsequential when considered at the Forest scale.

THREATENED, ENDANGERED, AND SENSITIVE PLANT SPECIES

Existing Condition

An evaluation of threatened, endangered, and sensitive list plant species for the Haacke-Claremont analysis area was conducted. This evaluation began by reviewing the Montana Natural Heritage Program (MTNHP) database for known locations of sensitive plants within the area. The analysis area is also assessed for inclusion of habitat that might be suitable for other sensitive plant species by reviewing timber stand data and aerial photo interpretation.

Based on this evaluation, a list was compiled of sensitive plant species that were either known to occur near the analysis area or had the potential to occur in the Haacke-Claremont analysis area. Field surveys for the following species were conducted in the summers of 2006 and 2007 for the following species:

Western boneset	Ageratina occidentale
Tapertip onion	Allium acuminatum
Dwarf onion	Allium parvum
Rocky Mountain paintbrush	Castilleja covilleana
Yellow lady's-slipper	Cypripedium parviflorum
Western pearl-flower	Heterocodon rariflorum
Turkey-peas	Orogenia fusiformis
Lemhi penstemon	Penstemon lemhiensis
Hollyleaf clover	Trifolium gymnocarpon
California false hellebore	Veratrum californicum

The closest population of Lemhi penstemon is found in the North Fork of Rye Creek, about 30 miles to the south of the Haacke-Claremont analysis area. A population of hollyleaf clover occurs about ten miles to the southeast in the Rock Creek drainage on the Lolo National Forest. Except for this population, hollyleaf clover has only been found in the vicinity of Painted Rocks Reservoir in the state of Montana. Puzzling halimolobos has been found in the extreme southern end of the Bitterroot National Forest, on the West Fork Ranger Distrcit, near Beaver and Woods Creeks. Taper tip onion has been found far to the south in the Anaconda-Pintlar Wilderness and further north on the Lolo NF. Rocky Mountain paintbrush has only been found on the West Fork and Sula Ranger Districts in Montana. The closest populations of dwarf onion have been found in the Trapper Creek drainage on the Darby Ranger District, almost forty miles southwest of the analysis area. All of these species are found associated with grasslands and open ponderosa pine *(Pinus ponderosa)* forests and were surveyed for in these habitats in the Haacke-Claremont area. Hollyleaf clover, turkey-peas and Rocky Mountain paintbrush have also been found associated with Douglas-fir/pinegrass *(Pseudotsuga menziesii/Calamagrostis rubescens)* habitat types. Although this habitat was seen within areas of proposed activities, none of these species were found during surveys.

Populations of western boneset have been found scattered throughout the Bitterroot Forest on all ranger districts. This species grows in rocky sites and talus slopes. Any such areas encountered during survey work were checked for this species. No new populations were located.

Yellow lady's-slipper has never been found on the Bitterroot National Forest. It has been found further to the north on the Lolo and Flathead National Forests. Yellow lady's-slipper is found in wet areas and moist forests from 3,000 to 6,200 feet. California false hellebore has been found on the Sapphire Divide on the Bitterroot and Beaverhead-Deerlodge National Forests. It is associated with riparian areas and seeps. Western pearl-flower is associated with canyon seeps and vernally moist swales and has been found in the Lost Horse Canyon, McCalla Creek drainage and near the Lee Metcalf National Wildlife Refuge. Populations may be overlooked due to its small size. All of these species were surveyed for whenever these habitats were encountered, but none of them were found.

Since our knowledge of most of the species on the Bitterroot National Forest sensitive plant list is still fairly limited it is important to be aware that species may be found in areas outside of what is currently thought to be "suitable" habitat. Therefore, during the course of field surveys, plant species taken out of consideration due to distribution or habitat unsuitability were also cursorily surveyed for. No other sensitive plant species were found.

Environmental Effects

Effects Common to all Alternatives

There were no sensitive plant species found in the Haacke-Claremont project area, although potentially suitable habitat does exist for some species (refer to the table below)

All of the present or foreseeable future actions currently proposed on Bitterroot National Forest lands are based on maintaining the population viability and geographic distribution of all sensitive plant subpopulations on the Forest. Therefore, none of the present or foreseeable future actions currently proposed on the Forest (including the activities proposed in the Haacke-Claremont project area) should adversely affect the population viability of sensitive plants at the Forest level.

Effects of Alternative 1 – No Action

Direct and Indirect Effects

Alternative 1 (No Action) has no activities planned in areas where potentially suitable sensitive plant habitat occurs, so this alternative is unlikely to adversely affect any habitat. However, with continued fire suppression, changes in fuel loadings may result in more intense fires, increasing the possibility of soil heating and damage to below ground plant tissue. This may also result in more bare soil and an increased chance of knapweed spread. Observations after the 2000 fires on the Bitterroot Forest indicate that in areas where spotted knapweed was present prior to the fires, knapweed plants increased in vigor and new seedlings were appearing in the second year post-fire in areas of bare soil exposed by the fire. Although the No Action alternative is not likely to adversely impact any potentially suitable sensitive plant habitat there is a possibility that a large-scale, natural fire event may result in the creation of more bare soil, invasive plant spread and negative impacts on suitable sensitive plant habitat.

Units with Suitable Sensitive Plant Habitat

Unit	Western bontset	Turkey-peas	Dwarf onion	Rocky Mtn paintbrush	Lemhi penstemon	Hollyleaf clover	Woolly-head clover	Taper-tip onion
1		H		h	h	H	H	
2		H		h	h	H	H	
3		H		h	h	H	H	
4		h				h	h	
5		H		h	h	H	H	
6		h				h	h	
7	H	H		h	h	H	H	
9		H		h	h	H	H	
10		H		h	h	H	H	
12		H	h	h	h	H	H	h
13		h				h	h	
14		h				h	h	
15		H		h	h	H	H	
16		H				H	H	
17	h	H		h	h	H	H	
18		H		h	h	H	H	
20		H		h	h	H	H	
21		H		h	h	H	H	
22		H		h	h	H	H	
23		H				H	H	
24		H				H	H	
25		H				H	H	
26		H		h	h	H	H	
27		H		h	h	H	H	
28		H				H	H	

H = suitable habitat present
h=patches of suitable habitat present

Cumulative Effects

The extent to which sensitive plants and their habitat have been impacted by past management activities is unknown. It is probable that more suitable habitat existed prior to fire suppression activities, in which case continued fire suppression would result in more forest encroachment on these open forest habitats. There was probably more suitable habitat prior to the introduction and spread of spotted knapweed. Invasive plant spread may be attributed to many factors including livestock and wildlife grazing, road construction, timber harvest, off-road vehicle use, fire and

drought. Timber harvest activities in the past, particularly where clearcutting and ground-based activities over bare soil occurred likely contributed to the loss of suitable sensitive plant habitat. Timber harvest in the 1970s may have been the main contributor to the introduction and spread of spotted knapweed. In the past, timber contracts did not require the cleaning of equipment and grass seed used on disturbed sites and road cuts may have been contaminated with weed-seed. However, it is still unknown what the status of sensitive plant populations were at the time so the impacts of any such activities on these populations would be speculative at this time. Mitigations such as winter or helicopter harvest have been used in present and future timber harvests across the Forest to protect sensitive plant populations and habitat.

The introduction of off road vehicles (ATVs and motorcycles) that travel over rougher terrain than in the past has contributed to weed spread into new areas. These vehicles are vectors for weed seed as seed is picked up and deposited when traveling off-road. Off-road vehicles can also travel over and damage or destroy sensitive plants as noted with a small population of Lemhi penstemon in the lower Robbins Gulch drainage (personal observation).

Wildfires, such as those occurring in 2000, have also contributed to weed spread and habitat alteration by removing canopy cover and understory vegetation, creating sites for weed colonization. Spotted knapweed populations that were in existence prior to the fires resprouted and have increased seed germination. Nearby sites not previously infested were also being colonized by new seedlings (Sutherland 2003). Post-fire spotted knapweed colonization was noted in a study done in Douglas-fir habitats (Ferguson et al 2007). The areas with the highest burn severities had the greatest increase in spotted knapweed coverage.

Continued fire suppression with no fuel reduction activities in the Haacke-Claremont area could increase the risk that a more severe fire event would occur in the coming years. As noted below in Effects Common to All Action Alternatives a more severe fire could contribute to further spread of spotted knapweed on drier, south and west-facing aspects and increase the risk of cheatgrass spreading.

Effects Common to all Action Alternatives

All action alternatives that involve timber harvest to open the forest canopy and/or burning on south or west facing slopes have the potential for spreading invasive plants - particularly spotted knapweed *(Centaurea biebersteinii {C. maculosa}) (See Invasive Plants section).* The spread of invasive plants threatens sensitive plants and native plant diversity. As spotted knapweed increases, cover of more desirable, but less competitive native plant species can be significantly reduced, sometimes by as much as 60 to 90 % (Duncan 1997). Rare plant species can be particularly vulnerable since their numbers tend to be lower. There were no sensitive (rare) plant species found in areas of proposed activities although potentially suitable habitat was found.

Spotted knapweed prefers the warm, dry ponderosa pine and Douglas-fir habitat types which historically burned at an interval of 5 to 25 years (USDA Forest Service 1995). Fire suppression activities have increased this interval to about 50 years, resulting in increased fuel loadings and the potential for a severe fire event in these areas. Spotted knapweed is highly adapted to disturbance and open canopies, particularly on drier sites (Zouhar 2001a). In western Montana it appears that the more vegetation consumed in a fire on sites previously infested with knapweed, the higher the probability of spotted knapweed spreading into newly opened areas in its immediate vicinity. Observations two years after the 2000 fires on the Bitterroot Forest indicate that areas where spotted knapweed was previously established have notably healthier looking

plants with new seedlings colonizing on-site, as well as off-site, in previously weed-free areas (Sutherland 2003). Another post-fire study revealed that over time Douglas-fir habitats with hotter burn severities had a higher increase in spotted knapweed than areas with lower burn severities (Ferguson et al 2007). This same study concluded that disturbance was a prerequisite for spotted knapweed invasion in Douglas-fir habitats but not in ponderosa pine habitats. Bull thistle *(Cirsium vulgare)*, another invasive species, was seen in many burned areas within a couple of years of the fires (Sutherland 2005). Populations of bull thistle tend to be short lived and should decline as native vegetation recovers (Zouhar 2002a). Cheatgrass has also been observed coming in after the fires, especially under ponderosa pine trees where needle litter often several inches thick was burned off (personal observations). On north and east-facing sites not previously infested with weeds, native vegetation appears to be recovering well enough to compete with any potential new invaders (personal observations). This observation was confirmed by the Ferguson study where it was noted that west-facing slopes were the most prone to spotted knapweed invasion (Ferguson et al 2007).

Timber harvest or prescribed fire alone would be less impactive than the combination of both on spotted knapweed spread, particularly in Douglas-fir habitats. However, without reducing some of the fuels prior to igniting fires there is a greater potential for the fire to carry into the forest canopy. Ground-based timber harvest activities increase the risk of weed spread by scarifying the soil and potentially carrying weed-seed on equipment to the project area. Skyline harvest will create less ground disturbance. Underburning post-harvest further increases the potential to open the canopy as well as create more bare soil.

Prescribed fires in the Haacke-Claremont project will most likely be done under cool conditions, which would reduce the fire severity and ground disturbance leading to weed spread. Based on the results of research on the Bitterroot National Forest after the 2000 fires it appears that over time high severity fires are more conducive to weed spread than low severity fires in Douglas-fir habitats (Ferguson et al 2007). Ponderosa pine habitats tend to already have established spotted knapweed populations which will continue to be present in these habitats, with or without added disturbance (Ferguson et al 2007). Studies done on prescribed fire effects on sulfur cinquefoil *(Potentilla recta)* show similar results. Hotter fall burns were more likely to increase sulfur cinquefoil and damage native grass species than cooler spring burns (Lesica and Martin 2003). Prescribed burning in Sequoia and Kings National Parks determined that as fire severity increased, cheatgrass populations grew larger so burning had to be discontinued (Rice 2003). If prescribed burns in the project area do get hot enough to burn understory vegetation and remove more canopy there will be more light entering the understory and more bare soil, so the risk of spreading weeds would be higher. However, any fuel reduction activities conducted prior to the prescribed burn should help reduce this risk. The trade-off with the proposed activities is that of reducing fuels and burning under controlled conditions where some of the native plant community will be left intact to help compete with weeds, or risking a potentially severe natural fire event in the drier summer months (see Invasive Plants – Environmental Consequences, below, for more information). As invasive plants increase and alter the native plant community the more difficult it will be to return the area to a pre-invasive fire regime (Brooks et al 2004).

All action alternatives that involve timber harvest to open the forest canopy and/or under burning on lower elevation south or west facing slopes have the potential for spreading invasive plants - particularly spotted knapweed *(Centaurea biebersteinii*). Studies in Montana and Michigan show varying responses of knapweed to burning (FEIS 2002). In western Montana it appears that the more vegetation consumed in a fire on sites previously infested with knapweed, the

higher the probability of spotted knapweed spreading into newly opened areas in its immediate vicinity. Observations two years after the 2000 fires on the Bitterroot Forest indicate that areas where spotted knapweed was previously established have notably healthier looking plants with new seedlings colonizing bare soil nearby (personal observations, 2002). Areas that weren't previously infested with knapweed are not currently seeing new invaders other than some bull thistle *(Cirsium vulgare)* (Sutherland, personal communication). Native vegetation appears to be recovering well enough to compete with any new invaders on sites not previously infested.

The spread of invasive plants threatens native plant diversity. As spotted knapweed increases, cover of more desirable, but less competitive native plant species can be significantly reduced, sometimes by as much as 60 to 90 % (Duncan 1997). Rare plant species can be particularly vulnerable since their numbers tend to be lower. Spotted knapweed prefers the warm, dry ponderosa pine and Douglas-fir habitat types which historically burned at an interval of 5 to 25 years (USDA Forest Service 1995). Fire suppression activities have increased this interval to about 50 years resulting in increased fuel loadings and the potential for an intense or severe fire event in these areas. Such an event would cause more disturbance and bare soil, and a higher likelihood of weed spread than would occur with a prescribed burn under controlled conditions. If a wildfire occurs without the proposed vegetation management activities, chances are the fire will be of such an intensity to create the bare soil necessary for spotted knapweed colonization. With no native vegetation left for competition the knapweed infestation could be worse than with a planned ignition under moister conditions. The trade-off here is whether to burn under controlled conditions where most of the native plant community will be left intact, or risk the occurrence of a natural fire in the hotter summer months. In either case, spotted knapweed is likely to increase, but mitigations such as spring burning may lessen the risk of spread.

Effects of Alternative 2

Direct and Indirect Effects

Alternative 2 proposes commercial and non-commercial thinning and prescribed burning on 1400 acres. Although there were no sensitive plant species found there is suitable habitat for Lemhi penstemon, turkey-peas, Rocky Mountain paintbrush, hollyleaf clover, woolly-head clover, dwarf onion, taper-tip onion and western boneset in areas of proposed activities (see table above). The biological evaluation determined that for these species this alternative "May Impact Individuals or Habitat, but Will Not Likely Result in a Trend Toward Federal Listing or Reduced Viability for the Population or Species." Most of these species are known to occur in fire-adapted plant communities that experienced frequent, low intensity natural fires (Arno 1976). Species like dwarf and taper-tip onion have an underground bulb that should easily survive the flashy types of fires that have historically burned through grasslands and open ponderosa pine stands in this area. Lemhi penstemon, turkey-peas and hollyleaf clover have deep tap roots, an adaptation to survive ground fires during plant dormancy. These type plants will usually resprout the following season after fire. Lemhi penstemon has a dormant seed bank which has been known to be activated by soil heating from fire (Heidel and Shelly 2001). For all other sensitive plant species analyzed this project would have "No Impact".

The impacts on potentially suitable sensitive plant habitat will mostly be a result of opening the canopy and increasing the risk of spotted knapweed encroachment (see Effects Common to All Action Alternatives). Slash will either be hand piled and burned or left on site and broadcast

burned. Burning piles can create enough bare soil to make a seed bed for weeds such as knapweed, cheatgrass, mullein or bull thistle. Mullein and bull thistle are usually transitory weeds and will slowly be overtaken as the native plants come in, but knapweed and cheatgrass can become more long-term problems. The size of piles will be minimized to no larger than 10 feet wide and 6 feet tall to reduce the risk of a hot burn (see Mitigation Measures in Chapter 2).

Commercial Harvest

Tractor harvest over bare ground may adversely impact some sensitive plant habitat due to the high likelihood of spreading invasive plants. Summer tractor harvest both disturbs soil (up to 15%) and increases the risk of transporting weed seed into the unit. Units 4, 9, 28 and portions of units 2, 3, 5, 6, 13 and 14 will be tractor harvested. Most of these units contain spotted knapweed except 3, 4, 5 and 6 which either have heavy canopy cover or have not been treated before, helping to deter weed encroachment. Therefore, weed prevention mitigation measures (FSM 2080) will be strictly followed in order not to introduce or further spread weed seed into these harvest units. After completion of harvest, disturbed sites, including skid trails will be evaluated and the Timber Sale Administrator and/or resource specialists will determine erosion control and revegetation needs. Topography, presence and condition of adjacent vegetation, and amount of disturbance will be used to determine need and treatment. Appropriate erosion control and revegetation may include seeding and fertilizing per the timber sale contract; and planting of shrubs, mulch and/or scattering of slash as funding permits. Planting native shrubs would help restore root structure to the soil and speed up vegetative recovery if funding is available. The additional rehabilitation opportunities would further reduce the risk of weed spread, by restoring the native soil and plant components, but are not a certainty. In order to prevent weeds from invading or increasing in all activity units, additional mitigation measures such as cleaning weed-seed off equipment and revegetating disturbed areas as soon as feasible will be used (see FSM 2080). (See also Required Mitigations and Project Design Features in Chapter 2, Section 2).

The risk of weed spread intensifies in tractor units with the reintroduction of fire. This risk is greatest with burn piles that burn intensely and destroy the mineral soil layer. With summer tractor harvest there already is some soil disturbance so the added disturbance from fire may be enough to cause increases in weeds, particularly if burning is done in areas where ground disturbance has occurred or conditions are very dry (i.e., south or west-facing slopes).

Skyline cable harvest is proposed for units 1, 10, 15 and portions of units 2, 3, 5, 6, 13 and 14. Skyline cable harvest can disturb from 2 to 5% of the soil so the potential for adversely impacting sensitive plant habitat are less than for summer tractor. Units 3, 5 and 6 contain little or no spotted knapweed due either to the thick canopy cover or lack of previous harvest activities. With skyline harvest ground disturbance can be associated with cabling logs up slope. If logs are fully suspended, there should be very minimal disturbance. Logs that are dragged up by one end can tear up the soil and vegetation in the skyline corridor creating sites for weed colonization. If no weeds are in the area and vegetation is replaced in corridors after cabling, the risk of weed encroachment is minimal. Seeding should only be done if cable harvest creates large areas of bare soil.

Seeding with commercial seed mixes increases the risk of introducing weed, or other unwanted seed on site, therefore all seed mixes must be approved by the Forest Botanist and be certified weed seed free. If weed spread is minimized and soil/vegetation displacement is kept to a minimum, there should not be any adverse impacts to potentially suitable sensitive plant habitat.

Skid trails will be evaluated post-harvest to determine the need for seeding. Any other rehabilitation work such as pulling soil and vegetation back over the trails are opportunities that can be accomplished in a stewardship contract if funding is available.

Prescribed Fire

Units 7 and 12 are proposed for prescribed burning with limited slashing of trees ten inches dbh and less. None of these treatments involve using machinery on the ground since thinning will be done by hand so ground disturbance will be minimal. They both contain spotted knapweed and unit 7 also has small amounts of houndstongue and cheatgrass. There is potential for expanding spotted knapweed further into these units when opening the canopy by thinning and disturbing the ground by burning piles (see more detail above in Commercial Harvest and **Effects Common to All Action Alternatives).** Burning piles has the potential to create more intense heating and create more disturbed areas for invasive plant encroachment than broadcast burning where heating would be more widespread but not as intense.

Non-commercial Thin

Units 16 through 27 are non-commercial thin units (409 acres total) that will be thinned by hand with the slash being piled and burned or left on ground and broadcast burned. Thinning should improve sensitive plant habitat for turkey-peas, dwarf onion, Rocky Mountain paintbrush, Lemhi penstemon, Payette Penstemon, hollyleaf clover, woolly-head clover, puzzling rockcress, taper-tip onion, and dwarf purple monkeyflower since all these species prefer open areas. Opening the canopy may increase the risk of invasive plant introduction or spread, but will lessen the chances of a severe natural fire event in the drier summer months which could spread weeds as well (see discussion above in *Commercial Harvest*).

Cumulative Effects

If Alternative 2 is selected the cumulative effects of these additional activities are likely to be continued invasive plant spread which may adversely impact some sensitive plant habitat. However, if mitigations to prevent weed spread are implemented as described in Chapter 2 then these affects could be minimal.

Effects of Alternative 3

Direct and Indirect Effects

Alternative 3 proposes commercial and non-commercial thinning and prescribed burning on 1464 acres, slightly more than for Alternative 2. The additional acreage is all in unit 14. This alternative also proposes the construction of 1.2 miles of temporary road into unit 14 to assist in accessing the additional acreage and 0.11 mile of temporary road reconstruction in unit 2. Direct and indirect effects of proposed activities will be the same as for alternative 2. However, the ground disturbance associated with temporary road construction will increase the risk of weed spread as will the additional 64 acres of commercial thinning. The temporary road will be rehabilitated after use in order to prevent the introduction and/or spread of invasive plants.

Cumulative Effects

The cumulative effects of activities proposed in Alternative 3 will be similar to those in Alternative 2 with the potential for slightly more impacts on sensitive plant habitat due to increase risk of weed introduction and/or spread. The biological evaluation determined that for Lemhi penstemon, turkey-peas, Rocky Mountain paintbrush, hollyleaf clover, woolly-head clover, dwarf onion, taper-tip onion and western boneset, this alternative "May Impact Individuals or Habitat, but Will Not Likely Result in a Trend Toward Federal Listing or Reduced Viability for the Population or Species."

Species	Alternative 1 No Action	Alternative 2	Alternative 3
Ageratina occidentale Western boneset	NI	MIIH	MIIH
Allium acuminatum Taper-tip onion	NI	MIIH	MIIH
Allium parvum Dwarf onion	NI	MIIH	MIIH
Arabis fecunda Sapphire rockcress	NI	NI	NI
Athysanus pusillus Sandweed	NI	NI	NI
Carex paupercula Poor sedge (Idaho only)	NI	NI	NI
Castilleja covilleana Rocky Mountain paintbrush	NI	MIIH	MIIH
Cypripedium parviflorum Yellow lady's slipper	NI	NI	NI
Douglasia idahoensis Idaho douglasia (Idaho only)	NI	NI	NI
Drosera anglica English sundew	NI	NI	NI
Dryopteris cristata Crested shield-fern	NI	NI	NI
Epipactis gigantea Giant helleborine	NI	NI	NI
Ericameria discoidea* var. *discoidea Discoid goldenweed	NI	NI	NI
Erigeron asperugineus Rough fleabane	NI	NI	NI
Erigeron evermannii Evermann's fleabane	NI	NI	NI
Glossopetalon spinescens* v. *aridum Green-bush	NI	NI	NI
Halimolobos perplexa Puzzling rockcress	NI	NI	NI

Species	Alternative 1 No Action	Alternative 2	Alternative 3
Heterocodon rariflorum Western pearl-flower	NI	NI	NI
Idahoa scapigera Scalepod	NI	NI	NI
Lesquerella humilis Bitterroot bladderpod	NI	NI	NI
Meesia triquetra Three-angled threadmoss (moss)	NI	NI	NI
Mimulus nanus Dwarf purple monkey flower	NI	NI	NI
Mimulus primuloides Primrose monkeyflower	NI	NI	NI
Nodobryoria subdivergens Old man's beard (lichen)	NI	NI	NI
Orogenia fusiformis Turkey peas	NI	MIIH	MIIH
Penstemon lemhiensis Lemhi penstemon	NI	MIIH	MIIH
Penstemon payettensis Payette penstemon	NI	NI	NI
Saxifraga tempestiva Storm saxifrage	NI	NI	NI
Scheuchzeria palustris Pod grass	NI	NI	NI
Tonestus aberrans Idaho goldenweed	NI	NI	NI
Trifolium eriocephalum Woolly-head clover	NI	MIIH	MIIH
Trifolium gymnocarpon Hollyleaf clover	NI	MIIH	MIIH
Veratrum californicum California false hellebore	NI	NI	NI

NI = No Impact
MIIH = May Impact Individuals or Habitat, but Will Not Likely Result in a Trend Toward Federal Listing or Reduced Viability for the Population or Species
LIFV* = Likely To Impact Individuals or Habitat with a Consequence that the Action may Contribute Towards Federal Listing or Result in Reduced Viability for the Population or Species
BI = Beneficial Impact

Consistency With The Bitterroot Forest Plan And Other Regulatory Direction

The Forest Plan specifies (p. II-21) that vascular plants identified as rare, pending study, or proposed as threatened or endangered will be identified and protected. The plants termed 'rare' are the ‘Rare’ plants are those on the Regional Forester's sensitive species list, as well as plants identified by the Forest as being of special concern. Stated goals of Forest Service policy (FSM 2670.22 and 2670.32) are to maintain the population viability of sensitive species across their geographic range, implement management practices to ensure that sensitive species do not become threatened or endangered because of Forest Service actions, and minimize impacts to all species whose viability has been identified as a concern. Information on the number of plants required for maintenance of viable populations is not available. Therefore a conservative approach is taken when determining the effects of management activities. In this project, all of the alternatives would be consistent with the Forest Plan and FSM policy.

INVASIVE PLANTS

Existing Condition

The Haacke-Claremont analysis area contains scattered populations of spotted knapweed *(Centaurea biebersteinii {C. maculosa})* along roads, in previously disturbed areas, and on south and west-facing open slopes below 6500 feet. Cheatgrass *(Bromus tectorum)*, although not listed as a noxious weed, is an invasive non-native species that occurs in patches throughout the grasslands and open ponderosa pine habitat in the Haacke-Claremont area. Almost every unit surveyed contained some spotted knapweed. Cheatgrass was found in units 1, 2, 7, 13 and 15. A trace of oxeye daisy *(Leucanthemum vulgare)* and sulfur cinquefoil *(Potentilla recta)* was found along the road in unit 14 and a trace of houndstongue was found in unit 7.

Open and closed roads in the analysis area have been treated with herbicides as analyzed in the Noxious Weed Treatment Project EIS (USDA Forest Service 2003a).

INVASIVE PLANTS PRESENT IN HAACKE-CLAREMONT UNITS

Unit	Spotted knapweed	Cheat grass	Oxeye daisy	Sulfur cinquefoil	Hounds tongue	Weed - free
1	X	X				
2	X	X				
3						X
4						X
5						X
6						X
7	T	T			T	
9	X					
10	X					
12	X					
13	X	X				
14	Tr along rd		Tr along rd	Tr along rd		
15	X	X				
16	X					
17	X					
18	X					
20	X					
21	X					
22	X					
23	X					
23	X					
24	X					
25	X					
26	X					
27	X					

Invasive Species Information

Spotted Knapweed (Centaurea biebersteinii {*C. maculosa*})

The Bitterroot National Forest is currently infested with about 274,000 acres of spotted knapweed (USDA Forest Service 2004). It generally occurs below 6,500 feet on the Bitterroot Forest, except on extreme southern aspects. There is a strong correlation between canopy closure and knapweed coverage; with more sunlight, there is an increased likelihood of infestation. Knapweed infestation is also correlated with aspect, soil type and the degree of soil disturbance. It is most commonly found on dry, sterile, gravelly, or sandy soils in pastures, and will quickly invade disturbed sites such as road and railroad right-of-ways, waste places, abandoned fields, timber harvest units and overgrazed rangeland. It is not common on cultivated land or on irrigated pasture. Spotted knapweed is not usually found in shaded areas. Ponderosa pine and/or Douglas-fir bunchgrass types, dry shrub communities and scree types are the most susceptible to knapweed invasion (Losensky 1987).

Current treatments for spotted knapweed include mechanical (hand pulling and mowing), biological and chemical. Hand pulling has proven to be up to 35% effective, costs up to $8,498 per acre and can only be accomplished for small areas (USDA Forest Service 2003a). Mowing has been done at recreation sites to make outdoor activities more accessible, although it does not reduce the number of plants. Several biological agents have been released throughout the Forest specific for spotted knapweed.

Biological controls are more of a long-term solution and no decrease in knapweed populations is expected until these insect levels have increased. Biological control agents should decrease knapweed seed production by up to 80% once they become well established. In the meantime, chemical control methods (especially picloram) appear to be the most successful for treatment of smaller infestations of knapweed or to aid in containment of existing populations (USDA Forest Service 1996a).

Oxeye Daisy *(Leucanthemum vulgare)*

Oxeye daisy infests about 1,000 acres on the Bitterroot National Forest (USDA Forest Service 1995b), with most infestations occurring along roadsides and trails. Moist sites such as mountain meadows and riparian areas are most susceptible to invasion by this species. Oxeye daisy appears to be expanding throughout the Forest (USDA Forest Service 2003a). The Noxious Weed Treatment Project EIS (2003) analyzed herbicide treatments for this weed throughout the Forest.

Cheatgrass *(Bromus tectorum)*

Although not listed in Montana as a noxious weed cheatgrass is an invasive plant that has become a concern on the Forest because of its reputation for altering fire regimes. Cheatgrass is commonly associated with disturbed areas, such as recently burned rangeland and wildlands, roadsides, and eroded areas. Cheatgrass seedlings usually germinate with fall moisture, and the root system continues to develop throughout the winter, so a well-developed root system is ready to exploit available spring moisture and nutrients before native species are able to germinate. Cheatgrass typically dries out and disperses seed by mid-June. The ability of the plant to dry completely, accumulate litter, and fine structure make it extremely flammable.

Houndstongue *(Cynoglossum officinale)*

There is estimated to be over 500 acres infested with houndstongue on the Bitterroot National Forest. Houndstongue is typically found along roadsides, trails, and areas disturbed by grazing and timber harvest. Infestations seem to be expanding on the Forest (USDA Forest Service 1995b).

Environmental Effects

Effects of Alternative 1 – No Action

Indirect and Indirect Effects

The No Action alternative proposes no ground disturbing activities. However, the plant communities that occur in the lower elevations of the Haacke-Claremont analysis area are adapted to frequent, low intensity natural or aboriginal caused fires (Arno 1976). Most of the species found in these plant communities have below ground woody root systems that should easily survive the flashy types of fires that historically burned through open ponderosa pine stands. With continued fire suppression, fuel loadings will increase and a wildfire occurring in the area could be more severe, increasing the possibility of soil heating and damage to below ground plant tissue. This may also result in more bare soil and an increased chance of knapweed spread. If native plant species are damaged by intense heat they will be less capable of recovering and competing with encroaching weed species. After the 2000 fire research plots were established throughout the Forest to determine the effects of the burn on weed spread. Initial results indicated that spotted knapweed plants present prior to the fire increased in vigor and new seedlings appeared in the second year post-fire in areas of bare soil exposed by the fire - both in sites where knapweed existed before and in adjacent, previously weed-free areas (Sutherland 2003).

If the No Action Alternative is selected weeds would likely continue to spread at a low to moderate rate due to various factors. Wildlife, livestock, humans, off-road vehicles or wind can continue to spread invasive plants by transporting weed seed into open areas (Zouhar 2001a). It's more likely that weeds will spread into canopy openings created in areas that are adjacent to weed-infested sites. Spotted knapweed, in particular, has an affinity for open areas on dry aspects and can invade these openings without soil disturbance as long as a seed source is available nearby (Zouhar 2001a).

Cumulative Effects

Past management activities and activities on private land have increased the invasive, noxious, and non-native plant populations in the Haacke-Claremont area. Road construction, livestock grazing, timber harvest, fire suppression activities, mining, housing developments, off-road vehicle use, and increased recreation use have all contributed to the spread of weeds. If the no action alternative is selected then no further activities related to this project potentially conducive to weed spread would occur. However, continued fuel build-ups from fire suppression will leave some areas in the Haacke-Claremont area at a very high risk should a wildfire occur. There is potential for a high severity fire such as occurred in some areas during 2000 and, should such an event occur, there is a high likelihood that weeds will spread to new areas as happened in areas burned in 2000 (see discussion above).

Effects Common to all Action Alternatives

All action alternatives that involve timber harvest to open the forest canopy and/or under burning on lower elevation south or west facing slopes have the potential for spreading invasive plants - particularly spotted knapweed. The effects of these activities on weed spread common to all action alternatives are discussed in detail in the "Environmental Consequences" section of "Threatened, Endangered and Sensitive Plant Species".

Effects of Alternative 2

Direct and Indirect Effects

Alternative 2 proposes commercial and non-commercial thinning and prescribed burning on 1400 acres. Opening the canopy creates more suitable habitat for weeds such as spotted knapweed and methods used to remove the canopy can also contribute to the spread of weeds. Tractor harvest over bare ground can disturb up to 5% of the soil in a unit and increases the likelihood of transporting weed seed into new areas with harvest equipment. Units 4, 9, 28 and portions of units 2, 3, 5, 6, 13 and 14 will be tractor harvested. Most of these units contain spotted knapweed except 3, 4, 5 and 6 which either have heavy canopy cover or have not been treated before, helping to deter weed encroachment. Following harvest, units will have slash piled and burned or will be broadcast burned. The risk of weed spread intensifies in tractor units with the reintroduction of fire. This risk is greatest with burn piles that burn intensely and destroy the mineral soil layer. With summer tractor harvest there already is some soil disturbance so the added disturbance from fire may be enough to cause increases in weeds, particularly if burning is done in areas where ground disturbance has occurred or conditions are very dry (i.e., south or west-facing slopes). Skid trails will be evaluated post-harvest to determine the need for seeding. Seeding should only be done if skidding creates large areas of bare soil. If weed spread is minimized and soil/vegetation displacement is kept to a minimum, the risk of weed introduction or spread will be reduced.

Skyline cable harvest has the potential to disturb 2% to 5% of ground, less than for tractor harvest, so the risk of weed spread will be less. Skyline cable harvest is proposed for units 1, 10, 15 and portions of units 2, 3, 5, 6, 13 and 14. Units 3, 5 and 6 contain little or no spotted knapweed due either to the thick canopy cover or lack of previous harvest activities. With skyline harvest ground disturbance can be associated with cabling logs up slope. If logs are fully suspended, there should be very minimal disturbance. Logs that are dragged up by one end can tear up the soil and vegetation in the skyline corridor creating sites for weed colonization. If no weeds are in the area and vegetation is replaced in corridors after cabling, the risk of weed encroachment is minimal. Seeding should only be done if cable harvest creates large areas of bare soil.

Seeding with commercial seed mixes increases the risk of introducing weed, or other unwanted seed on site, therefore all seed mixes must be be certified weed seed free and approved by the Forest Botanist. If weed spread is minimized and soil/vegetation displacement is kept to a minimum, the risk of weed introduction or spread will be reduced. Any other rehabilitation work such as pulling soil and vegetation back over skid trails are opportunities that can be accomplished in a stewardship contract if funding is available.

See discussion under **Threatened, Endangered and Sensitive Plant Species** for information on effects of Non-commercial Thinning on invasive plant spread.

Cumulative Effects

The cumulative effects analysis for Alternative 2 under Threatened, Endangered and Sensitive Plant Species covers much of the information relevant to invasive plants since competition with weeds is one of the major threats to sensitive plant habitat. The activities proposed in the Haacke-Claremont project may contribute to further spread of weeds along roadsides and other open and/or disturbed areas. Mitigation measures are designed to prevent weed spread from occurring. Controlling the spread of invasive plants into the Haacke-Claremont project area will continue with periodic herbicide treatments of roads accessing this area as analyzed in the 2003 Noxious Weed Treatment Project Environmental Impact Statement (USDA Forest Service 2003a).

Effects of Alternative 3

Direct and Indirect Effects

Alternative 3 proposes commercial and non-commercial thinning and prescribed burning on 1464 acres, slightly more than for Alternative 2. The additional acreage is all in unit 14. This alternative also proposes the construction of 1.2 miles of temporary road into unit 14 to assist in accessing the additional acreage and 0.11 mile of temporary road reconstruction in unit 2. Direct and indirect effects of proposed activities will be the same as for Alternative 2. However, the ground disturbance associated with temporary road construction will increase the risk of weed spread as will the additional 64 acres of commercial thinning. The temporary road will be rehabilitated after use in order to prevent the introduction and/or spread of invasive plants.

Cumulative Effects

The cumulative effects of activities proposed in Alternative 3 will be similar to those in Alternative 2 with the potential for slightly more risk of weed introduction and/or spread.

Consistency with the Bitterroot Forest Plan and Other Regulatory Direction

All alternatives would be consistent with Forest Plan goals to “control noxious weeds to protect resource values and minimize adverse effects on adjacent private land”. Mitigation measures and timber contracts require all machinery to be cleaned prior to entering the project area. All ground-disturbing activities are required to follow certain weed prevention methods as outlined in the Noxious Weed supplement to FSM 2080 (PF#K-Weeds1). Skyline cable harvest would reduce the risk of ground disturbance and weed spread. Summer ground-based harvest increases the risk of weed spread. Skid trails in these areas would be rehabilitated immediately after harvest activities are completed, reducing the risk of weed encroachment into disturbed areas. The No Action Alternative is consistent with the Forest Plan goal mentioned above, as existing weed control efforts (USDA Forest Service 2003a) are designed to protect resource values and prevent weed spread onto adjacent lands.

FISH AND AQUATIC HABITATS

Existing Condition

Location of the Project from an Aquatic Perspective

The proposed thinning, commercial harvest, and prescribed fire in the Haacke and Claremont drainages would be in small drainages of the Burnt Fork of the Bitterroot River. The access routes to the project area parallel Ambrose Creek to the north and Sawmill Creek to the south. Most of the access and any commercial product would be hauled via the Ambrose Creek route to the north of the project area. Ambrose Creek is a tributary of Threemile Creek, which flows into the Bitterroot River.

Condition of the Streams

All these creeks, on the Forest that are in or near the project area, are small, generally less than four feet wide and less than a foot deep in the summer. The streams are somewhat steep (8 to 13 % slope) and dominated by riffles and cascades with interspersed small pools. Small resident cutthroat trout exist in Ambrose and Sawmill creeks near the Forest boundaries and downstream.

On private valley bottom land downstream of the Claremont Creek confluence, the Burnt Fork has been segregated into several channels (North Burnt Fork; South Burnt Fork; Swamp Creek; Spring Creek; Robertson Creek) which are seasonally dewatered.

Condition of the Watershed from an Aquatic Perspective

The Haacke-Claremont project area has a history of commercial forest harvest, with much of the harvest occurring in the 1970s and 1980s. Networks of roads to support the timber harvest were constructed, and some of these roads have been maintained. Some roads have not been maintained and many of these have grown closed. The primary use by people has been as an area for motorized recreation, hiking, firewood cutting, and hunting. Culverts in these roads are not in fish-bearing streams, but other species such as amphibians may be present. The culverts are generally of the size and slope that may inhibit passage of some aquatic organisms.

The most concern related to aquatic habitat and this project is the potential effect of Ambrose road (Rd. 428), which closely parallels Ambrose Creek for approximately two miles. The road currently has adequate surfacing and generally shaped to drain appropriately, but its streamside location provides little buffer for road-related sediments to be trapped before reaching the channel, and little opportunity for riparian vegetation to reach its potential.

A related but secondary concern is that the culvert at the intersection of Ambrose Creek and Ambrose Road is undersized relative to today's standards and is a partial barrier to fishes. The undersized nature of the culvert makes it susceptible to over-topping and potentially washing-out. Ambrose creek is poorly connected to Threemile Creek and the Bitterroot River due to other culverts and irrigation dams and diversions, and other poor habitat conditions downstream, so improving this partial barrier for fisheries would rank as a mid-level priority. The Forest has primary responsibility for construction and maintenance of this road segment, but this piece of road is on private land and other landowners have easements on it too.

Regulatory Framework related to Fisheries and Aquatic Habitats

The primary document that governs the fisheries resource on the Bitterroot National Forest is the 1987 Bitterroot Forest Plan (USDA Forest Service, 1987) as amended by the 1995 Inland Native Fish Strategy (INFISH, USDA Forest Service, 1995).

The 1987 Bitterroot Forest Plan designates the westslope cutthroat trout as the management indicator species for assessing management's impact on the fishery (USDA Forest Service, 1987: pg II-20). A Westslope Cutthroat Trout Conservation Agreement (Montana Fish, Wildlife and Parks, 2007) also helps guide management of this species. The westslope cutthroat trout is designated as a sensitive species on the Bitterroot National Forest. A Biological Evaluation has been incorporated into this fisheries and aquatic habitat effects analysis. The bull trout is listed as a threatened species under the Endangered Species Act. As required by the Endangered Species Act, a Biological Assessment discloses the direct, indirect, and cumulative effects of the selected alternative. A Biological Assessment for bull trout was completed as part of this project and the effects from the proposed alternatives are determined to have "No Effect" on bull trout.

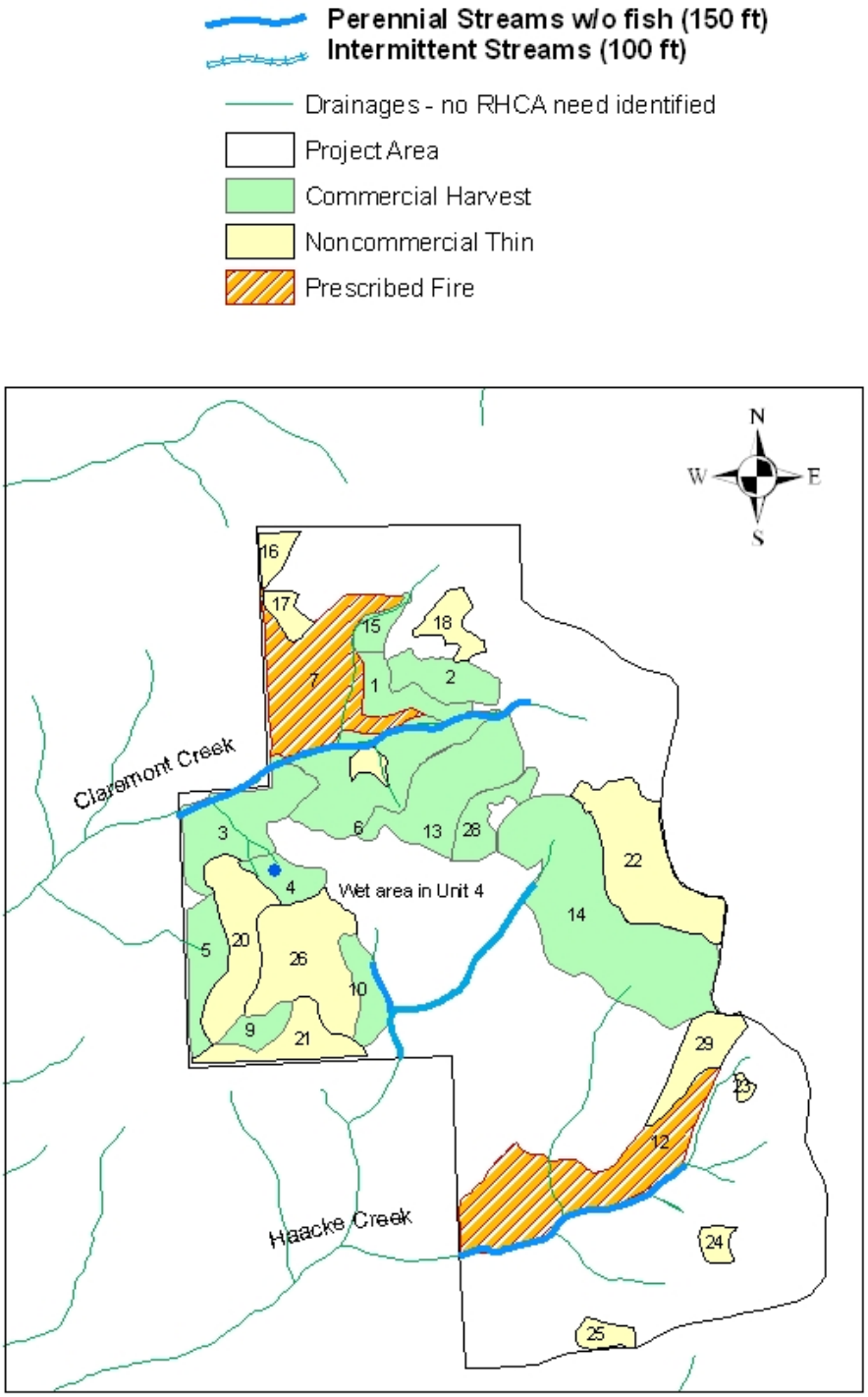
The activities most likely to affect fisheries and aquatic habitats are those near or within the Riparian Habitat Conservation Areas (RHCAs). The RHCAs are also defined as areas where riparian dependant species receive primary emphasis. The following table displays the Riparian Habitat Conservation Area (RHCA) widths.

RIPARIAN HABITAT CONSERVATION AREA (RHCA) WIDTHS. SEE MAP 1 FOR A DISPLAY OF THE PRELIMINARY LOCATIONS OF THE RHCAS FOR THE PROJECT AREA.

Category	Distance (both sides of the channel)
Fish-bearing Streams	**300 feet** This distance would not be applicable to the project area as there are no fish-bearing streams in it, although fish-bearing streams do occur along the access routes.
Permanently flowing non-fish-bearing streams	**150 feet**
Ponds, lakes, reservoirs and wetlands greater than 1 acre	**150 feet** None of these sites were located during project area reconnaissance, but ponds and wetlands are sometimes found during unit layout, and would be protected at that time
Seasonally flowing or intermittent streams wetlands less than 1 acre, and landslide-prone areas	**100 feet** No streams have been identified in this category. They may be found during layout. Field reconnaissance located permanently flowing streams and dry draws, but no intermittent streams. The 100 feet is the INFISH standard width for priority watersheds. Burnt Fork is a priority watersheds, and to be consistent throughout the Forest we used 100 feet.

The standards and guidelines most relevant to fisheries and this project are paraphrased below.

- INFISH - Timber Management - TM-1 Prohibit timber harvest, including fuel-wood cutting, in Riparian Habitat Conservation Areas (RHCAs), (Two exceptions exist, but not relevant to this project, so not listed here)
- INFISH - Roads Management - RF-1. Cooperate with agencies and partners to achieve consistency in road operation and maintenance necessary to attain Riparian management Objectives (RMOs).
- INFISH - Roads Management - RF-2. For each existing or planned road, meet the RMOs and avoid adverse effects to inland native fish
- INFISH – Fire / Fuels Management - FM-1. Design fuel treatment and fire suppression strategies, practices, and actions so as not to prevent attainment of RMOs, and to minimize disturbance of riparian ground cover and vegetation. Strategies should recognize fire as an ecosystem function.
- INFISH – Fire / Fuels Management - FM-4. Design prescribed burn projects to contribute to the attainment of the RMOs.


Perennial Streams w/o fish (150 ft)
Intermittent Streams (100 ft)
Drainages - no RHCA need identified
Project Area
Commercial Harvest
Noncommercial Thin
Prescribed Fire
N
W
E
S
Claremont Creek
Haacke Creek
Wet area in Unit 4
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Current Conditions Relative to INFISH Objectives

INFISH's Riparian Management Objectives (RMOs) generally apply to moderate to large watersheds (3rd to 6th order). Haacke and Claremont creeks are too small to meet these size criteria. Sawmill Creek might only be second order, but because it contains a substantial number of cutthroat trout on the Forest the RMOs for the stream were reviewed. RMOs apply to Burnt Fork and lower Ambrose Creek, which are downstream of the project area and along the access routes. Four habitat features could be used to evaluate effects of the project on RMOs: pool frequency, water temperature, large wood accumulation, and width/depth ratio. However, only three of four features have been applied because width/depth ratio of <10 does not fit with the areas reference streams (Overton, et al. 1995).

Pool Frequency: Pool frequency refers to the number of pools occurring in a given length of stream. Pools are the key RMO in the INFISH strategy, and probably the most important physical habitat component in streams. Pools are the habitats where trout spend most of their lives. Generally, the larger, deeper, more complex the pool, the greater its value in terms of fish use.

The Burnt Fork, between the FS boundary and Signal Creek, would fit the category of streams with a RMO of at least 47 pools per mile. Basin-wide habitat surveys indicate numerous high quality pools with complex woody hiding cover. Burnt Fork between the FS boundary and Signal Creek contains 43 pools per mile. One reach is noticeably deficient (33 pools per mile) was the 1.1-mile long section between Flat Rock Creek and the Burnt Fork trailhead.

Sawmill Creek, on the Forest, near the Forest boundary, lacks pools and pool quality. Habitat surveys comment that the stream is affected by the closeness of the road (Rd#710) and historical harvest upstream.

Ambrose Creek, along the 200-acre inholding and along private lands, would be in the category of streams less than 10' wide, and the pool frequency RMO at > 96 pools per mile. Data from 1998 showed that the creek lacks pools and this section of stream is impacted by fine sediment levels, which severely compromises pools by lowering their quality as fish habitat.

Large Wood Frequency: Large wood is a critical component of fish habitat. Large wood forms pools, provides cover, stabilizes stream channels, protects banks from scouring, traps sediment and organic material, and provides food and habitat for aquatic insects.

The default RMO for large wood frequency is > 20 pieces per mile. Habitat data collected in reference stream reaches in Burnt Fork drainage indicates that the RMO is low. A more realistic indicator of healthy fish habitat may be a minimum of 70 large wood pieces per mile.

Although the surveys of Burnt Fork showed that it contained more than 90 large wood pieces per mile within the FS portion of the watershed, the area between Flat Rock Creek and the Burnt Fork trailhead it had only 38 large wood pieces per mile. Wood has been removed from the Burnt Fork for firewood and to reduce the perceived loss of irrigation water. A project in September 1998 added large wood to Burnt Fork between the Gold Creek campground and Burnt Fork trailhead. Fires since the basin-wide survey have reduced some of the real big accumulations of large wood upstream of the analysis area, but much of the wood is still present, and some burned trees have fallen into the channel since then.

Ambrose and Sawmill creeks, and the Forest and where the RMOs apply, lack large wood. Most of the pieces that were counted in Ambrose Creek were placed there as a fish improvement project in 1997.

Mean-maximum Water Temperature: Mean-maximum water temperature refers to the mean of the maximum water temperatures recorded over the warmest 7-day period of the year. Bull trout have been repeatedly associated with the coldest stream reaches within basins. Bull trout and WSCT both prefer streams in which water temperatures seldom exceed 15° C. Generally, the colder the water, the better the habitat is for bull trout and WSCT.

The RMO is a mean-maximum water temperature < 15° C (59° F) within adult holding habitat and < 10° C (48° F) within spawning and rearing habitats over the warmest 7-day period of the year. Water temperature monitoring data collected in stream reaches throughout the Bitterroot National Forest since 1993 indicates that the RMO (< 15° C) is a good indicator of healthy bull trout and WSCT habitat and since < 10° C in rearing habitat is unrealistic. Water temperatures were monitored with continuously-recording HOBO-TEMP thermographs during summer, 1997 (an "average" air temperature summer). Streams in Burnt Fork were cold, with mean-maximum water temperatures < 12° C. Water temperatures are probably at or near reference conditions in these streams.

Temperature data for Ambrose and Sawmill creeks are lacking, but these streams are not expected to meet the temperature RMO because of its proximity to the road. The disturbance history along Ambrose Creek's riparian vegetation, both on private and National Forest System (NFS) lands (grazing, road brushing, and firewood collection) also have had an impact.

Portions of the smaller streams (2nd order streams: Haacke and Claremont creeks) have been observed, but not intensively surveyed. A manager of the private land, downstream of the Forest, was also interviewed regarding the streams' characteristics. Haacke and Claremont creeks on private lands have been shunted into ditches and ponds, but in the last few years some habitat improvement work was conducted on these lands to benefit stream ecology. Lower Sawmill Creek is paralleled by a relatively high-use road, has a small dam, on the Forest, near the Forest boundary, and has a very high road density in its headwaters (though many of the roads are closed to vehicles, and vegetated).

Condition of the Fisheries

Bull trout (*Salvelinus confluentus*), a species federally listed as threatened, have not been observed in Threemile-Ambrose Creek drainage or in Sawmill, but are known to inhabit the Burnt Fork, downstream of the project area. The closest bull trout habitat, documented to be occupied, to proposed activities in the project area, would be 2.5 miles downstream.

The altered stream system on the valley floor primarily supports a non-native assemblage of brook trout (S. fontinalis; abundant), brown trout (*Salmo trutta*, probably common), and rainbow trout (common near the Bitterroot River). Native species include mountain whitefish (*Prosopium williamsoni*), longnose sucker (*Catostomus catostomus*), several species of minnows, and some westslope cutthroat trout (WSCT, *Oncorhynchus clarki lewisi*) in scattered locations. The native channels of the Burnt Fork, on the valley floor, are considered historic bull trout and WSCT habitat. Bull trout may occupy about 16 miles of the mainstem Burnt Fork, up to about five miles on private land and eleven miles on FS land. This would be about 40% of their historic habitat in that stream. The number of bull trout on private lands is thought to be

very low. WSCT probably occupy more than 60% of their historic habitat in the mainstem Burnt Fork, but at greatly reduced densities on private land.

Bull trout and WSCT in the Burnt Fork both exhibit the "resident" life history form. Stream resident adult fish would usually be less than 12" in length. Migratory bull trout and WSCT, which can be much larger, are not known in the Burnt Fork drainage. Several year-round fish passage barriers on private land have severed the historic connection to the Bitterroot River for at least a few decades, and isolated the remaining bull trout and WSCT populations in the upper half of the drainage, mostly on FS land.

Private reaches of Claremont Creek and Haacke Creek on the valley floor near the Burnt Fork support small WSCT and brook trout populations. Some limited WSCT spawning may occur in the extreme lower ends of each stream. Bull trout have not been documented in these streams, and are believed to be absent.

Fish in Sawmill and Ambrose creeks are thought to be pure westslope cutthroat trout. Genetic testing of a small sample of trout in Ambrose Creek, and Burnt Fork near the mouth of Sawmill Creek, in the mid 1990s provided evidence that these fish were pure westslope cutthroat trout and not hybridized with other non-native trout. Surveys for native mussels were conducted across the Forest in 2007, which included sites in Ambrose and Sawmill creeks, and Burnt Fork. Mussels were not found in these streams.

Environmental Effects

Effects Common to All Alternatives

The impact on fisheries and aquatic habitat of implementing or not implementing any part of the proposed action would be minimal. The size of the areas proposed for treatment relative to the watershed areas is small and the intensity of treatments within the units proposed would not perceptibly affect the fisheries or aquatic habitat.

Reducing the risk of severe wildfire near streams does play a role in fish management, especially when the subpopulations of fish are isolated from other subpopulations. The isolation of fish subpopulations greatly increases the risk of local populations dying-out after large and high severity wildfires.

In all alternatives, existing roads would continue to generate the bulk of the human-caused sedimentation of aquatic habitat, particularly roads that encroach on streams.

Cumulative Effects Common to All Alternatives

The Cumulative Effects analysis area and timeframe for fisheries and aquatic habitat includes the Ambrose, Claremont, Haacke, and Sawmill watersheds. It also includes a large portion of the Burnt Fork watershed. It does not include the Bitterroot River because of the discontinuity between the headwater streams (Ambrose, Claremont, Haacke, and Sawmill creeks) and the river. The Bitterroot River was also not included in the analysis area because of the small size of the proposal and alternatives relative to the size of the river’s watershed. Although the project area does not encompass Ambrose or Sawmill creeks, these streams were included because roads that parallel them would be used to access the project area. Hydrologic Units (HUCs) were not used as analysis boundaries because the Burnt Fork HUC includes areas that would extend far

beyond any potential hydrologic effects of the project (see map: Fish and Aquatic Habitat Analysis Area).

The time frame that has been of most interest extends back to the 1970s when timber harvest was most substantial and looks forward into the foreseeable future about 5 years.

Human activities have caused major changes to the aquatic ecosystem in the drainages. These activities on the Forest include road construction, timber harvest, the construction and operation of Burnt Fork Dam, livestock grazing, fire suppression, angling, other recreational uses, and the introduction of exotic fish species. Similar activities occur on other ownerships. Differences are that on private lands, subdivision on housing development needs to be included in the assessment, irrigation dewatering has a devastating impact on fish and aquatic ecosystems, and livestock grazing tends to be more intense and often year-long.

Collectively, the activities have replaced the natural "pulsed" disturbance regime with an unnatural "press" disturbance regime. In a "press" disturbance regime, aquatic habitat losses and reductions are generally low-intensity, widespread, chronic, persistent, and cumulative. When comparing the existing and reference conditions in the Burnt Fork drainage, the following changes to fish habitat and populations are most evident:

- The Burnt Fork and Ambrose Creek, because of irrigation dewatering and diversion barriers, and possibly road culverts, on lands not managed by the Forest, no longer maintain a year-round connection to the Bitterroot River.

- The native fish assemblage has been altered throughout most of the drainage by the introduction and spread of exotic trout. Particularly threatening to bull trout viability is the spread of brook trout in the Burnt Fork.

- Livestock grazing has degraded riparian vegetation and stream channels on private lands downstream of the Forest. Conversely, some landowners have recently conducted habitat improvement projects on their lands.

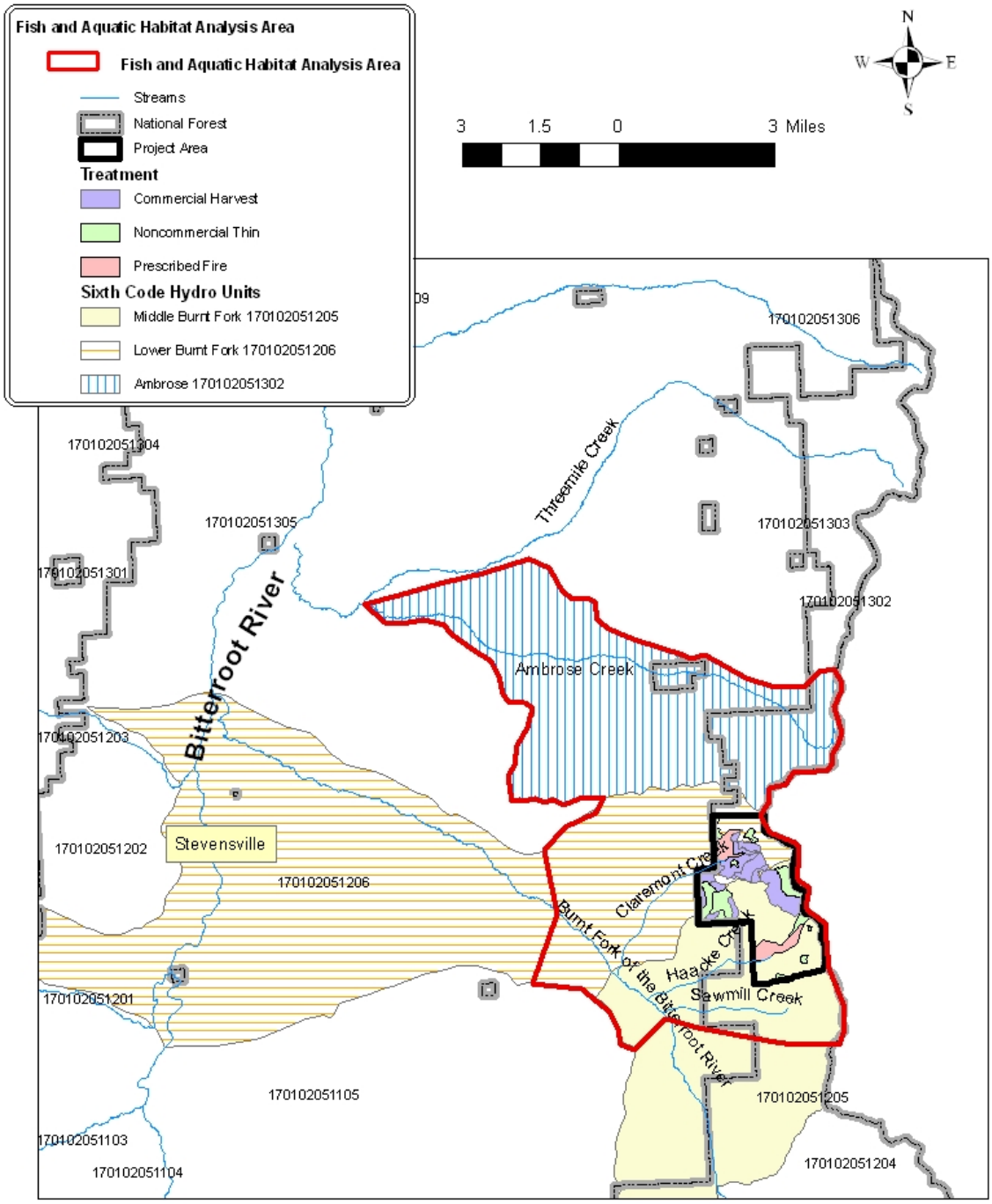
- On NFS land, native fish movement is blocked or severely restricted by Burnt Fork Dam and the dam on Sawmill Pond. Both of these dams appear to be year-round barriers to upstream fish movement, but the amount of habitat upstream of these two points is less than 1 mile apiece. Burnt Fork dam is privately owned and operated. The Sawmill Pond dam is owned by the Forest.

- On FS land, sediment levels have been elevated in two stream reaches: Ambrose Creek and Sawmill Creek. The legacy of past management practices (roads, harvest, grazing) and the close proximity of existing roads paralleling the streams are the likely causes. Livestock grazing in Ambrose Creek continues to be periodically troublesome in regards to sedimentation in the stream.

- On FS land, and a few sections of private lands, road encroachment has simplified fish habitat, modified stream channels, and reduced the riparian overstory. Three areas standout: Burnt Fork between the Sawmill Creek and the Burnt Fork trailhead (five miles); and Sawmill Creek downstream of Sawmill Pond (about one-half mile), and two miles along Ambrose Creek (0.8 miles of the 2 miles are NFS lands). Road-encroachment causes

increased water velocities, reduced overstory cover on the bank, fewer channel meanders, and fewer pools and less complex large wood accumulations.

- Between Sawmill Creek and the Burnt Fork trailhead, large wood has been removed from the Burnt Fork for firewood (illegally) and from past "cleaning" of the stream channel to speed up the flow of irrigation water.


Fish and Aquatic Habitat Analysis Area
Fish and Aquatic Habitat Analysis Area
Streams
National Forest
Project Area
Treatment
Commercial Harvest
Noncommercial Thin
Prescribed Fire
Sixth Code Hydro Units
Middle Burnt Fork 170102051205
Lower Burnt Fork 170102051206
Ambrose 170102051302
N
W
E
S
3 1.5 0 3 Miles
170102051306
170102051304
170102051305
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170102051105
170102051103
170102051104
170102051205
170102051204
Threemile Creek
Bitterroot River
Ambrose Creek
Stevensville
Claremont Creek
Haacke Creek
Sawmill Creek
Burnt Fork of the Bitterroot River

Effects of Alternative 1 (No Action)

Direct and Indirect Effects

The impact on fisheries and aquatic habitat of not implementing any part of the proposed action would be minimal.

Reducing the risk of severe wildfire near streams does play a role in fish management, especially when the subpopulations of fish are isolated from other subpopulations. The isolation of fish subpopulations greatly increases the risk of local populations dying-out after large and high severity wildfires.

The Ambrose Creek cutthroat trout subpopulation is the most tenuous of those in the affected area. Treatments that would be implemented under any of the alternatives would have no affect on Ambrose Creek trout populations or their habitat.

As witnessed by the fires of 2000, the patterns that fires burn in riparian areas are unpredictable (USDA Forest Service, 2000). Therefore, predicting the future behavior of fire in riparian areas is speculative and cannot be forecast with precision. Riparian areas in the project area tend to have higher fuel loads, are wetter, shadier, and likely to burn with less frequency than the surrounding upland vegetation (Dwire et al. draft 2005).

In all alternatives, roads would continue to generate the bulk of the human-caused sedimentation of aquatic habitat, particularly roads that encroach on streams. Ambrose Creek aquatic habitat would benefit the most from the no action alternative as it has no probability of increased impact.

Not doing the proposed thinning, which may include short sections of riparian areas along fishless streams, would result in a longer time span for trees to attain large size. The extent and intensity of any actions proposed would result in negligible impact to the amount of large wood the streams. The action alternatives would not affect the amount of shade, which is related to water temperature, and therefore, no action would also have no effect.

Cumulative Effects of No Action

The cumulative effect of no action is that the fuels in the forest would continue to accumulate. Other proposals for fuel reduction and forest management would likely be proposed if an action does not occur soon.

Alternatively, if a wildfire occurs the effect of fire would likely be more intense without implementation of the action alternatives. The degree of the effect of this project on future wildfire severity is unclear, but the effect on fisheries and aquatic habitat would be unlikely to be dramatically affected by implementation or lack of implementation of this project.

Effects of Alternative 2

Direct and Indirect Effects

The current condition of vegetation in Haacke Claremont: (dense stands, closed canopies, and ladder fuels) contributes to a high risk for high severity wildfire of moderate to large size. The action alternatives are designed to change stand conditions enough to modify fire behavior that would reduce fire severity and fire size. Reducing the risk of high severity wildfire of moderate

to large size *could* benefit aquatic habitat and fish, but needs to be balanced with the use and effects of roads.

If the treatment in alternative 2 were completed, fish habitat and populations downstream of the project area would be expected to continue on a trend similar to the existing condition. Long-term reductions in habitat quality or changes in fish population numbers, age-class structure, or size distributions would be unlikely to occur. Short-term effects likely to occur include minor amounts of fine sediment inputs to Ambrose Creek from the road adjacent to it (Rd 428). Any effects, resulting from Alternative 2, would be expected to be too small to be distinguishable from the existing condition, and too small to be detected with any degree of accuracy by monitoring.

Roads are commonly recognized as a chronic source of sediment that accumulates in streams. The effect of fine sediment in the stream is a decrease in the quality of pool habitat, fish hiding cover, trout spawning sites, and trout prey production areas (riffles). Some existing roads would be reconditioned by clearing brush and small trees that have encroached into the road prism. Road drainage would be improved on all haul routes by improving deficient road templates and ensuring that cross drainage is functioning. These activities may disturb vegetated ditches and roadsides creating an erosive surface, but the improved shape of the road and drainage would benefit streams and watershed by reducing the amount of sediment reaching the stream in the longer term. Generally, dry, well-drained and well-surfaced roads emit very little sediment to the surrounding land. Past monitoring on the Bitterroot National Forest has shown that the negative effects of harvest related travel, erosion from roads, can be limited by limiting use of the roads to periods when the road is relatively dry.

The effect of prescribed burning on the forest floor varies greatly, depending on fire severity and duration, forest floor consumption, and soil heating (Robichaud 2000). Prescribed burning sites that are low intensity and short duration, like proposed here, have little or no impact on aquatic habitat (Robichaud 2000, Elliott and Vose 2005). The native trout evolved under historical fire regimes in which disturbance to streams from forest fires resulted in a mosaic of diverse habitats. However, forest management and fire suppression over the past century have increased the likelihood of large, intense forest fires in much of the project area. Part of the reason for proposing burning is to make conditions more similar to that which native fish evolved.

In this proposal and in recent prescribed fires on the Forest, prescribed fires would typically not be lit within RHCAs, but are allowed to back into these zones. Prescribed fires on the Forest usually burn in a low intensity, a spotty pattern, or not at all in these zones due to higher humidity and moist vegetation.

The most severe effects of fire on native fish populations occur when fish cannot escape the heat and smoke of a severe or intense fire (Sestrich 2005, Gresswell 1999). Low intensity fires are proposed and severe fires would be unlikely to occur as a result of this project. Prescribed burns treat and follow-up thinning treatments, and benefit the resource by reducing the likelihood of severe fires in the treated area for more than a decade.

Both the pre-treatment of fuels (cutting small trees prior to burning) and the burning treatments have the probability of providing a longer-term benefit by reducing the probability of fire reaching and passing through the crowns of large, ecologically valuable, riparian trees.

Similar to the burning discussed above, thinning in units described as noncommercial tree thinning could also occur up to the stream edge when it is not mechanized. Literature suggests that thinning may allow remaining trees to grow faster, thereby decreasing the time required for

trees that would become large enough to provide the wood that forms pools in streams (Beechie and Sibley 1997). The premise for thinning riparian areas is that fires historically occurred in them (although less frequently than in uplands) and fires have been and continue to be suppressed even when they are ignited by natural causes. This leads to an over accumulation of vegetation in riparian areas, just like in the uplands. When thinning would occur within 100 feet of streams the sites would be reviewed by the fisheries biologist or hydrologist prior to implementation. This would ensure that small trees needed for bank stability, shade, or for future large wood would be retained. Projects, if within the Streamside Management Zone (delineated by the State of Montana) would also be reviewed to ensure compliance with current Streamside Management Zone Law and Rules.

Mechanized treatments would occur outside of the RHCAs. Mechanized thinning would not occur in the RHCAs because of the impacts to understory vegetation. Understory vegetation tends to be denser in the RHCAs than in uplands. This restriction also meets State Stream Management Zone (SMZ) Rule #4 that limits the operation of wheeled or tracked equipment in the SMZ.

Commercial Harvest

As previous mentioned, roads have the potential to affect streams. The heavy traffic, hauling logs, has the potential to affect the condition of Forest roads, and roads in degraded condition have the potential to erode and substantially affect streams. The degree of impact greatly depends on the conditions of the road when hauling is happening, and the proximity of roads to streams. Timber sale administrators on the Forest have become acutely aware of this and other soil and water conservation issues and application of standard BMPs have limited the potential for effects of haul routes on streams.

The Ambrose Creek road would be used for hauling. Surfacing was added in 2005 to improve the road. The roads shape is adequate for drainage. Relocating the road from its current poor location, paralleling the stream, was determined to be beyond the scope of this project. An alternate upland route appears to be available, but would need considerable improvements and may have several land-use agreements that need to be researched.

The standard RHCA widths would insolate the streams and riparian areas from effects of removing trees from the commercial harvest units. The trees that would be cut would be too far from the stream to affect stream shading and large wood accumulations in the channel (INFISH 1995).

Yarding of trees from the stump to the road-side landing has potential to affect streams by creating corridors of bare soil that are sediment pathways that may lead to streams. Monitoring since 2000 and other observations of harvest activities demonstrated that yarding operations that meet soil protection objectives tend not to affect the amount of sediment that may reach the stream.

Cumulative Effects of Alternative 2

Sediment increases into Ambrose Creek resulting from project related increases in road traffic would be the cumulative effect of most concern. The road is fairly heavily used by the public now, and human population growth in the valley practically assures that traffic is likely to increase along this streamside Forest access road. The State also plans to harvest in the Slocum

Creek area (Section 30) within the next few years, and access is likely to be along Ambrose Creek. Slocum Creek is a small stream between Ambrose and Claremont Creek. As identified in Chapter 2, road maintenance on existing roads in the project area will be completed by the Forest Service (or included as a requirement in the timber sale contract) prior to hauling logs. Maintenance will consist of cutting brush, small trees, and other vegetation that is encroaching into the road prism. Ditches and cross drains will be cleaned and restored to functioning condition. The road surface will be restored to provide adequate drainage. Coordination of road use and maintenance with the State and County could be critical to maintaining or improving current habitat quality in Ambrose Creek, and this is the reason for emphasis of "INFISH - Roads Management - RF-1: Cooperate with agencies and partners to achieve consistency in road operation and maintenance necessary to attain Riparian management Objectives (RMOs)" in the Regulatory Framework section of this fisheries report.

Cumulative aspects of all other activities, positive or negative, and the action alternatives would be negligible. Protection afforded to the streams by incorporating the RHCAs would offset the potential harmful effects.

Effects of Alternative 3

Direct and Indirect Effects

Alternative 3 increases the size of unit 14 by 64 acres and includes approximately 1.2 miles of temporary road to harvest and remove trees from the lower portion of this unit. An existing skid trail in unit 2 which is currently closed to motorized use would be temporarily re-opened for use as a temporary road in this alternative. This temporary road is approximately 600 feet in length. These temporary roads would be closed and rehabilitated following its use by restoring the natural contour of the slope.

This minor change in size of one unit, which is high in the Haacke Creek drainage, will not affect fish or aquatic habitat. The road construction would remove vegetation and expose soils to erosion, but the soil type and upland location of the road would be likely to limit the amount of erosion that could reach a perennial stream and be even less likely to reach a fish-bearing stream.

Cumulative Effects

Refer to cumulative effects discussion in Alternative 2. There would not be any measurable or observable difference in the cumulative effects of Alternative 3 relative to Alternative 2. The slight increase in acres harvested or the 1.2 miles of temporary road would occur high in the stable portions of the Haacke Creek drainage, and are also discussed in the Direct and Indirect Effects section above.

Determination for Threatened Species (Bull Trout)

Alternatives 1, 2 and 3

No action is likely to have "no effect" on bull trout. With environmental protection measures in place, the effects of the two proposed action alternatives have also been determined to have "no effect" to bull trout. (PF#J-Fish2)

Determination for Sensitive Species (Westslope Cutthroat Trout)

The westslope cutthroat trout is designated as a Sensitive Species by the Regional Forester, and is the management indicator species for fisheries changes in the Bitterroot Forest Plan (USDA Forest Service, 1987: II-20, e(7)). The biological evaluation has been incorporated into this fisheries report (FSM 2670.4). The following paragraphs summarize the determination of effects on westslope cutthroat trout.

Alternative 1

No action is likely to have "no impact" on westslope cutthroat trout. Population viability is unlikely to change from the current depressed condition at both the local population scale, and elsewhere on the Forest.

Alternatives 2 and 3

The determination for alternatives 2 and 3 is "may impact individuals or habitat, but will not likely contribute to a trend towards federal listing or loss of viability to the population or species". The affects of the action alternatives do not differ enough to warrant separate determinations. Rationale for this determination is described in the "Direct and Indirect Effects" and "Cumulative Effects" sections. This determination is based on the potential for minor negative short term impacts to a section of Ambrose Creek, and the lack of long term negative effects. Population viability is unlikely to change from the current depressed condition at both the local population scale, and elsewhere on the Forest.

SOILS

This section describes the soil resources in the Haacke Claremont Analysis area in terms of:

- Existing soil condition - the extent of detrimental soil disturbance (DSD) from past and present management activities in activity areas (treatment units); and
- Environmental consequences - the potential for proposed and alternative management activities to create additional DSD in activity areas.

Detrimental soil disturbance (DSD) is defined in Forest Service Manual, FSM 2500; R-1 Supplement No. 2500-99-1 (PF#K-soils1). A comprehensive description of the Regulatory Framework, the analysis area, methodologies, and research findings can be found in the Soils Project File.

Area of Analysis and Analysis Methods

The analysis area for soils encompasses all land within an individual treatment unit. In general, soils outside the unit boundaries (activity areas) are not expected to be directly, indirectly, or cumulatively affected by this proposal (no harvest or post-harvest equipment will operate off system roads outside the unit boundaries).

Sources of information used in the description of soil resources include:

- Field assessment of existing soil conditions conducted by a professional journey level soil scientist.
- Soils within the analysis area have been mapped and are described in the Bitterroot National Forest Land System Inventory (NRCS soil survey)

Assessment of Existing Soil Condition and Detrimental Soil Disturbance

Haacke Claremont proposed treatment units were assessed by field reconnaissance, air photo interpretation, and GIS data analyses. Method of assessment was based upon a number of factors, including:

- Potential for ground based harvest and yarding activities as a function of slope gradient. Currently, the Bitterroot Forest Plan does not allow for ground based yarding on slopes steeper than 40 percent. To further minimize disturbances, ground based operations on the Bitterroot National Forest are generally restricted to slopes less than 35 percent.
- Potential for proposed treatment types to cause detrimental disturbances to the soil types in the area. Ground based yarding typically incurs some of the highest soil disturbance of forest management activities whereas maintenance and prescribed burning treatments are typically of low severity and have a low risk of affecting soil quality.
- Occurrence of documented previous harvest activities, based upon records in the FACTS data base. This database documents the date and kind of silvicultural treatment performed on timber stands in the Haacke Claremont project area (PF#K-soils2). Treatments performed previous to 1966 are not documented in the database.

Field Measurement Methodology:

Commercial Thinning Units

Commercial thinning units were field surveyed according to Region 1 Soil Monitoring Protocol (DRAFT - The 2007 Northern Region Soil Quality Monitoring Protocol, 6-15-07, Version 3.1(PF#K-soils8). In order to determine the severity and extent of existing soil disturbances from previous forest management activities, observations of soil conditions were noted along randomly oriented transects at a pre-set sample spacing within each activity area. At each of the sample locations, soil information including surface cover, displacement, compaction, and structure were recorded. Observations of compaction were completed by observing the resistance to tile spade penetration into the soil. Tile spade observations in the project area were difficult due to the high amount of coarse fragments present throughout the soil profile. Survey data was collected on a hand held computer in the field in Excel spreadsheets which calculated sample statistics and the number of samples required to meet an 80 percent confidence level in sample variability. Copies of the spreadsheets are included in the Project File (PF#K-soils3). Further discussion is provided in the Affected Environment section below.

Non – Commercial Thinning and Prescribe Fire Units

The proposed activities involving non-commercial thinning and prescribe fire typically do not pose detrimental effects on soils; therefore a less intensive survey was completed on these units. The survey consisted of walkthroughs to achieve representative views of the units. The intention of the walkthrough surveys was to ensure that these units do not currently exceed R1 soil quality guidelines.

Regulatory Framework

The Bitterroot National Forest Land and Resource Management Plan and FSM 2500 and 2550, provide direction for the management of soils within activity areas. This direction can be found in the following documents. A detailed description of the Regulatory Framework can be found at the end of the soils section.

- The National Forest Management Act
- The Bitterroot Forest Plan (USDA Forest Service 1987)
- Forest Service Manual (FSM 2550).
- FSM 2500 – R-1 Supplement R1 2500-99-1 and R1 2509.18-2003-1
- Montana State Guidelines for Best Management Practices (BMPs) (Appendix A)
- Soil and Water Conservation Practices (SWCPs) Handbook 2509.22 (Appendix A)
- Executive Order 11990

Affected Environment

Soil Characteristics, Potentials, and Limitations to Management

The project area landscape is comprised of steep mountain slopes and ridgelines. Slopes tend to be moderately incised with major drainages occurring every ¼ to ½ mile from north to south across the mountain slopes. Soils across the project area are shallow, poorly developed, gravelly to extremely gravelly sandy loams formed in quartzite colluvium (talus). In many locations open

talus slopes are present with no soil development. Soils across the steep slopes have formed in voids between the talus rock. These soils are shallow and in some cases only organic soil and duff material can be found overlying the rock or among the rocks. Mineral soil horizons in these locations are typically no deeper than 6 inches over quartzite colluvium. Ridgeline soils are deeper (8-10 inches over quartzite bedrock) and more developed but still contain a high percentage of coarse fragments. Detailed information on soil properties is included in PF#K-soils4.

The potential for compaction with ground-based equipment on these shallow, coarse textured, and high coarse fragment content soils is low. The high amount of coarse fragments in the soil limits the ability of ground based equipment to compress soil particles, since the equipment is supported primarily by rock. Displacement of duff and organic horizons are of a much greater concern since soil development is so minimal. Soil productivity in these shallow soils is dependent on the organic soil horizons for nutrient cycling and water holding capacity. Mitigations, Montana BMPs, and SWCPs (Section II) have been prescribed for ground based yarding to address potential risks to soil productivity.

The Bitterroot Forest Plan determines suitable land (areas suitable for timber management) with the recognition that there are unsuitable land inclusions within this broader designation. The identification of these inclusions and their significance is left to the project level. Determination of suitability within each unit was completed with the premise of “the growing, tending, harvesting, and regeneration of crops of trees…” (NFMA). Small inclusions of open talus slopes were identified in various units. These inclusions typically occupied less than 1 acre and did not contain productive timber stands. Thinning and ground based operations would not occur on these open talus slopes. There may be occasions where skyline yarding corridors pass through these areas in order to reach the portions of units below these areas. As stated in the Bitterroot Forest Plan, thinning can occur on unsuitable lands to meet the goals and standards of the management area (MA1 p. III-5(e (8)) and MA 3a p. III-18(e (7))) and meeting cover/forage objectives (MA2 p. III 11(e)(1)).

The following table shows the dominant landtype map units that occur within the proposed activity areas. Only dominant landtype map units within the boundaries of the treatment units were considered; small map units that made up less than 15 percent of a treatment unit were considered too small to affect overall management prescriptions. The data in the following Table is derived from the Bitterroot National Forest Soil Survey.

Dominant Landtype Map Units Found Within Proposed Treatment Units

* Landtype Map Unit Symbol	Landtype Map Unit Name	Landform	Parent Material	Dominant Texture	Limitations to Proposed Treatments	** Found in Proposed Units
30B23	Wilde family steep mountain slopes, extremely cobbly	Mtn slopes	Colluvium derived from quartzite	Extremely cobbly loam	Regen.	7
30B26	Wilde family, steep mountain slopes	Mtn slopes	Colluvium derived from quartzite	Very gravelly sandy loam	Regen.	2, 5, 7, 9, 10, 17, 18, 20, 21, 24, 26, 29
30D26	Klootch family, steep mountain slopes, moist	Mtn slopes	Colluvium derived from quartzite	Cobbly fine sandy loam	Regen.	3, 4, 6, 13, 20, 25, 27
30G23	Klootch family, steep mountain slopes, extremely cobbly	Mtn slopes slopes	Colluvium derived from quartzite	Extremely cobbly loam	Regen.	14, 22, 28
30T13	Klootch family-Rubble land-Rock outcrop complex, steep mountain slopes	Mtn slopes	Colluvium and mass movement deposits derived from mixed meta-sediments	Very stony sandy loam	Regen.	17
32D44	Klootch-Growden families complex, moderately steep mountain slopes	Mtn slopes	Volcanic ash over colluvium derived from quartzite	Very cobbly ashy loam	Regen.	13, 16, 28
32G44	Klootch-Growden-Crawfish families complex, moderately steep mountain slopes	Mtn slopes	Volcanic ash over colluvium & residuum derived from quartzite	Very cobbly ashy loam	Regen.	14, 18, 22, 23, 24, 29
33B35	Wilde-Trapps families complex, mountain uplands and ridges	Ridges	Colluvium derived from quartzite and dolomite	Very gravelly loam	Regen.	9, 22, 26

* Landtype Map Unit Symbol	Landtype Map Unit Name	Landform	Parent Material	Dominant Texture	Limitations to Proposed Treatments	** Found in Proposed Units
61B11	Wilde family-Rock outcrop-Rubble land association, breaklands	Mtn slopes	Colluvium derived from quartzite, gneiss, and mixed meta-sediments	Very stony sandy loam	Regen.	1, 2, 7, 10, 12
61B25	Klootch-Crawfish families complex, breaklands	Mtn slopes	Colluvium & residuum derived from quartzite	Very stony sandy loam	Regen.	1
61D25	Klootch family, breaklands	Mtn slopes	Colluvium derived from quartzite	Cobbly fine sandy loam	Regen.	15

* Descriptions of the Landtype Map Unit Symbols are located in the project file (PF#K-soils4).
** Dominant Landtype Map Unit located within unit –comprises greater than 15 percent of the unit.

Data in the table indicates that all soils have limitations to regeneration (Regen) potential due to shallow and coarse textured mineral soil horizons and high coarse fragment content. Most of the thinning treatments are not intended to promote regeneration potential but improve the vigor of the current stand and minimize fuel loading conditions (see further discussion of desired conditions in silviculture section: *Desired (Preferred) Stand Conditions*. Some regeneration is planned and will occur on these soils (as evidenced by regeneration from past harvest and fires); however, at a slower rate than other soils across the forest that have deeper mineral horizons and considerably less coarse fragment content. Limitations in regeneration would not prevent project objectives from being met and are consistent with Forest Plan objectives and goals.

Site Conditions in Activity Areas

Field surveys of soil conditions were performed by a professional soil scientist during the summer of 2007 in all proposed treatment units within the Haacke Claremont project area. Refer to the Field Measurement Methodology section for survey methods and assumptions.

No DSD was identified in the proposed Haacke Claremont units. Evidence of past ground based operations was noted in several units; however no detrimental disturbance in the form of soil compaction or displacement was noted on the old skid trails. Compaction was not detected on these old skid trails due to the high coarse fragment content. Past displacement of organic horizons was not evident due to the new development of duff and surface organic horizons. Organic horizons and duff on the old skid trails resembled that of adjacent undisturbed areas. Several of the old skid trails cross through talus slopes that have thin organic horizons with little to no mineral soil. In today's logging operations these areas would be skyline yarded due to slope restrictions for ground based equipment.

Environmental Consequences

Soil disturbance is an unavoidable consequence of forest management activities. Montana BMPs, SWCPs, and mitigations are applied to reduce disturbance and limit the effects of

resource management activities on soil resources; however, it is not possible to completely eliminate disturbance. Management activities can result in both direct and indirect effects on soil resources. Direct and indirect effects may include alterations to physical, chemical, and/or biological properties. Physical properties of concern include structure, density, porosity, infiltration, permeability, water holding capacity, depth to water table, surface horizon thickness, and organic matter size, quantity, and distribution. Chemical properties include changes in nutrient cycling and availability. Biological concerns commonly include abundance, distribution, and productivity of the many plants, animals, microorganisms that live in and on the soil and organic detritus.

Impacts known to cause the greatest adverse effects on physical, chemical, and biological soil properties include soil compaction, displacement, puddling, burning, erosion, and mass wasting. Direct effects of management activities commonly include compaction, displacement, puddling, and burning. Erosion, mass wasting, and changes in water table, soil biology, organic detritus recruitment, and fertility (such as the fertilization effects of ash after a light-severity fire) usually occur as indirect effects.

Direct and indirect effects of the Alternatives and associated activities on soil resources will be analyzed in terms of:

- Soil productivity; and
- Detrimental soil disturbance (DSD) by activity areas.

Cumulative effects will be considered for all past, proposed, current and reasonably foreseeable activities within activity areas.

The primary concern is the impact of direct and indirect effects of management activities on soil productivity and disturbance (Forest Plan Forest Wide Management Standards 2.h.3, 5, 6, 7, 8, and 9). The magnitude of productivity loss associated with any action is influenced by the degree, extent, and duration of adverse soil conditions within and adjacent to each activity area. Degree refers to the magnitude of change in soil properties, such as an increase in bulk density or a decrease in macroporosity, and the depth to which those changes occur. Extent refers to the area affected by such changes. Duration refers to the length of time such changes may persist on or adjacent to the site.

The criteria used to determine direct, indirect, and cumulative effects on soil productivity is the percentage of area within an individual treatment unit where DSD has occurred or is anticipated from proposed activities. DSD is defined in Forest Service Manual, FSM 2500; R-1 Supplement No. 2500-99-1 (PF#K-soils1).

Treatment units are considered the activity areas for which direct, indirect, and cumulative effects on soil productivity are analyzed. Soil productivity is a site specific characteristic. Loss of soil productivity in a treatment unit alone will not lead to a loss in soil productivity in an adjacent stand or other areas across a watershed. Soil productivity is a site specific variable and dependent on a number of climatic characteristics and soil forming factors that occur at very small scales. Soil productivity can vary from one square foot to the next with each area functioning independently. Thus, the highly variable and independent nature of soil productivity requires site specific analyses to maintain the proper context. Assessment of cumulative effects on soil productivity at scales larger than the specific treatment unit boundary (such as the watershed scale) also misrepresents the effects of management activities by diluting the site specific effects across a larger area. In contrast to soil productivity, processes such as erosion

regime and hydrologic functions occur at a watershed scale and have been analyzed as such in the Watershed Section.

Discussion concerning the amount of area in the project area previously harvested and effects on the soil resource at the landscape scale is included in the Soils Section C - Cumulative Effects for All Alternatives.

Direct and Indirect Effects for Alternative 1 – No Action

Alternative 1 is the no action alternative. This alternative maintains the existing condition of the project area and provides a base line to evaluate the effects of the action alternatives. The effects on soils are discussed as changes over time on soil productivity which includes soil properties of organic matter, groundcover, and coarse woody material, nutrient cycling, soil erosion and soil disturbance (detrimental compaction, displacement, puddling, and severe fire). Soil disturbance evaluations identify physical changes including detrimental compaction, displacement, puddling, severe fire, and changes in hydrologic function.

Soil Productivity

Soil Erosion and Mass Movements

The No Action Alternative would not alter the current soil erosion and mass wasting regimes in the project area. Natural and human caused wildfires will likely continue to affect the project area and cause consumption of the protective layer of litter and duff on the soil surface (background information on the 2000 fires and erosion are provided in PF#K-soils5).

The occurrence of substantial levels of soil erosion and mass movements on the forest has been low where low severity fire has occurred (based on monitoring conducted on the forest over the last 15 years). Larger fires and those with moderate or high severity may result in soil erosion and mass movement depending on ground conditions and storm activity (Parrett et al. 2003). Soil erosion occurs where ground cover, duff, and litter are consumed or hydrophobic soil conditions develop. Mass movement occurs primarily in the form of debris torrents within channels following high severity, short duration storm events (Background information on debris torrents provided in PF#K-soils5).

Based on the talus slopes and high coarse fragment content soils in the project area, erosion and mass wasting potential following a severe fire would be minimal. Colluvial activity may increase in areas where structural support from trees is lost; however, sediment transport would not occur on the rocky slopes. Loss of productive organic horizons through fire consumption would be of greater importance for soil productivity.

Organic Matter, Groundcover and Coarse Woody Material

The No Action Alternative would allow all standing trees (dead and alive) over time to shed needles and fine branches that would accumulate on the soil surface. Eventually, trees would fall to the ground, providing coarse wood for decomposition into the soil. Soil organisms would slowly decompose the organic materials, adding beneficial humus to the soil. The primary source of soil organic matter is the decomposition of fine roots rather than the decomposition of

surface organics (Powers, et. al., 2004). Nutrients associated with this material would slowly become available for plant growth. This process would continue until another major disturbance such as fire consumes or partially consumes the accumulated litter, duff, and woody material.

Long-term effects on soil health and productivity are likely to be relatively small from future fires that are within the historic range of variability (Brown et al. 2001). Fire severity exceeding the historic range could have detrimental effects on soil productivity and health through the oxidation and loss of soil organic matter and associated soil biota, as well as through accelerated rates of erosion (Harvey et al. 1987; Harvey et al. 1988; Hungerford 1995).

Following the Fires of 2000, Brown et al. (2001) recommended "optimal levels" of 5-15 tons/acre of coarse wood for warm, dry ponderosa pine and Douglas-fir habitat types, and 10 to 25 tons/acre for cool, dry to moist Douglas-fir and for cool lodgepole pine and lower elevation subalpine fir habitat types in burned areas. Optimal levels account for the historic range of variability in fuel loadings, fire responses to these loadings and to climatic factors in the past few hundred years of the pre-settlement period, as well as considering the risks to resources and firefighters. Brown et al (2001) coarse woody material recommendations agree with those of Graham et al. (1994) and Harvey et al. (1981) for unburned Rocky Mountain forests.

Nutrient Cycling

Microorganisms would continue to populate the soils, contributing towards site productivity through nutrient cycling and development of soil structure aggregates in areas of poorly developed mineral soils. The occurrence of severe wildfire may alter soil microbial communities by super heating mineral soils and consuming organic matter necessary for microorganism functions.

Soil Disturbance

The No Action Alternative would not lead to direct detrimental soil disturbances in the project area. However, current vegetative conditions across portions of the project area are at risk for severe wildfire. Not treating at risk vegetative stands may indirectly reduce soil productivity in the event of severe wildfire.

Direct and Indirect Effects for Alternatives 2 and 3

The effects on soils are discussed in terms of the magnitude, duration, and extent of change on soil productivity including soil erosion, mass movement, organic matter (groundcover, coarse woody material, and nutrient cycling) and soil disturbance. Soil disturbance evaluations look at physical changes that may affect productivity. Examples of soil disturbance include detrimental compaction, displacement, puddling, severe fire, and change in hydrologic function.

The proposed treatment units were designed through mitigation measures to minimize loss in soil productivity or increases in soil disturbance. Furthermore, this effects analysis assumes that State of Montana Best Management Practices (BMPs), Region 1 Soil and Water Conservation Practices (SWCPs) Handbook 2509.22, and Forest Standards and Regional Guidelines will be implemented and be effective. Soil technical support has been provided for all project alternatives throughout project design and planning.

Soil Productivity

Soil Erosion and Mass Movement

Forests generally have very low erosion rates unless they are disturbed in a manner that exposes bare soils to the erosive energy of water. Management caused disturbances include prescribed fire, harvesting, and post-harvest operations. Soil erosion in harvest units is diminished by minimizing the amount of bare soils created by disturbance (Clayton and Megahan 1997; Robichaud et al. 2000). The practices that maintain soil productivity (such as leaving organic material on the soil surface, reducing the area impacted by skid trails, and maintaining the hydrologic function) all reduce the risk of soil erosion (Montana BMPs and SWCPs in Appendix A). In addition, implementing specific erosion control measures such as water bars, placing slash on bare soils, and vegetating disturbed soils conserve the soil resource (Mitigations - Section II). The high coarse fragment content of these soils provides armoring against erosion. In many places across the project area, talus slopes and high surface rock content would prevent overland flow.

The shallow soils overlying talus slopes are not conducive to surface mass movements. The proposed thinning treatments would not affect surface stability of these shallow soils and talus slopes. Mass movements are only likely in the event of a deep seated geologic failure. In summary, the risk of landslide initiation as a result of forest thinning in the action alternatives is very low.

Risk of mass movement from prescribed fire is also very low. Prescribed fire is typically completed when soil moisture is high (greater than 80 percent) and weather conditions are cool and humid. Intense heating of the soil and complete consumption of organic soil horizons typically does not occur except in select cases where a log or accumulated fuel pile burns for an extended period of time. The probability of these small areas of disturbance altering slope stability is very low. It should also be noted that mature trees are typically not affected during prescribed burning. The rooting systems of these mature trees would remain intact to provide surface stability.

Organic Matter, Groundcover, and Coarse Woody Material

The action alternatives are designed to leave a variety of organic matter on the site. The practice of leaving organic matter on site provides for microbial populations which help maintain site productivity (Harvey et al. 1994). Vegetation and organic matter protects the soil surface from raindrop impact, dissipates energy of overland flow, binds soil particles together, and dampens soil temperature extremes and daily fluxes. Studies have found that 60 percent effective ground cover reduced sediment movement substantially and 30 percent ground cover reduced erosion by half compared to bare soil (Robichaud et al. 2000). Logging slash will add to effective ground cover until fine logging slash decomposes over several decades (Clayton 1981).

Any increase in groundcover and/or fine logging slash through harvest may be offset by fuel treatments. Fuel treatments may reduce the amount of organic matter and groundcover in the short-term (0-5 years after treatment) through the use of prescribe fire. In the long-term (greater than 5 years), re-growth of vegetation and annual needle drop would provide groundcover and leaf and litter material necessary for soil organic matter development.

Displacement moves the forest floor and top soil from one place to another. In the absence of fire or erosion, the displaced material is not lost from the site. Page-Dumroese et al. (2000)

reports that productivity losses from displacement (while initially high in localized areas less than 100 square feet) may not be significant to site sustainability when compared to large-scale losses from fire or erosion. Powers et al. (2004) noted that complete organic matter removal on long-term soil monitoring plots across the nation had no impact on total vegetative production at 10 years.

Summer Ground Based Harvest Effects

Summer ground-based harvest will reduce ground cover on heavily used landings, skid trails, and near landings. An estimated reduction of ground cover up to 10 percent in the proposed ground based units has been used for soil disturbance analysis in this project. Old skid trails remaining from past timber management operations are present in some of the ground based units. These old trails have naturally rehabilitated and do not currently have detrimental soil conditions. These old trails are difficult to locate in many areas. In order to minimize disturbance to soils that have never been ground based yarded, the old trails that are easily identifiable will be reused to the extent feasible.

The main soil concern for ground based yarding in the project area is displacement of thin organic and topsoil horizons. On lightly used trails (one or two passes) ground cover is not anticipated to be reduced along the entire trail length. Compaction of mineral soils may occur but is likely to be buffered by the high percentage of coarse fragments in the soils. Constructing water bars, creating brush sediment traps, or seeding/planting forbs, grasses, or shrubs, will hasten groundcover recovery and reduce soil erosion and movement of soil off-site (SWCPs). Disturbed vegetation would re-grow in less than 5 years except where there is root kill.

Skyline Harvest Effects

Groundcover in skyline corridors would be reduced approximately 5-10 percent as a result of choker setting, cables, and removing logs from the site (Clayton 1981; Klock 1975). In many cases, the displaced groundcover along the corridor occurs in small patches. These small areas (less than 100 square feet) of displacement are not considered DSD. Ground cover reduction would only occur along the corridor where log suspension is limited and numerous yarding passes occur. At landings, there would be additional reduction in groundcover due to equipment operations and corridor convergence.

Loss of groundcover in the corridors and landings will be lessened through partial suspension of logs during yarding and ceasing of operations if wet conditions are encountered. Corridors and landings will have erosion control treatments following logging and site prep activities. Treatments included in the timber sale contract would include construction of water bars and placing of slash on bare soils in the corridors and landings where deemed necessary by the timber sale administrator. In the long-term, (greater than 5 years) it is anticipated that groundcover would become re-established in displaced areas, with or without post-activity rehabilitation. Groundcover recovery would be achieved with needle cast and vegetation re-growth.

Coarse Woody Material

All harvest prescriptions would leave a portion of the existing stand on the site. Yarding will be either whole tree or leave tops attached. Coarse woody material (material greater than 3 inches in diameter) will be left from designated leave trees, both standing and down, and from breakage of limbs and broken tops that will occur during harvest. Coarse wood is defined as material greater than 3 inches in diameter. However, by leaving larger sized, faster growing trees that will eventually die, becoming snags and then down coarse woody material, the treatments are designed to provide future coarse wood greater than 15 inches in diameter. Large coarse wood persists for longer durations and provides greater benefits to soil development than smaller coarse wood. Large coarse wood is also much less of a concern for fire management. Following the treatments, the stands will be capable of producing large coarse wood at a faster rate for soil development than current conditions. Currently, in many of the commercial thinning stands, tree diameter at breast height (dbh) measurements are less than 15 inches (especially in lodgepole pine stands); therefore, wood smaller than this will be required to meet coarse wood guidelines developed for this project. To the extent feasible, the largest coarse wood (snags or logs) will be left on-site to satisfy coarse woody material requirements for each treatment unit. Silvicultural prescriptions will account for additional trees that will be required for future coarse wood recruitment in the thinned stands.

The amounts of coarse wood listed in the following table for each Fire Group will maintain future soil productivity. Additional information concerning coarse woody material is outlined in PF#K-soils6.

Coarse Woody Material (CWM) Requirements for Soil Productivity.

Fire Group	CWM
2 and/or **4** = Warm, Dry Ponderosa Pine and Douglas-fir Habitat Types	5 to 10 tons/acre
5, 6 = Cool, Dry and Moist Douglas-fir Habitat Types	10 to 20 tons/acre
7, 8, and/or **9** = Cool Lodgepole Pine and Lower Subalpine Fir Habitat Types	8 to 24 tons/acre

The proposed commercial and non-commercial thinning treatments are anticipated to leave slash on the ground through the winter and into late summer/fall before prescribed burning will be completed. This will provide opportunity for the nutrients in the slash to be leached into the soil.

Nutrient Cycling

Nearly all units proposed for harvesting will include whole tree yarding or leaving tops attached. Regarding effects of whole tree harvesting on the growth of trees, Wells and Jorgensen (1979) believe that as long as rotations are long, the depletion of the major nutrients needed by plants should not be excessive in relation to total reserves in the soil and that the reserves would be replenished between cuttings. However, they also recognize that plant growth is dependent on the amount of nutrients actually available to the plants and that this available pool of nutrients can become in short supply in some circumstances.

Wells and Jorgensen (1979) reviewed literature about nutrient pools and cycling in forest ecosystems. Their publication indicates that most of the total nutrient content occurs in the mineral soil. The majority of stands examined had 8 to 10 times as much nitrogen in the soil reserves as in the trees. Nitrogen is typically the most limiting plant nutrient in forested

ecosystems. The major source of nitrogen replenishment to the soil reserves is through mineralization of organic matter, atmospheric inputs, and nitrogen fixation by soil organisms. Jurgensen et al (1981) concluded there would be no long-term depletion of nitrogen reserves because lost nitrogen would be more than replenished by inputs from precipitation and by biological nitrogen fixation over a rotation of 100 to 150 years.

Phosphorus is a nutrient (macronutrient) critical for plant growth and is often only slowly available to plants. Its main sources are the weathering of soil minerals such as apatite and through organic matter decomposition. The phosphorus removal rate through timber harvest is usually less than it is for nitrogen because an even larger proportion of total site phosphorus occurs in the soil than in above ground biomass. Morrison and Foster (1979) site the disparity in nutrient distribution between above and below ground biomass in a *Pinus banksiana* forest growing in sandy glacio-fluvial soil in Ontario. The percentage of total site nitrogen was 95 percent in the soil reserves and 5 percent in the tree canopy; for phosphorus 99 percent of total site phosphorus occurred in the soil whereas only 1 percent was found in the tree canopy.

The status of other nutrients is unknown although there are no site indicators which would point to a problem with nutrient availability or cycling in the units. Removal of potassium in whole tree harvests is modest in comparison to soil reserves according to Wells and Jorgensen (1979). Tree growth and ground cover is within the range expected for the site conditions.

Page-Dumroese (2000) found that relatively small levels of disturbance (less than 15 percent of the area) resulted in relatively small losses in carbon, nitrogen, and cation exchange capacity (CEC), ranging between 1 to 13 percent of the available pools. She concludes that at these levels of loss, current soil quality guidelines appear to be adequate. It must be noted that this is based on initial research from the Long-term Site Productivity Project (LTSP) and results may change as more data is accumulated in future years.

Fire suppression in Ponderosa pine has resulted in a build-up of forest litter and accumulation of organic matter (DeLuca 2000). DeLuca's research has shown the positive benefits of reducing fuel loading and renewing the growth of desirable understory plants through the use of fire or harvest or a combination of both. Ponderosa pine communities commonly accumulate little inorganic nitrogen in mineral soil because of the slow decay rates and rapid uptake by plants and microorganisms. In addition, limited quantities of nitrogen may be available due to the accumulation of organic matter composed of woody residue, naturally low in nitrogen. Wildfire and prescribed fire release plant available nitrogen, however a first entry of high severity wildfire may result in root kill and overall reduction in nitrogen mineralization potential.

DeLuca (2000) found prescribed fire following a selection or shelterwood harvest to have a short-term increase in mineral nitrogen followed by a long-term decline in available nitrogen. This may seem like a negative impact of fire reintroduction; however, the reduced stand density has a lower nitrogen demand. In addition, the Nitrogen: Potassium ratio would be in better balance increasing the trees resistance to disease and insects.

Retaining limbs and branches on site over the winter provides for nutrient leaching into the soil (Palviainen et al. 2004; Baker et al. 1989). Baker et al. 1989 found that there was little leaching of nutrients from live or dried needles immediately after harvest. However, after 3 months of decomposition he noted appreciable nutrient releases. Some of these nutrients may not be available to the remaining stands as organisms in the forest floor use them during decomposition. Researchers conclude that logging slash acts as a nutrient sink (Barber and Van Lear 1984).

To summarize, by maintaining organic matter and ground cover on at least 85 percent of the site, as prescribed in the action alternatives nutrient cycling and availability will not be altered. The mitigations (Section II) and Region 1 soil quality guidelines are prescribed to achieve this desired outcome. Localized losses may occur at landings or where severe fire occurs.

Soil Disturbance

Commercial thinning and slashing within proposed treatment units is designed to avoid detrimental soil impacts on more than 15 percent of the activity area. This goal would be achieved by implementing mitigations described in as well as Montana BMPs and SWCPs. These design features and management practices would minimize the extent of compaction, rutting, puddling, and displacement.

Summer Ground-Based Harvest, Units or Portions of Units

Summer ground-based harvest is proposed on 9 units covering 173 acres in Alternative 2 and 228 acres in Alternative 3. Areas of reduced soil productivity from ground based yarding include temporary roads, skid trails, and landings. Mitigations (Section II) and Montana BMPs and SWCPs (Appendix A) are prescribed to limit the severity of any soil damage or its areal extent. The following table provides a summary of DSD estimated for each ground based unit.

Summary of Summer Ground-Based Activities and Potential DSD for Both Action Alternatives.

*Unit	Ground–Based Harvest (Ac.)	Potential DSD (%)
2	18	5.1
3	4	0.8
4	24	10.0
5	4	1.1
6	28	3.0
9	18	10.0
13	27	3.8
14 – Alternative 2 **14 – Alternative 3**	30 85	1.9 3.8
28	20	10.0
Total	Alt 2 = 173, Alt 3 = 228	Max DSD = 10.0

* Proposed activities in units are the same for Alternatives 2 and 3 with the exception of Unit 14.

** DSD calculations are based on the areas within the units proposed for commercial thinning operations (actual ground based and skyline acres –analysis excludes deferred acres and portions of the units planned for prescribe burns only). As a result, the combination of ground-based and skyline acres shown here is less than the total acres planned for harvest and burning displayed in the alternative descriptions in Chapter II.

The DSD estimates for the action alternatives are conservative calculations. Actual detrimental soil conditions are anticipated to be less due to the high coarse fragment content soils. The high percentage of coarse fragments will minimize compaction during ground based activities. Displacement and loss of organic and topsoil horizons is of greater concern in these coarse textured soils. Individual unit analysis is included in (PF#K-soils7). The summer ground based treatments in both action alternatives will have less than 15 percent DSD after treatment and will meet Region 1 soil quality guidelines.

The high coarse fragment content of soils in the project area will provide protection from compaction from ground based activities. In order to further protect soils, ground based yarding in this project will occur when soils are dry (soil moisture is near or below the permanent wilting point). During the summer, drying of the soil profile increases the soil density and strength reducing equipment impacts. This densification occurs even on undisturbed soils due to surface sealing. The dry soil conditions will limit displacement and mixing of organic horizons.

Research conducted during dry season operations (summer) have documented increases in ground disturbance of 5 to over 40 percent, depending on equipment used and method of operation. Typically, soil disturbance is found on less than 15 percent of the activity unit (McNeel et. al 1992; Seixas, 1995; McIver and Starr, 2000; Clayton, 1990; Watt and Krag, 1985; Klock, 1975). Disturbance is generally limited to main skid trails and landings due to increased traffic. Recent monitoring of summer ground based harvest on the Bitterroot indicates that DSD ranges from 0 to 10 percent, typically averaging 5 percent (Forest Monitoring Reports 2002-2006 (PF#K- ForestPlan8)). Soil quality monitoring (Summer 2006) on three different sales indicated that summer ground based harvest added 0 to 4 percent DSD (2006 - BNF Forest Soil Quality Monitoring).

Bitterroot National Forest monitoring data will be used for purposes of calculating DSD in this project. Soils analysis in this project uses a conservative 10 percent DSD estimate – the high end of the range noted for summer ground based harvest during recent soil quality monitoring on the Bitterroot National Forest. Average detrimental soil condition typically ranged from 2 to 5 percent based on the recent monitoring (Forest Plan Monitoring Reports 2002-2006 (PF#K-ForestPlan8)). Detrimental effects on soils are anticipated to be less on the high coarse fragment content soils in the project area.

Research out of Canada suggests that coarse textured soils with low clay contents may resist compaction because aeration pores result from packing together mineral grains (British Columbia Canada 2002). Gomez et al. (2002) found that on sandy soils severe compaction actually increased water holding capacity. The severe compaction was found to increase the number of days that water was available for uptake from 45 days to 131 days. The water holding capacity was increased in the sandy loam soils by altering the soil physical structure to create more fine pores for water storage. The majority of the project area is comprised of coarse textured soils (primarily sandy loams derived from quartzite) with less than 15 percent clay. However, as previously mentioned, compaction will be limited by the high amount of coarse fragments which will support the weight of the ground based equipment and prevent soil particle compression.

Summer Skyline Yarding

Skyline yarding is proposed on 9 units covering 387acres in Alternative 2 and 402 acres in Alternative 3. Areas of reduced soil productivity from skyline yarding include skyline corridors, swing trails, and landings. Mitigations and SWCPs are prescribed to limit the severity of soil damage or its areal extent. The following table provides a summary of DSD estimated for each skyline unit.

Summary of Skyline Activities and Potential DSD for Both Action Alternatives.

*Unit	Skyline Harvest (Ac.)	Potential DSD (%)
1	21	6.0
2 – Alternative 2 **2 – Alternative 3**	17 12	2.9 2.4
3	47	5.5
5	32	5.3
6	64	5.6
10	24	6.0
13	45	5.0
14 – Alternative 2 **14 – Alternative 3**	129 139	6.5 5.0
15	13	6.0
Total	Alt 2 = 387, Alt 3 = 402	Max DSD = 6.5

* Proposed activities in units are the same for Alternatives 2 and 3with the exception of Unit 14.

** DSD calculations are based on size of unit that is actively managed (actual ground based and skyline acres– excludes deferred acres within the units). Unit 14 for example has a much larger managed area (224 acres) for Alternative 3 than Alternative 2 (159 acres); therefore, the percentage of DSD from skyline activities in Alternative 2 is calculated to be greater. The combination of ground-based and skyline acres shown here is less than the total acres planned for harvest and burning displayed in the alternative descriptions in Chapter II.

Skyline treatments in both action alternatives will have less than 15 percent DSD after treatment and will meet Region 1 soil quality guidelines.

Soil disturbance occurs during skyline yarding when moving trees to and within the skyline corridor. These corridors are narrower than skid trails created by ground-based equipment. Skyline corridor spacing typically averages 100 feet. In this situation, corridors comprise approximately three (3) percent of a unit. Skyline logging soil disturbance may be greatest at the landing where logs are no longer suspended and corridors converge. Ensuring good suspension of the log and avoiding wet soil conditions can minimize these effects. Soil SWCPs for summer skyline yarding include construction of waterbars (included in timber sale contract clauses) and covering areas of bare soil within the corridors with slash where the timber sale administrator identifies the need in order to minimize the risks of soil erosion. Skyline yarding should also be completed during dry soil conditions to minimize soil disturbances.

Research and monitoring has found that summer skyline logging typically causes from 3 to 10 percent detrimental soil damage (McIver 1998; Clayton 1981; McIver and Starr 2001). Monitoring following salvage logging in the Bitterroot National Forest after the Fires of 2000, found summer skyline yarding to detrimentally disturb little of the unit (Forest Plan Monitoring Reports 2002-2006 (PF#K- ForestPlan8)). In addition, the monitoring found mitigation measures employed in the corridors were effective at limiting offsite erosion (no erosion, rill or gully formation in the corridors was noted). Loss of organic matter and ground cover was minimal (BAR timber sale unit logs, 2001-2004). Monitoring of skyline sales on the Bitterroot has indicated that DSD did not occur in the absence of tractor swing (Forest Plan Monitoring Reports 2002-2006 (PF#K- ForestPlan8)). However, summer skyline combined with summer tractor swing was shown to detrimentally disturb 2 to 9 percent of a unit, primarily due to the disturbance from the ground base swing trail.

Mechanical felling and bundling of timber with a feller/buncher machine has been proposed on portions of select skyline units (6, 13, and 14). This treatment is recommended for slopes ranging from 35 to 50 percent. Currently the Bitterroot National Forest does not have forest specific monitoring data to provide an estimation of effects on soils. However, the Bitterroot Forest soil scientist has observed feller/buncher operations on private lands near Philipsburg, MT and estimated detrimental effects on soils at approximately 2 percent. The Flathead NF has also completed skyline harvest in combination with feller/buncher on several harvest units. Monitoring of these units has indicated that overall DSD averaged approximately 8 percent, with 2 percent attributed to the feller/buncher operations. On the Bitterroot National Forest, monitoring of skyline only has indicated that units typically average 6 percent DSD, with the majority of DSD associated with the tractor swing trails. An estimation of 2 percent DSD for feller/buncher operations in combination with skyline and tractor swing on the Bitterroot National Forest would total 8 percent DSD for the overall skyline units, similar to the Flathead National Forest.

Since the Bitterroot Forest does not have local data for the feller/buncher operations, the operations will be monitored closely by the sale administrator and soil scientist to ensure soil quality guidelines are not exceeded. The feller/buncher operations will cease immediately if soil effects exceed R1 soil quality guidelines. It is anticipated that through careful sale administration the feller/buncher operations would be within 3 percent or less.

Calculations of DSD in the table above show an increase of 6 percent for conventional skyline units and an 8 percent increase for skyline units with feller/buncher. The 6 percent increase in DSD for conventional skyline operations is a conservative estimate that is based upon the assumption that tractor swing will be required for all skyline units. Skid trails created during the tractor swing are the cause of the majority of soil disturbances during this type of operation. Not all skyline units will require tractor swing depending on the proximity of the skyline yarder to the road system.

All skyline units have slopes greater than 35 percent, which increases the risk of erosion; however, erosion will be minimized in the high coarse fragment content soils. SWCPs for skyline operations (water bars, slash placement over the corridors, and partial suspension of the logs) will be implemented to reduce loss of groundcover and the expanses of bare soil susceptible to erosion (Section II).

Post-Harvest and Fuel Reduction Activities

Harvest generated slash treatment and fuel reduction would be completed on commercial and non-commercial thinning units. In some cases, only part of the unit requires slash treatment. Options for treatment include jackpot burning, underburning, lop and scatter, mechanical removal of material, or a combination of these treatments.

Duration of Harvest Effects

The main concern for loss of soil productivity in the project area is the displacement of thin organic and topsoil horizons during ground-based operations and in skyline corridors. The potential for compaction with ground-based equipment on these shallow, coarse textured and high coarse fragment content soils is low. The high amount of coarse fragments in the soil limit the ability of ground based equipment to compress soil particles, since the equipment will be supported primarily by rock.

Long-term recovery of surface organic and topsoil to current conditions should occur within 30 to 40 years. This time frame is based on the observations of past skid trails in the activity units. Past skidding operations occurred in the 1970's and early 1980's. The trails are still evident, but observations of during field surveys indicated that surface soil conditions on the skid trails were similar to adjacent undisturbed areas.

Short-term recovery of surface horizons can be expected within 5 years in most areas. The short-term timeline for surface organic matter recovery is based on monitoring observations of burned units on the Lil Lyman Salvage and Reforestation Project. Monitoring of these units was completed 3 to 5 years following the fires of 2000. Surface organic horizon (surface litter and duff) depth was measured at approximately 1 to 1.5 inches. Ground cover (large rock, duff, surface litter, and plant cover) averaged greater than 60 percent except in Units 5 and 4 where the fire was more severe. Prior to the fires, organic matter in the top six inches of soil averaged 3 to 5 percent of the soil volume with a duff depth of 1 to 3 inches.

In addition to project monitoring, research from the Sleeping Child burn found herbaceous cover to increase up to five percent a year for the first 2 years (Lyons 1976 and 1984). Lyons (1976, 1984) further found herbaceous plant cover to increase to approximately 15 percent by year 3, 20 to 25 percent by year 6, and 60 percent by year 10.

Though recovery timelines for both physical soil properties and organic matter with humus and topsoil formation are long; the Haacke Claremont project will not change the natural recovery processes. Vegetation, organic matter, and ground cover will be preserved on all but the landings and heavily used skid trails. Soil disturbance will be limited to the extent feasible through implementation of BMPs, SWCPs, and mitigations. This project will not result in irreversible changes to soil structure or organic matter over time.

Maintenance Burning and Prescribed Fire

The effects of this treatment would be similar to a low severity wildland fire that reduces fuels while preserving most of the live trees, shrubs, and other forest vegetation. Underburning, broadcast burns, or prescribed fire is proposed on all units in acres in Alternative 2 (1,399 acres) and Alternative 3 (1,1463 acres). Burning in spring or fall would reduce effects caused by high soil heating such as loss of nutrients through volatilization (DeBano et al. 1999). Soil organisms necessary to recycle nutrients would be available on the burned sites. Ideal soil conditions for maintenance and prescribed burns typically occur in the spring or fall.

Bacteria (Nitrosomas bacteria) and fungi are relatively sensitive to the increased soil temperatures encountered with light to moderate severity fire whereas sulfur, soil structure, soil wettability, nitrogen, and organic matter are only moderately sensitive (DeBano et al. 1999). The risks to soil organisms lowers when soil moisture content is low (less than 15 percent) and the duration of the heat is less than 30 minutes. Conversely, the potential for nitrogen loss and infiltration loss increases in dry soils.

Upon completion of maintenance burning or other prescribed fire activities, at least 70 percent ground cover is necessary to prevent detrimental accelerated erosion and loss in soil productivity. Mitigation for this project will assure that in those cases where ground cover is less than 70 percent prior to burning, consumption and loss of ground cover should not exceed 15 percent. Ground cover includes duff, organic soil horizons, basal area of vegetation, fine woody material, coarse woody material, and surface coarse fragments. Prescribe fire prescriptions will be designed to meet these soil protection requirements (Fire and Fuels Section).

Coarse woody material (CWM) requirements must also be considered where prescribed fire is used. Mitigations will assure that prescribe fire operations will attempt to minimize the loss of CWM needed for soil development. In fuel reduction project areas where CWM is nearing the low threshold levels, care will be taken to not intentionally ignite CWM during hand lighting operations. Prescribe fire can be used in these areas to recruit additional CWM through burn mortality. Burning prescriptions will be carefully written and implemented to take these as well as other resource limitations into consideration. These treatments would not create DSD and would meet the Region 1 soil quality guidelines for all action alternatives.

Lopping and Scattering

Lopping and scattering of small, unmerchantable material will mitigate the loss of nutrients from whole-tree yarding. This practice will also add small coarse woody material to the site. Slashing of this material may occur on some commercial thinning units. It is therefore anticipated that no major, long-term negative effects will result from this whole tree harvesting prescription. These proposed activities were reviewed in the field by the soil scientist in conjunction with the commercial thinning units.

Landing Construction and Use

Landings would be associated with each commercial thinning unit. Frequent, small, roadside landings would be used for the skyline and ground-based operations. These landings would be located on the edge of existing system roads and generally within the road right-of-way. For planning purposes, it is estimated that the needed landings would be approximately ¼ - ½ acre in size. Disturbances associated with landing construction are not considered DSD since landings are considered part of the forest transportation system. Necessary erosion controls will be implemented (slashing, waterbars) and revegetation practices will be completed to prohibit invasive plant establishment.

Temporary Road Construction and Rehabilitation

No temporary road construction would be required in Alternative 2. In Alternative 3, an estimated 0.11 mile in Unit 2 and 1.26 miles in Unit 14 would be required. Soil disturbance from temporary road construction has been considered detrimental for the purpose of DSD calculations in this document. Temporary road disturbances are considered DSD even after rehabilitation activities; however the detrimental effects will slowly be reduced through natural recovery. The detrimental soil conditions from temporary roads may reduce soil productivity for several decades until vegetation, organic matter, and hydrologic function is restored.

All temporary roads would be rehabilitated as part of the timber sale or stewardship contract. Rehabilitation activities would include recontouring, slashing, and seeding to restore soil productivity to the extent possible (Section II). Recontouring speeds the process of vegetation and hydrologic recovery, which alleviate detrimental conditions over time. By completing the rehabilitation activities, the detrimental soil conditions are not anticipated to persist nor are they considered to be a permanent loss in soil productivity. Assuming an average road prism width of 25 feet, approximately 4.1 acres would be affected in Alternative 3.

Effectiveness of Mitigations, SWCPs, and Montana BMPs

The State of Montana conducts Forestry Best Management Practices Monitoring every two years, the last one was conducted in the summer of 2006 (State of Montana 2006). A ground based harvest unit from the Bitterroot National Forest was included in this monitoring effort. Overall, the review found that the Forest applied Montana BMPs and SWCPs such that harvest operations met the requirements of the BMPs. Effectiveness of applied harvest BMPs and SWCPs was found to adequately protect soil and water resources. For a larger perspective, the State Audit in 2004 (State of Montana 2004) found that across all ownerships, BMPs were properly applied 97 percent of the time and overall effectiveness of the implementation was 98 percent. The Lolo National Forest produced a BMP Effectiveness Monitoring Report in 2002 (USDA Forest Service 2002). The report found harvest BMPs to be effective with the recommendation to leave additional coarse woody material scattered across rehabilitated landings, BMP 14.10.

Cumulative Effects for All Alternatives

Cumulative Effects includes a discussion of the combined, incremental effects of human activities. For activities to be considered cumulative their effects need to overlap in both time and space with those of the proposed actions. For the soil resource, the area of consideration is the harvest unit since effects on soil effects are site specific. Soil erosion (including mass failure) is an exception. Soil erosion is discussed in the watershed cumulative effects section.

To address cumulative effects this section is organized into three sections;

1. The existing condition which includes past activities,
2. Additional effects from implementation of Alternatives 2 and 3, and
3. The effects of on-going and reasonable foreseeable actions.

Existing Conditions and Past Activities

Legacy soil disturbance (disturbance that occurred as a result of past activities) forms the foundation of the soil conditions on the landscape today, the existing soil condition. These activities include but are not limited to: timber harvest, grazing, road construction, recreation, restoration, and fires. Evidence of past management activities was observed; however, disturbances had rehabilitated naturally and none was considered to be detrimental to soils.

For past, present, or future activities to overlap in time, the effects on soils from the activities must overlap. Soil physical changes (detrimental compaction, detrimental displacement, detrimental erosion, severe burning, and puddling) can persist in the landscape for greater than 20-40 years following management activities. Biological soil conditions change quicker, for example re-vegetation occurs within 5 years (under most situations) and organic matter begins to rebuild in 10 years but may take greater than 50 years to reform humus. Time discussions will look back to at least the 1970's, which cover both the physical and biological aspects of the soil.

Cumulative Effects of Harvest at the Project Scale (Landscape Context)

At the landscape scale, approximately 888 acres or 28 percent of the project area has been previously harvested since the early 1970's (FACTS database). Harvest previous to 1970 was not indicated in the database. Although past skid trails were noted in several units, these past

disturbances have naturally rehabilitated and are no longer considered detrimental. This is based on soil monitoring during recent field surveys. Cumulative effects of past management at the landscape scale (excluding Forest system roads) have not negatively impacted soils.

Cumulative Effects of Harvest at the Treatment Unit Scale (Activity Area)

Cumulative activities that have occurred within treatment units are discussed throughout the following section. The harvest designs and mitigations proposed for treatments have been developed from the field review of disturbances from past activities. Discussions for on-going and future projects are found below.

Invasive Plants

Small populations of spotted Knapweed have invaded portions of the planning area, primarily along road systems (See Invasive Plants Section). The site-specific effects of these invasions on soil productivity is not known, however, research has shown soil productivity alteration to be minimal where the invasive plants are interspersed with native plants (LeJeune and Seastedt 2001; Hawkes et al. 2005). Where invasive plants form a monoculture, soil productivity in the form of carbon to nitrogen ratios, nitrogen to phosphorus rations, and soil organism and mycorrhizae communities may be altered (LeJeune and Seastedt 2001; Hawkes et al. 2005).

Past Harvest and Post Harvest Activity Effects

Past harvest/thinning activities have occurred in the proposed treatment units. The majority of these units have had entries since 1970. Past vegetation management has involved a wide variety of treatments including clear-cutting, shelterwood harvest, and salvage & sanitation treatments (PF#K-soils2).

Past harvest consisted primarily of skyline yarding with select areas of ground based operations similar to the proposed project. Ground based yarding was noted on continuous slopes exceeding 35% which would not occur during today's logging practices. Machine piling of slash and mechanical site preparation was not observed in the project area, this was a common practice prior to the mid 1980's (Meurisse 1987).

Past ground based operations often gave little thought to skid trail layout. 1n 1981, Froehlich showed that designating skid trail locations greatly decreased the areal extent of soil disturbance. When skid trails were established at 100 foot spacing, 11 percent of a unit would be covered in skid trails (Froehlich 1981). By the mid to late 1980's, forest practices were changing to incorporate these findings. For example, skid trails were designated, season of use considered, and the practice of machine piling slash was limited. These and other BMPs, SWCPs, and Forest Plan Standards and Guidelines were developed using this research to manage timber harvest yet sustain site and soil productivity (Appendix A and State of Montana Department of Forestry BMP program).

In the current era of resource management and harvesting practices, additional emphasis is given to the season of harvest, ensuring that equipment operations are limited to designated areas, and that post-harvest activity does not reduce site and soil productivity. Conservation of soil organic matter and coarse woody material are considered in every project. Skid trails used in current harvest operations are rehabilitated with waterbars, slash placement, ripping or subsoiling, and/or

planting shrubs or sowing grass seed to speed natural recovery and keep nutrients and soil on site. The intent is to meet and exceed the BMPs and SWCPs outlined in Appendix A.

The Forest has basically ended the practice of dozer-piling slash, opting for selective grapple-piling using low ground pressure equipment or whole tree yarding. This combination of equipment requires repeated trips on closely spaced skid trails due to the limitations of boom-reach with the feller-buncher. The use of low ground-pressure FMC torsion-bar suspension skidders lessens these detrimental soil impacts substantially (Froehlich, 1978).

Coarse Woody Material (CWM)

The CWM requirements for this project are discussed previously and are displayed in a previous table. These CWM requirements are based on the most current science, which varies from the amounts shown in the current Forest Plan. A Forest Plan Amendment has been developed to address the CWM issue. The amended CWM requirements for this project will encompass less than 0.1 percent of the Bitterroot National Forest (based on maximum treatment area of 1,535 acres in Alternative 3). Since the establishment of the Forest Plan in 1987, two other forest plan allowances have been made which include the Burned Area Recovery Project in 2001 and the Middle East Fork Project in 2006. The Burned Area Recovery CWM amendment was needed to address soil and site productivity concerns related to salvage following large wildfires and was also based on similar current science. Burned Area Recovery treatments comprised approximately 0.6 percent of the Bitterroot National Forest. The Middle East Fork project amendment (0.3 percent of the forest) was needed to ensure CWM retention for fuel reduction treatments were based on current science. An additional amendment has been proposed for the upcoming Trapper Bunkhouse project. These amendments in combination with Alternative 3 of this project (maximum treatment area) cumulatively amount to approximately 1.3 percent of the forest. The modifications of the CWM requirements for this project will not have appreciable cumulative effects at the site or forest scale.

Cumulatively, by implementing this site-specific standard for CWM and snags, the area is expected to have appropriate levels of CWM by fire group, over time, fully supporting the Forest goals and objectives.

Other Activities

Dispersed camps may be located along the roads and adjacent to or on the edge of harvest units. No dispersed camps were noted in the field review. Off-road vehicle use has occurred within the project area, primarily on old road prisms. In units where existing skid trails are reused, rehabilitation activities will discourage future illegal OHV use by placing slash on the trails. Access to skid trails from landings will be closed by placing slash from the landing on the rehabilitated skid trail. Similar actions would be completed on recontoured temporary roads to discourage illegal OHV use.

Other activities such as road maintenance, firewood collection, and other past projects have occurred outside unit boundaries and are discussed under the watershed cumulative effects analysis.

Additional Effects from the Implementation of the Alternatives

Summary of Effects on the Soil Resource

Haacke Claremont Proposed Treatment			
Alternative	**Summer Ground-based (Ac.)**	**Skyline & Track-line (Ac.)**	**New Temp. Roads (Mi.)**
Potential %Soil Disturbance by Treatment Used for this Analysis →	+10%	+6% +8% Skyline + Feller/Buncher	25 feet wide x length of temp road
Total Acres to be Treated			
Alt. 1	0	0	0
Alt. 2	173	387	0 mile
Alt. 3	228	402	1.4 mile
Potential Acres of Additional Soil Disturbance (1)			
Alt. 1 – Total = 0	0	0	0
Alt. 2 – Total = 48	17	31	0 ac
Alt. 3 – Total = 58	23	32	4.1 ac

(1) This is a conservative estimate found by multiplying the number of acres to be treated with the risk of soil disturbance. For example, the risk of soil disturbance on 173 acres of summer ground based harvest is 10 percent which equates to approximately 17 acres.

Discussion

Care must be taken when reviewing the estimates of additional soil disturbance (Table 7). These estimates are not absolute but can be used to compare differences between alternatives. In essence, the more acres harvested the higher the potential for additional soil disturbance on the ground. Precise and definitive calculations of additional detrimental disturbance are difficult to attain since detrimental disturbance is a combination of such factors as existing ground cover, soil texture, timing of operations, equipment used, skill of the equipment operator, amount of wood to be removed, and sale administration. Mitigations, Montana BMPs, and SWCPs will be employed to minimize soil disturbances.

Alternative 1 would not add to cumulative soil effects unless fires outside of the normal range of variability occurred. No additional detrimental soil effects would be realized since ground-based logging would not occur. Invasive plant populations would persist except where treatments are initiated and successful.

Alternative 2 will produce additional soil disturbance that will overlap in time and space with the existing soil conditions. Fire potential and OHV use appear to be the most likely on-going and reasonably foreseeable actions that will overlap in time and space and produce cumulative effects on the soil resources. Mitigations will insure Alternative 2 meets the Bitterroot Forest Plan and Region 1 soil quality guidelines.

Approximately 48 acres are at risk of increased soil disturbance (Table 7). Areas of reduced soil productivity include summer skid trails, skyline corridors, temporary roads, and landings. Mitigations and SWCPs and Montana BMPs are prescribed to limit the severity of any soil damage or its areal extent.

Invasive plant populations would persist outside of proposed harvest and burn units and may spread into proposed activity units. Mitigations measures (Section II) would reduce the spread of weeds into newly disturbed areas.

Alternative 3 will also produce additional soil disturbance that will overlap in time and space with the existing soil conditions. Fire potential and OHV use appear to be the most likely on-going and reasonably foreseeable actions that will overlap in time and space and produce cumulative effects on the soil resources. Mitigations will insure Alternative 3 meets the Bitterroot Forest Plan and Region 1 soil quality guidelines.

Approximately 58 acres are at risk of increased soil disturbance (Table 7). Areas of reduced soil productivity include summer skid trails, skyline corridors, temporary roads, and landings.

Invasive plant populations would persist outside of proposed units and may spread into burn units and helicopter landings. Mitigations measures (Section II) would reduce the spread of weeds into newly disturbed areas.

The Effects of On-going and Reasonably Foreseeable Actions

There are no on-going or reasonably foreseeable timber harvest units overlaying any of the proposed units in the action alternatives. The State of Montana is proposing harvest on State lands adjacent to the NW corner of the project area in Section 30, Range 18 West, Township 9 North, Principle Meridian. The State plans to harvest approximately 200 acres of timber in three separate blocks. The project is scheduled to potentially occur in three years. The harvest would also include the construction of ½ mile of temporary road to provide access to the SE corner of section 30. This harvest will lead to additional soil disturbance in the immediate area but is outside of the Haacke Claremont project area. Based on worst case scenario, the State harvest would add an additional 20 acres of harvest disturbance and 1.5 acres of temporary road disturbance to the soils in the immediate area.

New dispersed recreational and hunting camps may be located along the roads and adjacent to or on the edge of units. OHV use will continue in the area contingent on forest restrictions on off-road vehicles. Fires are always a possibility and may overlap the proposed units. Other activities such as road construction, reconstruction, maintenance, and obliterations, firewood gathering, and other past projects will continue but generally not within unit boundaries.

Regulatory Framework and Consistency

Region 1 Soil Quality Guidelines and Region 1 Supplement 2500-99-1

All proposed activities are designed to meet the Region 1 soil quality guidelines and Supplement direction. These guidelines require that soil properties and site characteristics be managed in a manner consistent with the maintenance of long-term soil productivity, soil hydrologic function, and ecosystem health. Activities within harvest areas are designed to detrimentally disturb less than 15 percent of the activity area. None of the proposed activities in the action alternatives are estimated to exceed the 15 percent guideline after treatments are completed.

Forest Plan Management Direction

Forest wide standards for soil resources in the Forest Plan are found in Chapter II, pages 17-33, and Chapter III under the individual management areas, page II-46. The Bitterroot National Forest plan does not have numeric Soil Quality Guidelines; however the plan addresses soils in the following standards and guidelines.

- Page III-6(3) Consider soils during project planning.

  How addressed: A Soil Scientist participated on the IDT and will participate in the implementation as needed.

- Page II-25(7) Plan and conduct land management activities so that reductions of soil productivity potentially caused by detrimental compaction, displacement, puddling, and severe burning are minimized.

  How addressed: A Soil Scientist field reviewed all of the proposed units in the two action alternatives for existing site conditions. Utilizing this data, the Soil Scientist was able to plan, design, and prepare implementation mitigations to protect soil productivity. The mitigations are found in Section II of the document. These mitigations have been reviewed by a timber contracting specialist and were found to be operationally feasible. The mitigations were also reviewed by the IDT so that the mitigations are integrated.

- Page II-25(8) Plan and conduct land management activities so that soil loss, accelerated surface erosion and mass wasting, caused by these activities, will not result in an unacceptable reduction in soil productivity and water quality.

  How addressed: See above discussion under Section II-25(7).

- Page II-25(9) Design or modify all management practices as necessary to protect land productivity and maintain land stability.

  How addressed: See above discussion under Section II-25(7).

- Page II-25(6) Soil and Water Conservation Practices (SWCPs) will be a part of project design and implementation to ensure soil and water resource protection (FSH 2509.22).

  How addressed: SWCPs are linked to the timber sale contract provisions to insure implementation. Timber Sale Administrators monitor the implementation of Montana BMPs and SWCPs during harvest and post-harvest activities.

- Page III-6(4) identified the level of organic matter and coarse woody material (CWM) following harvest.

  How addressed: Target levels for CWM are described in the alternative descriptions and mitigations. The levels of CWM material have been modified via a site specific Forest Plan Amendment for the action alternatives based on the purpose and need of the project. The amendment allows a quantitative measurement of the amount of CWM to be left by fire group. This Forest Plan Amendment is needed because more recent research has been published since the Forest Plan was approved in 1987. Graham et al., 1994 and Brown et al. 2001 suggest a range of CWM depending on habitat type and/or VRU. The suggested range provides adequate CWD for soil productivity and other resource benefits without creating conditions that would lead to unacceptable fire intensity.

National Forest Management Act

The National Forest Management Act requires the Forest Service to insure that timber will be harvested only where soil will not be irreversibly damaged (16 USC Section 1604 (g)(3)(E)(i)) and even-aged regeneration harvest be carried out in a manner consistent with the protection of soil (16 USC Section 1604 (g)(3)(F)(v)). The intent is that by maintaining productivity of the parts (i.e. the treatment units), the productivity of the land in the larger picture will thereby be maintained.

Proposed activities in Alternatives 2 or 3 will not result in irreversible damage to the soil resource. Proposed activities that will have the greatest effect on soil are ground based yarding. Skid trails will be designated and historic skid trails will be used to the greatest extent feasible to limit new disturbances.

Limited data has been released from the Long-term Site Productivity Project (LTSP) (Powers et al. 2005; Powers et al. 2004). Data released from the first 10 years (Sierra Nevada and Southern Coastal Plain sites) suggests that site productivity has not been impaired despite substantive soil compaction and a massive removal of surface organic matter on the test plots (Powers et al 2004). The authors also suggest that there is no evidence that the 10 year productivity was universally impacted by soil compaction. Possible reasons for this result include that the increase in bulk density was not severe enough, bulk density changes are strongly tied to initial soil bulk density, or that increased bulk density in coarse soil increases the water holding capacity on droughty soils. The authors caution against using this information for other sites and climate and the data suggests only 10 years of study and that future data may alter the above conclusions.

Powers (1990) defines the processes that lead to declines in soil productivity. He concludes that if the loss of biomass, organic matter, soil porosity and topsoil is limited; soil productivity should be preserved. The Haacke Claremont Project protects organic matter, soil porosity, and topsoil through the use of Montana BMPs, SWCPs, and mitigations. Localized and limited losses will occur on landings, skid trails, temporary roads, or where the soil is sterilized with fire. However, over the majority of a unit and the landscape, the processes that lead to soil productivity will be preserved.

Monitoring

Harvest activities, including impacts to soils, will be monitored during implementation by Timber Sale Administrators and other Forest Service personnel. Soil monitoring of timber sale activities in the Haacke-Claremont project will be completed as part of the annual soil monitoring program on the Bitterroot National Forest. To accomplish this task, soils will be evaluated against definitions and guidelines provided in the Bitterroot Forest Plan as well as the Forest Service Manual (2550, Amendment No 2500-90-2 and Region 1 Supplement 2500-99-1) and Handbook (2509.18 WO Amendment 2509.18-91-1 and Region 1 Supplement 2509.18-2005-1). Treatment units will be randomly selected and monitored for implementation and effectiveness of mitigations, Montana BMPs and SWCPs. Detrimental soil conditions will also be monitored post-treatment to determine if activities were within Region 1 soil quality guidelines.

HERITAGE

Heritage resources (also known as cultural resources) include buildings, structures, sites, areas, and objects of scientific, historic, or social value. They are irreplaceable, nonrenewable resources documenting the legacy of past human use of the Forest.

Regulatory Framework

The primary legislation governing modern heritage resource management is the National Historic Preservation Act (NHPA) of 1966 (amended in 1976, 1980, and 1992). All other heritage resource management laws and regulations support, clarify, or expand on the National Historic Preservation Act. Federal Regulations 36 CFR 800 (Protection of Historic Properties), 36CFR 63 (Determination of Eligibility to the National Register of Historic Places), 36 CFR 296 (Protection of Archaeological Resources) and Forest Service Manual 2360 (FSM2360) provide the basis of specific Forest Service heritage resource management practices. These laws and regulations guide the Forest Service in identifying, evaluating, and protecting heritage resources on national forest system lands. The Forest Service is required to consider the effects of agency actions on heritage resources that are determined eligible for the National Register of Historic Places (NRHP) or on heritage resources not yet evaluated for eligibility. Guidelines for Archaeology and Historic Preservation are also an important element of federal agencies' management of cultural resources on public lands.

Several other laws address various aspects of heritage resource management on national forests, including the National Environmental Policy Act of 1969 (NEPA), the National Forest Management Act of 1976 (NFMA), the Antiquities Act of 1906, the Historic Sites Act of 1935, and the Archaeological Resource Protection Act of 1979, as amended in 1988 (ARPA). ARPA and two other regulatory acts describe the role of Tribes in the federal decision-making process, including heritage management. ARPA requires Tribal notification and consultation regarding permitted removal of artifacts from federal lands. The Native American Graves Protection and Repatriation Act of 1990 (NAGPRA) recognizes Tribal control of human remains and certain cultural objects on public lands and requires consultation prior to their removal. The American Indian Religious Freedom Act of 1978 (AIRFA) requires federal agencies to consider the impact of their actions on traditional Tribal cultural sites. The National Historic Preservation Act (NHPA) also specifically calls for Tribal participation in the NHPA Section 106 consultation process.

The Confederated Salish and Kootenai Tribes of the Flathead Reservation regard the entire Bitterroot National Forest as an area of concern, and are consulted on all projects occurring on the Forest. Consultation with the Confederated Salish and Kootenai Tribes regarding this project is considered ongoing, pending a visit by tribal cultural representatives to the project area in May 2008.

Area of Analysis

For cultural resource purposes, the area of analysis for the Haacke-Claremont Vegetation Management Project comprises all national forest lands within and immediately contiguous to the project boundaries.

Effects Analysis Methods

When a project is proposed on the Bitterroot National Forest, heritage program specialists participate in its planning and in the analysis of potential project effects. This participation consists of: 1) reviewing historical materials, archival documents, and overviews relevant to the project area; 2) analyzing the nature of the project and its potential to affect cultural resources; 3) reviewing public concerns regarding the project and its potential effect; and 4) consulting with interested Tribes, heritage interest groups, and the Montana State Historic Preservation Office. In the process, the heritage specialist determines the project's "area of potential effect" (APE) based on the geographic area in which a project may alter the character or use of any existing historic properties.

Based on this information, heritage specialists determine whether existing cultural resource data is adequate to complete the environmental analysis and disclose potential effects on cultural resources. If the information is insufficient, additional research and/or inventory will be undertaken. Where additional inventory is needed, heritage personnel design a survey strategy to locate all historic properties within the area of potential effect. This strategy is designed in accordance with the criteria defined in "Site Identification Strategy Prepared for the Bitterroot, Flathead, and Lolo National Forests" (SIS). If a survey discovers previously unknown cultural resources, those resources are recorded and their National Register eligibility status determined in consultation with the Montana State Historic Preservation Office (MTSHPO). Both background research and fieldwork are documented in a report submitted to the MTSHPO. The heritage program manager consults with MTSHPO to determine the nature of the project's effects on significant properties. If needed, the heritage program manager and MTSHPO work together to determine appropriate project redesign, restrictions, designation of sensitive areas, or mitigation measures. The heritage program manager coordinates recommendations, actions, and monitoring with the project leader, MTSHPO, and interested Tribal preservation officials.

A project is determined to affect a historic property when project activities alter the characteristics that qualify the property for inclusion in the National Register of Historic Places (NRHP). In determining the effect, alteration to features of the property's location, setting, or use may be relevant, depending on the property's significant characteristics. An "adverse effect" results when the project may diminish the integrity of an historic property's location, design, setting, materials, workmanship, feeling, or association. Adverse effects include (but are not limited to): physical destruction, damage, or alteration of all or part of the property; isolation of the property from its setting; alteration of the setting's character when that character contributes to the property's National Register eligibility; introduction of visual, audible, or atmospheric elements out of character with the property or its setting; and neglect of a property resulting in its deterioration or destruction (National Register Bulletin #15; How to Apply the National Register Criteria for Evaluation, US Dept. of Interior, National Park Service, rev. ed., 1995).

The Forest Service Heritage Resource Program is responsible for managing cultural resources to prevent loss or damage before they can be evaluated for scientific study, interpretive efforts, or other appropriate uses. This requires projects to be implemented in a manner that avoids adverse effects on historic properties. Project design should ensure that the essential form and integrity of historic properties is not impaired. If the potential for adverse effects cannot be avoided, appropriate mitigation treatments are determined in accordance with 36 CFR 800.5. As an example, mitigation of impacts for timber harvest may include establishment of buffer zones, directional falling, alteration of harvest unit boundaries, changes in road locations, location of skid trails away from historic properties, limiting the harvest methods in certain areas, seasonal

limitations, and restrictions on slash disposal or tree planting activities. Where a project has the potential to impact a property of Tribal concern, the Forest Service will consult with Tribal representatives to develop appropriate mitigation measures.

Existing Condition

As of October 31, 2007, all moderate-to-high probability terrain within the analysis area has examined for cultural resources by a qualified archaeologist. Since 1976, seven cultural resource inventories have been conducted within the project's area of potential effect (APE). These include the Haacke-Claremont Timber Sale (76-BR-1-13, McLean), Haacke Timber Sale (84-BR-1-1, Light), Ambrose Timber Sale (84-BR-1-3, McLeod & Munger), Ambrose Post & Pole (89-BR-1-1, Bolton), Creech/Burnt Fork Land Exchange (97-BR-1-2, Horstman & Varnum), and the current project survey (05-BR-01-06, Williams), completed in October 2007. As a result of previous surveys, five cultural sites are known to be present within the Haacke-Claremont Fuel Reduction area of potential effect (APE). These include a portion of the 1870s "Bitter Root Direct" road, a tent platform site, a prospect pit, and two sites associated with tribal use of the area. None of the sites have been evaluated for eligibility for the National Register of Historic Places. Three of the four previously recorded sites were revisited during the 2007 survey, and their conditions documented. These three sites are all contiguous to or within proposed treatment units. The fourth site, a possible tent platform associated with 1940s logging, could not be located and may no longer exist. Its recorded location is well outside all proposed treatment units. A fifth site, the prospect pit, was located as a result of the current survey. Forest maps suggest the pit might date to c. 1910, and encroaching vegetation supports this. However, with no additional context, the pit is unlikely to be eligible for the National Register of Historic Places. As required by Section 106 of the National Historic Preservation Act and 36CFR800, the 2007 survey report will be submitted to the Montana State Historic Preservation Office (SHPO) in December 2007 for consultation and determination of the sites' eligibility status and the project's potential effects on these sites. Completion of consultation with Montana SHPO is anticipated by February 2008. Tribal consultation regarding this project was initiated in 2006, and will be completed following a visit by tribal cultural representatives to the project area in the spring of 2008.

Environmental Effects Common to All Alternatives

Direct and Indirect Effects

The only direct effect on cultural resources common to all alternatives is the potential for road maintenance activities (grading) to damage a known cultural site adjacent to the road prism within the project area. The site is currently unevaluated and must be managed as eligible, requiring either avoidance of the site by maintenance activities or mitigation of adverse effects. No indirect effects on cultural resources have been identified as common to all alternatives.

Cumulative Effects

Prior to establishment of the Forest Service Heritage Resource Program in 1976, timber harvest, reforestation, and trail, road, and recreational facility development occurred with little analysis of cultural resource impacts. Areas logged, roaded, terraced, or otherwise subjected to extensive ground disturbance or subsequent erosion experienced substantial cultural resource destruction. Other adverse effect resulted from livestock grazing, irrigation development, and dispersed

recreation. Little or no effort was made to deter private collection of historic or tribal artifacts on National Forest lands. The loss of cultural resources to looting was extensive in many places. While adoption and enforcement of federal cultural resource protection legislation and regulations over the past 30 years has reduced the rate of cultural resource deterioration, it is unrealistic to expect that deterioration can be completely eliminated.

Forest management practices over the past century, resulting in fuel accumulation, have contributed to the occurrence of intense, stand-replacing wildfire. While many types of cultural resources can survive low-severity fires with little or no damage, high-severity burns destroy or damage a wide range of cultural sites and artifacts. One example is the centuries-old cambium-peeled ponderosa pine trees that mark many tribal trails and camping areas. On the Bitterroot Forest, many of these peeled trees survived a succession of low-intensity burns over the past 300 years, only to be destroyed by fire in 2000.

Plants important to the lives of the Bitterroot Salish, Pend d'Oreille and Kootenai Indians, and the areas where the tribes traditionally gathered these plants have been progressively affected by loss of habitat, herbicide use, livestock grazing, and a variety of other impacts associated with use of National Forest lands. Tribal access to and use of traditional cultural areas has also been affected by development of private lands, resource extraction on Forest lands, and increased recreational use in traditional areas.

Cumulative effects will continue, and will be intensified by additional impacts such as increasing population and new technology resulting in new uses for Forest lands. Where recreational damage to cultural sites was once limited to areas adjacent to heavily used trails, roads and campsites, the increase in modern motorized recreation has caused more site damage by motorized vehicles running over archaeological sites. Deliberate looting and vandalism of Heritage resources in remote areas has also increased with improved access.

Effects of Alternative 1 (No Action)

Direct and Indirect Effects

Because no fuel reduction or vegetation management activities would occur, there would be no potential for direct effects to Heritage resources resulting from those activities within the project area. Failure to reduce fuels could contribute to a greater long-term risk to cultural resources within and around the Haacke-Claremont project area from severe wildfires and related erosion, flood events and invasive plant establishment. Wildfire also increases the risk of site looting and vandalism due to exposure through erosion and lack of vegetative cover.

Cumulative Effects

See Effects Common to All Alternatives.

Effects of Alternative 2

Direct and Indirect Effects

Activities proposed in Alternative 2 have the potential to adversely affect two cultural sites. Site 24RA0554, a surviving segment of the 1870 Bitter Root Direct road, lies crosses Units 5 (commercial harvest) and 20 (noncommercial thin) and lies on the edge of Unit 9 (proposed for

commercial harvest). Although the 1870 road surface (a dirt two-track) may have been compromised by subsequent logging operations, the visible track adheres to the original alignment of the Bitter Root Direct road, as shown on early General Land Office maps. Use of this track by logging equipment, the crossing of the track by equipment or skidding, or road reconditioning/drainage work along this segment could obscure or obliterate the historic road alignment. If thinning and commercial harvest results in more open timber stands in Units 5, 9, and 20, those activities could have the beneficial effect of returning the road segment's setting to its historic appearance.

A second site, 24RA0285, is located between two units proposed for commercial harvest. Although the site is outside those units, it is in close proximity to both, and adjacent to a jeep trail. If that trail is used by heavy equipment, there is potential to adversely affect the site. During a 1989 post-and-pole sale, the site was protected by establishment of a 100-foot buffer zone. While acknowledging that a buffer zone may be all that is needed to protect the site itself, The Confederated Salish and Kootenai Tribal Preservation Office has expressed concern about the Haacke-Claremont project's potential effects on the site's setting, pending a tribal visit to the site in May or June 2008.

Cumulative Effects

Reduction of accumulated fuels will have the long term beneficial effect of reducing the threat of wildfire damage to cultural resources in the Haacke-Claremont project area. More open timber stands will also benefit cultural resources in the project area by returning the cultural site settings to their historic appearance.

See also Effects Common to All Alternatives.

Effects of Alternative 3

Direct and Indirect Effects

Potential effects on cultural resources for activities proposed in Alternative 3 are identical to those of Alternative 2. Although Alternative 3 involves larger acreage in treatment units 12 and 14, and includes 1.2 miles of temporary road construction, these areas were surveyed with negative results and no cultural sites identified within them.

Cumulative Effects

Reduction of accumulated fuels will have the long term beneficial effect of reducing the threat of wildfire damage to cultural resources in the Haacke-Claremont project area. More open timber stands will also benefit cultural resources in the project area by returning the cultural site settings to their historic appearance.

See also Effects Common to All Alternatives.

Consistency with the Forest Plan and Other Regulatory Direction

Heritage and Tribal interests are regulated by federal laws that direct and guide the Forest Service in identifying, evaluating and protecting cultural resources. All the alternatives would comply with federal laws. The Bitterroot Forest Plan tiers to these laws, therefore the proposed action alternatives will meet Forest Plan standards.

WATER RESOURCES

Introduction

This report provides information on the watersheds surrounding the proposed Haacke-Claremont project. A physical characterization of Haacke and Claremont Creek watersheds is provided, along with a summary of their existing conditions. Potential water resource effects of the various management alternatives are included.

Regulatory Framework

The Bitterroot National Forest Plan (USDA 1987) provides direction to protect and manage resources. Only direction pertaining to the water resources portion of the project is included here.

The Forest Plan forest-wide goal for soil and water resources is to:

- Maintain soil productivity, water quality, and water quantity (p. II-3).

Forest –wide Management Objectives state how resources will be managed under the Forest Plan:

- Manage riparian areas to prevent adverse effects on channel stability and fish habitat (p. II- 6).

Forest-wide Management Resource Standards provide further detail:

- Utilize equivalent road area or similar concept to evaluate cumulative effects of projects involving significant vegetation removal, prior to including them on implementation schedules. (p. II-23)
- Maintain the percentage of "hydrologically unrecovered" area permitted in a landscape within the guidelines of Table II-5 of the Forest Plan. (p. II-24). This applies to regeneration harvests only.
- As part of project planning, site-specific water quality effects will be evaluated and control measures designed to ensure that the project would meet Forest water quality goals; projects that will not meet State water quality standards will be redesigned, rescheduled, or dropped. (p. II-24)
- Soil and water conservation practices will be a part of project design and implementation to ensure soil and water resource protection. (p. II-25)
- Actively reduce sediment from existing roads. Sediment reduction measures to be considered include:
    - Cross-drains into vegetative filter strips away from streams,
    - Grass seed, fertilized, mulch and netting on cuts and fills,
    - Slash filter windrows or straw bales at toe of fill in contributing areas; and
    - Gravel ditches and road surfaces (p. II-25)

The following Management Areas have further Management Goals and Management Standards that pertain to water resources. (Forest-wide Goals and Standards, and Federal regulations apply to all.)

MA1, 2, 3a, 3c: Management Standards:

Utilize watershed rehabilitation projects such as stabilizing road cut or fill slope slumps to repair problems. (pp. III-6, 12, 18, 33, 59)

MA3b: Additional Management Area Goals:

Manage riparian areas to maintain flora, fauna, water quality, and water-related recreation activities. Emphasize water and soil protection. Roading in riparian areas will be restricted to meet water quality and fish objectives (pg. III-22).

MA3b: Management Standards:

Utilize watershed rehabilitation projects such as stabilizing road cut or fill slope slumps to repair problems. (p. III-27)

Other regulatory or legal requirements that direct watershed management are:

Section 208 of the 1972 amendments to the Federal Water Pollution Control Act (Public Law 92-500), which specifically mandates identification and control of nonpoint-source pollution resulting from silvicultural activities.

Clean Water Act, Sections 303, 319, 404

Section 303(d) directs states to list water quality impaired streams (WQLS) and develop total daily maximum loads to control the non-point source pollutant causing loss of beneficial uses. Up until late March 2001, agencies were instructed to use the 1996 Montana 303d list of Water Quality Impaired Streams. The Environmental Protection Agency (EPA) approved the 2000 Montana 303d list in late March 2001. Because of a 2000 court order to the state to complete TMDL's (water quality standards and restoration plans) for all streams on the 1996 list, both lists are referenced in this report. At this time, TMDLs have not yet been developed for Bitterroot National Forest streams. Section 319 directs states to develop programs to control non-point source pollution, and includes federal funding of assessment, planning and implementation phases. At this time, no known Section 319 projects would be detrimentally affected by project activities. Section 404 controls the dredge and fill of material in waterbodies of the U.S.; the current proposal for the analysis area does not contain any activities that fall under this regulation.

Section 403 of Title IV of the Agricultural Credit Act of 1978 (16 U.S.C. 2201-2205) and Title 7, Code of Federal Regulations, Part 624 (7 CFR 624), the Emergency Watershed Protection Program. The objective of these emergency watershed protection and conservation programs is to assist in relieving imminent hazards to life and property from floods and the products of erosion created by natural disasters that cause a sudden impairment of a watershed.

ARM 16.20.603 – Best management practices (BMPs) are the foundation of water quality standards for the State of Montana. The Forest Service has agreed to follow BMPs in a Memorandum of Understanding with the State of Montana. Many BMPs are applied directly as

mitigations for this proposal. Implementation and effectiveness monitoring for BMPs would be routinely conducted by contract administrators, and during other implementation and annual monitoring events.

ARM 17.30 Sub-chapter 6 details water quality standards for the State of Montana. The USFS has primary responsibility to maintain these standards on lands under their jurisdiction in the State of Montana.

Designated Beneficial Uses of Local Waters

The Montana Department of Environmental Quality has given all National Forest waters its B-1 classification (ARM 16.20.604). The associated beneficial uses of B-1 waters are 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.

Water quality is currently maintained and improved through the application of Best Management Practices (BMPs) for controlling nonpoint sources of pollution to surface water. Use of BMPs is the foundation of water quality standards for the State of Montana. This is documented in ARM 16.20.603 and means "land and management activities must not generate pollutants in excess of those that are naturally occurring, regardless of the stream's classification". Naturally occurring as defined by ARM, is the water quality condition resulting from runoff or percolation over which man has no control or from developed lands where all 'reasonable' land, soil and where conservation practices (commonly called BMPs) have been applied. Effectiveness of these measures is rated through the State of Montana BMP audit process every other year on a mix of land ownerships where timber harvest has occurred. The results of these audits are published annually by the Department of Natural Resources and Conservation. In 2000, on Federal lands BMP application was rated as 96 percent compliant and 97 percent effective.

The proposed action has the potential to affect the physical and biological quality of the waters within the project area. The associated water quality criteria that could be affected are:

> 2. No person may violate the following specific water quality standards for water classified B-1:
>
> > (d) The maximum allowable increase above naturally occurring turbidity is 5 nephelometric turbidity units except as permitted in ARM 16.20.633.
> >
> > (e) A 1 degree F maximum increase above naturally occurring water temperature is allowed within the range of 32 to 66 degrees F;
> >
> > (f) No increases are allowed above naturally occurring concentrations of sediment...which are likely to create a nuisance or render the waters harmful, detrimental, or injurious to public health, recreation, safety, welfare, livestock, wild animals, birds, fish or other wildlife (ARM 16.20.633).

Desired Condition and Regulatory Consistency

The desired condition for water resources is stated above in the Regulatory Framework section. The implied goal is to meet all regulatory standards for water quality pertinent to the Montana DEQ B-1 classification. Intermittent channels provide only seasonal support to cold water fishery and other aquatic life, mainly through flow contributions to larger channels.

Analysis Methods

Specific methods were used to determine existing watershed condition, sensitivity, and to predict watershed response to the various alternatives. The table below lists the measurement indicators and the pertinent analysis method. Details and assumptions for the methods used are described in the Water Resources Specialist Report (PF#J-Water1)

Measurement Indicators and Analysis Methods to Evaluate Effect to the Watershed

Measurement Indicators (assessed for whole project area)	Analysis Methods
Existing stream channel condition & sensitivity	Site surveys
Percent sediment delivery increase (decrease) over existing (Long-term and short-term)	Watershed Erosion Prediction Project Model (WEPP)
Water Yield Increase (Long-term and short term)	Equivalent Clear Cut Acres (ECA)
Potential risk of impacts to stream channel conditions (low, medium or high risk) (Long-term and short term)	Stream Channel Condition Assessment – Equivalent Clear Cut Acres (ECA)
Road/Stream Interaction (Long-term and short term)	Geographical Information System

Existing Condition

This section describes the environmental setting for water resources, including current conditions. This section does not address environmental effects or consequences, but rather serves as the baseline for the comparisons in the Environmental Consequences section.

Physical Characteristics

Water resources in the analysis area are comprised mainly of Haacke and Claremont Creeks, their intermittent and perennial reaches, and their adjacent riparian areas. Wetlands are limited to beaver ponds, streamside areas and small seeps and springs. While all water resources in the analysis area watersheds are important, none are considered unique for the area.

Haacke Creek is a small drainage within the Gold Creek composite 6th-level watershed (HUC 170102051205, 21,339 acres), which also includes Sawmill Creek, Gold Creek, and a portion of Burnt Fork Creek. Claremont Creek's drainage is in the lower Burnt Fork Bitterroot River 6th level watershed (HUC 170102051206, 32,678 acres**),** along with lower reaches of Burnt Fork Creek, Slocum Creek and Sheep Creek. Haacke and Claremont Creeks head near the Sapphire crest, at approximately 7,000 feet elevation and contribute flow to the Burnt Fork Bitterroot River at about 4,360 feet elevation for most of the year. The only perennial flow on Forest Service lands is a reach of Haacke Creek, in the NW1/4 of S18, T8N, R18W, just above the USFS/private boundary. All other reaches are intermittent or ephemeral. Precipitation in the 6th-level watershed comes mainly as snow between October and April, with a mean annual precipitation ranging from around 14 inches (water equivalent) at lower elevations to about 38 inches at the upper elevations. Long-term average precipitation across the Haacke and

Claremont watersheds is estimated at 22-26 inches, while 15-18 inches would be more likely across the 6th-level Lower Burnt Fork watershed, due to its lower average elevation. Precipitation has been below the long-term average for the last several years, likely leading to commensurate reductions in soil moisture and stream flow.

The two drainage basins are relatively rocky, with common bedrock outcrops and talus slopes. Geology is mainly belt calc-silicates (quartzite) at upper elevations, changing to decomposed granites near the forest boundary. Calc-silicates are relatively resistant to weathering, and skeletal or thin soils are common, as are soils with high percentages of rock fragments (please see Soil Specialist's report for this project for more detail).

Analysis area streamflow follows a typical snowmelt-driven pattern, although intermittent channel reaches generally lose flow completely when snowmelt is over. Peak flows generally come in May, and subside from late spring through fall. Fall rainstorms may provide enough groundwater to boost flows in perennial reaches before freezing temperatures reduce flow again in winter. Most runoff occurs between April and July, and flow response to summer thunderstorms is generally minimal due to soil and the vegetation characteristics.

Vegetation communities are mainly forest types, with Douglas Fir or Ponderosa Pine dominating the overstory and various dryland shrubs (e.g., ninebark) and grasses (pine grass and bear grass) forming the understory. Forest density is relatively high except on talus/rock slopes and some south & western aspects.

Land Uses and Existing Condition

Land uses in the analysis area include timber harvest and road building on Bitterroot National Forest (BNF) lands, although neither has occurred within the last 10 years. The most recent harvest inside this analysis area was the 1993 Ambrose Mistletoe Salvage timber sale. Only 4 acres were cut within the Haacke-Claremont watersheds. Several other sales in the mid to late 80's also had small acreages cut within the analysis area. Timber harvest, grazing, agriculture, road building and housing development occur on private lands in the watershed, although much of the lower elevation area is dominated by several ranches that are more or less intact. The table below displays management influences in the Lower Burnt Fork watershed that could affect watershed condition. Since these activities and their effects may overlap in time and space, they are potentially cumulative effects.

Existing Condition Table for the Haacke and Claremont Cr. drainages.

Watershed condition factors	**Haacke Creek**	**Claremont Creek**
Total road miles (density)	16 (4.5 miles per sq. mi.)	8.5 (5.7 per sq. mi.)
Total road/stream crossings (density)	18 (3.6 crossings per sq. mi.)	15 (10 per sq. mi.)
Road Impact Factor (RIF)	14 (low)	57 (moderate)

Higher road and crossing densities have been related to increases in fine sediment in streams, suggesting a negative impact to fish and invertebrate habitats. The Road Impact Factor (RIF) is an index created by multiplying total road density times the total stream crossing density. It is designed to assess both the amount and location of roads, and assumes a linear relationship between RIF and management effects (Higher RIF suggests higher impacts or sensitivity). It does not take into account many physical factors such as geology or precipitation. For 4th-order

watersheds (roughly equivalent to current 6th-level watersheds) on the Bitterroot National Forest, this index ranged from zero to 225 in 1991.

Equivalent clearcut area (ECA) modeling considers vegetation alteration by fire and harvest, and has been less strongly correlated to fine sediment increases in streams than road/stream crossings. Water yield in a watershed is directly correlated with the amount of forest cover, with yield declining during periods of increasing forest cover and water yield increasing with decreased forest cover, if precipitation is held constant. The Gold Creek and Lower Burnt Fork 6th-level watersheds currently have an estimated on-Forest ECA of less than 10%. Water yield increases are generally not detectable in forested basins until ECA increases beyond 20 to 25%. No large (greater than 100 acres) fires have occurred within the Haacke – Claremont analysis area over the past 20-30 years. The lack of fire or harvest, near-continuous forest cover and high stand density suggest water yields are at the low end of the expected range for the analysis area. The 2003 Gold 1 fire burned approximately 9,000 acres or about 11% of the mostly un-managed upper Burnt Fork 6th-level watershed, which is upstream of and outside the current analysis area. This amount of burned area and ECA is within the historical range for fire-dependent ecosystems and over the long term, is considered beneficial for both upland and aquatic species.

Prescribed fire has not been used in the recent past in the Haacke or Claremont Creek drainages. The low-elevation Ponderosa Pine – Douglas Fir (VRU2) vegetation type that dominates the analysis area evolved closely with fire, and use of prescribed fire is considered beneficial in this ecosystem. Unless a prescribed fire kills a significant portion of a watershed's forest overstory, it would not contribute measurably to water yield increases.

None of these measures are over pertinent 1987 Forest Plan Standards for this watershed or management area, and none suggest high levels of impact to water resources. Potential effects of proposed activities in this watershed can be analyzed by comparing changes in these management indices and the Forest Plan Standards.

Streamside and riparian habitats in the Haacke-Claremont analysis area are relatively limited by minimal streamflow, well-drained slopes and V-shaped valley configurations. Most stream channels are well-armored by rock and vegetation, and appeared to be in good condition on National Forest Lands during field visits. Native vegetation dominated all riparian and streamside areas surveyed in the Haacke and Claremont Creek watersheds, with some weedy areas near road crossings.

Private and State Lands

The 6th-level Lower Burnt Fork watershed and the smaller Haacke-Claremont drainages have a mix of private, State, and Federal lands. Information on specific conditions on private and State lands is partially lacking, but reviews suggest the following:

- Section 30, T9N, R18W is a State parcel with planned forestry activities. Approximately 100 acres of commercial thinning and 100 acres of dead/dying/mistletoed salvage are scheduled for roughly 2010 – 2011. None of this section is within the Haacke or Claremont Creek drainages, but it is within the larger 6th-level Lower Burnt Fork watershed. Due to the small area being cut, along with partial-cut and salvage prescriptions, these treatments are not expected to add significantly to water yield increases in the Lower Burnt Fork watershed.

- A portion of the private lands within Haacke and Claremont Creek drainages has been harvested in the recent past. A commercial thinning/fuel reduction prescription was used, leaving sparsely to moderately stocked stands on these low-elevation sites. Due to the low annual precipitation, partial-cut and salvage prescriptions, these treatments are not expected to add significantly to water yield or sediment increases in the Haacke and Claremont Creek drainages or Lower Burnt Fork watershed.
- Both Haacke and Claremont Creeks have perennial reaches on private lands below the forest. Landowners in this area have completed numerous watershed improvement projects including road reshaping and surface stabilization, planting trees, rehabilitating meandering channel sections and actively controlling grazing in riparian areas. Haacke and Claremont Creek stream channels are considered in "good" condition in these reaches.

Past Watershed Improvement Projects

The Haacke and Claremont Creek watersheds have had no substantial watershed improvement projects in the recent past. The relatively resistant quartzite geology, few perennial stream reaches, lack of connection with a larger stream and low fisheries priority has led to few high-priority projects being proposed.

303(d) Impaired Waters and TMDL Status

Neither Haacke nor Claremont Creeks are on the 2006 MTDEQ 303(d) list or past lists. Cold water fisheries beneficial use is generally not supported in the mainly intermittent channels. Other aquatic life (e.g., invertebrates) support is achieved through seasonal flow, but this varies with annual precipitation and weather pattern. Stream reaches off-forest are in generally good and improving condition due to conservation efforts by private landowners in the area.

North Burnt Fork Creek (downstream of the analysis area) is currently on the MTDEQ 303(d) list as partially supporting cold water fisheries and aquatic life. Probable causes of impairment include bottom deposits, total Phosphorus and total Kjehldal Nitrogen (TKN), with probable sources being listed as grazing in riparian or shoreline zones and irrigated crop production. Haacke Creek may contribute flow to the North Burnt Fork Creek during large hydrologic events, but Claremont Creek is generally diverted to agricultural use once it reaches private land.

Summary – Existing Condition

Overall, the limited water resources in the Haacke-Claremont analysis area are in good condition. Most channels are intermittent and don't support fish, although one perennial reach exists on Forest Service lands. Little harvest has occurred in the recent past and most available ground is fully forested with dense stands of various conifers. Resistant geology has helped create durable, rocky road surfaces at stream crossings in most of the analysis area.

Environmental Effects

This portion of the watershed analysis describes the potential environmental effects of the Proposed Action and various alternatives. The effects discussion assumes that appropriate best management practices and mitigation measures will be implemented for all action alternatives. Please see the Mitigation Measures listed in chapter 2 for more details. The analysis also

seriously considers the above discussions of existing condition when forecasting effects of alternatives. Please see the silviculture report for this project for proposed vegetation management details.

Alternative 1 - No Action

This alternative would not implement any management activities, other than to allow the analysis area to continue on its current trends. Current maintenance of roads and gates would continue.

Direct and Indirect Effects

If the proposed treatments were not implemented, forest density and biomass in the proposed units would continue to increase. Young trees would continue to grow, and shade-tolerant species (e.g., Douglas-fir) would reproduce under the thick canopy. Densely treed stands would eventually slow in growth as available soil moisture is utilized fully. Thickly forested areas tend to have lower per unit area streamflows than sparsely forested areas, all other variables remaining constant (Stednick 1996, Troendle, et al, in press). The no-action alternative would result in **not** implementing about 735 acres (Alternative 3) of various vegetation treatments, including prescribed fire, commercial thinning and non-commercial thinning in the foreseeable future. These acres constitute about 23% of the USFS-managed area within Haacke and Claremont Creek watersheds. Treating (and conversely, not treating) this small portion may have a moderate effect on soil moisture and stream flow in the 3,164 acre project area.

Increased forest density increases the potential for atypical wildfire effects, especially in forests that evolved under low-severity fire regimes (Agee 2002). Surface erosion, caused by overland flow, is the dominant post-fire landscape response in the Northern Rocky Mountains (Wondzell and King 2003), while debris flows and mass wasting have increased importance in Coastal and Interior Northwest regions. Robichaud et al (in press) note that high severity wildfire increases erosion and runoff rates to a much greater level than low severity fire. Under the current fire-suppression policy, fuels would likely continue to increase in all levels of the stands, adding to the risk of high-intensity wildfire. During high-intensity wildfires, soil heating is intense and most organic material in the upper horizons is burned off. These soils often end up in a water-repellent (hydrophobic) condition that severely increases erosion rates. Post-fire monitoring of the 2000 fires on the Bitterroot National Forest, directly east of the analysis area, suggests that debris flows, gully rejuvenation, and channel adjustments would be common (Hyde, in press) after large fires that occur under extreme weather conditions. Watershed “sponge & filter” functions are often significantly degraded, resulting in heavy sediment delivery to streams, channel adjustments, and higher-than-normal mortality in local aquatic organism populations.

In this project, about 23% of the USFS jurisdiction of the combined Haacke and Claremont Creek drainages would be proposed for treatment. If this project were implemented, fire severity and effects may be reduced on these acres, along with some immediately adjacent areas. This suggests that there would be a moderate increase in watershed risk under the no-action alternative.

It is difficult to predict the occurrence and intensity of future wildfires. Fire history on the Bitterroot National Forest suggests that forested areas in the analysis area watersheds will eventually experience a wildfire. The analysis area is currently densely forested with pole to mature tree sizes with appreciable ladder fuels. If a fire started along the lower Forest Service

boundary or on private land, the late day burning period alignment of slope, wind, and solar energy increase the probability of high intensity fire. Fuel and fire models suggests that because the area is more densely forested than historic conditions, fires will likely be larger and of a higher severity than would have been expected in the past. Potential watershed effects depend on these fire characteristics. Riparian areas may have longer mean fire return intervals than adjacent uplands (Dwire and Kaufmann 2003) and thus be less affected by past fire suppression. Fire is directly and indirectly responsible for much of the ecological diversity of riparian corridors (Dwire and Kaufmann 2003), and fire is considered beneficial in many cases (Brown 1989), increasing contributions of large fire-killed trees to the stream and regenerating deciduous plants. Riparian areas on the Bitterroot have generally recovered quickly after the 2000 fires, due to the inherent high productivity of the sites and vegetation characteristics. Recovery of upland areas has varied with fire severity.

Forest density in the proposed units would continue to increase, resulting in thicker, brushy stands with higher potential fire severity. Young, thick regeneration and plantation stands would slow in growth due to moisture stress and become more susceptible to insects and wildfire. Stream flow may decrease slightly due to increasing stand density, which leads to higher interception and transpiration losses. No haul-related sediment would occur, and watershed conditions and water quality would generally remain the same as described in the affected environment section (above), unless a wildfire occurred. No wetlands or riparian habitats would be disturbed or affected in any way unless a wildfire occurred.

Without ongoing forest management, fuels are likely to increase and stands would become more susceptible to high-intensity wildfires. Watershed effects associated with these types of fires can be severe. While there is no guarantee that the implementation of this alternative will cause an intense wildfire, a no-action approach may increase the probability of this type of event.

Cumulative Effects

The cumulative effects analysis area is the Lower Burnt Fork watershed, including both Bitterroot National Forest and private lands. Effects to Ambrose Creek are also considered. The most likely result of the No-Action alternative is the status quo for water resources, with no new watershed impacts. Other ongoing or proposed activities such as road use, road maintenance, prescribed fire, culvert replacements, timber harvest and recreation would continue to occur in the future, but cumulative effects to water resources would be limited because these projects are or would be designed to minimize watershed impacts. Site visits in 2006 and 2007 suggest "good" stream health in the upper Haacke and Claremont Creek watersheds, and this is likely to continue with the no-action alternative.

<u>Summary Of The No-Action Alternative:</u>

- No acres are proposed for treatment. The no-action alternative would retain present stand density and moisture stress.
- The no-action alternative would have no harvest or hauling-related sediment contributions. Roads would still provide a small but chronic sediment input to streams at crossings.
- Implementing the no-action alternative would mean no watershed improvement projects would be completed in the near future, although they could be proposed at a later date.

- Predicting future fire effects is difficult, as fire may be either beneficial or detrimental to watershed health depending on its characteristics. Implementing the no-action alternative would maintain the current risk of watershed damage from high-intensity wildfire, and increase it over time. Over the next 10-year time span, risk of substantial high intensity fire is estimated at moderate to high.
- Wetlands and floodplains would continue in their current condition and trends.

Effects Common to all Action Alternatives

Alternatives 2 and 3 share many activities and water resource effects are similar for both. Distribution and intensity of treatments or activities are similar, with Alternative 3 including a temporary road and slightly more timber harvest. Due to the alternatives being so similar, the effects analysis for Alternative 3 discussed below would also apply to Alternative 2.

Direct and Indirect Effects

Commercial Thinning - There are many common beneficial elements to the treatments. All leave stocked stands of either mature or sapling-age trees on the sites except for a single 12-acre opening in unit 4. This limits water yield increases greatly, as in all cases there will be remaining healthy stands to utilize a portion of the moisture made available by the treatments.

All would utilize pertinent BMPs and Forest Plan guidance designed to reduce sediment contributions to the practicable minimum. All avoid riparian areas either through upland locations or RHCA buffers within the units. Bitterroot National Forest monitoring results suggest that recent timber sales designed with water resource protection in mind and implemented with BMPs produce few negative watershed effects (Bitterroot National Forest Plan Monitoring and Evaluation Reports for 1997, 1998, 1999, 2000, 2001). Both alternatives utilize Log yarding methods appropriate for treatment unit slopes. Designated skid trails would minimize soil disturbance and loss of ground cover, to help meet current soil standards. Both tractor and skyline yarding may disturb ground cover and soil structure on a small (less than 15%) portion of a harvest unit. Skyline yarding tends to disturb less than 5% due to required leading-end log suspension. These disturbed areas are generally discontinuous and would be isolated from streams by RHCA buffer strips to filter out potential sediment.

Temporary Road Construction - Soil and ground cover would be disturbed over about 4-5 acres for the temporary road proposed in Alternative 3. The upland location would not threaten water resources, and full re-contouring after use would prevent long-term watershed effects. During use, some erosion of the road surface is expected, but this is not likely to reach any water-related features due to its location.

Pre-commercial Thinning and Prescribed Burning - Pre-commercial thinning and prescribed burning are similar for both alternatives. Neither activity degrades water resources when implemented under the proper prescription. Both lead to vigorous residual forest stands and ground cover that maintain watershed and forest health. This work is predominately completed by hand crews that create few soil impacts. Prescribed burning would occur on all thinned units and as the only treatment on an additional 368 acres. There is a very slight risk of an escaped prescribed burn turning into a wildfire, but this event is rare. The benefits of burning are felt to outweigh the small, short-term risk of negative watershed effects. Beneficial effects from the

proposed prescribed burns include reduction of fuels, rejuvenation of shrubby and herbaceous species, and protection of watershed functions such as infiltration and vegetative filtering. Negative effects would be limited to small sediment contributions in the case of large precipitation events following within several weeks of a burn.

Road System Effects – Proposed commercial treatments require log hauling on forest roads. Log truck traffic tends to disturb road surfaces more than recreational or light vehicle traffic. Water resource concerns are associated with road/stream crossings and roads that closely parallel stream channels.

No new permanent roads or crossings are proposed, helping to minimize road system effects. Currently there are 2 road/stream crossings in the Claremont drainage that would be on the proposed log haul route, and none in the Haake Creek drainage. These intermittent stream crossings are within calc-silicate (quartzite) geology and are quite durable. No substantial sediment production is predicted at these crossings.

The proposed haul route would use four road/stream crossings in the Ambrose Creek drainage. The upper two are within are within calc-silicate (quartzite) geology and are quite durable. No substantial sediment production is predicted at these crossings. The lower two crossings and a segment of riparian road are within decomposed granite geology and are more sensitive to log haul effects. Potential effects include increased sediment at these crossings during hydrologic events. The proposed haul road (FR428) also closely parallels Ambrose Creek for about 2 miles. Ambrose Creek Road currently has a gravel surface from Ambrose Saddle throughout the streamside area. Gravel surfaces help to minimize road effects to nearby water resources by limiting sedimentation to the practicable minimum. Pre-haul maintenance would also be used to minimize road-related sediment. Please see the Cumulative Effects section (below) for a more detailed discussion on Ambrose Creek and road use effects.

Sporax® Applications

Sporax® (an EPA-listed antimicrobial) applications are prescribed for some commercial thinning treatments to prevent the spread of annosus root disease. The Forest Service has completed a risk assessment of the use of *Sporax*® (USDA Forest Service 2006g). The use of *Sporax*® in Forest Service programs will not typically or substantially contribute to concentrations of boron in water (USDA Forest Service 2006g). Results from exposure scenarios indicate that aquatic animals and plants are not at risk (USDA Forest Service 2006g). Sporax® has low toxicity to most animal species and therefore has low potential to create water quality problems. No case studies of forestry sporax applications creating water quality problems were found in web searches, and past use on the Bitterroot National Forest has produced no known problems to date.

For additional information on Sporax® treatments, refer to the Vegetation section description of Commercial Thinning treatments.

Cumulative Effects

The cumulative effects analysis area would be the same as for the No Action alternative and includes Ambrose Creek due to potential log haul effects. Due to the lack of watershed effects (please see discussion for direct and indirect effects, above), no increase in cumulative effects related to sedimentation or excessive water yield increases is expected. A Watershed Sensitivity and ECA analysis was completed for the Haacke-Claremont Project and is included in the project file (PF#K-Water5). Alternative 3 would increase ECA by approximately 315 acres, widely dispersed over the two drainages. This would keep ECA well below the 25% level generally associated with measurable or significant water yield increases in forested watersheds, and no detrimental effects are predicted for this change. This very low ECA also suggests that no further modeling of this factor is warranted.

There would be no increase in any road or road/stream crossing factors, as no new permanent roads are proposed. Currently there are 2 road/stream crossings in the Claremont drainage that would be on the proposed log haul route, and none in the Haacke Creek drainage. These crossings are within the quartzite geology and are quite durable. No substantial sediment production is expected at these crossings.

All stream channels would be isolated from harvest unit activity using INFISH RHCA guidelines. Please see the fisheries report for this project for more discussion on the use and effectiveness of these buffers. Harvest units are highly unlikely to contribute sediment to stream channels due to the following favorable factors:

- The majority of treatments are partial cuts and leave stocked stands, with nearly-continuous ground cover to limit sediment travel;
- Some openings will be created but are generally less than two acres. One larger opening would be created in unit 4.
- Specific log yarding methods are prescribed for each unit, tailoring the method to the slope and terrain
- Wet sites and stream channels would be excluded from ground-disturbing activities and protected by RHCA stream buffers;
- Little harvest or fire activity in the last 10 – 15 years;
- Timber sale contract clauses would be used to enforce BMPs that further limit resource damage to soils and remaining vegetation.

For these reasons, the proposed harvest activities for either alternative are not expected to add to cumulative effects in the Haacke-Claremont analysis area.

Ambrose Creek Watershed

Commercial timber would be hauled out of the forest on FR428 (Ambrose Creek Road). This road closely parallels Ambrose Creek for about 2.5 miles. Ambrose Creek Road currently has a gravel surface from Ambrose Saddle through the streamside area. Gravel surfaces help to minimize road effects to nearby water resources by limiting sedimentation to the practicable minimum. Pre-haul maintenance would also be used to minimize road-related sediment.

Due mainly to its proximity to the stream, this road segment contributes sediment to Ambrose Creek during hydrologic events. Ambrose Creek is currently listed on the MTDEQ 303(d) list for nutrients and physical habitat alterations, but not for sediment. Full details for the listing are provided in the table below.

AMBROSE CREEK 303(D) LISTING

Waterbody #	USGS 6th level HUC in project	Stream Name	Est. size (mi.)	Beneficial Use, Partial Support	Beneficial Use, Not Supporting	Probable Cause	Probable Source	Predicted TMDL completion date
MT76H004 120	1702050703 1702050705	Ambrose Creek	11.4	Primary contact recreation	Aquatic Life, Cold Water Fishery	Nutrients; Nitrogen, Phosphorus, and Physical Habitat Alterations	Agriculture, Grazing in Riparian or Shoreline Zones	2009

USFS stream surveys in the lower watershed (NW ¼ S18, T9N, R18W) during 1995 and 2004 show more fine sediments than found in local reference stream channels of the same type. Potential contributors are the road and grazing activity, within this section and private land holdings upstream of the survey site.

The route between the Haacke –Claremont activity area and public paved roads has 5 stream crossings in the Ambrose Creek drainage and about 2.5 miles of valley-bottom road. FS WEPP-Road sediment modeling suggests high-traffic (log haul) sediment from this section of road would increase by about 390 lbs/year, which is about 50% more than a low traffic situation. Kirchner et al (2001) used reservoir data to calculate a mountain erosion rate range of 7-25 tons/sq km in nearby Idaho river systems. Using this range and converting to English units, the 7 square miles of Ambrose Creek watershed above this road segment would produce from 126 to 450 tons of sediment annually. This suggests the relatively small potential sediment increase from haul traffic on Ambrose Creek road may affect the stream segment immediately adjacent, but is unlikely to cause significant downstream effects.

The project is consistent with Montana Impaired Waters (303(d)) programs. Currently sediment is not listed as a pollutant in Ambrose Creek, but the on-going TMDL assessment on the lower Bitterroot River basin may produce updated information on this stream. Montana State Code (75-5-703, Annotated 2001) provision 10 c) states that " new or expanded nonpoint source activities affecting a listed water body may commence and continue provided those activities are conducted in accordance with reasonable land, soil, and water conservation practices". This proposal within a water body listed for reassessment meets these requirements and is therefore consistent with State law regarding this situation. Applicable soil and water conservation practices include road surfacing (graveling) of potential contributing road segments (Ambrose road has an existing gravel surface), and inclusion of timber sale contract clauses that control haul operations during wet conditions and direct road surface maintenance activities (Appendix A, TSC B5.12 and C5.12, with others as applicable).

Other on-going and foreseeable future activities in the analysis area watersheds include road use, road maintenance, future timber treatments, prescribed fire, culvert and bridge replacements, but cumulative effects to water resources would be limited because these projects are or would be designed to minimize watershed impacts. Recreation use is likely to continue on its current trends, and some minor local watershed effects at trail and road stream crossings are expected. These effects would be limited to small sediment contributions from OHV, road, bike, horse, and foot traffic adjacent and across streams. Past activities include timber harvest, road building, maintenance and use, grazing and recreation.

Overall, additions to cumulative effects would be extremely limited. This is due to the small amount of area being treated, no new permanent roads or crossings being built, the thinning and partial-cut methods proposed, and application of BMPs. FS WEPP modeling suggests only a precipitation event in the 40 to 50 year return interval class would deliver sediment to streams from the harvest units. Forest Plan Monitoring Reports (PF#K-ForestPlan8) in 1997, 1998, 1999, and 2000 suggests that conservatively designed and mitigated (i.e., using all pertinent BMPs) timber harvest activities generally create no detectable changes in stream channel conditions.

Monitoring and Adaptive Management

Activities associated with the project would be monitored for water resource impacts. This would include inspection by a timber sale administrator (TSA) and Contract Officers (CO) or their representative (COR) of BMP implementation and any other mitigation measures required in the timber sale contract. Resource specialists, including hydrologists and fishery biologists, would also monitor BMP implementation and effectiveness during and after implementation of the timber sale. Standard operating procedure is to require the contractor to have all BMPs in place before the unit is officially closed.

If management activities are found to be impacting water resources (e.g., sediment-bearing overland flow from harvest units or skid trails, excessive soil disturbance), measures will be taken to eliminate the impact or reduce it to the practicable minimum. These measures would include corrective actions, control treatments accomplished by machine or hand crews, or where appropriate, delay of treatment or change in methods.

Regulatory Consistency

All alternatives are consistent with Bitterroot National Forest Plan Standards and Guidelines for water resources and all pertinent Federal and State regulations.

Summary

Analysis considering the design and size of this proposed action suggests it is very unlikely to produce even minor sediment in the Haacke and Claremont Creek watersheds, and neither alternative is likely to negatively affect water quality. Conversely, the management activities proposed produce moderate benefits to the watershed, mainly through the reduction of fuels and potential fire intensity on the treated areas. All Federal, State, and Forest Plan regulations are met with this proposal.

RECREATION

Regulatory Framework - Current Forest Plan Direction

The areas proposed for this project are in MA 3a (2149 ac), MA 2 (889 ac) and MA 1 (93 ac). Forest Plan goals for MA 3a recreation are to emphasize dispersed recreation. Relevant standards for recreation are:

1. Manage for recreation opportunities associated with main access roads and fishing streams. Most of the area that can be roaded is already roaded. Areas with sensitive soils and steep slopes, including some sites along Skalkaho, Daly, and Sleeping Child Creeks, and the West Fork River will remain unroaded. The recreation opportunity spectrum setting is roaded natural.

2. Interpretive sites and trails will be compatible with the partial retention objective.

3. Off-road vehicle use will be restricted during critical periods on susceptible ranges such as high-use winter range, spring range, and densely roaded fall range.

Forest Plan goals for MA 2 recreation will provide for roaded dispersed recreation activities. Relevant standards for recreation are:

1. Manage for recreation activities associated with roads and motorized equipment. The recreation opportunity spectrum setting is roaded natural (USDA, nd). Interpretive sites and trails will be compatible with winter range management goals. Off-road vehicle use will be controlled during critical periods on susceptible ranges such as high-use winter range, spring range, and densely roaded fall range.

Forest Plan goals for MA 1 recreation will provide for roaded dispersed recreation activities. Relevant standards for recreation are:

1. Manage for recreation activities associated with roads and motorized equipment. The recreation opportunity spectrum setting is roaded natural.

2. Interpretive sites and trails will be compatible with timber goals.

Direction for Off Road Vehicle use was amended by the 2001 Off Highway Vehicle Decision (Tri-state EIS) which currently prohibits any off road vehicle travel throughout the proposal area. The Forest Service and Bureau of Land Management issued a decision in January 2001 to limit or restrict motorized wheeled cross-country travel on lands administered by the two agencies. The decision restricts yearlong, wheeled motorized cross-country travel, where it was not already restricted. Motorized vehicles continue to be allowed on routes that have existing motorized use. A Special Order was completed for the Bitterroot NF and signs were placed across the Forest prior to July 1, 2001.

Existing Condition Relevant to Recreation.

The current, and primary recreational use of the Haacke and Claremont Creek area is for dispersed recreation. This use level is low to moderate. The general forest areas are used mainly

for day hikes, hunting, firewood cutting and motorized travel on the roads. Road 1339B provides access to Trail 313 which runs along the east boundary of Unit 14 (proposed for commercial harvest) and Unit 22 (proposed for noncommercial thinning). A 150 foot buffer along Trail 113 will help visually screen proposed project activities from trail users.

This area has past history of logging especially in the 1970's and 1980's. Commercial harvest through the years provided a network of roads for the recreating public. There has been minimal illegal off road use by motorized vehicles in the project area. This is likely because of the light to moderate use in the area and the existing high density of roads open to public use.

Direct, Indirect, and Cumulative Effects

The No Action Alternative would have no effect on current recreation use in the area.

The action alternatives would use a combination of commercial harvest, noncommercial thinning and prescribed fire in the project area. Alternative 3 would build 1.2 miles of temporary road and harvest 64 acres more than Alternative 2.

Harvest and burning activities would result in more open forest conditions creating the potential for offroad access into areas where it doesn't exist and it is not allowed. Anywhere access is opened up on more gentle slopes that might allow for travel on more gentle slopes, between roads, or areas behind gates is a concern. Mitigation measures are proposed that would limit illegal off road use.

Vehicle traffic from log hauling, contractors associated with the project, and Forest Service personnel will increase during project implementation. Firewood cutting in the project area will also likely increase during and after project completion because of the increase in wood availability. Existing roads being used in the project area will be maintained to meet contract specifications for log hauling and safety. Better road conditions may attract more recreational use in the area but is not likely to significantly change the use level in the area. Road density in the area will remain high but no permanent road miles will be added and current seasonal and yearlong closures will remain the same.

Consistency with the Bitterroot Forest Plan

The Haacke-Claremont Vegetation Improvement Project meets Forest Plan standards for recreation. Road maintenance activities would likely improve the users travel experience and additional firewood opportunities will likely be created as a result of the project. The proposed activities will create a more desirable appearance in the landscape over time.

SCENERY

Regulatory Framework

The Bitterroot National Forest scenic resource is managed by direction provided in the Bitterroot Forest Plan (1987). Visual quality is assessed and evaluated under the National Forest Landscape Management, USDA, Forest Service Handbook Nr. 462, April 1974; and Landscape Aesthetics, USDA Forest Service Handbook Nr. 701, December 1995.

The Bitterroot Forest Plan includes forest-wide management goals for scenery to maintain a high level of visual quality on landscapes seen from population centers, major travel routes, and adjacent fishing streams.

The Plan also includes the following management-wide (MA Standards):

- MA 3a (2149 acres), The Visual Quality Objective (VQO) is partial retention where human activity may be evident but must remain subordinate to the characteristic landscape.

- MA 2 (889 acres), Visual Quality Objective (VQO) is modification where human activities may dominate the characteristic landscape butt must, at the same time, utilize naturally established form, line, color, and texture. It should appear as a natural occurrence when viewed in middle-ground or background.

- MA 1 (93 acres), Visual Quality Objective (VQO) is generally maximum modification and modification. Maximum modification: Human activity may dominate the characteristic landscape, but should appear as a natural occurrence when viewed as background. Modification: see above in MA 2.

Forest – wide standards for visual quality include:

1. The time required for openings to visually recover before adjacent stands can be harvested will vary by visual quality and other management objectives as determined through application of the visual management system and project interdisciplinary team process. As a general guide, recovery in retention and partial retention areas, from middle ground viewing distances, occurs when the site is stocked with about 300 trees per acre, with dominate trees 20 feet tall. This condition is reached within 26 to 34 years from the time of harvest. Habitat types not typically capable of supporting 300 trees per acre generally recover in about 30 years. For maximum modification VQO, visual recovery occurs when a new forest stand is established and certified stocked.

2. Openings created by timber harvest should be designated to blend with natural openings to the extent practical.

3. The size, shape and location of the area between openings will be consistent with water, wildlife and visual resource considerations. Documentation of rationale and trade-offs will be required if the proposed openings are larger that the intervening leave areas.

Area of Analysis

The Haacke-Claremont project is located on the Bitterroot National Forest on the Stevensville Ranger District, east of Highway 93 in the Sapphire Mountains, and about 8 to 9 miles east of Stevensville, Montana. A small portion of the project can be seen as middle ground from Highway 93 and the town of Stevensville. The Foreground is privately owned, sparsely populated, ranch and timber lands. The middle ground is lightly populated with smaller ranches, hobby farms, and some rural development.

Existing Condition

The project is located on moderate to fairly steep slopes and tree-covered terrain. The area has an existing network of roads that supported past logging activities in the 1970s and 1980s. The area, though heavily logged, has had 25 – 35 years to recover with dominant tree growth being well over 20 feet tall. The area currently meets the Visual Quality Objectives (VQO) for the project area.

Environmental Effects

Direct and Indirect Effects

Management activities such as timber harvesting can affect forest scenic quality by changing the form, color, line, or texture in a given viewing area. The degree of visibility of these events (i.e. visual impacts) depends on the interaction of certain elements to the view such as:

- Slope and aspect of the land
- Surrounding landscape
- Frequency and duration of view

The table below lists retension levels for each of the proposed harvest units. Most of these units will retain an average of 50% canopy cover with several units having openings and areas with no harvest. Leave areas in units, varying harvest methods (skyline and tractor), irregular unit boundaries, and small openings will soften the visual impacts and provide visual variety across the landscape. Proposed activities should provide a positive viewing element to the landscape when completed.

All units are located within in Management Area 1, 2, or 3a as defined above.

VISUAL QUALITY OBJECTIVES BY TREATMENT UNIT

Unit	VQO	Logging Method	Proposed Tree Removal
1	M	Skyline, parallel and fan-shaped setting/21 ac	Average 50 % canopy retained /w ¼ to 1 ac canopy gaps
2	M	Skyline, fan-shaped/17 ac, tractor/18 ac	Average 50 % canopy retained /w ¼ to 1 ac canopy gaps
3	M	Skyline, parallel & fan-shaped/47 ac, tractor 4 ac. About 10% of skyline will be thru green plantation	50% of unit removed & average 50% canopy retained.
4	M	Tractor 24 ac	12 acre canopy opening to remove LP, 12 ac w/ 50% canopy retained
5	M	Skyline, parallel/32 ac, tractor 4ac	Average 50 % canopy retained /w ¼ to 1 ac canopy gaps
6	PR & M	Skyline, parallel/64 ac, tractor 28 ac	Average 50 % canopy retained /w ¼ to 2 ac canopy gaps
9	PR	Tractor 18 ac	Average 50 % canopy retained
10	PR	Skyline, parallel/24ac 150 foot buffer east	Average 50 % canopy retained
13	PR & M	Skyline, parallel & fan-shaped/45 ac tractor/27 ac	Average 50 % canopy retained /w ¼ to 2 ac canopy gaps. 7ac excluded for visuals & LP in eastern unit feathered for visuals
14	PR	Skyline, parallel & fan-shaped/139 ac tractor/85 ac	Average 50 % canopy retained /w ¼ to 2 ac canopy gaps, mitigate trail 313 on eastern part of unit, 1200 feet of temp road needed to treat entire unit
15	M	Skkyline, fan-shaped/13 ac	Average 50 % canopy retained /w ¼ to 1 ac canopy gaps
28	PR	Tractor/20ac	Average 50 % canopy retained /w ¼ to 1 ac canopy gaps

- Alternative 3 would add 1.2 miles of temporary road to commercial harvest an additional 64 acres. Unit 2 will require reconstruction of 0.11 miles of temporary road.
- Units 1, 2, 3, 5,6,13, and 28 have leave areas inside the unit that will provide visual relief from specific logging method.
- Units 2, 3, 5, 6, 13 and 14 use a combination of skyline and tractor which will further soften the visual impacts to the casual observer.
- Unit 4 will remove a pocket of pure LP leaving a 12 acre opening.
- Units 1, 2, 5, 6, 13, and 28 will have openings of 1 to 2 acres.
- In Unit 14 a 150 foot buffer will be maintained along Trail 313 to reduce visual impacts to the trail user.
-

Cumulative Effects

The State of Montana plans a timbers sale in Section 30 northwest of the project area. About 200 acres will be manipulated using skyline, light thinning and sanitation harvest to clean up

dead, dying, and mistletoe infested Douglas-fir. About ½ mile of road construction would be needed.

The private landowner has recently completed timber harvest west of section 6 on forest boundary.

Consistency With Forest Plan Standards

The Bitterroot Forest Plan includes Forest-wide management goals for scenery to:

- Maintain a high level of visual quality on landscape seen from population centers (Stevensville) and major travel routes, (Highway 93) and adjacent to fishing streams. Due to project design and Forest Plan direction specific to management areas (MA), found in the project area all action alternatives meet the visual quality objective of partial retention, modification or maximum modification for this project.
- Forest-wide standards for areas to visually recover as a general guide can be reached in 26 to 34 years from the time of harvest. This area was last harvested 25 – 30 years ago.

IV. CONSULTATION AND COORDINATION

The Forest Service consulted the following individuals, Federal, State, and local agencies, tribes and non-Forest Service persons during the development of this environmental assessment:

ID TEAM MEMBERS:

1. Interdisciplinary Team Leader – Ken Hotchkiss / Sue Macmeeken
2. Silviculturist – Cheri Hartless
3. Fuels Specialist – Alex Hartless
4. Fisheries Biologist – Rob Brassfield
5. Wildlife Biologist – Brian Logan
6. Operations – Ed Hayes / Chip Britting
7. Hydrologist – Ed Snook
8. Soil Scientist – Cole Mayn
9. Botanist – Linda Pietarinen
10. Heritage Resources – Mary Williams
11. Recreation/Scenery – Gary Richtmyer
12. GIS Support – Jack Cornelisse
13. Transportation – Jake Pintok
14. NEPA Specialist –Sue Heald

FEDERAL, STATE, AND LOCAL AGENCIES:

Montana Department of Natural Resources

Montana Fish, Wildlife, and Parks

TRIBES:

Confederated Salish and Kootenai Tribes

OTHERS:

V. LITERATURE CITED

Threatened, Endangered, and Sensitive Plant Species / Invasive Plants

Arno, Stephen F. 1976. The historical role of fire on the Bitterroot National Forest. Ogden, UT: USDA Forest Service, Intermountain Forest and Range Experiment Station. Res. Pap. INT-187, 29p. [0047]

Brooks, M.L.; D'Antonio, C.M.; Richardson, D.M.; Grace, J.B.; Keeley, J.E.; DiTomaso, J.M.; Hobbs, R.J.; Pellant, M.; and Pyke, D. 2004. Effects of invasive alien plants on fire regimes. Bioscience Vol. 54, No. 7, 677-688. [0043]

Brown , James K; Smith, Jane Kapler, eds. 2000. Wildland fire in ecosystems: effect of fire on flora. Gen Tech. Rep. RMRS-GTR-42-vol. 2. Ogden, UT: USDA Forest Service, Rocky Mountain Research Station. 257 p. http://www.fs.fed.us/rm/pubs/rmrs_gtr42_2.html [0037]

Duncan, Celestine. 1997. Environmental Benefits of Weed Management: A Technical Summary. Presented at Noxious Weed Management Short Course; 1997 Sept. 22-25; Bozeman, MT.

Ferguson, Dennis E., C.L. Craig, and K.Z. Schneider. 2007. Spotted knapweed (Centaurea biebersteinii DC) response to forest wildfires on the Bitterroot National Forest, Montana. Northwest Science, Vol. 81, No. 2.

Heidel, B. and J.S. Shelly. 2001. The effects of fire on Lemhi penstemon (Penstemon lemhiensis) – final monitoring report, 1995-2000. Report to the Beaverhead-Deerlodge national Forest and the Dillon Field Office – Bureau of Land Management. Montana Natural Heritage Program, Helena. 22 pp. plus appendices. [0471]

Korb, Julie E.; Johnson, N.C.; and Covington, W.W. 2004. Slash pile burning effects on soil biotic and chemical properties and plant establishment: recommendations for amelioration. Restoration Ecology Vol. 12, No. 1, pp. 52-62. [0005]

LeJeune, K.D. and T.R. Seastedt. 2001. Centaurea Species: the Forb that Won the West. Conservation Biology 15(6):1568-1574. [0275]

Losensky, B.J. 1987. An Evaluation of Noxious Weeds on the Lolo, Bitterroot, and Flathead Forest with Recommendations for Implementation a Weed Control Program. pp 1-18, 33-34, 84-85, 89 [0042]

MNHP. Montana Natural Heritage Program database. 2007. Montana Natural Resource Information System. Montana State Library, Helena, MT. http://nhp.nris.state.mt.us/ [0467]

Rice, Peter M. 2003, Dec. Cheatgrass (Bromus tectorum) in Forest Habitats: A Literature Review. University of Montana, Division of Biological Sciences, Missoula, MT. [0045]

Sutherland, Steve. 2003. Wildfire and weeds in the northern Rockies. Presentation at 2nd International Wildland Fire Ecology and Fire Management Congress. Orlando, FL. [0038]

Sutherland, Steve. 2005. Fire and weeds: general patterns. Unpublished manuscript under review (12/2005). USDA Forest Service, Fire Sciences Laboratory, Rocky Mountain Research Station, Missoula ,MT [0468]

USDA Forest Service. 1995. Bitterroot National Forest Fire Groups. Biophysical Classification Habitat Groups and Descriptions. Bitterroot National Forest, Hamilton, MT. [0048]

USDA Forest Service. 1996. Bitterroot National Forest Noxious Weed Implementation Guide. Hamilton, MT. [0044]

USDA Forest Service. 2002. Forest Plan Monitoring and Evaluation Report, Fiscal Year 2002. Bitterroot National Forest, Hamilton, MT. [0128]

USDA Forest Service. 2003a. Final Environmental Impact Statement Noxious Weed Treatment Project. Bitterroot National Forest, Hamilton, MT. [0201]

USDA Forest Service. 2003b. Forest Plan Monitoring and Evaluation Report, Fiscal Year 2003. Bitterroot National Forest, Hamilton, MT. [0013]

USDA Forest Service. 2004. Forest Plan Monitoring and Evaluation Report, Fiscal Year 2004, Bitterroot National Forest, Hamilton, MT [0325]

Zouhar, Kris. 2001a. Centaurea maculosa. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/plants/forb/cenmac/introductory.html [2004, November 16]. [0189]

Zouhar, Kris 2001b. Cirsium arvense. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/plants/forb/cirarv/introductory.html [2004, December 17]. [0187]

Zouhar, Kris 2002a. Cirsium vulgare. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/plants/forb/cirvul/introductory.html [2004, November 16]. [0190]

Zouhar, Kris 2002b. Cynoglossum officinale. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/plants/forb/cynoff/introductory.html [2004, December 17]. [0186]

Zouhar, Kris. 2003. Bromus tectorum. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/plants/graminoid/brotec/introductory.html [2004, December 17]. [0188]

Fish and Aquatic Habitats

Bitterroot North Zone Interdisciplinary Team. 2004. Burnt Fork ecosystem analysis at the watershed scale (EAWS). Stevensville Ranger District, Bitterroot National Forest, Stevensville MT.

Buck, F. 1958. Water Resources Survey, Ravalli County, Montana. Part 1, History of Land and Water Use on Irrigated Areas. State Engineers Office. Helena, MT.

Dwire, K. A., C. C. Rhoades, and M. K. Young. 2005. Potential Effects of Fuel Management Activities on Riparian Functions. USFS GTR (in review).

Elliott K. and J. Vose. 2005. Initial Effects of Prescribed Fire on Quality of Soil Solution and Streamwater in the Southern Appalachian Mountains. Southern. Journal of Applied Forestry. 29(1):5-15

Fortunate, N. 1994. Guide to the Streamside Management Zone Law and Rules. Montana Department of State Lands. Missoula, MT.

Gresswell, R., 1999. Fire and aquatic ecosystems in forested biomes of North America, Transactions of the American Fisheries Society 128:193-221. [G17 – Rob's Library]

Jakober M. 1996. BNF Fish Habitat Survey Form; Sawmill Creek; Mile posts 0.9 and 1.3; 4/23/96.. Bitterroot National Forest, Stevensville Ranger District.

Jakober M. 1997. BNF Stream Reach Measurements. Mile posts 0.9 and 1.3. Bitterroot National Forest, Stevensville Ranger District.

Jakober M. 1998. BNF INFISH Habitat Survey Form; Ambrose Creek; Reach 4; 3/31/1998.. Bitterroot National Forest, Stevensville Ranger District.

Montana Bull Trout Scientific Group. 1995. Bitterroot River drainage: bull trout status report. Montana Bull trout Restoration Team. Helena MT.

Montana Department of Fish, Wildlife, and Parks. 2007. Fisheries Presence-Absence Database 2007. Hamilton, MT.

Montana Fish, Wildlife & Parks. 2007. Memorandum of Understanding and Conservation Agreement for Westslope Cutthroat and Yellowstone Cutthroat Trout in Montana 2007 Helena, Montana. http://fwp.mt.gov/wildthings/concern/westslope.html

Overton, K., et al. 1995. User's guide to fish habitat: descriptions that represent natural conditions in the salmon river Basin, Idaho. USDA Forest Service. INT GTR-322.

Robichaud, P. 2000. Fire effects on infiltration Rates after prescribed fire in Northern Rocky Mountain forests, USA. Journal of Hydrology 231:220-229.

Sestrich, C. 2005. Changes in native and nonnative fish assemblages and habitat following wildfire in the Bitterroot River basin, Montana. MS thesis, Montana State University. Bozeman, Montana. http://www.montana.edu/etd/available/unrestricted/Sestrich_1205.pdf.

USDA, Forest Service, 2003. Forest Plan Monitoring and Evaluation Report. Fiscal Year 2003. Bitterroot National Forest, Hamilton, Montana.

USDA, Forest Service, 2002. Forest Plan Monitoring and Evaluation Report. Fiscal Year 2003. Bitterroot National Forest, Hamilton, Montana.

USDA Forest Service. 1995. Inland Native Fish Strategy Environmental Assessment, Decision Notice and Finding of No Significant Impact. Interim strategies for managing fish-producing watersheds in eastern Oregon and Washington, Idaho, western Montana and portions of Nevada. U.S. Department of Agriculture, Forest Service, Intermountain, Northern, and Pacific Northwest Regions.

USDA Forest Service. 1987. Bitterroot National Forest Plan, Final Environmental Impact Statement, Volumes I and II. Bitterroot National Forest, Hamilton, Montana.

U.S. Fish and Wildlife Service. 2002. Chapter 3, Clark Fork River Recovery Unit, Montana, Idaho, and Washington. 285 p. U.S. Fish and Wildlife Service. Bull Trout (Salvelinus confluentus) Draft Recovery Plan. Portland, Oregon. http://www.fws.gov/pacific/bulltrout/colkla/recovery/chapters/Chapter_3/C3_Executive_Summary.pdf

USDI Fish and Wildlife Service. 1998. Determination of Threatened Status for the Klamath River and Columbia River Distinct Population Segments of Bull Trout. Federal Register: June 1998. 63(111):31647-31674.

USGS (U.S. Geological Survey). 2007. USGS 12344000 Bitterroot River near Darby MT, Daily Statistics. Ravalli County, Montana, Hydrologic Unit Code 17010205. http://waterdata.usgs.gov/nwis/

Western Montana Bull Trout Level I Team. 2001. Programmatic biological assessment/evaluation – prescribed burning; bull trout and westslope cutthroat trout. Bureau of Land Management and National Forest System Lands; western Montana. Missoula, MT.

Soils

Baker, T.G., G,M. Will, and G.R. Oliver. 1989. Nutrient Release from Silvicultural Slash: Leaching and Decomposition of *Pinus radiate* Needles. Forest Ecology and Management 27:53-60. [0326]

Barber, B.L. and D.H. Van Lear. 1984. Weight Loss and Nutrient Dynamics in Decomposing Woody Loblolly Pine Logging Slash. Soil Science America Journal 48:906-910. [0327]

British Columbia Canada Ministry of Forests. March 2002. Forest Soil conservation and Rehabilitation in British Columbia – Opportunities, Challenges, and Techniques. www.for.gov.bc.ca/hfd/pubs/Docs/Bro/Bro70.htm [0264]

Brown, J.K., E.D. Reinhardt, and K. Kramer. 2001. Coarse woody debris and succession in the recovering forest. Unpublished Report. USDA, Forest Service, Rocky Mountain Research Station, Missoula, MT.. 13pp. [0080]

Clayton, J.L. 1981. Soil disturbance caused by clearcutting and helicopter yarding in the Idaho Batholith. USDA, Forest Service; Intermountain Forest and Range Experiment Station Research Note, INT-305, 7p. [0092]

Clayton, James L. 1990. Soil disturbance resulting from skidding logs on granitic soils in Central Idaho. [0337]

Clayton, J.L. and W.F. Megahan. 1997. Natural erosion rates and their prediction in the Idaho Batholith. J. Am. Water Resources Assoc.; Vol. 33(3):689-703. [0058]

DeBano et al. 1999. Fire effects on belowground sustainability: a review and synthesis. Forest Ecology and Management, Volume 122, Number 1, 13 September 1999, pp. 51-71(21). [0463]

DeLuca, T.H. 1999. Soil and Nutrient Considerations. in: Smith, H.Y. ed 2000. the Bitterroot Ecosystem Management Research Project: What we have learned: symposium proceedings; 1999 May 18-20; Missoula Mt. Proc RMRS-P-17. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 23-25. [0217]

Froehlich, H.A. 1978, July. Soil compaction from low ground-pressure, torsion-suspension logging vehicles on three forest soils. Forest Research Lab; Oregon State University; Research Paper 36; 12pp. [0051]

Froehlich, H.A. 1980. Predicting soil compaction on forested land. Final Project Report to U.S. Forest Service; Pacific Northwest Forest and Range Experiment Station and Missoula Equipment Development Center. Cooperative Agreement No. 228; 120pp. [0066]

Gomez, A., R.F. Powers, et al. 2002. Soil Compaction Effects on Growth of Young Ponderosa Pine Following Litter Removal in California's Sierra Nevada. Soil Sci. Soc. Am J. 66:1334-1343 (2002) [0074]

Graham, R.T., A.E. Harvey, M.F. Jurgensen, T.B Jain, J.R. Tonn, and D.S. Page-Dumroese. 1994. Managing coarse woody debris in forests of the Rocky Mountains. UDSA, Forest Service, Intermountain Research Station; Research Paper INT-RP-477, 13 pp. [0089]

Harvey, A.E., M.F. Jurgensen, and M.J. Larsen. 1981. Organic reserves: importance to ectomycorrhizae in forest soils of Western Montana. Forest Sci. Vol 27(3):442-445. [0079]

Harvey, A.E., M.F. Jurgensen, M.J. Larsen, and R.T. Graham. 1987. Decaying organic materials and soil quality in the Inland Northwest: A management opportunity. USDA, Forest Service, Intermountain Research Station; General Technical Report INT-225, 15p. [0072]

Harvey, A.E., M.F. Jurgensen, and R.T. Graham. 1988. The role of woody residues in soils of ponderosa pine forests. In: Ponderosa Pine: the species and its management; Washington State University Cooperative Extension; Symposium Proceedings; Sept. 29 – Oct. 1, 1987, compiled by D.M. Baumgartner and J.E. Lotan. pp 141-147. [0073]

Harvey, A.E., R.T. Graham, M.F. Jurgensen, T.B Jain, J.R. Tonn, and D.S. Page-Dumroese. 1994. Managing coarse woody debris in forests of the Rocky Mountains. UDSA, Forest Service, Intermountain Research Station; Research Paper INT-RP-477, 13 pp. [0509]

Hawkes, C.V., I.F. Wren, D.J. Herman, and M.K. Firestone. 2005. Plant invasion alters nitrogen cycling by modifying the soil nitrifying community. Ecology Letters 8:976-985. [0349]

Hungerford, R.D. 1995. Effects of fire or fire exclusion on soil sustainability- New Perspectives. (from: Region One, Forest Service, Fire Effects Training Course in March,1995 at Missoula, MT) [0085]

Klock, G. 1975. Impact of five postfire salvage logging systems on soils and vegetation. J. Soil and Water. Conserv.; March-April, pp. 78-81. [0055]

LeJeune, K.D. and T.R. Seastedt. 2001. Centaurea Species: the Forb that Won the West. Conservation Biology 15(6):1568-1574. [0275]

Lyon, L.J. 1976. Vegetal Development on the Sleeping Child Burn in Western Montana 1961-1973. Intermountain Forest and Range Experiment Station, Ogden Utah. Res Paper INT-184. [0362]

Lyon, L.J. 1984. The Sleeping Child Burn – 21 years of Post Fire Change. Intermountain Forest and Range Experiment Station, Ogden Utah. Research Paper INT-330. [0366]

McIver, James. 1998. Economics and Environmental Effects of Fuel Reduction at Limber Jim. Tech Notes from the Blue Mountain Natural Resource Institute-TN-10 (April). [0348]

McIver, J.D. and L. Starr eds. 2000. Environmental effects of postfire logging: literature review and annotated bibliography. Gen. Tech. Rep. PNW-GTR-486. Portland Oregon: USDA Forest Service, Pacific Northwest Research Station. 72 p. [0225]

McIver J.D. and Starr L. 2001. A Literature Review on the Environmental Effects of Postfire Logging. Western Journal of Applied Forestry, Volume 16, Number 4, 1 October 2001, pp. 159-168(10). [0460]

McNeel, J.F. and T.M. Ballard. 1992. Analysis of Site Stand Impacts From Thinning with a Harvester-Forwader System. Journal of Forest Engineering. 4(1): 23-29. [0342]

Meurisse, R.T. 1987. Soil Productivity Protection and Improvement: Objectives, Policy, and Standards in the Pacific Northwest Region of the Forest Service. in: Slaugher, C.W., Gassbarre, T. eds. Proceedings of the Alaska forest Soil Productivity Workshop; 1987, April 28-30; Anchorage, Ak. Gen. Tech. Rep. PNW-219. Portland, Oregon: U.S. Department of Agriculture, Forest Service. 63-68. [0220]

Montana Department of Natural Resources and Conservation, Forestry Division. 2004. Forestry BMP Audit Report. Missoula Mt. 64p. [0213]

Montana Department of Natural Resources and Conservation, Forestry Division. 2006. Forestry BMP Audit Report. Missoula Mt. 66p. [0562]

Page-Dumroese, D., M. Jurgensen, W. Elliot, T. Rice, J. Nesser, T. Collins, and R. Meurisse. 2000. Soil quality standards and guidelines for forest sustainability in northwestern North America. Forest Ecology and Management 138:445-462. [0329]

Palviainen, M., L. Finer, A. Kurka, H. Mannerkoski, S. Piirainen, and M. Starr. 2004. Release of potassium, calcium, iron and aluminum from Norway spruce, Scots pine and silver birch logging residues. Plant and Soil 259:123-136. [0330]

Parrett, C., S.H. Cannon, and K.L. Pierce. 2003. Wildfire-Related Floods and Debris Flows in Montana in 2000 and 2001. U.S. Geological Survey, Water-Resources Investigations Report 03-4319:22 p. [0214]

Powers, R.F. 1990. Are we maintaining the productivity of forest lands? Establishing guidelines through a network of long-term studies. in: Harvey, A.E., and L.F. Neuenschwander eds. Proceedings - Symposium on Management and Productivity of Western-Montana Forest Soils, Boise, Id, 1990 April 10-12. p 70-81. [0223]

Powers, R.F., F.G. Sanchez, D. Andrew Scott, and D. Page-Dumroese. 2004. The North American Long-term Soil Productivity Experiment: coast-to-coast findings from the first decade. USDA, Forest Service Proceedings; RMRS-P-34, pp. 191-206. [0032]

Powers, R.F., D.A. Scott, F.G. Sanchez, R.A. Voldseth, D. Page-Demroese, and J.D. Elioff. 2005. The North American Long-Term Soil Productivity Experiment. Finding from the First Decade of Research. Forest Ecology and Management (accepted, to be published later this year). [0331]

Robichaud, P. R., J.L. Beyers, and D.G. Neary. 2000. Evaluating the Effectiveness of Post-fire Rehabilitation Treatments. US Department of Agriculture, Rocky Mountain Research Station; General Technical Report RMRS-GTR-63. [0033]

Seixas, Fernando et.al. 1995. Effect of Slash on Forwarder Soil Compaction. Sustainability, Forest Health and Meeting the Nation's Need for Wood Products, proceedings of the council on forest engineerings 18th annual meeting. pp 77-86. [0343]

USDA Forest Service, Lolo National Forest. March 2002. Best Management Practices Effectiveness Monitoring Report. 86 p. www.fs.fed.us/r1/lolo/resources-natural/soil-water/best-mgt-practices.shtml. [0219]

Watt, W.J. and R.K. Krag, 1985. A Comparison of Soil Disturbance Caused by Cable and Small Tractor Logging. Session 1-1 Timber Harvesting pp. 44-53. [0344]

Water Resources

Agee, J. K. 2002. The fallacy of passive management – Managing for firesafe forest reserves. Conservation Biology in Practice (3)1 18-25 [0573]

Belt, G. H., J O'Laughlin, and T. Merrill 1992. Design of forest riparian buffer strips for protection of water quality: analysis of scientific literature. Idaho Forest, Wildlife and Range Policy Group Analysis Group, Report No. 8. http://www.uidaho.edu/crwr/pag/pagr8.html [0532]

Brown , James K; Smith, Jane Kapler, eds. 2000. Wildland fire in ecosystems: effect of fire on flora.

Gen Tech. Rep. RMRS-GTR-42-vol. 2. Ogden, UT: USDA Forest Service, Rocky Mountain Research Station. 257 p. [0037]

Burroughs, E. R., Jr.; King, J. G. 1990 Reduction of soil erosion on forest roads in erosion control. General Technical Report INT-264. Ogeden, UT: U.S. Forest Service Intermountain Research Station 21 p. [0155]

Callahan, P. 2001. Burned Area Recovery Watershed Analysis. Bitterroot National Forest, Hamilton, MT. [0585]

Dwire K.A. and J.B. Kauffman 2003. Fire and riparian ecosystems in landscapes of the western USA. Forest Ecology and Management 178 61-74. [0538]

Elliot, W.J., and M. Foltz 2001. Validation of the FS WEPP Interfaces for Forest Roads and Disturbances. Paper 01-8009, Proceedings of the 2001 American Society of Agricultural Engineers (ASAE) Annual International Meeting, Sacramento, CA. [0539]

Elliot, William J., David E. Hall and Dayna L. Scheele. 2002. Disturbed WEPP: WEPP Interfaces for Disturbed Forest and Range Runoff, Erosion and Sediment Delivery. USDA Forest Service, Rocky Mountain Research Station and San Dimas Technology and Development Center, Moscow, Idaho. [0174]

Flanagan, D.C., and S.J. Livingston (eds.) 1995. WEPP User Summary. NSERL Report No. 11, W. Lafayette, IN. National Soil Erosion Research Laboratory. 131 pp. http://topsoil.nserl.purdue.edu/nserlweb/weppmain/docs/usersum.pdf [0557]

Harrelson, C.C., C.L. Rawlins, J.P. Potyondy 1994. Stream channel reference sites: an illustrated guide to field technique. Pp 49-52. USDA Forest Service General Technical Report GTR-RM-245. Fort Collins, CO. http://www.stream.fs.fed.us/publications/PDFs/RM245E.PDF [0558]

Hyde, K. S. Woods, J. Potyondy 2006. Challenges to watershed modeling in forested mountainous environments. Proceedings, American Water Resource Association Summer Specialty Conference, June 26-28, 2006. [0545]

Ketcheson, G.L. and W.F. Megahan 1996. Sediment production and downslope sediment transport form forest roads in granitic watersheds. Intermountain Research Station Research Paper INT-RP-486. USDA Forest Service Logan, UT. [0578]

King J.G. 1989 Streamflow responses to roadbuilding and harvesting; a comparison with the equivalent clearcut area procedure. USDA Forest Service Intermountain Research Station Publication INT-401 [0698]

Kirchner, J.W., R.C. Finkel, C.S. Riebe, D.E. Granger, J.L. Clayton, J.G. King, and W.F. Megahan. 2001. Mountain erosion over 10 yr, 10 k.y., and 10 m.y time scales. Geology, July 2001:591-594. [0063]

Laflen, J.M., D.C. Flanagan, B.A. Engel 2004. Soil erosion and sediment yield prediction accuracy using WEPP. Journal of the American Water Resources Association (JAWRA) 40(2):289-297. [0549]

MTDEQ 2005. Water quality restoration plan and total maximum daily loads for the Bitterroot

Headwaters Planning Area. Montana Department of Environmental Quality, Helena, MT. Available online at http://www.deq.state.mt.us/wqinfo/TMDL/BitterrootHeadwaters/FinalBitterrootMaster.pdf [0607]

MTDEQ 2006. Clean Water Act Section 303(d) list of impaired waterbodies submitted to Environmental Protection Agency for reporting year 2006. Montana Department of Environmental Quality, Helena, MT. Available on line at http://www.deq.state.mt.us/CWAIC/default.aspx

Potyondy, J.P., T. Hardy 1994. Use of pebble counts to evaluate fine sediment increase in stream channels. Water Resources Bulletin 30(3) 509-520. [0580]

Robichaud, P.R., L.H. MacDonald, and R.B. Foltz, in press. Fuel management and erosion. In Cumulative Watershed Effects of Fuels Management: A Western Synthesis. Gen. Tech. Rep., U.S. Department of Agriculture, Rocky Mountain Research Station. Available online at http://www.warnercnr.colostate.edu/frws/people/faculty/macdonald/publications/Robichaud_MacDonald_Foltz_CWE_Fuel_Mgmt.pdf [0559]

Rosgen, David L. 1994. A classification of natural rivers. Catena (22) 169-199 http://csmres.jmu.edu/geollab/eaton/web/eaton_files/Courses/Hydrogeology/CLASS_OF_NATURAL_RIVERS_300.pdf [0560]

Stednik, John D. 1996. Monitoring the Effects of Timber Harvest on Annual Water Yield. Journal of Hydrology Vol. 176. 79-95 pp. [0151]

Troendle, C.A. 1987. The potential Effect of Partial Cutting and Thinning on Streamflow from the Subalpine Forest. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Ft. Collins, Colorado. [0204]

Troendle, C.A., L.H. MacDonald, and C.H. Luce, in press. Fuels management and water yield. In Cumulative Watershed Effects of Fuels Management: A Western Synthesis. Gen. Tech. Rep., U.S. Department of Agriculture, Rocky Mountain Research Station. Available: http://forest.moscowfsl.wsu.edu/engr/cwe/ [0554]

Troendle, C.A., M.S. Wilcox, G.S. Bevenger and L.S. Porth 2001. The Coon Creek water yield augmentation project: implementation of timber harvesting technology to increase streamflow. Forest Ecology and Management 143 (2001) 179-187. http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6T6X-42H1RTV-M&_user=4250274&_coverDate=04%2F01%2F2001&_rdoc=1&_fmt=&_orig=search&_sort=d&view=c&_acct=C000052423&_version=1&_urlVersion=0&_userid=4250274&md5=27a8db8f27952b4f297a1b159b534f18 [0561]

USDA Forest Service. 1974. Forest Hydrology Part II: Hydrologic Effects of Vegetation Manipulation. [0167]

USDA, Forest Service, 2000. Forest Plan Monitoring and Evaluation Report. Fiscal Year 2000. Bitterroot National Forest, Hamilton, MT [0126]

USDA, Forest Service, 2001. Forest Plan Monitoring and Evaluation Report. Fiscal Year 2001. Bitterroot National Forest, Hamilton, MT [0127]

USDA, Forest Service. 1987. Forest Plan, Bitterroot National Forest. USDA Forest Service, Northern Region. Hamilton MT, September, 1987. [0120]

USDA, Forest Service. 1999. Forest Plan Monitoring and Evaluation Report. Bitterroot National Forest. Hamilton, MT [0125]

USDA Forest Service. 2006g. Human Health and Ecological Risk Assessment for Borax (Sporax) ® - FINAL REPORT. Forest Health Protection, USDA Forest Service, Arlington, VA. 136 pg [0519]

Vegetation and Silviculture

Alexander, M.E.; and Hawksworth, F.G..1975. Wildland fires and dwarf mistletoes: a literature review of ecology and prescribed burning. USDA. Forest Service. Gen. Tech. Rep. RM-14. 12p. Rocky MT. For. And Range Exp. Stn. Fort Collins, CO.

Amman, G.D. 1977. The role of the mountain pine beetle in lodgepole pine ecosystems: impact on succession. p. 3-18. IN: Arthropods in the forest ecosystems. W.J. Mattson, ed. Proc. in the Life Sciences. Springer-Verlag, NY.

Amman, G.D., M.D. McGregor, D.B. Cahill and W.H. Klein. 1977. Guidelines forreducing losses of lodgepole pine to the mountain pine beetle in unmanaged stand in the Rocky Mountains. Gen. Tech. Rep. INT-36. Ogden, UT: USDA, Forest Service, Intermountain Forest & Range Exp. Station. 19p.

Amman, G.D. 1978. Biology, ecology and causes of outbreaks of the mountainpine beetle in lodgepole pine forests. IN: Theory and Practice of MountainPine Beetle Management in Lodgepole Pine Forests - Symposium Proceedings, A.A.Berryman, G.D. Amman and R.W. Stark editors, Pullman, WA, April 25-27, 1978.Published by Forest, Wildlife and Range Experiment Station, University of Idaho, Moscow, ID. pp. 39-47.

Anderson, L., C.E. Carlson and R.H. Wakimoto. 1987. Forest fire frequency and western spruce budworm outbreaks in western Montana. Forest Ecology Management. 22: 251-260.

Arno, S F. 1976. The historical role of fire on the Bitterroot National Forest. Intermt. For. and Range Exp. Sta., Missoula, MT. USDA Forest Service Research paper INT-187. 29 pp.

Arno, S.F.; Sneck, K.M. 1977. A method for determining fire history in coniferous forests of the Mountain West. Gen. Tech. Rep. INT-42. Odge, UT USDA, Forest Service, Intermountain Forest. and Range Exp. Station. 28p.

Arno, S.F. 1980. Forest fire history in the Northern Rockies. Journal of Forestry 78(8): 460-465.

Arno, S.F. and T. D. Peterson. 1983. Variation in estimates of fire intervals: a closer look at fire history on the Bitterroot National Forest. Research paper INT-301. Ogden, UT: USDA, Forest Service, Intermountain Forest. and Range Exp. Station.

Arno, S. F. 1988. Fire ecology and its management implications in ponderosa pine forests. IN: Ponderosa Pine: The Species and its Management – Symposium Proceedings. Eds. D.M. Baumgartner and J.E.

Lotan, Spokane, WA. September 29-October 1, 1987. Published by Washington State Univ, Pullman, WA. 1988. Pages 133-140.

Arno, S.F.; Simmerman, D.G.; Keane, R.E. 1985. Forest Succession on four habitat types in western Montana. Gen. Tech. Rep. INT-177. Ogden, UT: U.S.Department of Agriculture, Forest Service, Intermountain Research Station. 74p.

Arno, S F.; Scott, J.H. and Hartwell, M.G. 1995. Age-class structure of old growth ponderosa pine/Douglas-fir stands and its relationship to fire history. Res. Pap. INT-RP-481. Ogden, UT: U.S. Dept. of Agriculture, Forest Service, Intermountain Research Station. 25 p.

Arno, S F.; Harrington, M.G.; Fiedler, C.E.; Carlson, C.E. 1995. Restoring fire dependent ponderosa pine forest in Western Montana. Pacific Northwest Reports. Restoration & Management Notes. Summer 13(1). 32-36.

Arno, S.F.; Smith, H.Y.; Krebs, M.A. 1997. Old growth ponderosa pine and western larch stand structure: influences of pre 1900 fires and fire exclusion. Res. Pap. INT-RP-495. Odgen, UT: US Dept. Of Agriculture, Forest Service, Intermountain Research Station.20p.

Barrett, S.W. 1981. Relationship of Indian-caused fires to the ecology of western Montana forests. Missoula, MT: University of Montana. 198p. Thesis.

Barrett, S.W.; Arno, S.F. 1982. Indian fires as an ecological influence in the Northern Rockies. Journal of Forestry. 80:647-651.

Blais, J.R. 1983. Trends in frequency, extent and severity of spruce budworm outbreaks in eastern Canada. Can. J. Res. 13:539-547.

Brown, J.K., S.F. Arno, L.S. Bradshaw, J.P. Menakis. 1993. Comparing the Selway-Bitterroot fire program with pre-settlement fires. Paper presented atsymposium on Fire in Wilderness and Park Management: Past Lessons and Future Opportunities, March 30-April 1, 1993, University of Montana, Missoula, MT.

Brown, J K. 1994. Fire Regimes and Their Relevance to Ecosystem Management.

Carlson, C.E., D.G. Fellin and W.C. Schmidt. 1983. The western spruce budworm in Northern Rocky Mountain forests: A review of ecology, past insecticidal treatments and silvicultural practices. IN: Management of Second-growth Forests, The State of Knowledge and Research Needs - Symposium Proceedings, J.O'Loughlin and R.D. Pfister, editors, May 14, 1982, Missoula, MT. Published by School of Forestry, University of Montana, Missoula, MT. pp. 76-103.

Covington, W.W.; Moore, M.M. 1994. Southwestern ponderosa forest structure: changes since Euro-American settlement. Journal of Forestry. 92(1): 39-47.

Cunningham, C.A.; Jenkins, M.J.; Roberts, D.W. 2005. Attack and brood production by the Dougals-fir beetle (Coleopetra: Scolytidae) in Doulas-fir, *Pseudotsuga menziesii* var. *glauca* (Pinaceae), following a wildfire. Western North American Naturalist. 65:70-79.

Fielder, C.E.; Becker, R.R.; Haglund, S.A. 1988. Preliminary guidelines foe uneven-aged silvicultural prescriptions in ponderosa pine. In Baumgartner, D.M.; Loten, J.E.; compilers. *Ponderosa pine*- the species and its management. Pullman, WA; WashingtonState University Cooperative Extension. 235-241.

Fielder, C. E.; Keegan, C.E.; Arno, S.F. 1997. Utilization as a component of restoring ecological process in ponderosa pine forests. In Barbour, R.J.; Skog, K.E., eds. Role of wood production in ecosystem management, proceedings. Gen.Tech. Rep. FPL-GTR-100. Madison, WI: US Dept. Of Agriculture, Forest Service, Forest Products Laboratory: 24-28.

Fischer, W.C.; Bradley, A. F. 1987. Fire ecology of western Montana forest habitat types. General Tech. Report INT-223, Ogden, UT: USDA, Forest Service, Intermountain Research Station; 95 pp.

Furniss, Malcolm M. 1965. Susceptibility of Fire-Injured Douglas-Fir to Bark Beetle Attack in Southern Idaho. Journal of Forestry. January 1965. Pp. 8-11

Fowler, J.F.; Sieg, C.H. 2004. Postfire mortality of ponderosa pine and Douglas-fir: a review of methods to predict tree death. Gen Tech. Rep. RMRS-GTR-132. Fort Collins, CO. USDA Rocky Mountain Research Station. 25p.

Graham, Russell T.; Harvey, A. E.; Jain, T. B.; Tonn, J. R. 1999. The effects of thinning and similar stand treatments on fire behavior in Western forests. Gen. Tech. Rep. PNW-GTR-463. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 27 p.

Graham, Russell T.; McCaffrey, S.; Jain, T. B. (tech. eds.) 2004. Science basis for changing forest structure to modify wildfire behavior and severity. Gen. Tech. Rep. RMRS-GTR-120. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 43 p.

Green P., J. Joy, D. Sirucek, W. Hann, A. Zack and B. Naumann. 1992. Old growth forest types of the Northern Region. USDA Forest Service, Northern Region Document Number R-1 SES 4/92. Missoula, MT. 609 p.

Hawksworth, Frank G. and Delbert Wiens. 1996. Dwarf Mistletoes: Biology, Pathology, and Systematics. Agriculture handbook 709. USDA Forest Service, Washington, DC. 410 pp.

Hawksworth, Frank G. and Delbert Wiens. 1972. Biology and and classification of dwarf mistletoes (*Arceuthobium*) . USDA Forest Service. Agricultural Handbook No. 401.

Hillis, M.; Applegate, V.; Slaughter, S.; Harrington, M.; Smith, H. 2001. Simulating historical disturbance regimes and stand structures in old-forest ponderosa pine/Douglas-fir. In: Barras, S.J., eds. 2001Proceeddings: National silvicultural workshop; 1999 Kalispell, MT. Proc. RMRS-P-00. Ogden, UT: USDA, Rocky Mtn. Res. Station.

Hood, S.; Bentz, B; Gibson, k.; Ryan, K; Denitto, G. 2007. Assessing post fire Douglas-fir mortality and Douglas-fir beetle attacks in the northern Rocky Mountains. Gen. Tech. Rep. RMRS-GTR-199. Fort Collins, CO: US. Dept. of Agriculture, Forest Service, Rocky Mountain Research Station. 31p. Includes Supplement.

Landres, P.B., P. Morgan, and F.J. Swanson. 1999. Overview of the use of natural viability concepts in managing ecological systems. Ecological Applications 9(4): 1179-1188.

Leiberg, J.B. 1899. Bitterroot Forest Reserve. USDI-USGS Annual Reports. 19th Annual Report. pp. 253-282.

Lockman, Blakey. 2006. Annosus Root Disease: P-Type, Ecology and Management. In: Forest Insect and Disease Management guide. Forest Health Protection, State and Private Forestry, USDA Forest Service, Northern Region. 6 p. www.fs.fed.us/r1-r4/spf/fhp/mgt_guide/index.htm [0794]

Losensky, J. 1993. Draft Report. Revision 2. Historical Vegetation in Region One by Climatic Section. Missoula, MT: Northern Region, USDA Forest Service. 55p.

Losensky, J. 1994. Historical Vegetation Types of the Interior Columbia River Basin. Prepared under Contract INT-94951-RJVA for Systems for Environmental Management. 108p.

McCune. 1983. Fire frequency reduced two orders of magnitude in the Bitterroot Canyons, MT. Can. J. For. Res. 13:212-218.

Nauman, J.R. 1988. Uneven-aged management: practice, issue, or cause. . In Baumgartner, D.M.; Loten, J.E.; compilers. *Ponderosa pine*- the species and its management. Pullman, WA; Washington State University Cooperative Extension. 235-241.

Peterson, D.L.: Arbaugh, M.J. 1986. Postfire survival in Douglas-fir and lodgepole pine:comparing the effects of crown and bole damage. Candian Journal of Forest Research. 19: 1175-1179.

Pollet, J.; Omi, P.N. 2002. Effect of thinning and prescribed burning on crown fire severity in ponderosa forests. International Journal of Wildland Fire 11:1-10.

Pfister, R.D., B.L. Kavalchik, S.F. Arno and R.C. Presby. 1977. Forest habitat types of Montana. USDA Forest Service Intermt. Forest and Range Exp. Station, Gen. Tech Rep. INT-34. 174 pp.

Rasmussen,LA; Amman, G.D.; Vandygriff, j.C.; Oakes, R.D.; Munson, A.S.; Gibson, K.E. 1996. Bark beetle and wood borer infestation in the Greater Yellowstone Areaduring four postfire years. Res. Pap. Int-RP-487. Ogden, UT: USDA, Intermountain Research Station. 10p.

Rippy, Raini C.; Stewart, Jane E.; Zambino, Paul J.; Klopfenstein, Ned B.; Tirocke, Joanne M.; Kim, Mee-Sook; Theis, Walter G. 2005. Root diseases in coniferous forests of the Inland West: potential implications of fuels treatments. Gen. Tech. Rep. RMRS-GTR-141. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 32 p. http://www.fs.fed.us/rm/publications/titles/rmrs_gtr.html [0793]

Ryan, K.C.; Amman. G.D. 1994. Interactions between fire-injured trees and insects in the Greater Yellowstone Area. In Despain, D.G. ed. Plants and their environment: proceedings of the first biennial scientific conference on the Greater Yellowstone ecosystem; 1991 September 16-17; Yellowstone NP, WY. Technical Report NPS/NRYELL/NRTR. Denver, CO: US Dept. of the Interior, NPS, Natural Resources Publication Office:259-271.

Ryan, K.C.; Amman. G.D. 1996. Bark Beetle activity and delayed tree mortality in the Greater Yellowstone Area
following the 1988 fires. In Greenlee, J.,.ed. The ecological implications of fire in Greater Yellowstone Area following 1988 Plants and their environment: proceedings of the second biennial scientific conference on the Greater Yellowstone ecosystem; 1993 September 19-21; Yellowstone NP, WY. Technical Report NPS/NRYELL/NRTR. Denver, CO: US Dept. of the Interior, NPS, Natural Resources Publication Office: 151-158.

Schmidt, W.C. 1985. Historical Considerations. IN: Managing trees and stands susceptible to western spruce budworm. USDA Forest Service Technical Bulletin No. 1695. 111 p.

Stipe, L.E. 1982. Outbreak Chronology. IN: Western spruce budworm, USDA, Forest Service Technical Bulletin No. 1694. 198 p.

Smith, Helen Y.; Arno, Stephen F., eds. 1999. Eighty-eight years of change in a managed ponderosa pine forest. Gen. Tech. Rep. RMRS-GTR-23. Ogden, UT: U.S. Department of Agriculture, Rocky Mountain Research Station. 55 p. + 14 foldout photo point pages, one poster.

USDA Forest Service. 1999. Bitterroot Landscape Assessment (Draft), Bitterroot National Forest, Stevensville and Darby Ranger Districts. Bitterroot National Forest, Stevensville Ranger District, 88 Main Street, Stevensville, MT. 59870. March 1999.

USDA Forest Service. 1999. Vegetation Response Unit Characterizations and Target Landscape Prescriptions. Libby MT: Kootenai National Forest, USDA Forest Service. 174p.

USDA Forest Service. 2000. Bitterroot Fires 2000. An overview of the events, effects on people and resources, and post-fir recovery priorities. Bitterroot National Forest, Hamilton, MT. December 2000.

USDA Forest Service, 2000. Bitterroot Fires 2000. An assessment of Post-Fire Conditions With Recovery Recommendations. Bitterroot National Forest, Hamilton, MT. December 2000.

Weatherby, J.C.; Progar, R.A.; Mocettini, P.J. 2001. Evaluation of tree survival on the Payette national Forest 1995-1999. FHP Rep. R4-01-01. Ogden, UT. USDA, Intermountain Region. 11p.

Weaver, H. 1943. Fire as an ecological and silvicultural factor in the ponderosa pine region of the Pacific slope. Journal of Forestry 41:7-14.

Weaver, H. 1951. Fire as an ecological factor in the southwestern ponderosa pine forests. Journal of Forestry 49:93-98.

Weaver, H. 1967. Fire and its relationship to ponderosa pine. Proc. 7th Annual Tall Timbers Fire Ecol. Conf. 127-149.

Weaver, H. 1974. Effects of fire on temperate forests: Western United States. In: Kozlowski, T.T.; Ahlgren, C.E., eds. Fire and ecosystems. New York: Academic Press: 279-319.

Wulf, N.W. and R.G. Gates. 1987. The western budworm and forest succession. IN: Western Spruce Budworm, M.H. Brookes, R.W. Campbell, J.J. Colbert, R.G.Mitchell and R.W. Stark editors, USDA Forest Service Technical Bulletin No.1694. pp. 2-3.

Fire and Fuels

Agee, James K. 1993. Fire Ecology of Pacific Northwest Forests. Washington, DC: Island Press. 493p.

Anderson, Hal E. 1982. Aids to Determining Fuel Models for Estimating Fire Behavior. Gen. Tech. Rep. INT-122. 22 p.

Brown, J. K. 1995. Fire Regimes and their relevance to ecosystem management. *In* Proceedings of Society of American Foresters National Convention, September 18-22, 1994, Anchorage, AK. Society of American Foresters, Wash. DC.

Cohen, Jack D. 1999. Reducing the Wildland Fire Threat to Homes: Where and How Much?. Gen. Tech. Rep. PSW-GTR-173.189-194.

Cohen, Jack D. 2000. What is the Wildland Fire Threat to Homes?. Presented at the Thompson Memorial Lecture, Northern Arizona University, Flagstaff, AZ. April 10, 2000. 13p.

Fischer, William C. 1981. Photo Guide For Downed Woody Fuels In Montana. Gen. Tech. Rep. INT-97. 133 p.

George E. Gruell – Fire and Vegetative Trends in the Northern Rockies.

Graham, Russell, T. 1999. The effects of thinning and similar stand treatments on fire behavior in western forests. Gen. Tech. Rep. PNW-GTR. 43p.

Graham, Russell T. 2004. Science basis for changing forest structure to modify wildfire behavior and severity. Gen. Tech Rep. RMRS-GTR. 43p.

Scott, Joe H. 2001. Assessing crown fire potential by linking models of surface and crown fire behavior. Gen. Tech. Rep. RMRS-RP-029.

Scott, Joe H. 2005. Stereo photo Guide for estimating canopy fuel characteristics in conifer stands. Gen. Tech. Rep. RMRS-GTR-145.

Smith, Helen Y.; Arno, Stephen F., eds.1999. Eighty-eight years of change in a managed ponerosa pine forest. Gen. Tech. Rep. RMRS-GTR-23. Ogden, UT: U.S. Department of Agriculture, Rocky Mountain Research Station.

Rothermel, Richard C. 1991. Predicting Behavior and Size of Crown Fires in the Northern Rocky Mountains. Gen. Tech. Rep. INT-438. 46 p.

Rothermel, Richard C. 1983. How to Predict the Spread and Intensity of Forest and Range Fires. Gen. Tech. Rep. INT-143. 161 p.

Van Wagner, C.E. 1977. Conditions for the start and spread of crownfire. Can. J. For. Res. (7) 23-34. [0620]

Wildlife

Apfelbaum, S. and A. Haney. 1981. Bird populations before and after wildfire in a Great Lakes pine forest. Condor 83:347-354. http://elibrary.unm.edu/sora/Condor/files/issues/v083n04/p0347-p0354.pdf

Arnett, E.B., B. Altman, and W.P. Erickson. 1997a. Relationships between salvage logging and forest avifauna in lodgepole pine forests of the central Oregon Pumice Zone. Unpubl. 1996 annual report to the Weyerhaeuser Co., Springfield, OR.

Arnett, E.B., B. Altman, and W.P. Erickson. 1997b. Effects of salvage logging on neotropical migratory landbirds in lodgepole pine forests of central Oregon: 1997 preliminary results. Unpubl. report to the Weyerhaeuser Co., Springfield, OR.

Barbour, R.W. and W.H. Davis. 1969. *Plecotus townsendii*. Pp. 164-178 *in*: Barbour, R.W. and W.H. Davis. Bats of America. University of Kentucky Press, Lexington, Kentucky. 286 pp.

Bloom, P.H. 1983. Notes on the distribution and biology of the flammulated owl. Western Birds 14:49-52. http://elibrary.unm.edu/sora/wb/v14n01/p0049-p0052.pdf

Bock, C.E. and J.F. Lynch. 1970. Breeding bird populations of burned and unburned conifer forest in Sierra, NV. Condor 72:182-189. http://elibrary.unm.edu/sora/Condor/files/issues/v072n02/p0182-p0189.pdf

Bonar, R.L. 2001. Pileated woodpecker habitat ecology in the Alberta foothills. Ph.D. dissertation, University of Alberta. Edmonton, Alberta, Canada

Bull, E.L. and E.C Meslow. 1977. Habitat requirements of the pileated woodpecker in northwest Oregon. J. Forestry 75(6):335-337.

Bull, E.L. and Anderson, R.G. 1978. Notes on flammulated owls in Northeastern Oregon. The Murrelet 59:26-27.

Bull, E.L. and A.K. Blumton. 1999. Effect of fuels reduction on American martens and their prey. Res. Note PNW-RN-539. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 9 p. http://www.fs.fed.us/pnw/pubs/rn_539.pdf

Bull, E.L. and R.S. Holthausen. 1993. Habitat use and management of pileated woodpeckers in northeastern Oregon. J. Wildl. Mgmt. 57(2):335-345.

Bull, E. L., and J. E. Jackson. 1995. Pileated Woodpecker (Dryocopus pileatus). In The Birds of North America, No. 148 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, D.C. http://bna.birds.cornell.edu/BNA/account/Pileated_Woodpecker/HABITAT.html

Bull, Evelyn L.; Clark, Abe A.; Shepherd, Jay F. 2005. Short-term effects of fuel reduction on pileated woodpeckers in northeastern Oregon – a pilot study. Res. Pap. PNW-RP-564. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 17p. [0285]

Bull, E. L. and E. C. Meslow. 1988. Breeding biology of the Pileated Woodpecker—management implications. U.S. Dep. Agric., For. Serv., Res. Note PNW-RN-474, Portland, OR. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 8 pp. http://www.fs.fed.us/pnw/pubs/pnw_rn474.pdf

Buskirk, S.W. and Powell, R.A. 1994. Habitat ecology of fishers and American martens. Pp. 283-296 *in*: Buskirk, S.W., Harestad, A., Raphael, M., comps. Eds. Martens, sables and fishers: biology and conservation. Ithaca, NY: Cornell University Press.

Cannings, R.J. 1982. A flammulated owl nests in a nest box. Murrelet 63:66-68.

Caton, EL. 1996. Effects of fire and salvage logging on the cavity-nesting bird community in NW Montana. Dissertation, University of MT, Missoula. [0256]

Christie, D.A. and A.M. van Woudenberg. 1997. Modeling critical habitat for flammulated owls (*Otus flammeolus*). Pp. 97-106 *in:* Duncan, J.R., D.H. Johnson and T.H. Nicholls, eds. Biology and conservation of owls of the Northern Hemisphere: 2nd International symposium; 1997 February 5-9; Winnipeg, MB. General Technical Report NC-190. St. Paul, MN: U.S. Dept. of Agriculture, Forest Service, North Central Forest Experiment Station.

Cilimburg, A. 2006. 2005 flammulated owl surveys: final report. Avian Science Center, University of Montana. Missoula, Montana. [0465]

Claar, J.J., N. Anderson, D. Boud, M. Cherry, B. Conard, R. Hompesch, S. Miller, G. Olson, H. Ihsle Pac, J. Waller, T. Wittinger, H. Youmans. 1999. Carnivores. Pages 7.1-7.63 in Joslin, G. and H. Youmans, coordinators. Effects of recreation on Rocky Mountain Wildlife: A review for Montana. Committee on Effects of Recreation on Wildlife. Montana Chapter of the Wildlife Society. [0375]

Conner, RN. 1979. Seasonal changes in woodpecker foraging methods; strategies for winter survival. Pp. 95-105 In: Dickson J.G., Conner R.N., Fleet R.R., Kroll J.C., Jackson J.A. 1979. The role of insectivorous birds on forest ecosystems. Academic Press New York [0227]

Conner, Richard. 1980. Foraging Habitats of Woodpeckers in Southwestern Virginia. Journal of Field Ornithology 51(2):119-127 [0283]

Cook, J.G., L.L.Irwin, L.D.Bryant, R.A. Riggs, and J.W. Thomas. 1998, October. Relations of Forest Cover and Condition of Elk: A Test of the Thermal Cover Hypothesis in Summer and Winter. Wildlife Monographs, The Wildlife Society. pgs. 59. [0253]

Douglas, C.W., and Marjorie A. Strickland. 1987. Fisher. Wild Furbearer Management and Conservation in North America. Novak, M., Baker, M.O., and Malloch, B. eds. Ministry of Natural Resources, Ontario, Canada. pgs. 1150; pp. 511-529. [0245]

Fix, D. 1986. Flammulated owls in the western Oregon Cascades. Oregon Birds 13:38-40.

Foresman, K.R. 2001. The wild mammals of Montana. Special Publication No. 12, American Society of Mammalogists, Lawrence, KS. 278 p. (Book available at District)

Franklin, J.F. and Spies, T.A. 1991. Composition, function, and structure of old-growth Douglas-fir forests. In: Ruggiero, L.F., Aubry, K.B., Carey, A.B. comps., eds. Wildlife and vegetation of unmanaged Douglas-fir forests. Gen Tech. Rep. PNW-285. Portland, OR: U.S. Dept. of Agriculture, Pacific Northwest Research Station: 71-89. http://www.fs.fed.us/pnw/pubs/gtr285/gtr2853a.pdf

Gallant, A.L., A.J. Hansen, J.S. Councilman, D.K. Monte and D.W. Betz. 2003. Vegetation dynamics under fire exclusion and logging in a Rocky Mountain watershed. Ecological Applications 13:385-403. [0645]

Giese, C.L.A and F.J.Cuthbert. 2003 Influence of surrounding vegetation on woodpecker nest tree selection in oak forests of the Upper Midwest, USA. Forest Ecology and Mgmt. 179:523-534. . [0284]

Goggans, R., R. D. Dixon, L. C. Seminara 1989. Habitat use by Three-toed and Black-backed woodpeckers. Oregon Dept. Fish and Wildl. Nongame Rep. 87302.

Green, P., Joy, J., Sirucek, Hann, W., Zack, A., and B. Naumann. 1992. Old-growth forest types on the Northern Region. R1 SES 4/92. USDA Forest Service, Northern Region, Missoula, MT. (errata corrected 2/05) [0132]

Groves, C., T. Fredrick, G. Frederick, E. Atkinson, M. Atkinson, J. Shepard and G. Servheen. 1997. Density, distribution, and habitat of flammulated owls in Idaho. Great Basin Naturalist 57: 116-123. http://contentdm.lib.byu.edu/cgi-bin/docviewer.exe?CISOROOT=/NANaturalist&CISOPTR=4303

Hanna, W.C. 1941. Nesting of the flammulated screech owl in California. Condor 43:290-291 http://elibrary.unm.edu/sora/Condor/files/issues/v043n06/p0290-p0291.pdf

Hargis, C.D.; J.A. Bissonette and D.L. Turner. 1999. The influence of forest fragmentation and landscape pattern on American martens. Journal of Applied Ecology. (1999) 36, 157-172. [0290]

Harrington, M.G. and S.S. Sackett. 1992. Past and present fire influences on southwestern ponderosa pine old-growth. *In* W.R. Kaufmann, W.H. Moir, and R.L. Bassett. Old-growth forests in the Southwest and Rocky Mountain regions: proceedings of a workshop. Gen. Tech. Rep. RM-213. Portal, AZ. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station.

Harris, M. A. 1982. Habitat use among woodpeckers in forest burns. Master's thesis, Univ. of Montana, Missoula.
Harris, R.B. 1999. Abundance and Characteristics of Snags in Western Montana Forests. RMRS-GTR-31. Ogden, UT U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 24p. [0407]

Hasenyager, R.N., J.C. Pederson, A.W. Haggen.1979. Flammulated owl nesting in a squirrel box. Western Birds 10:224
http://elibrary.unm.edu/sora/wb/v10n04/p0224-p0224.pdf

Hayward, G.D. 1986. Activity patterns of a pair of nesting flammulated owls (*Otus flammeolus*) in Idaho. Northwest Science 60:141-144.

Hayward, Gregory D. and Ronald E. Escano. 1989. Goshawk nest-site characteristics in western Montana and northern Idaho. The Condor 91:476-479. [0277]

Hayward, G.D. and J. Verner, tech. eds. 1994. Flammulated, boreal and great gray owls in the United States: a technical conservation assessment. Gen. Tech. Rpt. RM-253. Fort Collins, CO: U.S. Dept. of Agriculture, Forest Service, Rocky Mtn. Forest and Range Experiment Station. 214 p [0651]

Hendricks, P., and J. D. Reichel. 1996. Amphibian and reptile survey of the Bitterroot National Forest: 1995. Montana Natural Heritage Program. Helena, MT. pp. 95. [0376]

Hillis, J. M., M. J. Thompson, J. E. Canfield, L. J. Lyon, C. L. Marcum, P. M. Dolan, and D. W. McCleerey. 1991.Defining Elk Security. In: A. G. Christensen, L. J. Lyon, and T. N. Lonner, comps., Proc. Elk Vulnerability Symp., Montana State University, Bozeman, MT. pgs. 330; pp. 38-43.

Hitchcox, S.M. 1996. Abundance and nesting success of cavity-nesting birds in unlogged and salvage-logged burned forest in northwestern Montana. M.S. Thesis, Univ. of Montana, Missoula, MT. 89 p.

Hoffman, R.S., D.L. Pattie, and J.F. Bell. 1969. The Distribution of some Mammals in Montana. II Bats. Jour. Mammology 50(4).

Howie, R.R. and R. Ritcey. 1987. Distribution, habitat selection, and densities of flammulated owls in British Columbia. Pp. 249-254 *in* R.W. Nero, R.J. Clark, R.J. Knapton, and R.H. Hamre, eds. Biology and conservation of northern forest owls. Gen. Tech. Rep. RM-142. Fort Collins, CO. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. [0251]

Hoyt, J. S., and S. J. Hannon. 2002. Habitat associations of black-backed and three-toed woodpeckers in the boreal forest of Alberta. Canadian Journal of Forest Research 32:881-1888.
http://article.pubs.nrc-cnrc.gc.ca/ppv/RPViewDoc?_handler_=HandleInitialGet&journal=cjfr&volume=32&calyLang=eng&articleFile=x02-109.pdf

Hutto, R.L. 1995. Composition of Bird Communities Following Stand-Replacement Fires in Northern Rocky Mountain (U.S.A.) Conifer Forests. Conservation Biology, V.9, No. 5, October, 1995. p 1041-1058. [0241]

Interior Columbia Basin Supplemental Final Environmental Impact Statement, Vol. 2, Appendix 12. 2000. Requirements for snags and downed wood. Interior Columbia Basin Ecosystem Management Project, U.S. Dept. of Agriculture, Forest Service, and U.S. Dept. Of the Interior, Bureau of Land Management. March 2000.

Kirk, D.A. and B.J. Naylor. 1996. Habitat requirements of the pileated woodpecker (*Dryocopus pileatus*) with special reference to Ontario. Ontario Ministry of Natural Resources, *CRST Tech. Rept. No. 46.* 65 pp.

Koehler, G.M., and M.G. Hornocker. 1977. Fire Effects on Marten Habitat in the Selway-Bitterroot Wilderness. Journal of Wildlife Management. 41(3). pp. 500-505. [0259]

Linkhart, B.D. 2001. Life history characteristics and habitat quality of Flammulated Owls in Colorado. PhD dissertation, University of Colorado, Boulder, Colorado. 206 pp.

Lyon, L.J. 1983. Road Density Models Describing Habitat Effectiveness for Elk. Journal of Forestry 81(9). [0267]

McCallum, D. Archibald and Frederick R. Gehlbach. 1988. Nest-site preferences of flammulated owls in western New Mexico. Condor 90: 653-661. [0282]

McCallum, D. A. 1994. Flammulated Owl (*Otus flammeolus*). *In* The Birds of North America, No. 93 (A. Poole and F. Gill, Eds.). Philadelphia: The Academy of Natural Sciences; Washington, D.C.: The American Ornithologists' Union. [0182]

McClelland, B.R. Undated. Influences of harvesting and residue management on cavity-nesting birds.

McClelland, B.R. 1977. Relationships between hole-nesting birds, forest snags, and decay in western larch-Douglas-fir forests of the northern Rocky Mountains. Ph.D dissertation, University of Montana, Missoula, Montana. 432 pp. plus appendices.

McClelland, B.R. and P.T. 1999. Pileated woodpecker nest and roost trees in MT: links with old growth and forest health. Wildlife Society Bulletin 27: 846-857. [0229]

McGrath, M.T., S. Destefano, R.A. Riggs, L.L. Irwin, and G.J. Roloff. 2003. Spatially explicit influences on northern goshawk nesting habitat in the interior Pacific Northwest. Wildlife Society Monograph 154.

Montana Department of Fish, Wildlife and Parks. 2004. Montana statewide elk management plan, 2004. Wildlife Division. Helena, MT. 397 pp. http://fwp.mt.gov/FwpPaperApps/hunting/ElkPlanFinal.pdf

Montana Natural Heritage Program MNHP, 2006 [467]

Montana Natural Heritage Program (MNHP). 2007. Species of Concern Report. Helena, MT. Available online at http://nhp.mt.gov/SpeciesOfConcern/Default.aspx

Murphy, E.C. and W.A. Lehnhausen. 1998. Density and foraging ecology of woodpeckers following a stand replacement fire. Journal of Wildlife Management 62: 1359-1372. [0231]

Pearson, O.P., M.R. Koford and A.K. Pearson. 1952. Reproduction of the lump-nosed bat (Corynorhinus townsendii) in California. J. Mammalogy 33:273-320.

Reynolds, R.T. and S.M. Joy. 1998. Distribution, territory occupancy, dispersal, and demography of northern goshawks on the Kaibab Plateau, Arizona. Final report for the Arizona Game and Fish Heritage Project No. 194045. USDA Forest Service, Rocky Mountain Research Station, Fort Collins, CO.

Reynolds, R.T. and B.D. Linkhart. 1987. The nesting biology of flammulated owls in Colorado. Pp. 239-248 *in* Biology and Conservation of Northern Forest Owls: proceedings of the symposium; 1987 February 3-7; Winnipeg, Manitoba. Gen. Tech. Rep. RM-142. USDA Forest Service, Fort Collins, CO. [0249]

Reynolds, R.T. 1989. *Accipiters*. Pp. 92-101 *in*: Pendleton, B.G., C.E. Ruibal, D.L. Krahe, K. Steenhof, M.N. Kochert and M.N. LeFranc, Jr. (editors). Proceedings of the Western Raptor Management Symposium and Workshop; 1987 October 26-28, Boise, ID. National Wildlife Federation Scientific and Technical Series No. 12. Washington, D.C.

Reynolds, R.T. and B.D. Linkhart. 1992. Flammulated owls in ponderosa pine: evidence of preference for old growth. Pp. 166-169 *in* Old growth forests in the SW and Rocky Mt. regions: proceedings of a workshop. USDA FS General Technical Report. RM-213, Fort Collins, CO. [0250]

Reynolds, R.T., R.T. Graham, M.H. Reiser and others. 1992. Management recommendations for the northern goshawk in the southwestern United States. Gen Tech. Rep. RM-217. Ft. Collins, CO.: U.S Dept. of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 90 p. [0293]

Ruggiero, L.F., Aubry, K.B., S.W. Buskirk, L.J. Lyon, W.J. Zielinski, tech. eds**.** 1994. The scientific basis for conserving forest carnivores: American marten, fisher, lynx, and wolverine in the western United States. USDA Forest Service Gen. Tech. Rep. RM-254. 183 p
http://www.fs.fed.us/rm/pubs_rm/rm_gtr254.pdf

Saab, V. A. and J. G. Dudley. 1998. Responses of cavity-nesting birds to stand-replacement fire and salvage logging in ponderosa pine/Douglas-fir forests of southwestern Idaho. U.S. For. Serv. Res. Pap. RMRS-RP-11, Ogden, UT.
http://www.fs.fed.us/rm/pubs/rmrs_rp011.pdf

Samson, F. B. 2002. Population viability analysis: management, and conservation planning at large scales. Pages 425-441 *in* Population viability analysis. S. R. Beissenger and D. R. McCullough, editors. University of Chicago Press, Chicago, Illinois, USA.
http://fsweb.r1.fs.fed.us/wildlife/wwfrp/wl_eco/PDFs/Samson2002.pdf

Samson, F.B. 2005. A Conservation Assessment for the Northern Goshawk, Black-Backed Woodpecker, Flammulated Owl, and Pileated Woodpecker in the Northern Region, USDA Forest Service. Unpublished report on file, Northern Region, Missoula, MT [0389]

Samson, F. B. 2005 (amended March 6, 2006). Conservation assessment of the northern goshawk, blacked-backed woodpecker, flammulated owl, and pileated woodpecker in the Northern Region, USDA Forest Service. Unpublished report on file, Northern Region, Missoula, Montana, USA. [0413]

Samson, F.B. 2006. Habitat estimates for maintaining viable popoulations of the northern goshawk, black-backed woodpecker, flammulated owl, pileated woodpecker, American marten and fisher. USDA Forest Service. Unpublished report on file, Northern Region, Missoula, Montana, USA.

Shackelford, C. and R. Conner. 1997. Woodpecker abundance and habitat use in three forest types in eastern Texas. Wilson Bull. 109(4): 614-629 [0281]

Smith, J.K., ed. 2000. Wildland fire in ecosystems: effects of fire on fauna. Gen. Tech. Rep. RMRS-GTR-42-vol. 1. Ogden, UT: U.S. Dept. of Agriculture, Forest Service, Rocky Mountain Research Station. 83 p. [136]

Squires, J.R. and R.T. Reynolds. 1997. Northern Goshawk. No. 298. In The Birds of North America. The Acadamy of Natural Sciences, Philadelphia, Pennsylvania, and The American Ornithologists' Union, Washington, DC.

Squires, J.R. and P.L. Kennedy. 2006. Northern goshawk ecology: an assessment of current knowledge and information needs for conservation and management. Studies in Avian Biology 31:8-62

Strickland and Douglas. 1987. Wild Furbearer Management and Conservation in North America. CD-ROM can be ordered from National Trappers Association. http://www.nationaltrappers.com/cdrom.html [0142]

Terres, J.K. 1980. The Audubon Society Encyclopedia of North American Birds. Alfred A. Knopf, N.Y., NY. pgs. 1109. Full text available for review at the District office. [0400]

Thompson, I.D., I.J. Davidson, S. O'Donnell and F. Brazeau. 1989. Use of track transects to measure the relative occurrence of some boreal mammals in uncut forests and regeneration stands. Canadian Journal of Zoology 67: 1816-1823.

van Woudenberg, A.M. 1992. Integrated management of flammulated owl breeding habitat and timber harvest in British Columbia. M. S. thesis, University of British Columbia, Vancouver, B.C. 56 p.

van Woudenberg, Astrid M. 1999. Status of the flammulated owl in British Columbia. Ministry of Environment, Lands and Parks, Wildlfie Branch, Victoria BC. Wildlife Working Report No. WR-95. [0289]

Winter, J. 1974. The distribution of the flammulated owl in California. Western Birds 5(2): 25-44. http://elibrary.unm.edu/sora/wb/v05n02/p0025-p0044.pdf

Witmer, Gary W.; Martin, Sandra K.; Sayler, Rodney D. 1998. Forest carnivore conservation and management in the interior Columbia basin: issues and environmental correlates. Gen. Tech. Rep. PNW-GTR-420. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 51 p. (Quigley, Thomas M., ed.; Interior Columbia Basin Ecosystem Management Project: scientific assessment). [0278]

Wright, V. 1996. Multi-scale analysis of flammulated owl habitat use: owl distribution, habitat management, and conservation. Master's thesis, University of MT, Missoula. [0226]

Wright, V., S.J. Hejl and R.L. Hutto. 1997. Conservation implications of a multi-scale study of flammulated owl (Otus flammeolus) habitat use in the northern Rocky Mountains, USA. Pp. 506-516 in: Duncan, James R.; Johnson, David H.; Nicholls, Thomas H. 1997. Biology and conservation of owls of

the Northern Hemisphere: 2nd International symposium; 1997 February 5-9; Winnipeg, MB. General Technical Report NC-190. St. Paul, MN: U.S. Dept. of Agriculture, Forest Service, North Central Forest Experiment Station.

http://avianscience.dbs.umt.edu/documents/8__1997GTR-flamm.pdf

USDA, Forest Service. 1978. Guides for Elk Habitat Objectives, Bitterroot National Forest, Hamilton MT.25 pp. [0361]

USDA, Forest Service. 1987. Forest Plan, Bitterroot National Forest. USDA Forest Service, Northern Region. Hamilton MT, September, 1987. [0120]

USDA Forest Service. 1990. "Old growth habitat and associated wildlife species in the Northern Rocky Mountains." Nancy Warren (ed.), Northern Region Wildlife Habitat Relationship Program. Missoula, Montana. pp. 47 [0358]

USDA Forest Service. 2000. Northern Region Snag Management Protocol. 34 p. [0137]

USDA Forest Service. 2000b. Bitterroot Fires 2000, An Assessment of Post-fire Conditions With Recovery Recommendations. Bitterroot National Forest, Hamilton, MT. [0075]

USDA 2000 Interior Columbia Basin Ecosystem Management Project FEIS

USDA Forest Service. 2004. Forest Plan Monitoring and Evaluation Report, Fiscal Year 2004, Bitterroot National Forest, Hamilton, MT [0325]

USDA Forest Service. 2005. Draft Bitterroot Forest Plan Monitoring Report

USDI, 1994 Final Gray Wolf Recovery Plan [0402]

USFWS 1998 [goshawk habitats] [0292]

USDI Fish and Wildlife Service, Nez Perce Tribe, National Park Service, Montana Fish, Wildlife and Parks, Idaho Fish and Game and USDA Wildlife Services. 2007. Rocky Mountain Wolf Recovery 2006 Annual Report. C. A. Sime and E. E. Bangs, eds. USFWS, Ecological Services, Helena, MT. 235 pp. Available online at: http://www.fws.gov/mountain-prairie/species/mammals/wolf/annualrpt06/index.htm

APPPENDIX A - MONTANA BEST MANAGEMENT PRACTICES & SOIL AND WATER CONSERVATION PRACTICES

Class	SWCP Number	State BMP Ref.	SWCP Title	TSC Provision	Applicable ? y/n	Planning Review
Section 11 Watershed Management\						
A	11.01	IV.A.1	Determination of Cumulative Watershed Effects	NA	Y	Completed during project planning, refer to EA
E	11.03	III.D.10	Watershed Improvement of Roads, OHV Trails and Skid Trails	C5.419	Y	See road decommissioning discussion in EA
A	11.05	IV.A.1	Wetlands Analysis and Evaluation	B6.61 B6.62 SAM B6.62 C6.62	Y	Wetlands, SMZ, RHCA marked and excluded from harvest or equipment entry per mitigation (refer to EA), law and policy. Soil scientist will help mark any units identified in mitigation to ensure wetlands are properly identified.
A	11.09	IV.A.2, IV.B.1	Management by Closure to Use	C5.41#	Y	Specifics of closures and affected roads identified in TS Contract and enforced by TSA (timber sale administrator)
W	11.13		Sanitary Guidelines for Construction of Temporary Labor, Spike, Logging, Fire Camps and Similar Installations	B6.2	Y	Applicable only if camps are established during logging operation.
Section 13 Vegetation Manipulation						
G	13.02	IV.A.2 IV.B.1	Slope Limitations for Tractor Operation (14.07)	C6.4#	Y	Tractor units identified in Unit Table, restricted to slopes less than 35% or 20% adverse.

G	13.03	IV.A.1 IV.B.1&2	Tractor Operation Excluded from Wetlands, Bogs, & Wet Meadows	B6.61 B6.422 B6.62 SAM C6.62#	Y	INFISH prohibits and DEIS supports exclusion of tractors from RHCAs (wetlands, bogs, wet meadows). These areas will be excluded from harvest units.
E	13.04	IV.B.6 IV.C.1	Revegetation of Surface Disturbed Areas	B6.6 C6.601# C6.633#	Y	Revegetation would occur per TSC, seed mix identified by Forest Botanist and included in TSC.
W	none	IV.B.2 V.C.2,3,7	Inclusion of INFISH (7/95) Recommendations	SAM B6.5	Y	Integral part of analysis, RHCA restricted from harvest.
	13.06		Soil Moisture Limitations for Tractor Operations	C6.4#	Y	Soil moisture limits based on soil texture, see soils report for details.
Section 14 Timber Harvest						
A	14.02	IV.A.2-6	Timber Harvest Unit Design (14.08, 14.10)	B6.422 C6.4# C6.6	Y	These provisions are only relevant after all presale (design) work is complete Skid trails will be identified and authorized prior to use and will be about 120' apart, existing skid trails will be use when feasible. Winter yarding conditions specified in mitigation.
A	14.03	IV.A & B	Use of Sale Area Maps for Designating Soil and Water Protection Needs	B1.1 B.42 B6.5 B6.42 B6.61 B6.62 C6.4	Y	SAM will identify protected stream courses, wetlands and riparian areas, slumps and other areas excluded from harvest
A	14.04	IV.A.1	Limiting the Operating Period of Timber Sale Activities	B6.65 B6.6 B6.31 B6.311 B6.312 C6.316# C6.6	Y	Normal operating seasons will be identified in the TSC. TSA will monitor conditions and enforce as needed.
A	14.05	IV.A.1	Protection of Unstable Areas	C6.4#	N	No unstable (mass-movement-prone) areas located during planning or fieldwork

A	14.06	II. (all) III.D.10	Streamside Management Zone Rules, Riparian Area Designation	B6.5 B1.1 C6.4# C6.41# C6.50#	Y	SMZ's are typically more narrow than RHCA's that will be marked and excluded from harvest.
G	14.07	IV.A.2&4	Determining Tractor Loggable Ground	B1.1 B6.42	Y	Initially determined during project planning in IDT discussions. Will be field checked during marking. Refer to mitigation, Soils and Watershed reports as well as BMPs 13.02, 13.03, 14.02, 14.03, 14.05, 14.06, and soil moisture limitations.
E	14.08	IV.A.2,4, 5	Tractor Skidding Design	B6.422 C6.4# C6.42#	Y	Mitigation indicates skid trail spacing, Unit Table lists units appropriate for ground based yarding.
E	14.09	IV.A.1, 2	Suspended log Yarding in Timber Harvesting	B6.42 B6.5(b) C6.4#	Y	Minimum one end suspension required for cable logging.
A	14.10	IV.B.4	Log Landing Location and Design	B6.422 C6.422	Y	Potential landings have been identified and reviewed on the ground for accessibility, INFISH constraints. Mitigation describes treatment after use.
E	14.11	IV.B.4	Log Landing Erosion Prevention and Control	B6.6 B6.311 B6.64 C6.6 C6.601#	Y	BMP describes design of landings and post-use treatment to minimize erosion
E	14.12	IV.B.5&6	Erosion Prevention and Control Measures During Timber Sale Operations	B6.6 B6.64 B6.311 C6.4 C6.6 C6.601#	Y	Various mitigations described in EA, yarding systems identified that minimize ground disturbance on sensitive areas.
E	14.15	IV.B.1,5 &6	Erosion Control on Skid Trails	B6.6 B6.311 B6.65 B6.66 C6.4 C6.6 C6.601#	Y	Water bar spacing identified in BMP, skid trails no less than 120' apart, limit summer skidding based on soil moisture to reduce compaction and displacement.

E	14.16	IV.A.1&5	Meadow Protection During Timber Harvesting	B1.1 B5.1 B6.422 B6.61 C6.4# C6.66	Y	Equipment will be prohibited from entering meadows.
S	14.17	IV.A.1&5	Stream course Protection (Implementation and Enforcement)	B1.1 B6.5 B6.6 C6.50# C6.6	Y	Stream courses will be identified on SAM, excluded from equipment entry (SMZ and INFISH), and excluded from treatment area or be identified as no treatment zone.
E	14.18	IV.B.(all)	Erosion Control Structure Maintenance	B6.67	Y	TSC requires maintenance of erosion control structured by purchaser and is monitored by TSA
A	14.19	IV.B.5	Acceptance of Timber Sale Erosion Control Measures Before Sale Closure	B6.36	Y	Direction according to TSC and certification by TSA required prior to sale closing.
E	14.20	IV.C (all)	Slash Treatment in Sensitive Areas	SAM B6.5 C6.50# B6.7 C6.7 C6.71 C6.753	N	No mechanized slash treatment identified in this project.
A	14.22		Modification of the Timber Sale Contract	B2.37 B8.3	Y	Within TSC provision to modify contract for resource reasons.
A	14.23	IV.C.1	Reforestation Requirement		N	All units partial cut, no reforestation proposed
G	NA	IV.C.3,4, 6	On-site Large Woody Residue and Soil Litter Retention	C6.7# C6.406#	Y	Silvicultural Rx prescribes amount of woody materials to be left on site following treatments and is displayed in mitigation table. Soil scientist involved in final recommendations.
G	NA	VI. (all)	Winter Logging	C6.4#	Y	If purchaser chooses to utilize winter logging, specific winter conditions must be met.
Section 15 – Roads and Trails						

S	15.02	III.A,B,C III.D.5	General Guidelines for the Location and Design of Roads and trials	(124 prmt)	Y	Applies to temp road, no new permanent road proposed.
E	15.03	III.C.7	Road and Trail Erosion Control Plan	B6.31, B6.5, B6.6, and C6.3	Y	Maintenance of haul routes and skid trails would occur as directed by TSA and TSC.
E	15.04	III.D.4 III.E.4,7	Timing of Construction Activities	B6.31 B6.311	Y	TSA will monitor conditions and restrict when needed to prevent adverse results.
E	15.06	III.D.7	Mitigation of Surface Erosion and Stabilization of Slopes	C6.601#	Y	No new road construction planned but temporary roads would be managed to prevent erosion and be stabilized prior to sale closure.
E	15.07	IIIC.1,5 III.D.2	Control of Permanent Road Drainage	B5.3, C5.31	Y	No new road construction associated with this proposal. Drainage issues arising on existing roads addressed by pre-haul and other needed maintenance and TSA monitoring.
E	15.08	III.D.1	Pioneer Road Construction		N	No permanent road construction.
E	15.09	III.D.2 III.E.7	Timely Erosion Control Measures on Incomplete Road and Stream crossing Projects	B6.6 B6.66 C6.6 C5.23# rd pkg	N	No stream crossing work proposed.
E	15.10	III.D.3,8	Control of Road Construction Excavation & Side cast Material	B6.222 rd pkg	Y	No new road construction proposed. This BMP regulates side-casting during pre-haul maintenance.
S	15.11	VII.A.(all)	Servicing and Refueling of Equipment	B6.34 B6.341 B6.342	Y	Servicing of equipment will be excluded from RHCAs and appropriate sites will be authorized by TSA with input from specialists as needed.
S	15.12	III.A.5 IV.B.1	Control of Construction in	B6.5	N	No permanent road construction, no temp roads proposed in riparian areas.

			Riparian Areas			
S	15.13	III.E.5	Controlling In-Channel Excavation	(124 prmt)	N	No permanent road construction.
S	15.14	IV.A.(all) V.C.5	Diversion of Flows Around Construction Sites	B6.5	N	No permanent road construction.
S	15.15	IV.A.(all) V.B.2	Stream crossings on Temporary Roads	B5.1 B6.5 C5.1 (124 prmt)	N	No live water stream crossings proposed on temp roads. Likely still included in contract to cover unknowns.
S	15.16	IV.A.(all) V.C.(all)	Bridge and Culvert Installation (Disposition of Surplus Material and Protection of Fisheries)	B6.5	N	No live-water crossing installation work proposed.
E	15.18	III.D.6,8	Disposal of Right-of-Way and Roadside Debris	B6.5	N	No stream crossings proposed.
E	15.21	III.D.1 III.E.1,2	Maintenance of Roads	C5.12 C5.31# C5.316# C5.314# C5.312# C5.41	Y	Engineering rep should be involved on newly graveled and upgraded roads to ensure protection of gravel surface during maintenance activities.
E	15.22	III.D.7	Road Surface Treatment to Prevent Loss of Materials	C5.31# (T-103) C5.314#	Y	As directed by TSA.
E	15.23	III.D.6 IV.B.1	Traffic Control During Wet Periods	B5.12, and C5.12	Y	As directed by TSA and made necessary by weather conditions.
E	15.24	III.E.3,4 VI.B.2	Snow Removal Controls	C5.316#	Y	Refer to TSC and mitigation. If contractor chooses to plow roads, must meet FS specs.
E	15.25	III.E.8	Obliteration of Temporary Roads	C6.632#	Y	Refer also to mitigation in soils report for temporary roads.
Section 18 Fire Suppression and Fuels Management						

A	18.02	IV.C.2	Formulation of Fire Prescriptions	Not in contract – USFS crews	Y	Rx have been developed in IDT setting with specialist input and considered habitat type, existing vegetation, fuel loadings and position on landscape.
E	18.03	IV.C.8	Protection of Soil & Water from Prescribed Burning Effects	Not in contract – USFS crews	Y	Burning should only occur during Rx window to meet prescribed fire intentions. All entries must consider O-layer and large woody debris needs.
E	18.04	None	Minimizing Watershed Impacts from Fire Suppression Efforts	Not in contract – USFS crews	Y	Should a prescribed fire escape, resource advisor would advise suppression team of sensitive areas and resource concerns.
E	18.05	None	Stabilization of Fire Suppression Related Watershed Damage	Not in contract – USFS crews	Y	Should a prescribed fire escape, resource advisor would advise suppression team of sensitive areas and resource concerns.

Key:
B clause – standard in all timber sale contracts
C clause – optional in timber sale contract, see "applicable" column for potential inclusion.
- numerical value or dates determined by timber contract officer, specialist, EIS, or line officer during contract construction.
CLASSES OF SWCP (BMP)
A = Administrative
G = Ground Disturbance Reduction
E = Erosion Reduction
S = Stream Channel Protection/Stream Sediment Reduction
W = Water Quality Protection
SWCP (Soil and Water Conservation Practice) number – From R1-R4 Soil and Water Conservation Practices Handbook
State BMP reference number from MTDNRC 2004 Best Management Practices for Forestry (PF_WAT_08, Trapper-Bunkhouse Project File)
Applicability – does this BMP/SWCP apply to this project?
Planning Review – how is the BMP implemented or addressed in environmental planning for this project?