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Idaho Panhandle
National Forests

St. Joe
Ranger District

May 2008

Bussel 484

Final Environmental Impact Statement

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Bussel 484
Final Environmental Impact Statement

Idaho Panhandle National Forests, St. Joe Ranger District
Shoshone County, Idaho

May 2008

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Abstract: The final environmental impact statement (FEIS) addresses needs to manage vegetative resources, provide wood products, work toward full support of designated beneficial uses in the Bussel Creek Watershed, and manage access to provide for multiple uses. The project area encompasses approximately 14,646 acres which are approximately 83 percent National Forest System lands. The major issues identified during scoping include effects of road construction, controversy over proposed access management changes, and effects on cultural resources. Alternatives considered include:

Alternative A - No Action: Maintain the existing level of management including fire suppression, road maintenance, recreation use, and previously authorized projects.

Alternative B - Proposed Action: Includes activities common to action alternatives and timber harvest and associated fuels treatment on approximately 2,137 acres. Silvicultural prescriptions include 1,486 acres of commercial thins, 521 acres of group shelterwood cuts, 53 acres of seedtree cuts, and 78 acres of clearcuts with reserves. Logging systems include 552 acres of ground-based, 873 acres of cable/skyline, and 712 acres of helicopter. Approximately 5.1 miles of system road construction, 0.5 miles of temporary road construction, and 6.7 miles of road reconstruction would be required on NFS lands to facilitate the timber harvest. Approximately 0.2 miles of road would be constructed on Potlatch Corporation lands to facilitate timber harvest on National Forest System lands. The entire Norton Creek Railroad Grade would be repaired and would be designated open to ATVs.

Alternative C – No Road Construction: Includes activities common to action alternatives and timber harvest on approximately 2,137 acres with no road construction. Approximately 5.4 miles of road would be reconstructed to facilitate the timber harvest. Silvicultural prescriptions would be the same as those for Alternative B. Logging systems include 389 acres of ground-based, 317 acres of cable/skyline, and 1,431 acres of helicopter. Portions of the Norton Creek Railroad Grade would be repaired and would be designated open to ATVs.

Activities Common to Action Alternatives: Decommissioning and storing 29.1 miles of road; planting 367 acres after timber harvest; pocket gopher control on 367 acres; precommercial thinning and pruning on 821 acres; changes in access management including installing effective restrictive devices on some roads, removing gate on Road 1498, constructing 0.2 miles of new trail for ATV use, converting Bussel Creek Trail 258 to non-motorized use, designating Lines Creek Historical Trail open to ATVs; planting some portions of riparian areas in Bear Creek, Little Bear Creek, and other parts of Bussel Creek; placing large woody debris in Bear Creek and Bussel Creek; correcting two fish migration barriers, and upgrading twelve culverts.

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INTRODUCTION

Changes between Draft EIS and Final EIS

Changes in Alternatives

Alternatives B & C

Unit 24 – dropped entire unit (34 acres); allocated as old growth

Unit 97 - dropped entire unit (25 acres); existing condition is close to desired condition; treatment would not improve conditions

Unit 212 – dropped entire unit (31 acres); allocated as old growth

Unit 295 – dropped entire unit (13 acres); 2007 Elm Street Fire

Unit 224 – Added site-specific mitigation of decompacting skid trails after use and monitoring

Units 14, 70, 100, 170, 215, 224, 225, 226, 232, 233, 248, 251, 254, 271, and 322: Monitor soils with field surveys using the IPNF "Onsite Assessment Method" after completion of ground-disturbing activities

Added replacement of twelve culverts to road reconstruction to accommodate 100-year flood event

Alternative B

Unit 14 – 7 acres changed from skyline yarding to ground-based skidding

Unit 225 – changed logging system from 56 acres skyline yarding to 20 acres ground-based skidding, 30 acres helicopter yarding, and 6 acres skyline yarding

Unit 323 – changed logging system from 52 acres helicopter yarding to 41 acres skyline yarding and 11 acres helicopter yarding

Unit 325 – entire unit changed from helicopter yarding to skyline yarding (15 acres)

Unit 336 – entire unit changed from ground-based skidding to helicopter yarding (8 acres)

Temporary road NR21added above and outside of Unit 224; access for Unit 215 (0.23 miles) – decommission with full recontour after use

NR6A – dropped (0.89 miles) – eliminates construction through high potential mass failure hazard area, eliminates the only stream crossing proposed in DEIS; Road Rx C after use

NR22 – Added construction (0.59 miles) off Road 3332 to replace NR6A (473 feet = 0.09 miles = 0.4 of an acre through 59-acre old growth stand allocated as 11); access for Units 254, 283;

NR8A – relocated for a total length of 0.9 miles; access for Units 264, 299, 301; it now extends to the private property line on the south and stops before wrapping around the ridge at the north

Total temp road construction on NFS land = 0.5 miles

Total system road construction on NFS land = 5.1 miles

Total road construction on private land needed for Alternative B = 0.2 miles

Changes in Purpose and Need

Reducing the potential for large, severe wildfire is analyzed as an effect of the project, it is not a purpose of the project. The statement "Reduce the potential for large, severe wildfires while promoting conditions for safe and effective wildland fire management." was originally listed as a purpose and need during project development. Subsequent analysis of the fire regimes within the analysis area revealed that large and occasionally severe wildfires are not unnatural. The only structures located in or immediately adjacent to the analysis area are an electrical transmission line and an electronic site. It was decided that due to the nature and locations of these structures, in combination with the habitat types and fire regimes, conducting fuel treatments specifically for the purpose of protecting these sites was unnecessary. The statement was unintentionally left in the purpose and need of the Draft EIS. Therefore reducing the potential for large, severe wildfire was removed from the purpose and need of the project.

The Draft EIS stated that one purpose of the project is to manage access to provide for multiple uses and reduce the possibilities of new weed establishment, and reduce sites that are suitable for weeds. That statement was an error and was removed for the FEIS. Decommissioning roads would reduce one vector of weed dispersal (motorized vehicles), but it would disturb soil which could provide habitat for noxious weeds. The action alternatives would meet the intent stated in the Forest Plan for moderate control, through the implementation of design features. The key to preventing long-term weed establishment is out-year monitoring after project implementation and early treatment of new weed occurrences. New populations of noxious weeds would be treated in accordance with priorities set by the noxious weed program. New invader species would be slated for eradication immediately upon discovery. Other weed infestations would be treated according to the direction in the St. Joe Noxious Weed Project EIS and District priorities. All weed treatments would be monitored for effectiveness and the need for additional treatments.

General

The term “timber sale contract” was change to “contract” or “timber harvest contract” because instead of the traditional timber sale contract a stewardship contract or a service contract may be used to implement part or all of the proposed activities.

Introduction to Final EIS

This final environmental impact statement (FEIS) addresses needs to manage vegetative resources, provide wood products, work toward full support of designated beneficial uses in the Bussel Creek Watershed, and manage access to provide for multiple uses. Chapter 1 describes the purpose and need for the project, the scope of the project, and decisions to be made.

The proposed action was developed to address the purpose and need and is discussed in Chapter 2. Chapter 2 describes the alternative development process including scoping and public involvement. The major issues with the proposed action identified during scoping include effects of road construction, controversy over proposed access management changes, and effects on cultural resources. The No-Action Alternative (Alternative A) and Alternative C address these issues. Summaries of the alternatives are given at the end of Chapter 2.

The affected environments and environmental consequences for affected resources are discussed in Chapter 3. Chapter 3 begins with a discussion of past, present, and reasonably foreseeable activities which is followed by resource discussions in alphabetical order.

Throughout the DEIS project file documents are referenced in parentheses when applicable. The following abbreviations are used to indicate sections of the project file:

PD = Project Development	FF = Fire and Fuels	S = Soils
PI = Public Involvement	F = Fisheries	SW & SSW = Water
ACT = Past, Present, Foreseeable Activities	V = Forest Vegetation	T = Transportation
AQ = Air Quality	NW = Noxious Weeds	VQ = Visual Quality
B – Botany (Rare Plants)	OG = Old Growth	WL = Wildlife
CR = Cultural Resources	REC = Recreation	
E = Economics	RDLS = Roadless	

CHAPTER 1 - PURPOSE AND NEED

Project Area Description

The Bussel 484 Project Area is located within the Bussel Creek Watershed which is a tributary of Marble Creek and is eight miles northeast of Clarkia, Idaho in Shoshone County. It includes portions of Township 43 and 44 North; Range 2 and 3 East, Boise Meridian. See Map 1 in Appendix A. The entire project area falls within Compartment 484 and covers 14,646 acres. Of this, approximately 2,454 acres are privately owned, so approximately 83% or 12,192 acres of the analysis area is National Forest System land. There are no inventoried roadless areas within or adjacent to the project area.

Forest Plan Direction

Management direction defined in the Idaho Panhandle National Forests' Forest Plan sets the general direction for managing all of the resources for the Forest. It provides both Forest-wide and area-specific goals, standards, and guidelines. This EIS documents the analysis of the second level of planning, Forest Plan implementation, for the Bussel 484 Project Area.

The Forest Plan divides National Forest System land into 20 management areas (MAs). MAs affected by the proposed treatments have been validated by the interdisciplinary team and are determined to be suitable for timber production (project file (PF): V-12). The Forest Plan designated National Forest System lands within the project as MA-1 (10,533 acres), MA-4 (1,477 acres), MA-9 (283 acres), and MA-16. A full description of management area direction is in the Forest Plan. A brief description of the management area direction pertinent to the proposed activities for this project is displayed in Table 1-1.

For this analysis management area boundaries were adjusted based on site-specific data and analysis (PD-68, V-12). Approximately 84 acres of MA-9 are considered MA-1 for this project, and a final determination for management area boundaries will be made when a decision is issued for this project. These adjustments will be monitored in accordance with the Forest Plan page IV-10 Item B-2. The original Forest Plan management areas and proposed management areas for the project area are displayed on Map 2.

Table 1-1 Forest Plan Management Area Descriptions for Proposed Action

MA-1: Timber Production (Forest Plan Vol. 1, III-2) Lands are variable. Vegetation is mostly mixed conifer, all major habitat types are present. Goals: Manage lands suitable for timber production for the long-term growth and production of commercially valuable wood while protecting soil; meeting water quality standards; providing wildlife habitat and dispersed recreation; and meeting visual quality objectives (VQOs).
MA- 4: Big Game Winter Range with Timber Production (Forest Plan Vol. I, III-17) Generally < 4,000' elevation with southerly exposures. Vegetation includes brush fields and all stages of forest cover. MA-4 includes elk and whitetail deer winter range. Goals: Manage big game winter range through scheduled timber harvest and permanent forage areas and provide long-term growth and production of commercial wood products, provide for cost effective timber production, protect soils, meet water quality standards, provide dispersed recreation consistent with wildlife needs and meet VQOs.
MA –9: Unsuitable for Timber Production (Forest Plan Vol. I, III-39) Generally higher ridge tops > 5,000' elevation and steep break lands of major streams which have numerous rock bluffs. Vegetation is typically scattered tree (subapline fir habitat types) cover interspersed with a ground cover of brush or grass. Goals: Maintain & protect improvements and resource productive potential, meet VQOs.
MA –16: Riparian Areas (Forest Plan Vol. I, III-68) Areas with distinctive resource values and characteristics that are comprised of an aquatic ecosystem and adjacent upland areas that have direct relationships with the aquatic system. This includes floodplains, wetlands, and all areas within a horizontal distance of approximately 100 feet from the normal high water line of a stream channel. Goals: Manage to feature riparian dependent resources, maintain natural channels and certain vegetation and wildlife communities. Produce other resource outputs that meet state water quality standards, protect soils, provide for cost effective timber production, provide wildlife habitat and dispersed recreation and meet VQOs.

Purpose and Need for Action

The purpose and need was developed as a result of an ecosystem analysis at the watershed scale (EAWS) that identified past, existing, and desired future conditions for the Bear Bussel Area (Appendix A Map 1; PD-2). Input from the public was solicited with direct mailings (PI-3), posters in the area (PI-1, PI-2), and comment forms handed to forest visitors in the area (PI-26). The interdisciplinary team recommended opportunities to manage the project area to achieve desired future conditions for vegetation, fire, fuels, recreation, access, wildlife, fisheries, soil, and water. The team also conducted a roads analysis process (RAPS) (PD-4) for the area in and around the Bussel Creek Drainage to evaluate the risk roads pose for resources and to evaluate the need for roads to manage National Forest System lands. In addition to the EAWS, public input, and RAPS; the development of the purpose and need was guided by goals, objectives, and standards in the Idaho Panhandle National Forests Forest Plan as well as information in the "Integration of Forest Planning into Ecosystem Management Toward a Forest Ecosystem Approach: An Assessment for the St. Joe Area" known as the "St. Joe Geographic Assessment", the Upper Columbia River Basin Integrated Scientific Assessment, and the National Fire Plan. Detailed information on project proposals to meet the purpose and need is presented under the *Alternative Descriptions* section of Chapter 2.

Maintain or improve resilience of the vegetative resources to disturbances such as insects, disease, and fire:

- Promote and accelerate the development of long-lived, early-seral, shade-intolerant species (western white pine and western larch): With the substantial increase in mid-to late-seral species dominance and decrease in early-seral species, forest resiliency following disturbance is decreasing; and the risk of stand loss to insects, disease and fire has increased dramatically compared to historic conditions.
- Promote or maintain large-diameter trees, snags, coarse woody debris, and stands dominated by large-diameter trees: The substantially higher contribution of pole/small/medium size classes coupled with a similar reduction in the mature/large size class increases the susceptibility to substantial loss to disturbance from insects, disease, and fire.
- Reduce stand densities to enhance and encourage resilience to insects, disease, and other disturbances: Existing stands conditions consist of elevated representation of the pole/small/medium size classes with higher tree densities and there is a reduction in the representation of mature/large size classes from historical conditions.

Provide wood products for local communities:

- Contribute to local employment, income and lifestyles (Forest Plan II-11) through long-term growth and production of commercially valuable wood products and cost-effective timber production (Forest Plan III-2, III-16).
- Provide biomass for the St. Maries Fuels to School Project. The Forest Service will initially supply biomass to get the Heyburn Elementary School biomass heating system going (St. Maries Joint School District #41, 2007, Heyburn Elementary Woody Biomass for Energy Application, Appendix C).

Work toward full support of designated beneficial uses in the Bussel Creek Watershed:

- Reduce sediment production and increase stream shading in Bussel Creek and its tributaries. Bussel Creek and its tributaries are identified on Idaho's current 303(d) list (2002) of water quality limited segments (WQLS) due to the pollutants of concern: sediment and temperature. Sediment and temperature Total Maximum Daily Loads (TMDLs) have been identified to increase stream shade and reduce sediment for Bear Creek and Little Bear Creek which are tributaries of Bussel Creek. Stream temperatures currently exceed federal and state bull trout temperature standards in Bussel Creek.
- Replace or remove culverts that do not allow fish passage. Some culverts do not allow fish to pass through them. This limits the amount of available habitat in the corresponding stream.

- Increase the number of long pieces of large woody debris in stream channels. Based on objectives of the Inland Native Fish Strategy (INFS p. A-4 Table A-1), some streams within the project area do not have the recommended amounts of long pieces of large woody debris.

- Create more natural stream channel conditions where road crossings are removed. Crossing structure removal and channel form rehabilitation would enhance lateral (floodplain) and longitudinal (upstream and downstream) connectivity.

Manage access to provide for multiple uses:

- Decommission roads that are not needed for multiple-use management of National Forest System (NFS) lands. The interdisciplinary team conducted a roads analysis process (RAPS) for the area in and around the Bussel Creek Drainage to evaluate the risk roads pose for resources and to evaluate the need for roads to manage NFS lands.
- Moves towards the implementation of the National Off-Highway Vehicle Rule (36 CFR 212.51) by designating roads, trails, and areas open to motorized vehicle use. Motorized users are expanding their activities and are creating their own cross-country trails. Resource damage is occurring in meadows, along creeks, and in other sensitive areas within the project area.
- Access is needed for vegetation management activities.
- Provide a variety of recreation opportunities (motorized and non-motorized).
- Increase amount of and improve distribution of wildlife security areas in the project area to contribute to meeting forest plan goals and objectives for big game habitat. The Bussel 484 Project Area provides little to no security acres. This condition is a result of a combination of open gates, breached barriers, and ATV use of roads and trails. ATVs were not included in the road restrictions currently in effect because ATVs were not common and were not a concern when these restrictions were put in place in the1970s and 1980s. Preliminary data shows the existing amount and distribution of security areas are not adequate for achieving Forest Plan objectives and the desired condition for the project area.
- Reduce resource damage caused by roads and vehicles.
- Reduce the amount of road maintenance required.

Scope of the Project

Forest planning takes place at several levels: national, regional, forest and project. The Bussel 484 Project is a project-level analysis; its scope is confined to addressing the significant issues and possible environmental consequences of the proposed action. It does not attempt to address decisions made at higher levels. It would, however, implement direction provided at those higher levels.

The scope of the project refers to both the affected geographical area and the timeframe of the proposal including any connected, similar, or cumulative actions.

All proposed activities are within the Bussel 484 Project Area which encompasses the entire Bussel Creek Drainage. This includes 0.2 miles of new road construction on land owned by Potlatch Corporation.

The proposed action includes converting the Bussel Creek Trail 258 from single-track motorized use to non-motorized use. This would include the portion of the trail outside the project area, but no physical changes on the ground would occur outside the project area.

Implementation would begin in 2008 or 2009, and timber harvest is expected to be completed by 2013 if the sales sell in 2008 or 2009. Slash disposal, site preparation and reforestation are expected to be completed by 2015. These dates are tentative based upon anticipated budgets, workforce, and other considerations. Actual dates of implementation and accomplishment could vary.

Decisions to be Made

1. Whether to change an area mapped as Management Area 9 (not suitable for timber production) in the Forest Plan to Management Area 1 which is suitable for timber production based on site-specific data.
2. Whether to implement the proposed vegetation treatments (timber harvest, fuels treatment, tree planting and associated pocket gopher control, biomass removal, pre-commercial thinning, and white pine pruning).
3. If timber management practices were to be implemented what road construction and reconstruction would be necessary to provide access for them?
4. What changes in access management would be implemented?
5. What amount, type, and distribution of aquatic habitat improvement projects (riparian planting, large woody debris placement, fish migration barrier removal, and stream crossing rehabilitation) would be implemented?
6. What design features and mitigation measures are appropriate to be implemented for the selected activities?
7. What specific project monitoring is needed to evaluate how successfully project objectives are met and to assure design features are implemented and are effective?

Responsible Official

The responsible official for this decision is the Forest Supervisor, Idaho Panhandle National Forests, 3815 Schreiber Way, Coeur d'Alene, Idaho, 83815.

CHAPTER 2 - ALTERNATIVES

Introduction

This chapter describes how alternatives were developed, including how public comments helped formulate the alternatives; the alternatives considered but eliminated from detailed study; and the alternatives considered in detail. Two action alternatives are carried forward and analyzed in detail in Chapter 3, along with the No-Action Alternative.

In August 2003 the St. Joe Ranger District began collecting information from the public regarding conditions and uses in the Bear Bussel Assessment Area (Appendix A Map 1). This effort included posting notices at twelve locations in the Bear Bussel Assessment Area, information solicitation via the District mailing list, and talking with forest users in the assessment area and giving them comment forms to fill out and return.

In February 2004, an interdisciplinary team was formed to identify activities in the Bussel 484 Project Area that would move this area toward desired conditions as described by the public and as defined in the Forest Plan, the St. Joe Geographic Assessment, Bear Bussel Roads Analysis Process (RAPS), and an Ecosystem Analysis at the Watershed Scale (EAWS) for the Bussel 484 Project Area. The result of that effort was the proposed action that went to the public in 2005. See *Scoping and Public Involvement* below.

Alternative Development

Scoping and Public Involvement

Scoping was used to help the Forest Service develop the proposed action. In August 2003 posters were placed at twelve locations in and around the project area asking the public for input on conditions and uses in the area (PI-1, PI-2). The St. Joe Ranger District sent a letter and comment form to potentially interested people in December 2003 (PI-3) asking them to provide input on conditions and uses in the area. In the fall of 2004 comment forms were handed out to individuals in the Bussel 484 Project Area during routine road checks during hunting season (PI-26). In January 2005 Bussel 484 was listed on the Quarterly Schedule of Proposed Actions (PI-26a). District Ranger, Chuck Mark, discussed this project with the Coeur d'Alene Tribe during a meeting with them on March 25, 2005 (PI-27). Sixteen I individuals or groups submitted written comments before a description of the proposed action was sent to the public.

Once the proposed action was developed a scoping notice was sent to people on the district NEPA mailing list on April 19, 2005 (PI-31, PI-32), and the scoping notice was posted on the IPNF NEPA website that day (PI-34). A notice of intent to prepare an environmental impact statement was published in the federal register on April 25, 2005 (PI-36). In September 2005 we sent an invitation to people on the mailing list for a public field trip on September 30, 2005. Five people other than Forest Service employees attended this field trip. Fourteen individuals or groups submitted written comments as a result of this scoping effort (*Public Involvement* section of project file).

District Ranger, Chuck Mark, discussed this project with the Coeur d'Alene Tribe during meetings with them on March 24, 2006 and February 22, 2007 (PI-57, PI-63). They did not express concerns about the project at either of these meetings.

The St. Joe Ranger District contacted the Idaho Department of Environmental Quality (DEQ) to arrange a meeting. The project interdisciplinary team leader and hydrologist met with the Idaho Department of Environmental Quality on October 18, 2007 to discuss Bussel 484 and the water analysis (PI-66).

Copies of the Bussel 484 Draft Environmental Impact Statement (DEIS) were mailed to interested parties on February 25, 2008, and the DEIS was posted on the Idaho Panhandle National Forests' website on February 26, 2008. The notice of availability for the Bussel 484 DEIS was published in the Federal Register on March 7, 2008, and the 45-day comment period ended April 21, 2008. Two individuals, six groups, three agencies, and the Coeur d'Alene Tribe submitted written comments on the DEIS. DEIS Appendix I includes those comments and the Forest Service's responses to them.

District Ranger, Chuck Mark, discussed the Bussel 484 Project with representatives of the Coeur d'Alene Tribe on March 18, 2008 (PI-83A) after they were provided a copy of the Draft EIS. No specific concerns were raised.

Issue Identification

Comments received in response to scoping efforts were used to identify issues. These issues became the focus for alternatives presented in this Environmental Impact Statement. Two types of issues were used in this analysis: alternative-driving issues and other concerns. Alternative-driving issues were used to develop alternatives to the Proposed Action.

Other concerns helped frame the scope of the analysis, and were evaluated by the team during the scoping process. These concerns were not considered major issues, and therefore were not used to develop alternatives analyzed in detail. Most issues could be adequately addressed by the design of the proposed Bussel 484 Project (see Design Features). These concerns are discussed below and in the effects analysis by resource in Chapter 3 of this EIS.

Some concerns were determined to be outside the scope of this project or are addressed in the Forest Plan. Other issues are addressed through design features or by contrasting the no-action and action alternatives.

In addition to issue identification, the interdisciplinary team considered the following elements in design of the alternatives:

- The goals, objectives, standards and guidelines, and desired future condition for the project areas, as outlined in the IPNF Forest Plan and St. Joe Geographic Assessment Area
- The affected environment of natural resources within the project area as described in Chapter 3
- The laws, regulations, and policies that govern land use of the National Forest System lands
- The scientific findings of the Interior Columbia Basin Ecosystem Management Project
- The Roads Analysis (FS-643, August 1999) for National Forest Transportation System (PD-4)
- The Bear Bussel Ecosystem Analysis at the Watershed Scale (PD-2)

Alternative-Driving Issues

Issue 1 - Road Construction

(Addressed with Alternatives A and C)

Some people objected to new road construction because of potential effects on resources such as water quality, fisheries, and wildlife habitat. They were also concerned about future maintenance of new roads. Alternatives C does not include new road construction, specifically to address this issue. See descriptions of alternatives later in this chapter.

a. Effects of new road construction on water and fish in the project area: New road construction can impact water quality and fish habitat by increasing the potential for sediment delivery to the stream system. Sediment production from new road construction is compared in the alternatives.

Measurement Criteria:

- Miles of road construction
- Sediment increase from road construction (tons / year)
- Reduction in sediment production (tons / year)
- Watershed condition / road density
- Trend of fishery condition

b. The effects of road construction on wildlife security in the project area: Road construction may alter wildlife habitat by changing the amount of secure habitat and wildlife movement or habitat connectivity. A comparison of alternatives takes into account the long-term effects of roads as they relate to open-road densities. Current levels and changes in disturbance/security resulting from implementation of the project are displayed by alternative.

Measurement Criteria:

- Total road miles and densities (wildlife analysis area).
- Security acres

Issue 2 - Controversy Over Change in Access

(Addressed with Alternative A)

Although the proposed action would increase the number of loops for motorized vehicles that are less than 50 inches wide (ATVs), it would reduce the total miles of roads and trails designated for all motorized vehicles. Many comments received from the public indicated they would like motorized access maintained or increased in the project area.

Measurement Criteria:

- Miles of road open to all vehicles
- Miles of roads and trails open to motorized vehicles less than 50 inches wide (ATVs)
- Qualitative discussion regarding access for ATVs
- Single track motorized trails

Issue 3 – Cultural Resource Concerns

(Addressed with Alternatives A and C)

The Bussel 484 Project is entirely within the Marble Creek Historic District, which is a historic logging area that has been nominated to and listed on the National Register of Historic Places. The proposed action would cause adverse effects to some of the historic sites within this district through the development and designation of the Norton Creek Railroad Grade as an ATV route. It would also cause adverse effects to some other sites in the historic district through the reconstruction of a historic wagon road for the purpose of hauling logs.

Measurement Criteria

- Number of heritage sites affected by project activity.
- Type and severity of damage to heritage sites.
- Potential for mitigation measures to reduce damage to cultural resources.

Other Concerns

These concerns are not alternative-driving issues but are important for identifying design features and for showing effects of the alternatives on different resources. More detail is presented in Chapter 3 for past, present, and reasonably foreseeable activities on National Forest System lands and other lands; management indicator species viability; old growth; soil quality; effects of noxious weeds; visual quality; effectiveness of best management practices; models used for the water analysis; water quality; aquatic habitat conditions and trends; snag habitat and woody debris; previous regeneration success levels; forest insects and diseases; and economics.

Cumulative Impacts of the Project

Past, present, and reasonably foreseeable activities are displayed at the beginning of Chapter 3. These include actions on National Forest lands and on other lands. Each resource section in Chapter 3 discusses the existing condition and cumulative effects of alternatives in addition to past, present, and reasonably foreseeable future activities. The activities that occurred in the past in addition to natural conditions make up the existing condition for each resource. In some cases the effects of past activities are easily discernable (*e.g.* soils were disturbed as a result of previous logging), but in other cases the effects of past human activities and natural occurrences can only be displayed as part of the existing condition (*e.g.* Sediment moving through a stream may be a result of natural conditions combined with human activity; but separating individual sediment contributions from past sources is extremely difficult.). Cumulative effects areas are different for different resources. See Chapter 3 for discussions on cumulative effects and cumulative effects analysis areas for each resource.

Emphasis on Regeneration Harvest Systems

The proposed action that was sent to the public in 2005 did include more regeneration harvests, but some of the silvicultural prescriptions have changed since then. The proposed action as described in this EIS does not emphasize regeneration harvest systems. Approximately 16% of the proposed timber harvest areas would be treated with regeneration harvest systems (Table 2-1). Of the 2,137 acres of proposed timber harvest, 652 acres would be wholly or partially treated with regeneration systems (seedtree, clearcut with reserves, and group shelterwood). An estimated 521 acres would be group shelterwood harvests where the areas between openings

would only be thinned. Approximately 224 acres in the group shelterwood units would be openings or regeneration harvests. The portion of the GSW units that would be regeneration harvests (224 acres) added to the seedtree (53 acres) and clearcut units (78 acres) equals approximately 355 acres which is approximately 17% of the total proposed timber harvest. Please see descriptions of silvicultural systems under *Activities Common to the Action Alternatives*.

Table 2-1 Proposed Silvicultural Prescriptions

Proposed Acres of Each Silvicultural Prescription					
Commercial Thin	**Group Shelterwood (GSW)**		**Seedtree**	**Clearcut w/ Res.**	**Total**
	CT part of GSW	**GSW Regeneration Harvest**			
1,486 acres	297 acres	224 acres	53 acres	78 acres	2,137 acres
Percent of Total Proposed Harvest for each Silvicultural Prescription					
Commercial Thin	**CT part of GSW**	**Regeneration part of GSW**	**Seedtree**	**Clearcut w/ Res.**	**Total**
70%	14%	10%	2%	4%	100%

Concentrated Use in Other Areas after Roads are Closed

When roads are closed and access is reduced, other areas may experience increased use. This is considered in the Recreation analysis in Chapter 3.

Roadless Areas and Unroaded Resource Values

Roadless areas and unroaded resource values are not addressed in detail. Scoping did not reveal concerns about these subjects because they do not pertain to this analysis. There are no Inventoried Roadless Areas in or adjacent to the project area (RDLS-1). Areas without roads in the project area are not large enough to provide roadless resources values. Their proximity to roads would make them difficult to manage for wilderness, and they are too small to provide high-quality wilderness experiences (RDLS-2).

Grazing

There are no grazing allotments within the Bussel 484 Project Area, so livestock are not permitted to graze in the area. Cattle do occasionally wander into the project area, but there is no appreciable cattle grazing in the project area.

Sensitive Plants

Unit 137 was eliminated from the proposed action because sensitive plants occur throughout the unit, and it would be impractical to implement the vegetation treatments after incorporating protection measures in unit design.

Timber Targets

Part of the purpose and need for the proposed action is to provide wood products for the local communities (p. 2) and manage lands suitable for timber production. It is anticipated that the Bussel 484 Project would contribute timber volume to the IPNF's allowable sale quantity for fiscal years 2008 and 2009 (Table 2-20).

Law Enforcement and Unauthorized Vehicle Use

It's recognized that unauthorized vehicle use in the Bussel 484 Project Area is occurring (see Chapter 2: *Seasonal Closure of Road 3658 …*, *Road Management Prescriptions*; Chapter 3 *Cultural Resources, Fisheries, Recreation, and Wildlife*). Part of the purpose for this project is to address unauthorized motor vehicle use and move towards the implementation of the National Off-Highway Vehicle Rule (see *Purpose and Need*). Designating motorized vehicle routes would clarify where motorized vehicles are allowed.

Range Of Alternatives

Section 102(2)(e) of the National Environmental Policy Act (NEPA) states that all Federal agencies shall "study, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflict concerning alternative uses of available resources."

An environmental assessment must also "rigorously explore and objectively evaluate all reasonable alternatives" [40 CFR 1502.14(a)].

The courts have established that this direction does not mean that every conceivable alternative must be considered, but that selection and discussion of alternatives must permit a reasoned choice and foster informed decision making and informed public participation.

The range of alternatives presented in this chapter was determined by evaluating public and internal comments and the Purpose and Need for the project. Other influences included Forest Plan goals, objectives, desired future condition, and standards and guidelines; federal laws, regulations, and policies; and economic viability. Within these parameters, the alternatives developed by the interdisciplinary team display a reasonable range of outputs, treatments, costs, management requirements, design features, and effects on resources. In addition to the alternatives considered in detail, the interdisciplinary team examined a number of other alternatives during the analysis process.

Although these alternatives contributed to the reasonable range, they were eliminated from further consideration for the reasons listed below.

Management Options Considered but not Analyzed in Detail

Prescribed Burning (burning with no commercial timber harvest or burning outside proposed harvest units) See project file document FF-11 for more information.

Existing stand characteristics, adjacent privately owned land, potential risk of damage to actively managed timber stands, and the anticipated effects of the current trends in climate change on potential fire severity preclude the use of fire as the primary tool for managing the vegetation within the Bussel Creek watershed even though low- or mixed-severity fire is not uncommon to some of the habitat types within the analysis area. The use of fire as the primary management tool within this analysis area would not meet the stated purpose and need for vegetation management or for local community contributions.

The majority of the stands proposed for harvesting in the Bussel analysis area lie within the perimeters of two past fires (Appendix A Map 12). One fire occurred in 1922 and the other in 1931. Most of the overstory conifers within these stands were established no earlier than the year after the fires. Therefore, the oldest trees, with the exception of the few remaining survivors of the fires, are 84 or 76 years old within the 1922 and 1931 burns respectively. The area between the two burns in the Norton Creek vicinity is a patchwork of past harvesting activity with some unharvested areas. The Norton Creek drainage contains many of the young early seral regenerating stands within the analysis area. Except for the riparian areas, this land is Management Area 1 and 4 which is designated for timber production. Much investment has been made in these stands through site preparation and reforestation activities. These stands are stocked with young trees that, regardless of species, have thin bark because of their age and are therefore highly susceptible to fire induced mortality. An escape prescribed fire would pose unacceptable risks to these actively managed timber stands.

Early in the season it would not be possible to use prescribed fire under the tree canopy because of moist conditions, but when conditions begin to dry in mid-summer risk of escaped fire becomes too high. Canopy cover within the analysis area is very high. High canopy cover results in heavy shading of the forest floor, keeping fuel temperatures low and fuel moistures high throughout the spring and early summer. Natural fuels and the forest floor climate make it very difficult for a fire to spread on the ground during typical spring prescribed burning conditions. Later in the season on warm days from July through September the transition from benign surface fire to problematic crown fire can occur rapidly and is difficult or impossible to control. This type of fire behavior would result in much mortality and make it very difficult to keep a fire on the National Forest System lands. This would pose a substantial unacceptable risk to adjacent privately owned lands.

At the time when the Bussel 484 Project Area would be able to carry a fire other areas in northern Idaho, the Forest Service's Northern Region, and the Pacific Northwest could be experiencing wildfire activity. Research indicates that fire seasons have become longer and will continue that trend with more fires escaping initial suppression efforts and "hotter" fires (Brown 2004).

The St. Joe Ranger District is proposing to use prescribed fire in other areas on the district to achieve silvicultural and other resource objectives; but the Bussel Creek Drainage is not the place to do that because of the adjacent private land, the previous investment in regeneration, and the existing stand conditions (FF-11).

ATV Access for the Entire Bussel Project Area

Providing motorized recreational access is part of the purpose and need for this project, but direction for management of National Forest System lands in the Bussel Creek Drainage includes multiple uses. Most of the Bussel 484 Project Area falls within Management Areas 1 and 4. Forest Plan direction related to recreation and access for those areas are shown below.

> MA-1: Provide opportunities for dispersed recreation. Manage dispersed recreation primarily for roaded modified and roaded natural Recreation Opportunity Spectrum (ROS) classes. Maintain a diversity of recreation opportunities (FP III-2).
>
> MA-4: Provide for opportunities for dispersed recreation consistent with wildlife habitat needs. Manage dispersed recreation primarily for roaded modified and roaded natural ROS classes. Motorized use is generally restricted to designated routes. Within critical habitat components motorized recreation use may be restricted to provide needed wildlife security (FP III-17).

Access restrictions are needed to reduce sediment production, provide non-motorized recreational opportunities, protect sensitive areas, and increase the amount and improve the distribution of wildlife security. See *Purpose and Need for Action* above.

Restoration Alternative with No Motorized Access

The proposed action is a restoration alternative; however, the Bussel Creek Drainage has a long history of motorized use, and it is the intent of the Forest Plan to continue that use. There are many areas other places on the St. Joe District where motorized access is not allowed. As stated above, most of the Bussel 484 Project Area falls within Management Areas 1 and 4. Forest Plan direction related to recreation for those areas are shown below.

> MA-1: Provide opportunities for dispersed recreation. Manage dispersed recreation primarily for roaded modified and roaded natural Recreation Opportunity Spectrum (ROS) classes. Maintain a diversity of recreation opportunities (FP III-2).
>
> MA-4: Provide for opportunities for dispersed recreation consistent with wildlife habitat needs. Manage dispersed recreation primarily for roaded modified and roaded natural ROS classes. Motorized use is generally restricted to designated routes. Within critical habitat components motorized recreation use may be restricted to provide needed wildlife security (FP III-17).

The proposed action would reduce the miles of roads and trails designated for motorized use in order to increase wildlife security, protect water quality, provide non-motorized recreational opportunities, and protect sensitive areas; but it would continue to provide motorized access as directed in the Forest Plan.

Restrict Motorized Access on Lines Creek Trail 246 and Only Allow Non-motorized Use

The proposed action represents a compromise for wildlife security and motorized access in the project area. It would increase wildlife security in the northeast part of the project area and provide motorized access in the southwest part. The existing condition and the proposed action allow motorized access on Trail 246. This is part of the effort to balance the need for wildlife security in the eastern part of the project area with the need to provide motorized access some place in the project area.

Keep Bussel Creek Trail Open to Single-Track Motorized and Connect to Marble Creek

This is the existing condition and is considered under Alternative A. The proposed action attempts to balance motorized access with resource protection. The proposed action would provide increased wildlife security in the eastern part of the project area, while improving the motorized access in the western part of the project area. The State of Idaho has set total maximum daily loads (TMDLs) for sediment in Bear Creek and Little Bear Creek that require a reduction in sediment. Eliminating motorized use of the trail would help reduce sediment production at the crossings at Bear Creek and Little Bear Creek. Allowing motorized access on the Bussel Creek Trail has resulted in people using motorized vehicles off the trail in the meadows. Restricting motorized access on the trail will help protect the adjacent meadows.

Seasonal Closure of Road 3658 that would Allow ATV Access Part of the Year

Forest Road 3658 currently has a gate at its junction with FR 758. The gate is not effective in prohibiting use (e.g. ATV), and wildlife security is not provided because of motorized vehicle use on the road. Based on experiences with anything other than making it physically impossible for motorized vehicles to use a road, a seasonal restriction would not provide the security that is needed (see *Purpose and Need for Action* beginning on page 2). Problems with seasonal restrictions are primarily because of unauthorized use and the Forest Service's inability to enforce restrictions. Putting the road into Road Management Prescription C (see description of road management prescriptions in the *Activities Common to the Action Alternative* section later in this chapter) is the only way to assure that the security needed and analyzed for would actually be realized. Also, as discussed above, the State of Idaho developed TMDLs for Bear Creek and Little Bear Creek. Removing culverts and rehabilitating stream crossings would eliminate chronic sources of sediment in these streams and eliminate the potential for large sediment contributions if culverts were to wash out.

Leave Culverts in Place

Sediment enters streams where roads cross streams. Removing culverts and rehabilitating stream crossings would eliminate chronic sources of sediment and eliminate the potential for large sediment contributions if culverts were to wash out. As discussed above, the State of Idaho developed TMDLs for Bear Creek and Little Bear Creek that require the Forest Service to reduce sediment production. Roads are the biggest human-caused contributors of sediment, so rehabilitating stream crossings is the most effective method for reducing sediment additions. When roads are not needed or are not needed for a long time, removing culverts reduces road maintenance costs and eliminates the risk of culverts washing out.

Create Vistas to Incorporate Public Education about Past and Present Management

The need to create vistas was not identified because the project area currently provides some viewing areas. The Bussel Creek Drainage is within the Marble Creek Historical Area, so the opportunity for additional interpretive signs does exist. This project would not preclude installing additional signs in the future if funding becomes available.

Limit Ground-based Skidding to Dry Conditions or Frozen Ground with at Least Two Feet of Snow

Analysis shows that the selected timber harvest using the indicated logging systems and mitigation measures would meet Forest Plan and Regional standards for soils (see *Soils* section in Chapter 3), so the need to require additional measures was not identified. Winter logging does not always guarantee protection of soils. Weather conditions that allow effective winter logging do not always occur on the St. Joe Ranger District. If snow accumulations do result in a protective layer, weather conditions can change overnight making operations on snow impossible. At other times too much snow can make operations impracticable.

Alternative Descriptions

Alternative A – No Action

The National Environmental Policy Act (NEPA) requires that an EIS include a "no-action" alternative to serve as a baseline to compare action alternatives. The No-Action Alternative is based on the premise that ecosystems continue to change in the absence of active management. Alternative A addresses issues that arise with the proposed action by not proposing any of those activities.

This alternative proposes to maintain an existing level of management within the Bussel Creek Project Area. Fire suppression, road maintenance, recreation use, pocket gopher control approved in January 2008, transmission line maintenance, and previously authorized projects would continue. It does not propose any new management. A list of activities that would continue no matter which alternative the responsible official chooses is at the beginning of Chapter 3 under Past, Present and Reasonably Foreseeable Activities.

Alternative B - Proposed Action

Alternative B includes Activities Common to Action Alternatives and Design Features & Mitigation Measures Common to Action Alternatives described below in addition to the following activities:

Timber Harvest (see Maps 3 and 4): Approximately 2,137 acres would be treated with commercial timber harvest. See *Activities Common to the Action Alternatives* section for more information about silvicultural prescriptions. The commercial timber harvest would consist of the following:

Table 2-2 Alternative B Timber Harvest Summary

Silvicultural Prescription				Yarding Method			
Commercial Thin	Group Shelterwood	Seedtree	Clearcut w/ Res.	Cable (not skyline)	Skyline	Ground-based	Helicopter
1,486 acres	521 acres	53 acres	78 acres	79 acres	795 acres	552acres	712 acres

Table 2-3 Alternative B Timber Harvest Unit Details
H = helicopter; S = skyline; C = cable; GB = ground-based;
FL = hand fireline construction; Yard Tops (200 feet) = 200 feet from top of unit

Unit	Silvicultural Rx	Acres	Yarding Method	Fuel Treatment
5	Commercial Thin	15	H	Lop / Yard Tops (200 feet)
6	Commercial Thin	22	H	Lop / Yard Tops (200 feet)
11	Commercial Thin	14	GB	Yard Tops
		11	H	Lop
		32	S	Lop / Yard Tops (200 feet)
14	Commercial Thin	7	GB	Yard Tops / FL* / Jackpot Burn
		32	S	
15	Commercial Thin	8	GB	Lop / Grapple Pile
		15	S	Lop / Yard Top (200 feet)
17	Commercial Thin	10	GB	Lop / Slash
		43	S	Lop / Slash / Yard Tops (200 feet)
18	Seedtree	17	S	Lop / Yard Tops (200 feet) / FL / Broadcast Burn
30	Commercial Thin	23	H	Lop / Slash / Jackpot Burn
32	Commercial Thin	36	S	Lop / Slash
41	Group Shelterwood	41	H	Lop/Yard Tops, Slash, FL, Broadcast Burn Openings
70	Commercial Thin	22	GB	Lop / Grapple Pile
		16	S	Lop
84	Commercial Thin	34	GB	Lop / Grapple Pile
		10	S	Lop
95	Commercial Thin	16	H	Lop / Jackpot Burn
99	Commercial Thin	41	H	Lop
100	Clearcut w/ Reserves	3	GB	Lop / Broadcast Burn
		5	S	
104	Commercial Thin	27	H	Lop
107	Commercial Thin	3	C	Lop / Jackpot Burn
		26	GB	
110	Commercial Thin	11	GB	Lop / Slash / Jackpot Burn
		15	H	Lop / Jackpot Burn / FL / Slash
		11	S	Lop / Jackpot Burn / Slash
114	Group Shelterwood	37	GB	Lop/Yard Tops, Slash, FL, Broadcast Burn Openings
134	Group Shelterwood	49	H	Lop/Yard Tops, Slash, FL, Broadcast Burn Openings
141	Commercial Thin	9	H	Lop

Unit	Silvicultural Rx	Acres	Yarding Method	Fuel Treatment
143	Group Shelterwood	6	GB	Lop/Yard Tops, Slash, FL, Broadcast Burn Openings
		18	S	
148	Commercial Thin	19	H	Lop
		25	S	
153	Clearcut w/ Reserves	3	GB	Lop / Broadcast Burn
		8	S	
156	Commercial Thin	31	H	Lop
170	Commercial Thin	34	GB	Jackpot Burn
		7	S	Lop
175	Commercial Thin	22	H	Lop
176	Commercial Thin	6	H	Lop
		56	S	Lop / Jackpot Burn
181	Commercial Thin	14	GB	Slash / Jackpot Burn
		7	S	Lop
182	Commercial Thin	6	GB	Jackpot Burn / Slash
		12	S	Lop / Slash
183	Seedtree	36	H	Lop / FL / Broadcast Burn
197	Commercial Thin	18	H	Lop
198	Commercial Thin	46	GB	Lop / Grapple Pile
200	Commercial Thin	14	S	Yard Tops
209	Group Shelterwood	29	S	Lop/Yard Tops, Slash, FL, Broadcast Burn Openings
215	Commercial Thin	24	GB	Lop / Grapple Pile
		4	H	Lop
224	Commercial Thin	17	C	Lop
		8	GB	Lop / Grapple Pile
225	Commercial Thin	20	GB	Lop / Yard Tops
		30	H	
		6	S	
226	Commercial Thin	19	GB	Lop / Grapple Pile
232	Group Shelterwood	23	GB	Lop/Yard Tops, Slash, FL, Broadcast Burn Openings
		31	S	
233	Group Shelterwood	14	GB	Lop/Yard Tops, Slash, FL, Broadcast Burn Openings
235	Commercial Thin	10	H	Lop
248	Commercial Thin	69	GB	Lop / Grapple Pile
251	Group Shelterwood	20	C	Lop/Yard Tops, Slash, FL, Broadcast Burn Openings
		5	GB	
254	Group Shelterwood	5	GB	Lop/Yard Tops, Slash, FL, Broadcast Burn Openings
		45	S	
264	Group Shelterwood	6	GB	Lop/Yard Tops, Slash, FL, Broadcast Burn Openings
		50	S	
268	Group Shelterwood	17	GB	Lop/Yard Tops, Slash, FL, Broadcast Burn Openings
		10	S	
271	Commercial Thin	13	GB	Yard Tops
		14	S	Lop
273	Commercial Thin	22	H	Lop
275	Commercial Thin	43	H	Lop
283	Commercial Thin	39	C	Lop
		22	S	
296	Commercial Thin	17	GB	Lop
		36	S	
299	Group Shelterwood	5	GB	Lop/Yard Tops, Slash, FL, Broadcast Burn Openings
		46	S	
301	Group Shelterwood	50	H	Lop/Yard Tops, Slash, FL, Broadcast Burn Openings

Unit	Silvicultural Rx	Acres	Yarding Method	Fuel Treatment
		12	S	
302	Clearcut w/ Reserves	18	H	Lop / Broadcast Burn
303	Commercial Thin	57	H	Lop
307	Commercial Thin	10	GB	Yard Tops
		16	S	Lop
310	Commercial Thin	27	H	Lop / Jackpot Burn
311	Commercial Thin	10	GB	Yard Tops
		6	S	Lop
314	Commercial Thin	19	H	Lop
321	Commercial Thin	12	H	Lop
		16	S	Yard Tops
322	Clearcut w/ Reserves	7	GB	Yard Tops / Broadcast Burn
		33	S	Broadcast Burn
323	Commercial Thin	41	S	Lop
		11	H	
325	Commercial Thin	15	S	Lop
336	Commercial Thin	8	H	Yard tops / FL / Jackpot Burn

Fuel Treatment: Fuels resulting from timber harvest would be treated. This would include approximately 316 acres of yarding tops, 1,742 acres of lopping, 181 acres of slashing, 230 acres of grapple piling followed by pile burning, 20.2 miles of fireline construction, 307 acres of broadcast burning, and 289 acres of jackpot burning. Biomass removal for the St. Maries School District Fuels to Schools Project would be a by-product of the proposed fuel treatment. Piled material may be used for the Fuels to Schools Project. See *Activities Common to the Action Alternatives* section for more information about fuel treatments.

Reforestation: Conifer seedlings would be planted on approximately 367 acres in areas proposed for regeneration harvest. Planting would supplement the expected natural regeneration. Planted conifer seedlings would enhance diversity, assure timely reforestation, and contribute to long-term desired habitat conditions. All planting would be a mix of species, but would predominantly be early-seral western white pine, western larch, and ponderosa pine (where appropriate), mixed with Douglas-fir and other species appropriate for the habitat type and site conditions.

Pocket Gopher Control: Baiting may be done to control pocket gophers on approximately 367 acres in areas proposed for regeneration harvests if needed to protect regeneration. Baiting would include placing either 0.5% strychnine treated oats or 2.0% zinc phosphide oats into pocket gopher tunnels by hand. An initial treatment would be followed by additional treatments, if needed, to minimize losses in the regeneration and meet stocking objectives.

Timber Stand Improvement (see Map 6): Approximately 821 acres of precommercial thinning is proposed to improve the growing conditions of the selected trees by eliminating competition for light and nutrients. This includes 555 acres of white pine pruning that would be done in areas that are also thinned. See *Activities Common to the Action Alternatives* section for more detail about timber stand improvement work.

System and Temporary Road Construction and System Road Reconstruction (see Map 4):

Approximately 5.1 miles of system road and 0.5 miles of temporary road would be constructed on National Forest System lands to facilitate timber harvest. Additional 0.2 miles of road construction is proposed across lands owned by Potlatch Corporation (see *Cost Share Roads* below). When harvest-associated work is completed all 5.1 miles of the new system road would be placed into Road Management Prescription C for future use and would not be designated for motorized vehicle use. A total of 6.7 miles of road would be reconstructed.

Road construction plans, standards and specifications for new system roads would provide for minimum needed road width, drainage and safe operation while incorporating measures for mitigating for resource disturbances. New roads would be single-lane facilities, suitable for log truck or lowboy use.

Temporary roads would be fully recontoured to the natural slope when yarding operations served by that road are complete. Temporary roads that remain on the landscape more than one dry season would be waterbarred to minimize erosion. After recontouring they would then be covered with a natural, weed-free material to prevent runoff and erosion during spring and/or winter runoff events. This could be on-site slash, straw, or other suitable material.

Alternative B includes reconstruction of Road 3570A which would not be reconstructed in Alternative C. Alternative B would reconstruct a total of 6.7 miles of road (Table 2-4). See *Activities Common to the Action Alternatives* section for more detail about road reconstruction.

Table 2-4 Proposed Road Reconstruction for Alternative B

Road #	1900F	1902	1902B	1902C	1498C	3570A	Total
Miles	1.0	0.7	1.0	0.3	2.4	1.3	**6.7**

Cost Share Roads (see Map 4): Approximately 0.2 miles of road would be constructed on Potlatch Corporation lands under the Merry Creek Cost Share Supplement to facilitate timber harvest on National Forest System lands. New construction cost may be shared with Potlatch Corporation or a non-cost share easement would be given to the Forest Service. Forest Service would buy into Roads 226C, 226J, 226M and un-numbered existing Potlatch road to proposed Units 325 and 325.

Access Management (see Map 8): Approximately 20.3 miles of roads would be open to all licensed vehicles, 19.9 miles of roads and trails would be open to vehicles less than 50 inches wide, and 31.0 miles of roads and trails would be available for non-motorized use only. This includes 5.1 miles of road that would be constructed. Approximately 10.7 miles of road would be decommissioned and would no longer provide access. The proposed action would result in higher quality ATV routes with more loops and it would provide three areas of wildlife security to improve the amount and distribution of wildlife security in the area. The proposed action would:

- Install effective restriction devices throughout the project area.
- Remove the gate on Road 1498. The road is currently open and the proposed action is to leave the road open, so there is no need for the gate.
- Construct 0.2 miles of new trail for motorized vehicles less than 50 inches wide between Roads 1901C and 3590A.
- Convert Bussel Creek Trail 258 (6.5 miles in and outside of the project area) to non-motorized use, remove culverts, and harden stream crossings.
- Designate Lines Creek Historical Trail as open to motorized vehicles less than 50 inches wide (3.0 miles).
- Repair and restore the entire Norton Creek Railroad Grade and designate it open to motorized vehicles less than 50 inches wide (4.3 miles).

Table 2-5 Existing and Proposed Access on NFS lands in the Project Area (Alternative B)

Roads	Existing Access Alternative A	Proposed Access Alternative B	Net Change
Open	31.8 miles	20.3 miles	-11.5 miles
Motorized < 50”	28.4 miles	13.1 miles	-15.3 miles
Non-motorized	6.4 miles	31.0 miles*	+24.6 miles
Trails			
Motorized <50”	6.6 miles	6.8 miles	+0.2 miles
Non-Motorized	4.2 miles	4.3 miles	+0.1 miles

** Includes 5.1 miles of new road construction.*

Road Management Prescriptions (see Map 11): The proposed action decommissions as many high-risk, lower-value roads as possible. Approximately 32.3 miles of existing roads would be in Road Management Prescription C or D after implementation, and 57 culverts would be removed. See *Activities Common to the Action Alternatives* section for more detail about Road Management Prescriptions and proposed changes.

Aquatic Habitat Improvement:

Riparian Planting: Native conifers and shrubs would be planted in some riparian areas up to a total of approximately 1.8 miles along Bear and Little Bear Creeks and in other parts of the Bussel Creek Drainage. This would be accomplished over a period of 10 to 15 years.

Large Woody Debris Placement: A helicopter and hand crews would be used to place 100-200 cover logs in the stream channel of Bear Creek and mechanical equipment would be used to place 100-200 cover logs in upper Bussel Creek to increase stream cover, improve fish habitat and large woody debris to increase stream cover, improve fish habitat and large woody debris. This would take place over 2.5 to 3 miles of stream channel within the Bussel and Bear Creek drainages.

Fish Migration Barrier Removal: To eliminate two human-created fish passage barriers two culverts on Road 1900 would be replaced with culverts specifically designed for fish passage.

Stream Crossing Rehabilitation: Approximately forty-nine stream crossings would be removed throughout the project area as part of the road management prescription changes discussed above.

Alternative C

Alternative C differs from Alternative B to address concerns about road construction and cultural resources. Alternative C does not include any road construction on National Forest System lands or Potlatch Corporation lands. Approximately 5.4 miles of road would be reconstructed compared to Alternative B's 6.7 miles of reconstruction. Alternative C has more helicopter yarding than Alternative B, and fuel treatments would be different in some of those units (Tables 2-6 and 2-7). Only 2.9 miles of the Norton Creek Railroad Grade would be designated for ATV use, and ATV access to the rest of the grade would be blocked with physical barriers.

To address Issue 1 – Road Construction, Alternative C does not include road construction. Although it has the same timber harvest units with the same silvicultural prescriptions as Alternative B, some of the yarding methods are different because roads would not be constructed to access those areas. There would be no road construction, but approximately 5.4 miles of road would be reconstructed on NFS land (Table 2-8).

To address Issue 3 – Cultural Resource Concerns, only part of the Norton Creek Railroad Grade would be repaired and be designated open to ATVs, and Road 3570A would not be reconstructed for timber hauling. The remaining 1.4 miles of the Norton Creek Grade would not be designated for motorized use. Otherwise, access changes would be the same in Alternative C as they would be for Alternative B.

Alternative C includes Activities Common to Action Alternatives and Design Features and Mitigation Common to the Action Alternatives as part of the following activities:

Timber Harvest (see Maps 3 and 5): Approximately 2,137 acres would be treated with commercial timber harvest. It proposed the same timber harvest units and the same silvicultural prescriptions as Alternative B, but some of the yarding methods would be different. No roads would be constructed, so this alternative includes less ground-based yarding and more helicopter yarding than Alternative B. The commercial timber harvest would consist of the following:

Table 2-6 Alternative C Summary of Silvicultural Prescriptions and Yarding Methods

Silvicultural Prescription				Yarding Method			
Commercial Thin	Group Shelterwood	Seedtree	Clearcut w/ Reserves	Cable (not skyline)	Skyline	Ground-based	Helicopter
1,486 acres	521 acres	53 acres	78 acres	20 acres	297 acres	389 acres	1,431 acres

Table 2-7 Alternative C Timber Harvest Unit Details
H = helicopter; S = skyline; C = cable; GB = ground-based;
FL = hand fireline construction; Yard Tops (200 feet) = 200 feet from top of unit

Unit	Silvicultural Rx	Acres	Yarding Method	Fuel Treatment
5	Commercial Thin	15	H	Lop / Yard Tops (200 feet)
6	Commercial Thin	22	H	Lop / Yard Tops (200 feet)
11	Commercial Thin	14	H	Yard Tops (200 feet)
		43		Lop
14	Commercial Thin	39	S	Yard Tops / FL / Jackpot Burn
15	Commercial Thin	8	GB	Lop / Grapple Pile
		15	H	Lop
17	Commercial Thin	10	H	Slash / Yard Tops (200 feet) / Grapple Pile
		43		Lop / Slash
18	Seedtree	17	H	Lop / Yard Tops (200 feet) / FL / Broadcast Burn
30	Commercial Thin	23	H	Lop / Slash / Jackpot Burn
32	Commercial Thin	36	S	Lop
41	Group Shelterwood	41	H	Lop/Yard Tops, Slash, FL, Broadcast Burn Openings
70	Commercial Thin	22	GB	Lop / Grapple Pile
		16	S	Lop
84	Commercial Thin	34	GB	Lop / Grapple Pile
		10	S	Lop
95	Commercial Thin	16	H	Lop / Jackpot Burning
99	Commercial Thin	41	H	Lop
100	Clearcut w/ Reserves	3	GB	Lop / Broadcast Burn
		5	S	
104	Commercial Thin	27	H	Lop
107	Commercial Thin	3	C	Lop / Jackpot Burn
		26	GB	
110	Commercial Thin	11	GB	Lop / Slash / Jackpot Burn
		15	H	Lop / Slash / FL / Jackpot Burn
		11	S	Lop / Slash / Jackpot Burn
114	Group Shelterwood	37	GB	Lop/Yard Tops, Slash, FL, Broadcast Burn Openings
134	Group Shelterwood	49	H	Lop/Yard Tops, Slash, FL, Broadcast Burn Openings
141	Commercial Thin	9	H	Lop
143	Group Shelterwood	6	GB	Lop/Yard Tops, Slash, FL, Broadcast Burn Openings
		18	S	
148	Commercial Thin	19	H	Lop
		25	S	
153	Clearcut w/ Reserves	3	GB	Lop / Broadcast Burn
		8	S	
156	Commercial Thin	31	H	Lop
170	Commercial Thin	34	GB	Jackpot Burn
		7	S	Lop
175	Commercial Thin	22	H	Lop
176	Commercial Thin	62	H	Lop / Jackpot Burn
181	Commercial Thin	14	GB	Slash / Jackpot Burn
		7	S	Lop
182	Commercial Thin	6	GB	Slash / Jackpot Burn
		12	S	Lop / Slashing
183	Seedtree	36	H	Lop / FL / Broadcast Burn
197	Commercial Thin	18	H	Lop
198	Commercial Thin	46	H	Lop
200	Commercial Thin	14	S	Yard Tops
209	Group Shelterwood	29	S	Lop/Yard Tops, Slash, FL, Broadcast Burn Openings
215	Commercial Thin	24	GB	Lop / Grapple Pile

Unit	Silvicultural Rx	Acres	Yarding Method	Fuel Treatment
		4	H	Lop
224	Commercial Thin	17	C	Lop
		8	GB	Lop / Grapple Pile
225	Commercial Thin	56	H	Lop
226	Commercial Thin	19	H	Lop
232	Group Shelterwood	23	GB	Lop/Yard Tops, Slash, FL, Broadcast Burn Openings
		31	H	
233	Group Shelterwood	14	GB	Lop/Yard Tops, Slash, FL, Broadcast Burn Openings
235	Commercial Thin	10	H	Lop
248	Commercial Thin	69	GB	Lop / Grapple Pile
251	Group Shelterwood	25	H	Lop/Yard Tops, Slash, FL, Broadcast Burn Openings
254	Group Shelterwood	50	H	Lop/Yard Tops, Slash, FL, Broadcast Burn Openings
264	Group Shelterwood	56	H	Lop/Yard Tops, Slash, FL, Broadcast Burn Openings
268	Group Shelterwood	27	H	Lop/Yard Tops, Slash, FL, Broadcast Burn Openings
271	Commercial Thin	13	GB	Yard Tops
		14	S	Lop
273	Commercial Thin	22	H	Lop
275	Commercial Thin	43	H	Lop
283	Commercial Thin	61	H	Lop
296	Commercial Thin	53	H	Lop
299	Group Shelterwood	51	H	Lop/Yard Tops, Slash, FL, Broadcast Burn Openings
301	Group Shelterwood	50	H	Lop/Yard Tops, Slash, FL, Broadcast Burn Openings
		12	S	
302	Clearcut w/ Reserves	18	H	Lop / Broadcast Burn
303	Commercial Thin	57	H	Lop
307	Commercial Thin	10	H	Yard Tops
		16	H	Lop
310	Commercial Thin	27	H	Lop / Jackpot Burn
311	Commercial Thin	16	H	Lop
314	Commercial Thin	19	H	Lop
321	Commercial Thin	28	H	Lop
322	Clearcut w/ Reserves	7	GB	Yard tops / Broadcast Burn
		33	S	Broadcast Burn
323	Commercial Thin	52	H	Lop
325	Commercial Thin	15	H	Lop
336	Commercial Thin	8	H	Lop / FL / Jackpot Burn

Fuel Treatment: Fuels resulting from timber harvest would be treated. This would include approximately 273 acres of yarding tops, 1,766 acres of lopping, 145 acres of slashing, 175 acres of grapple piling followed by pile burning, 20.2 miles of fireline construction, 307 acres of broadcast burning, and 295 acres of jackpot burning. Biomass removal for the St. Maries School District Fuels to Schools Project would be a by-product of the proposed fuel treatment. Piled material may be used for the Fuels to Schools Project. See *Activities Common to the Action Alternatives* section for more information about fuel treatments.

Reforestation (same as Alternative B): Conifer seedlings would be planted on approximately 367 acres in areas proposed for regeneration harvest. Planting would supplement the expected natural regeneration. Planted conifer seedlings would enhance diversity, assure timely reforestation, and contribute to long-term desired habitat conditions. All planting would be a mix of species, but would predominantly be early-seral western white pine, western larch, and ponderosa pine (where appropriate), mixed with Douglas-fir and other species appropriate for the habitat type and site conditions.

Pocket Gopher Control (same as Alternative B): Baiting may be done to control pocket gophers on approximately 367 acres in areas proposed for regeneration harvests if needed to protect regeneration. Baiting would include placing either 0.5% strychnine treated oats or 2.0% zinc phosphide oats into pocket gopher tunnels by hand. An initial treatment would be followed by additional treatments, if needed, to minimize losses in the regeneration and meet stocking objectives.

Timber Stand Improvement (same as Alternative B; see Map 6): Approximately 821 acres of pre-commercial thinning is proposed to improve the growing conditions of the selected trees by eliminating competition for light and nutrients. This includes 555 acres of white pine pruning that would be done in areas that are also thinned. See *Activities Common to the Action Alternatives* section for more detail about timber stand improvement work.

Road Reconstruction (see Map 5): Alternative C includes 5.4 miles of road reconstruction (Table 2-8). To address cultural resource concerns, Road 3570A would not be reconstructed for timber hauling.

Table 2-8 Proposed Road Reconstruction for Alternative C

Road #	1900F	1902	1902B	1902C	1498C	Total
Miles	1.0	0.7	1.0	0.3	2.4	**5.4**

Cost Share Roads: No road construction would be required on Potlatch Corporation land.

Access Management (see Map 9): Approximately 20.3 miles of roads would be open to all licensed vehicles, 18.5 miles of roads and trails would be open to vehicles less than 50 inches wide, and 27.2 miles of roads and trails would be available for non-motorized use only. Approximately 10.7 miles of road would be decommissioned and would no longer provide access. To address concerns about cultural resources only part of the Norton Creek Railroad Grade would be repaired. The remaining 1.4 miles of the Norton Creek Grade would not be designated for motorized use. Alternative C would:

- Install effective restriction devices throughout the project area.
- Remove the gate on Road 1498. The road is currently open and the proposed action is to leave the road open, so there is no need for the gate.
- Construct 0.2 miles of new trail for motorized vehicles less than 50 inches wide between Roads 1901C and 3590A.
- Convert Bussel Creek Trail 258 (6.5 miles in and outside of the project area) to non-motorized use, remove culverts, and harden stream crossings.
- Designate Lines Creek Historical Trail as open to motorized vehicles less than 50 inches wide (3.0 miles).
- Repair part of the Norton Creek Railroad Grade and designate that part open to motorized vehicles less than 50 inches wide (2.9 miles).

Table 2-9 Existing and Proposed Access on NFS lands in the Project Area (Alternative C)

Roads	Existing Access Alternative A	Proposed Access Alternative C	Net Change
Open	31.8 miles	20.3 miles	-11.5 miles
Motorized < 50”	28.4 miles	13.1 miles	-15.3 miles
Non-motorized	6.4 miles	21.6 miles	+15.2 miles
Trails			
Motorized <50”	6.6 miles	5.4 miles	-1.2 miles
Non-Motorized	4.2 miles	5.6 miles	+1.4 miles

Road Management Prescriptions (see Map 11): The proposed action decommissions as many high-risk, lower-value roads as possible. Approximately 32.3 miles of existing roads would be in Road Management Prescription C or D after implementation, and 57 culverts would be removed. See *Activities Common to the Action Alternatives* section for more detail about Road Management Prescriptions and proposed changes.

Aquatic Habitat Improvement:

Riparian Planting: Native conifers and shrubs would be planted in some riparian areas up to a total of approximately 1.8 miles along Bear and Little Bear Creeks and in other parts of the Bussel Creek Drainage. This would be accomplished over a period of 10 to 15 years.

Large Woody Debris Placement: A helicopter and hand crews would be used to place 100-200 cover logs in the stream channel of Bear Creek and mechanical equipment would be used to place 100-200 cover logs in upper Bussel Creek to increase stream cover, improve fish habitat and large woody debris to increase stream cover, improve fish habitat and large woody debris. This would take place over 2.5 to 3 miles of stream channel within the Bussel and Bear Creek drainages.

Fish Migration Barrier Removal: To eliminate two human-created fish passage barriers two culverts on Road 1900 would be replaced with culverts specifically designed for fish passage.

Stream Crossing Rehabilitation: Approximately forty-nine stream crossings would be removed throughout the project area as part of the road management prescription changes discussed above.

Activities Common to the Action Alternatives

These activities apply to Alternative B and Alternative C.

Timber Harvest

All harvest would be on lands identified as suitable for timber production (V-12). Various harvest methods described below are prescribed depending on individual stand conditions (see Map 3):

Clearcut with Reserves (CC w/RES) (78 acres): This is a stand-replacement activity that would remove nearly all the standing crop for the purpose of creating a new, even-aged stand. Reserves would be any tree or group of trees left uncut and kept for part of or the entire next rotation. Reserves would be safe snags; live culls; healthy, early-seral trees; and other individuals /groups of trees with specific resource value scattered throughout stand. This treatment would develop an even-aged stand structure and would include site preparation and reforestation. Reforestation would be accomplished by hand planting a species mix which consists of more than 60% early seral species appropriate for the site.

Commercial Thin (CT) (1,486 acres): This is an intermediate harvest that would be used in an immature stand in order to accelerate diameter increment and improve the average form of the trees that remain, without permanently breaking or opening the canopy. No site preparation or planting would be required. The purpose of the treatment is to regulate stand density to promote tree growth and vigor. Generally, smaller trees would be harvested and larger trees would be retained. This treatment can be applied to both even- and uneven-aged stand structures.

Seedtree Cut (ST) (53 acres): This is a regeneration cut in a mature, or near mature, stand to open its canopy to provide conditions suitable for regeneration from the seed of trees retained for that purpose. Natural regeneration is often supplemented with artificial regeneration to assure rapid stocking of the site and to provide for a desirable species composition.

Group Shelterwood (GSW) (521 acres): This is a modification of the shelterwood system which creates a stand consisting of two to three crown classes by even-aged groups. This treatment would develop openings in stands ranging in size from three to five acres, and would often include thinning or other management activities in portions of the unit not included in the openings. In general, the openings would require adequate site preparation and planting with an appropriate species mixture to support the identified resource objectives, especially assisting in reestablishing early-seral species in the stand. Although this treatment would develop a multi-storied even-aged stand, it is restricted to development of three crown classes or less. All openings created in group shelterwood harvest units would have the tops yarded out of them and would have fire line constructed around them. Slashing of advanced regeneration would occur in units where excessively high numbers of mid- to late-seral saplings and small poles exist.

Road Reconstruction

Some existing roads would require reconstruction to their approved traffic service level or would be improved to increase safety, operational efficiency or resource protection (improve drainage and improve water quality). For this document, reconstruction includes rebuilding roads to their original standards. Reconstruction may include the installation of drain dips and culverts, grading, clearing, dust abatement, and resurfacing. All road reconstruction plans, standards and specifications would provide for minimum needed road width, drainage and safe operation while incorporating measures for mitigating for resource disturbances.

The overall existing condition of roads to be reconstructed is generally inadequate for resource protection or anticipated use or the road is impassable for the design vehicle. Spot reconstruction on some roads would also occur, where the primary disturbance is confined to a limited area, such as culvert installations, rebuilding a shoulder or addition of turnouts. Areas between the spots generally would need reconditioning (reshaping and processing the road surface and ditches and brushing the shoulders). Most of the work described as reconstruction and reconditioning would actually be maintenance (FSM 7705) to restore the road to its original condition. Twelve undersized culverts on Roads 1900, 1904, 758, 3590, 1254 would be replaced with culverts large enough to accommodate a 100-year flood event (Table 2-10; SW-31).

Table 2-10 Culvert Upgrades to Accommodate 100-Year Flood Event

Road #	# of Culverts Upgrades	Proposed Road Management Rx
1900	2	Open, A, B
1904	2	Open
758	4	Open
3590A	2	A
1254	2	Open, B
Total	12	

Fuels Reduction

Fuel reduction activities are prescribed in accordance with silvicultural prescriptions and are intended to facilitate the achievement of silvicultural objectives while fulfilling the requirements of Forest Plan protection standards.

Jackpot burning: Many units proposed for commercial thinning are anticipated to have an overstory composed primarily of desirable, long-lived, early-seral tree species that are large enough to endure low-intensity, surface fire. These units would be jackpot burned to kill existing natural regeneration of mid- and late-seral, fire-intolerant tree species; improve wildlife habitat; and reduce fuels generated by the timber harvest. Jackpot burning breaks up and reduces fuel concentrations.

Broadcast burning: All openings created through seed tree, group shelterwood, and clearcut with reserves silvicultural prescriptions would be broadcast burned to reduce fuels resulting from the harvest activities and for site preparation.

Excavator (grapple) piling: To facilitate fuel reduction while protecting remaining trees, woody debris would be gathered and piled mechanically using an excavator. The piles would be burned in the late fall during periods of optimum smoke dispersal. The piles would not be placed next to leave trees or leave islands to protect them from possible ignition.

Lopping: Lopped units would have limbs and unmerchantable tops of harvested trees left in units. These limbs and tops would be lopped to a maximum slash depth of 18 inches. The lopped limbs are more subject to compression by snow loads. This proximity to the ground increases the rate at which the slash decomposes.

Slashing: Slashing is the cutting of unwanted advanced regeneration that is between 0.1 and 5.0 inch diameter at breast height. Slashing reduces inter-tree competition for water and nutrients, controls the species composition of the developing understory, and removes ladder fuels that may contribute to torching in the event of a fire.

Fireline: Firelines would include a fuel break with a hand fireline to mineral soil on the outside edge of the fuel break. Mineral soil will be exposed for a minimum of 12 inches and a maximum 24-inches along the entire length of the fireline. The fuel break is an area within the unit, adjacent to the fire line that is cleared of all vegetative debris larger than 1 inch in diameter and 3 feet long for a minimum width of 8 feet.

Yarding Tops: Where tops are yarded the unmerchantable tops of all harvested trees would be yarded out of the unit attached to the last log with limbs still attached. Yarding tops would reduce post harvest fuel loading in units that cannot be prescribed burned. It would also facilitate achievement of prescribed burning objectives in units that would be prescribed burned. In some units tops would be yarded only from the first 200 feet below the road. Tops would be yarded out of openings created in group shelterwood units.

Biomass Removal

Biomass removal for the St. Maries School District Fuels to Schools Project would be a by-product of the proposed fuel treatment. Piled material may be used for the Fuels to Schools Project.

Timber Stand Improvement

Approximately 821 acres of precommercial thinning is proposed to improve the growing conditions of the selected trees by eliminating competition for light and nutrients (see Table 2-11 below and Map 6 in Appendix A). This includes 555 acres of white pine pruning that would be done in areas that are also thinned. Precommercial thinning would occur in previously harvested immature stands to improve or accelerate diameter increment growth and to improve the average form of the trees retained in the stand. Existing roads would be used for getting to stands for precommercial thinning. Stands would remain fully stocked following thinning. Resulting slash will be lopped to a maximum slash depth of 18 inches. Both pruning and thinning are referred to as timber stand improvement (TSI) work.

Table 2-11 Timber Stand Improvement

Stand ID	Acres	Includes White Pine Pruning		Stand ID	Acres	Includes White Pine Pruning
484010025	26	yes		484020057*	35	yes
10026	47	yes		20115*	19	yes
10035*	48	yes		484030041	7	yes
10051	15	no		30042	6	yes
10052	23	yes		30043	5	yes
10053	44	yes		30045*	41	yes
10054	1	yes		30046	9	yes
10055	9	no		30047	25	no
10056	5	yes		484040029	12	no
10058	23	no		40081	5	no
10060	23	yes		40082	3	no
10062	5	no		40083	4	no
10064	29	yes		40084	39	no
10065	32	no		40085	17	no
10070	15	yes		40087	36	no
484020002*	7	yes		40088	33	no
20012*	33	yes		40089	11	yes
20040*	17	yes		40105	35	yes
20052*	46	yes		40130	8	no
20056	23	yes		**Total**	**821**	

** = stand is within Lynx Analysis Unit and would be thinned and pruned according to standards and guidelines in the Northern Rockies Lynx Management Direction.*

Road Management Prescriptions

The interdisciplinary team conducted a roads analysis process (RAPS) for the roads in and around the Bussel Creek Drainage. The team considered the environmental risk of each road and weighed that against the need for each road to identify what road management prescription should be implemented for that road (PD-4). The proposed action decommissions as many high-risk, lower-value roads as possible. Approximately 29.1 miles of existing roads would be put into Road Management Prescription C or D, and 57 culverts would be removed.

The St. Joe Ranger District uses the following prescriptions to help clarify how certain roads are to be managed and the extent of stabilization or recontouring that is intended. There could be some overlap of individual elements of the prescriptions in the actual implementation of the road management prescription.

Open: These roads are open for all types of vehicles.

Prescription A: Gated - These roads are generally needed for administrative or fire protection purposes with use restricted for resource concerns and/or facility protection. Road use is intermittent and generally only open for a specific use or time period (e.g. timber sale or firewood collection). These roads remain on the transportation system for current and future needs. Road maintenance is at a custodial level to protect the road investment and to minimize damage to adjacent land and resources. The roads are on a maintenance schedule to check for erosion and/ or other maintenance needs. The roadbed should have sufficient inslope, outslope or driveable water bars to facilitate good drainage. Traffic is usually controlled with a gate. Some motorized public uses may be acceptable on some routes (i.e. ATV routes, single track use).

Prescription B: This prescription is similar to A, but the use and need for the road is anticipated to occur at a lower frequency. The road may remain "closed" for a period of 5 to 15 years between uses but remains on the transportation system for future use. Temporary bridges and culverts assessed to have a higher risk of failure would be removed, and the road surface may be water barred and seeded. Traffic is usually controlled with a physical static barrier (such as a guardrail, concrete or earth barrier). The management strategy is to eliminate all over 50" width motorized use during "closure" periods. Use by vehicles under 50" width may be accepted, discouraged, eliminated or prohibited.

Prescription C: This is a long-term "storage" with no foreseeable use for the road in the next 15 to 25 years, but it may be needed at some future date. Some low impact roads that do not have a reasonably foreseeable need in the future, may also be closed at this level. The road would be outsloped and have the drainage structures removed. The intent of this prescription is to put the road into "long-term storage" where the road is not a sediment source and does not channel water. The road prism is basically left intact but in a condition that would not require any maintenance. All water courses and problem areas would be stabilized. The roadbed may require light scarification, water bars, and/or decompaction. The road would be seeded and/or planted to establish a vegetative cover in the road prism. Motorized access would be eliminated by recontouring the beginning of the road. These roads would remain on the transportation system. The management strategy is to eliminate all motorized use.

Prescription D: Roads "closed" at this level generally have a higher potential for failure than roads with a C prescription and there is a very low probability of needing the road in the future. The road would be decompacted and have major fills, embankments, and higher failure risk areas pulled up onto the roadbed and stabilized. Drainage structures would be removed from stream channels and the adjacent slopes restored to resemble natural condition. The goal of this prescription is to restore site productivity, eliminate the potential of road failures, and reestablish natural water infiltration and drainage patterns. Recontouring or partial pullback is based on site specific conditions and could range from about 20 to 100 percent of the roads length. This may require only partial recontouring, only pulling up the amount of fill necessary to stabilize the slope condition. Some cut and fill slopes or parts of cut and fill slopes may be evident in areas of recontouring. Following prescription implementation, roads would be removed from the National Forest Road System but tracked as historic routes in the INFRA database. The road management strategy is to eliminate all motorized use.

Table 2-12 below compares existing and proposed **road management prescriptions**. The management prescription can differ from what the actual access is and what access is proposed. For example the intended road management prescription for a road may be "Rx A" with a gate, but the gate may be broken, so the road is actually open in terms of access. This is why the "existing Open road" miles in the above table differ from the "existing prescription Open roads" in the table below. The existing "Open" access includes roads where access was intended to be restricted, but people are actually using restricted vehicles on them. This is documented this way so environmental effects of the existing condition can be estimated more accurately.

Table 2-12 Existing and Proposed Road Management Prescriptions for NFS Lands

Roads	Existing Prescription Alternative A	Proposed Prescription Alternatives B & C	Net Change	Proposed Rx of New System Construction Alternative B	Alternative B Net Change
Open	24.3 miles	20.3 miles	-4.0 miles	0	-4.0 miles
Rx A	17.7 miles	5.2 miles	-12.5 miles	0	-12.5 miles
Rx B	23.2 miles	7.9 miles	-15.3 miles	0	-15.3 miles
Rx C	1.4 miles	21.6 miles	+ 20.2 miles	5.1 miles	+ 25.3 miles
Rx D	0.0 miles	10.7 miles	+ 10.7 miles	0	+ 10.7 miles

Table 2-13 Roads that would be put into Rx C or Rx D Before or Concurrent with Timber Harvest

Road #	# of Culverts	Length in Miles	Road Management Prescription		Drainage
			Existing	Proposed	
1498CA	0	0.11	A	D	Bear and Little Bear
1900C	2	1.40	B	C	Norton
1900CA	1	0.31	B	D	Norton
1900CB	0	0.39	B	D	Norton
1900CC	0	0.44	B	D	Norton
1900F	0	0.20	B	C	Norton
1900F	1	0.40	B	C	Toles
1900FA	0	0.55	B	D	Norton
1902A	1	0.57	B	D	Toles
1902D	0	0.20	B	D	Toles
3590	0	0.64	A	C	Lines
3591	6	0.77	A	C	Lines
3658A	5	1.29	A	D	Bear and Little Bear
Totals	**16**	**7.27**			

Table 2-14 Roads that would be put into Rx C or Rx D with the Timber Sales

Road #	# of Culverts	Length in Miles	Road Management Prescription		Drainage
			Existing	Existing	
1254D	2	1.00	A	C	Bussel
1498C	0	1.02	A	C	Bear
1900B	5	0.30	A	D	Norton
1900C	0	0.75	B	C	Norton
1900F	2	0.97	B	C	Norton
1901C*	0	0.47	C	C	Norton
1902	9	2.08	Open	C	Norton and Toles
1902	4	1.00	B	C	Toles
1902B	0	0.97	C	D	Toles
1902C	0	0.32	B	C	Toles
3591A	0	1.25	A	C	Lines
3658	7	3.93	A	C	Bear and Little Bear
3660	1	0.25	B	C	Toles
Totals	**30**	**14.31**			

** Road 1901C is currently in Road Management Prescription C, and it would be used for the timber harvest then be put back into Road Management Prescription C. There would be no change in the road management prescription, but work would be needed to use it for the timber harvest then put it back into storage.*

Table 2-15 Roads that could be put into Rx C or Rx D at Anytime

Road #	# of Culverts	Length in Miles	Road Management Prescription (Rx)		Drainage
			Existing	Proposed	
758DA	0	0.80	B	D	Lines
758DB	0	0.31	B	D	Lines
758DC	1	0.69	B	D	Lines
758F[3]	1	0.13	B	D	Toles
758G	0	0.54	B	D	Bear
758GA	0	0.15	B	D	Bear
1476	1	0.66	B	C	Toles
1498A	0	0.39	B	C	Bussel
1498FB	0	0.19	Open	C	Little Bear
1498FC	2	1.01	B	C	Little Bear
1498FD	0	0.15	B	C	Little Bear
1498FG	0	0.12	B	D	Little Bear
1498FI	0	0.32	B	D	Little Bear
1498G	0	0.63	B	C	Bear
1900A	0	1.18	B	C	Norton
1900B	2	1.00	A	D	Norton
1900D	0	0.48	B	D	Norton
1900EA	3	0.95	C	C	Norton
1900G	1	0.12	B	D	Norton
1900H	0	0.55	B	D	Norton
1904A	0	0.18	B	D	Toles
3590B	0	0.20	A	D	Norton
Totals	**11**	**10.75**			

Table 2-16 Existing and Proposed Access for Roads in the Bussel 484 Project Area

	Existing Access (miles)			Alternatives B and C (miles)			
Road #	Open	Vehicles < 50"	Impassable	Open	Vehicles < 50"	Road Rx C	Road Rx D
1254	3.65			2.56	1.09		
1254D		1.00				1.00	
1254UC	0.41			0.41			
1441		0.75			0.75		
1441A		0.02			0.02		
1470	0.42			0.42			
1471	0.42			0.42			
1476		0.66				0.66	
1498	1.85			1.85			
1498A			0.39			0.39	
1498B		0.04			0.04		
1498C		1.02				1.02	
1498CA		0.11					0.11
1498FA	0.33			0.33			
1498FB	0.19					0.19	
1498FC	0.11	1.01		0.11		1.01	
1498FD		0.15				0.15	
1498FG		0.12					0.12
1498FI		0.32					0.32
1498G		0.63				0.63	
1900	3.47	1.44		2.55	2.36		
1900A		1.18				1.18	
1900B		1.30					1.30
1900C		2.15				2.15	
1900CA		0.31					0.31
1900CB		0.39					0.39
1900CC		0.44					0.44
1900D			0.48				0.48
1900E		1.10			1.10		
1900EA			0.95			0.95	
1900F		1.13	0.44			1.57	
1900FA		0.55					0.55
1900G		0.12					0.12
1900H		0.55					0.55
190I	0.36		0.85	0.36	0.85		
1901A	0.53			0.53			
1901C			0.47			0.47	
1902	2.10	0.98				3.08	
1902A		0.57					0.57
1902B		0.97					0.97
1902C		0.32				0.32	
1902D		0.20					0.20
1904	1.73			1.73			
1904A		0.18					0.18
226	1.87			1.87			

	Existing Access (miles)			Alternatives B and C (miles)			
Road #	**Open**	**Vehicles < 50"**	**Impassable**	**Open**	**Vehicles < 50"**	**Road Rx C**	**Road Rx D**
3332	1.86			1.86			
3332UA	0.29			0.29			
3332UB	0.29			0.29			
3570A		0.82			0.82		
3590	2.46				1.82	0.64	
3590A		1.52			1.52		
3590B		0.20					0.20
3591	3.52				2.75	0.77	
3591A	1.25					1.25	
3658		3.93				3.93	
3658A		1.29					1.29
3660		0.25				0.25	
758	4.39			4.39			
758A	0.05			0.05			
758DA			0.80				0.80
758DB			0.31				0.31
758DC			0.69				0.69
758E**			0.85		0.85		
758F			0.13				0.13
758G		0.54					0.54
758GA		0.15					0.15
758J	0.07			0.07			
758K	0.17			0.17			
Total Miles	**31.79**	**28.41**	**6.36**	**20.26**	**13.97**	**21.61**	**10.72**

Design Features & Mitigation Measures Common to Action Alternatives

1. **Air Quality**

A. Proposed burning activities follow procedures outlined by the North Idaho Smoke Management Memorandum of Agreement. Currently, the period of air quality monitoring and restriction is March 1 to November 30.

i. During this period, all burning by the Forest Service is regulated to prohibit or restrict burning where stagnant weather conditions result in poor smoke dispersion and by conducting prescribed burns when ventilation and air quality conditions are good.

ii. The project is within Airsheds 12a and 12b, which contain no EPA designated non-attainment areas for pollutants. The project area does not contain any Class I Airsheds as designated by the Clean Air Act.

iii. Burning during any time of the year is regulated by the Idaho State Department of Environmental Quality, which issues burning closures when necessary to protect air quality. The Forest Service cooperates with the State by requesting approval to burn through the Montana/Idaho Airshed Management System in compliance with the Idaho State Implementation Plan.

iv. Particulate matter projections would be sent to the North Idaho Smoke Management Group one day prior to ignition.

B. Measures used to mitigate effects of prescribed burning on air quality would include:

i. The discretion to terminate burns when air quality is threatened.

ii. Slash piles would be constructed as clean as practical and be burned as dry as practical to enhance efficient combustion.

2. Cultural Resources

A. All known cultural resource sites, eligible or potentially eligible to the National Register of Historic Places, would be protected or mitigated as directed by the National Historic Preservation Act. Any future discovery of cultural resources sites or caves would be inventoried and protected if found to be of cultural significance. A provision would be included in contracts to ensure protection of the sites.

B. Directional felling would be used in timber harvest units along historic railroad and near eligible cultural resources, a buffer would be established near eligible cultural resources, and no logs would be dragged or skidded over the grade or eligible cultural resources. The appropriate Zone or Forest level archaeologist would accompany the layout personnel to ensure that a sufficient buffer is implemented.

C. Alternative B only: Damage to eligible cultural resources would be mitigated by data recovery of a sample of the remains and monitoring of project activities by a professional archaeologist.

3. Fish

A. In-channel activity would occur during base flows after July 15.

B. Inland Native Fish Strategy Standards and Guidelines are specific based upon the proposed activity, i.e. timber harvest, road management, pre-commercial thinning, etc. Standard buffer widths (summarized in Table 2-17) apply to activities within this project area unless otherwise designated by the district fisheries biologist or district hydrologist. During the layout of units the widths may be greater based on ground conditions. Standard buffer widths are described in Table 2-17 below.

Table 2-17 Summary of Inland Native Fish Strategy (INFS) RHCA Widths

INFS Category	Description	RHCA Width
1	Fish-bearing streams	300 feet from either side of channel
2	Permanent, flowing, non-fish-bearing stream	150 feet from either side of channel
4	Seasonal, flowing or intermittent streams; Wetlands < 1 acres; Landslide prone areas	50 feet (non-priority watersheds)

C. Straw bales would be used to mitigate effects of culvert removals where culverts that are fish migration barriers are replaced on Road 1900. Two straw bales placed in the stream at culvert removal sites caused a significant reduction in fine sediment yield (Foltz and others 2007).

D. Areas of exposed soil will be mulched and seeded as needed where large woody debris is placed in RHCAs.

4. Gopher Baiting

The following criteria would be followed during gopher baiting project implementation:

A. Follow manufacturer's recommendations for use.

B. Treated bait would only be applied outside of INFS designated buffers on Category 1, 2, 3, and 4 water bodies.

C. Treated bait would not be stored or transferred within 300 feet of any stream or live water.

D. Treated bait would not be applied to saturated soils.

E. Treated bait would not be applied during any forecasted or actual precipitation event.

F. Treated bait would not be directly applied to or discarded in open water bodies such as lakes, streams, ponds, and wetlands.

G. Treated bait would be applied by a licensed applicator in accordance with Idaho State law.

H. Initial setting of bait would occur after July 1.

I. A mandatory provision for bait spill cleanup and disposal would be included in contracts.

J. The application of bait would be monitored by a Forest Service employee, who has been trained in animal damage control.

K. Follow-up gopher control effectiveness surveys would be completed. Any evidence of non-target wildlife/fish mortality would be reported and dead animals would be collected for analysis where possible in order to determine the cause of death.

L. Existing closed gates used to access units would be locked after each entry and exit.

M. Activity behind closed gates and earth barriers would be scheduled for completion prior to August 30th. An extension may be allowed based on extenuating circumstances (fire, weather, etc.) after interdisciplinary review.

N. Earthen barriers removed to allow access for project activities would be replaced upon completion of the unit and before August 30th.

O. Roads that have naturally revegetated would not be cleared to improve access.

5. Noxious Weeds

The following preventative measures would be taken to reduce the risk of noxious weed introduction and spread in accordance with the St. Joe Weed Control EIS (ROD 10/12/99).

A. A provision would be included in all contracts that would require all off-road logging and construction equipment (including machinery used in restoration projects) to be cleaned prior to entering the project area to remove dirt, plant parts, and material that may carry weed seeds.

B. Mulching agents, such as hay or straw, would be certified weed-free prior to use.

C. All seed used for revegetation and erosion-control purposes would be certified weed-free.

D. After implementation, project areas would be reviewed for new populations of noxious weeds. If new populations are found more intensive surveys would be conducted, sites would be mapped, and treatment would be scheduled.

E. If new populations of noxious weeds are found, treatment would be implemented in accordance with priorities set by the noxious weed program. New invader species would be slated for eradication immediately upon discovery. Other weed infestations would be treated according to the direction in the St. Joe Noxious Weed Project EIS and district priorities.

F. All weed treatments would be monitored for effectiveness.

G. To the degree practicable gravel used for road maintenance would be certified from weed free-sources. Gravel sources will be inspected for the presence/absence of noxious weeds prior to utilization of gravel in the project area as appropriate.

6. Old Growth

No timber harvest would occur in allocated old growth stands.

7. Plants (Threatened, Endangered, and Sensitive)

If Threatened, Endangered, and Sensitive (TES) species were discovered during project implementation, an agency Botanist would be notified so that measures could be taken to maintain population viability. Measures to protect population viability and habitat for all known and newly discovered occurrences would include altering or dropping proposed units from activity, modifying the proposed activity, or implementing buffers around plant occurrences. Provisions for protection of Endangered Species, and settlement for environmental cancellation would be included in contracts.

Table 2-18 Site–Specific Design Features for Protection of Known Populations of Plant Species at Risk

Unit #	Green bug-on-a-stick moss (*Buxbaumia viridis*)	Naked mnium moss (*Rhizomnium nudum*)	Comments	Site-tree height buffer
41	One occurrence on the edge of the unit.	None in unit.	Formerly *Units 14 and 17*.	One
84	Two occurrences in unit.	One occurrence in unit.		Three

Unit #	Green bug-on-a-stick moss (*Buxbaumia viridis*)	Naked mnium moss (*Rhizomnium nudum*)	Comments	Site-tree height buffer
114	Two occurrences in unit.	None in unit.		Two
134	One occurrence in unit.	None in unit.		One
148	Two occurrences in unit.	None in unit.		Two
170	One occurrence in unit.	None in unit.		One
175	One occurrence just outside of unit.	None in unit.	Just outside of the edge of the unit, need to be careful during implementation to not affect shading.	None
176	None in unit.	One in riparian buffer.		None
198	Two occurrences, one in the unit and one on the edge of the unit.	One occurrence on the edge of the unit.	Just outside of the edge of the unit, need to be careful during implementation to not affect shading.	One
200	One occurrence on edge of unit.	None in unit.		One
215	One occurrence in unit.	None in unit		One
224	Two occurrences in unit.	None in unit.		Two
248	None in unit.	Two occurrences in unit.		Two
254	None in unit.	One occurrence just outside of unit.	Just outside of the edge of the unit, need to be careful implementation to not affect shading.	None
296	None in unit.	One occurrence in unit.		One
311	One occurrence on boundary of unit 321	One occurrence on boundary of unit 321 in same location as *Buxbaumia.*	On border of Unit 321.	One
321	One occurrence in unit.	One occurrence in unit in same location as *Buxbaumia*.	This is another location than the occurrences on the border of Unit 311.	One

8. <u>Precommercial Thinning</u>

A. The maximum diameter of felled trees would be seven inches. Cull trees that exceed the diameter limit would be girdled in lieu of felling to provide additional cavity-nesting habitat.

B. Snags or dead trees would not be cut unless they pose a safety hazard. Snags cut for safety reasons would preferably be left where they fall.

C. Directional felling would be used to minimize slash depths. Trees that cannot be directionally felled would be bucked in lengths not to exceed 6 feet.

D. Slash would be pulled back a minimum of four feet away from all system road cut banks to prevent slash from falling into ditches and culverts.

E. Established game trails would be kept clear of slash by directional felling and slash pullbacks to maintain travel linkages.

F. A 50-foot no-activity buffer would be maintained along all wetted defined channels, springs, and seeps within and adjacent to thinning units.

G. Existing closed gates would be locked after each entry and exit.

H. Activity behind closed gates would be scheduled for completion prior to the opening of the elk any-weapon hunting season (commonly referred to as “rifle season”). An extension may be allowed based on extenuating circumstances (fire, weather, etc.) after interdisciplinary review.

I. Earthen barriers or other restrictive devices that are removed to allow access for project activities would be replaced upon completion of the unit (within one week) and before October 10th each year.

J. Activity would be conducted using existing access – i.e. no brush would be cleared or other improvements made to roads/trails for precommercial thinning activities.

9. <u>Recreation</u>

A. Existing dispersed recreation sites used for harvest operations activities would be restored or rehabilitated if motorized access to the sites would remain available after project implementation.

B. Contractors would follow permit provisions required for camping on National Forest System lands.

C. Where skid trails approach or intersect open roads or designated ATV routes, restrictive devices or debris such as logs, brush and rocks would be placed to effectively stop vehicle use.

D. Warning signs would be placed to inform visitors of logging activities in areas where logging traffic may interfere with recreational traffic.

E. Before trails are officially designated for ATV use they would be reconstructed to standards for ATV use (REC-9).

10. <u>Soil and Water</u>

A. All activities would comply with:

i. Standards identified in the Inland Native Fish Strategy (INFS) EA Decision Notice and Finding of No Significant Impact, signed in July 1995. All alternatives would implement standard riparian habitat conservation area (RHCA) widths specified by INFS (Table 2-17). These buffer zones are no-entry for harvest and equipment. Exceptions are described in the Standards and Guidelines, General Riparian Area Management (RA-2) that states: Trees may be felled in riparian habitat conservation areas when they pose a safety risk. Keep felled trees on site when needed to meet woody debris objectives. When necessary to fall trees (for skyline/cable units); the sale administrator may approve the minimum number required and ensure that they remain where dropped.

ii. Objectives of Appendix O of the IPNF Forest Plan, Stream Protection.

iii. Protection of water quality. Best Management Practices (BMPs) would be used to achieve water quality standards (Appendix B). The Forest Service Handbook 2509.22 (Soil and Water Conservation Handbook) outlines BMPs that meet the intent of the water quality protection elements of the Idaho Forest Practices Act, Forest Plan Standards and replaces the Forest Plan Appendix S – Best Management Practices. Other site-specific BMPs may be identified and developed during layout, design or implementation of proposed activities.

iv. Requirements and erosion control guidelines of the Rules and Regulations pertaining to the Idaho Forest Practices Act, Title 38, Chapter 13, Idaho Code.

B. Areas of recent or historic landslides and slumping are considered landslide-prone areas. Although none were identified, if any are located during implementation INFS buffers for Category 4 RHCAs would be applied.

C. Tractor Yarding:

i. Ground-based yarding would be limited to slopes less than 35%.

ii. Only approved skid trail locations would be allowed.

iii. Trails would be spaced at least 100 feet apart, except where converging at intersections.

iv. Skid trail spacing closer than that listed above may occur on at least two feet of settled snow or frozen ground, when winter logging occurs, or where adequate slash matting exists.

v. No excavated skid trails would be constructed.

vi. Skid trails in tractor-yarded units would be limited to less than 15% of the unit acreage to comply with IPNF Forest Plan soil quality standards and Region 1 soil quality recommendations.

vii. To minimize disturbance (soil compaction or displacement), practices such as skidding, grapple-piling and mechanical harvesters would occur over slash or on existing skid trails (Forest Plan Monitoring Reports). Units would be designed to utilize non-excavated skid trails and directional falling.

D. Skyline Yarding: The leading end of logs would be suspended during yarding.

E. Temporary Road: All temporary roads would be fully recontoured to the natural slope upon completion of activities. Temporary roads that would remain on the landscape more than one dry season would be waterbarred according to specific interval direction and at specific angles to prevent erosion. After recontouring they would then be covered with a natural, weed-free material to prevent runoff and erosion during spring and/or winter runoff events. This could be on-site slash, straw, or other suitable material.

F. For roads that would be managed as Road Management Prescriptions C and D at a minimum:

   i. all culverts would be removed,

   ii. all fill within the stream crossing sites would be removed,

   iii. stream gradient and valley side-slopes would be returned to as near natural conditions as possible for 200 feet on both sides of stream,

   iv. road surfaces would be decompacted to a minimum of 18 inches to facilitate and augment infiltration,

   v. the beginning of the treatment area would be fully recontoured for 300 feet or a sight-distance (which ever is less) to eliminate motorized access.

G. Prescribed burning would be done when soil moistures exceed 25% to maintain soil productivity (IPNF Updated Soil Guidelines 1998).

H. The Intermountain Forest Tree Nutrition Cooperative assembled data suggesting that soil potassium levels may be conserved in treatment units by allowing logging slash to over-winter. By leaving sufficient levels of wood on site, long-term soil productivity would be protected.

   i. Potassium sources such as needles and limbs would be maintained on site by allowing slash to over-winter prior to all slash disposal treatments except where tops would be yarded (Intermountain Forest Tree Nutrition Cooperative- Garrison and Moore 1998).

   ii. Tops of trees would be left in most harvest units.

   iii. Silvicultural and burning prescriptions would retain sufficient levels of coarse woody debris on site after slash disposal (Graham and others 1994). The following recommendations would be used in prescriptions:

      a. Douglas-fir, larch, and pine types: minimum coarse woody residues of 4-6 inches diameters well distributed through a treatment area at 10-15 tons/acre (Harvey and others 1987).

      b. Grand fir / beargrass types at 7-14 tons/acre of coarse woody residues (greater than three inches diameter), western hemlock/bead lily types at 17-33 tons/acre coarse woody residues (greater than three inches diameter)

      c. Subalpine fir / beargrass types at 12-23 tons/acre coarse woody residues (greater than three inches diameter) Graham and others (1994).

J. Wetlands identified during field review or harvest preparation would be protected by INFS buffers (50 feet for those less than one acre and 150 feet for those greater than one acre). A resource protection provision in contracts would be used to protect wetlands that may be discovered during operations.

K. Where new road NR8B (see Map 4) is constructed through the draw it may be necessary to provide subsurface drainage to avoid moisture saturation and subsequent slope failure. Where it is necessary, horizontal drains, drainage trenches, or drainage blankets may be used to lower the subsurface water levels and to prevent groundwater from entering embankments.

L. Rodent control treatment would not occur within INFISH buffers; in areas where the soil is saturated; or during periods of or forecasted periods of heavy precipitation.

M. In Unit 224 skid trails would be decompacted after use and soils would be monitored to determine effectiveness of decompaction and amount of detrimental disturbance.

N. Culverts identified as not meeting the 100-year peakflow criteria would be upgraded to meet the required size for passing this flow. Roads proposed for storage and recontouring would not be upgraded because the culverts are proposed for removal.

11. Transmission Lines

A. Timber sale roads near the large transmission lines would be kept reasonably free of equipment, products, and debris. The Bonneville Power Administration (BPA) may need to have road access for emergencies. In this case "reasonably free" means that the road could be cleared within an hour of notice and roads would be left clear and passable when contractors leave the area for more than an hour at a time. Logging trucks and equipment may be parked on the right-of-way only during emergencies. When this occurs, the truck/equipment should be grounded with a flexible wire connecting the chassis to a ground rod driven into the ground, or by making the connection to ground with a drag chain attached to the truck/equipment chassis.

B. Where units are adjacent to the transmission line right-of-way, timber would be harvested to reduce the risk of blowdown into the transmission line. Trees immediately adjacent to or under the transmission line would be harvested. If this is not possible, enough timber would be left to maintain wind firmness and reduce the risk of wind-throw into the transmission line.

C. Haul roads would remain a minimum of 50 feet from the point where steel lattice tower legs enter the earth. If this clearance cannot be met, use of road may be permitted if adequate protection for BPA structures from vehicles were provided by the use of guard devices (guard rails, posts, Jersey-type barriers, etc.) If guard devices were used, their location and design must be approved by the BPA.

D. Yarders used near the transmission line would be grounded with copper wire attached to a copper rod pounded six to eight feet in the ground. Skyline cables would be grounded as described above at the tailhold.

E. Chokers would be allowed to hit the ground before they are touched. Track mounted equipment is recommended near transmission lines to drain off induced voltage. If rubber mounted machines are used, a chain should be dragged behind on the ground to drain off voltage. A minimum separation of 20 feet between equipment and transmission line conductors would be maintained.

F. High-lead or skyline yarding across the right-of-way would not be done.

G. Transmission lines sag on warm days or when they are weighed down by snow or heavy frost. Lines that span long distances have greater potential to sag. The distance between equipment and transmission line cables in the same place can be different with different conditions. The timber sale prospectus would describe this to potential timber sale bidders.

H. Concentrated columns of smoke under transmission lines would be avoided in order to prevent electrical arc. Burning proposed within the right-of-way would be discussed with the BPA prior to writing the burn plan.

I. No loading of logging trucks, fueling of vehicles or equipment, log decking or storage of logs or flammable materials would be allowed on the transmission line right-of-way.

J. Logging trucks would not be loaded to a height greater then 14 feet above the roadbed. If a tree comes in contact with the transmission line, no attempt would be made to remove it. The BPA Dispatcher would be contacted immediately, 24 hours per day, seven days per week: 360-693-4703 or 800-392-0816.

K. For extreme safety-hazard trees near the transmission line, BPA may be able to provide personnel at the work site with advance notification.

L. The right-of-way width for the Dworshak-Taft No. 1 500-kV transmission line is 150 feet, measured 75 feet on each side of transmission line centerline.

12. Visual Quality

Forest Plan Visual Quality Objectives would be met through implementation of the following:

C. Harvest unit preparation and silvicultural personnel would work closely with the District or Forest visual staff to determine that design criteria are adequate for each application.

D. Foreground Partial Retention (Fg/PR) - Unit 336: Activities would remain visually subordinate to the characteristic landscape, repeating the form, line, color and texture common to the surrounding area with differences in qualities of size, amount, intensity, direction and pattern.

E. Background Partial Retention (Bg/PR) - Units 11, 14, 15, 17, 18, 30, 32: Form, line color and textures not frequently found in the characteristic landscape might be introduced in these units. Changes would remain subordinate to the visual strength of the characteristic landscape.

13. White Pine Leave Tree Guidelines (Schwandt and Zack 1996)

These guidelines would be utilized in all silvicultural prescriptions for timber harvest. The objective of these guidelines is to retain and protect genetic resources which may contribute to long-term white pine restoration.

14. Wildlife

A. Slash depths next to new and reconstructed roads would not exceed 1.5 feet or if that is not practical, openings that are at least 16 feet wide would be created every 200 feet - especially on ridges and across game trails (IPNF Forest Plan Appendix Y [Leege 1984]).

B. To provide elk security, timber harvest in adjacent areas would have a ridgeline between the disturbance and security area (IPNF Forest Plan Appendix Y [Leege 1984]). This would be done by subdividing harvest areas or contract scheduling.

C. The following snag management recommendations (Table 2-19) from the Northern Region Snag Management Protocol (January 2000) would be met (where these or higher levels exist). The retention of snags and snag replacements would be applied at the scale of every 5 to 25 acres (Bull and others 1997). Replacement snags would be retained at five times the number of snags per acre.

Table 2-19 Snag Guidelines

Habitat	Snags / Acre Retention Prescriptions
Warm dry ponderosa pine and Douglas-fir	1-2 greater than 20” dbh
Cool Douglas-fir, warm grand fir, slope <30%	4 greater than 20” dbh
Cool Douglas-fir, warm grand fir, slope >30%	6-12 total, with 2-4 greater than 20” dbh
Cool, wet, and dry spruce, grand fir, hemlock, and alpine fir	6-12 total with 2 greater than 20” dbh
Low elevation cedar and hemlock	12 total with 4 greater than 20” dbh
High elevation spruce/fir/lodgepole pine	5-10 greater than 10” dbh
Whitebark pine/limber pine	All available

D. To meet the objectives listed above in Table 2-19 Snag Guidelines:

i. Silvicultural and burning prescriptions would be prepared with the goal of protecting snag and green tree replacement snags, and retaining recommended levels and distribution of coarse woody material during site preparation and fuels treatment.

ii. Snags that show signs of decay, loose bark, or broken tops would not be designated for harvest (Bull et al. 1997). Exceptions would be made for road construction and log landings.

iii. The Reserve Tree Guide (IPNF 1995) would be followed to reach objectives of the Snag and Woody Debris Guidelines (IPNF Forest Plan, Appendix X) and worker safety.

iv. Tree-marking guidelines for wildlife reserve trees would favor the retention of large diameter trees, particularly hollow and broomed trees (Bull and others 1997) except when they pose a safety concern. Western larch, ponderosa pine, and western redcedar greater than 20 inches d.b.h. would be marked as first choices for snags and reserve trees.

v. Snags cut for safety reasons would be left in the unit - preferably where they fall.

E. In most cases travel cover would be maintained and vegetation management would avoid making openings (i.e. areas with <30% canopy cover) within 200 feet of the ridge top or 400 feet if the other side of the ridge does not provide cover. Where openings would be created on ridges designated as potential travel areas they would meet the following criteria:

i. Less than 300 feet wide (Heinemeyer and Jones 1994)

ii. Limited to one side of the ridge top

iii. Minimum of 800 feet of cover between openings (IPNF Forest Plan Appendix Y [Leege 1984])

   iv. None to be situated in a saddle (IPNF Forest Plan Appendix Y [Leege 1984]; Heinemeyer and Jones 1994)

F. Excavator-piled slash would be left unburned at a rate of one slash pile per five acres and would be constructed to provide wildlife habitat (Heinemeyer and Jones 1994).

G. Goshawk nests found before and during implementation would be protected by a 40-acre, no-activity buffer (Brewer and others 2007). Project activity would be suspended within the post fledgling areas of any active goshawk nests between April 15 and August 15 (ibid). Activity restrictions could be removed after June 30 if the nest sites are determined by the district biologist to be inactive or unsuccessful. Activity within an approximately 420-acre area surrounding each active goshawk nest would comply with the following management recommendations (Reynolds and others 1992):
   i. 20% or less in shrub/seed/sapling size class
   ii. 60% or more canopy closure in immature and older size classes
   iii. Created openings are less than two acres with a minimum of 300 feet between existing or other created openings and snag retention guidelines are applied on each acre of created opening
   iv. Non-regeneration treatment in immature and older stands is thinning from below using irregular spacing of leave trees

H. Provisions for protection of Threatened, Endangered, and Sensitive (TES) Species, and settlement for environmental cancellation would be included in contracts. If TES species and/or significant habitat are discovered during project implementation the district wildlife biologist would be notified so that if needed, measures could be taken to avoid impacts and meet Forest Plan standards. Measures could include altering or dropping proposed units, modifying the proposed activity, or implementing buffers.

I. All activity on lynx habitat in the LAU would be consistent with standards and guidelines from the Northern Rockies Lynx Management Direction (USDA 2007).

Anticipated Timing of Activities

Any resulting timber sales would be offered for sale in 2008 and 2009. Timber harvest is expected to be completed by 2013, with slash disposal and reforestation completed by 2015. Activities not associated with the proposed timber harvest could occur at any time after the administrative appeal period ends. These dates are tentative based upon anticipated budgets, workforce, weather and other considerations. Actual dates of implementation and accomplishment could vary.

In order to have road access, putting some roads into Road Management Prescriptions C and D would need to be completed prior to the road work done under timber harvest contracts. This is a timing coordination and logistical issue. It is not required for resource protection. This includes Roads 1900C, 1900CA, 1900CB, 1900CC, 1900F, 1900FA, 1902A, 1902D, 1498CA, 3590, 3591 and 3658A. Roads 3658 and 1498C would be placed into Road Management Prescription C under a timber harvest contract as soon as possible without causing resource damage. At the most it would be done within one operating season after completion of timber sale purchaser activities in units associated with these roads. Other activities not associated with the proposed timber harvest contracts could occur at any time after administrative appeals are settled.

Monitoring

Monitoring is conducted on a sample basis and is designed to verify that the projects are implemented as designed, are effective in meeting the project and Forest Plan objectives, and determine whether the project and Forest Plan goals and objectives for the area are still appropriate. For this project, monitoring and evaluation would be conducted as described in Table 2-20. Those monitoring components not specifically discussed in this appendix tier to the monitoring described in the Forest Plan. The IPNF annually conducts a review of BMP implementation and effectiveness. The results of this and other monitoring are summarized in Annual Monitoring and Evaluation Reports which provide information about how well the management direction of the Forest Plan is being carried out and measures the accomplishment of anticipated outputs, activities and effects.

Table 2-20 Proposed Monitoring

Resource	Objective	Timing	Methodology	Responsible
Soils	Verify whether ground-based units with existing detrimental disturbance meet soil quality standards as expected	After all potential ground-disturbing activities (yarding, fuel treatment, ripping, re-contouring) are complete	Units 14, 70, 100, 170, 215, 224, 225, 226, 232, 233, 248, 251, 254, 271, and 322: Field surveys using the IPNF "Onsite Assessment Method"	District Hydrologist or Forest Soil Scientist
	Determine effectiveness of decompacting skid trails	After grapple piles are burned	Unit 224: Measure bulk density in skid trails	District Hydrologist or Forest Soil Scientist
Watershed	Implementation & effectiveness of applicable BMPs	Ongoing, during and a post harvest visit	Complete BMP inspection reports for the timber sale(s) and associated road work	Hydrologist/Sale Administration/ Engineering
Fisheries/ Watershed	Implementation of RHCAs	Prior to advertisement of timber sale(s)	Monitor application of RHCAs, as noted in Chapter 2	Fisheries Biologist / Hydrologist
	Determine status of riparian plantings	1st, 2nd, & 3rd year after initial planting	Walk-thru survey, ocular to determine survival of plants	Hydrologist
Silviculture /Fire	Determine whether silv. objectives were accomplished & assess site preparation and planting needs	Post harvest and prior to any site preparation or fuels treatment	Review treatment areas; evaluate silvicultural objectives compared with results; check for special fuels treatment needs and special planting needs	Fuels Mgmt Specialist / District Silviculturist
Silviculture	Determine status of regeneration harvest units and effectiveness of gopher control	1st, 3rd and, if needed, 5th year, following initial planting	Monitor stocking & status of regeneration using walk-through & standard plot exams following R1 procedures	District Reforestation Specialist
Wildlife / Fish	Detect poisoning of off-target species	After pocket gopher control baiting	Any evidence of non-target wildlife/fish mortality will be collected and reported to the District Fisheries Biologist or Wildlife Biologist.	District Reforestation Specialist
Noxious Weeds	Review of project area for new populations of noxious weeds	Following project implementation	Project areas will be reviewed for new populations of noxious weeds. If new populations are found more intensive surveys will be conducted, sites will be mapped, and treatment will be scheduled.	District Noxious Weed Specialist

Comparison of Alternatives

Table 2-21 Comparison of Proposed Activities by Alternative

Proposed Activity	Alternative A	Alternative B	Alternative C
Timber Harvest	0	2,137 acres	2,137 acres
Ground-based	0	552 acres	389 acres
Cable	0	79 acres	20 acres
Skyline	0	795 acres	297 acres
Helicopter	0	712 acres	1,431 acres
Road Construction	0	5.8 miles	0
System	0	5.1 miles	0
Temporary	0	0.5 miles	0
On Potlatch land with a cost-share agreement	0	0.2 miles	0
Road Reconstruction	0	6.7 miles	5.4 miles
Fuels Treatment: Total is more than timber harvest acres because some units would have more than one type of treatment			
Yard Tops	0	316 acres	273 acres
Lop	0	1,742 acres	1,766 acres
Slash	0	181 acres	145 acres
Grapple Pile & Burn Piles	0	230 acres	175 acres
Hand Fireline	0	20.2 miles	20.2 miles
Broadcast Burn	0	307 acres	307 acres
Jackpot Burn	0	289 acres	295 acres
Tree Planting in Timber Harvest Units	0	367 acres	367 acres
Pocket Gopher Control	207 acres	574* acres	574* acres
Timber Stand Improvement (thinning or thinning & pruning)	0	821 acres	821 acres
Riparian Planting	0	1.8 miles	1.8 miles
Large Woody Debris Placement	0	yes	yes
Fish Migration Barriers Corrected	0	2	2
Stream Crossing Rehabilitation	0	57	57

* = 367 acres proposed in Alternatives B & C and 207 acres reasonably foreseeable with any of the alternatives.

Table 2-22 How Alternatives Address the Purpose and Need

Measurement Parameters	Alternative A		Alternative B		Alternative C	
Maintain or improve resilience of the vegetative resources to disturbances such as insects, disease, and fire						
Composition:	Acres	%	Acres	%	Acres	%
Long-lived, early-seral tree species: WL/WP Forest Types	983	8	1,614	13	1,614	13
Stand Structure: Brush-seedling sapling Pole-small-medium Mature-large Old Growth = allocated w/in PA (Approximately 2,528 acres)	 1,284 9,442 1,937	 10 75 15	 1,699 9,033 1,828	 13 70 14	Same as Alt. B	
Stand Density: Reduction in stand density Improve conditions for overstocked seedling/sapling stands	0 0		1,827 acres 821 acres		Same as Alt. B	
Acres of long-term fire hazard reduction from combined harvesting and prescribed burning or grapple piling. Also includes acres of harvesting where fuels reduction treatment is limited to yarding tops only.	0		931		856	
Acres with short-term increase in fire hazard where post-harvest activity fuel loads are lopped but not reduced.	0		1,170		1,245	
Acres with short-term increase in fire hazard where pre-commercial thinning activity fuel loads are accumulated and not reduced.	0		821		821	

Measurement Parameters	Alternative A	Alternative B	Alternative C
Provide wood products for local communities			
Volume of timber produced (CCF)	0	49,353	49,353
Acres of yarding tops that may be used for the Fuels to Schools Project	0	316	273
Work toward full support of designated beneficial uses in the Bussel Creek Watershed			
Sediment reduction (tons/year): Bussel Creek Bear Creek / Little Bear Creek	 0 0	 26 to 66 7 to 46	 26 to 66 7 to 46
Change in stream temperatures in Bussel Creek and Bear Creek / Little Bear Creek	Slow improvement over time	Reduced stream temperature more quickly compared to A due to riparian planting	Same as Alternative B
# of culverts removed to allow fish passage	0	2	2
Increases large woody debris in stream channels?	no	yes	yes
Results in more natural conditions where 57 stream crossings are removed?	no	yes	yes
Manage access to provide for multiple uses			
Miles of road decommissioned	0	10.7	10.7
Moves towards implementation of the National Off-Highway Vehicle Rule by designating routes for motorized vehicles	no	yes	yes
Provides additional access for vegetation management activities	no	yes	no
Provides motorized and non-motorized recreation opportunities	yes	yes	yes
Acres of wildlife security	0	1,027 acres	1,027 acres
Improves distribution of wildlife security areas	no	yes	yes
Reduces resource damage caused by roads and vehicles	no	yes	yes
Reduces the amount of road maintenance required	no	yes	yes
Reduces site suitable for weeds	no	yes	yes

Table 2-23 How Alternatives Address Issues

Indicators	Alternatives		
Issue #1 – Road Construction	**A**	**B**	**C**
Miles of system road construction on National Forest System lands	0	5.1	0
Miles of temporary road construction on NFS lands	0	0.5	0
Miles of road construction on Potlatch land to access NFS lands	0	0.2	0
Sediment increase from road construction (tons/year)	0	1.4	0
Reduction in sediment production (tons/year) Bussel Creek Bear Creek / Little Bear Creek	 0 0	 26 to 66 7 to 46	 26 to 66 7 to 46
Watershed condition / road density	No change	Improved condition	Improved condition
Trend of fishery condition	Long-term improvement	Immediate improved condition	Immediate improved condition
Total road miles and road densities in the wildlife analysis area (roads affecting wildlife in the wildlife analysis area)	62 miles 3.2 mi/mi^2	35.2 miles 1.8 mi/mi^2	35.2 miles 1.8 mi/mi^2
Security acres	0	1,027 acres	1,027 acres
Issue #2 – Change in Access	**A**	**B**	**C**
Miles of road open to all vehicles	31.8	20.3	20.3
Miles of roads and trails open to motorized vehicles < 50“ wide	35.0	19.9	18.5
Qualitative discussion regarding access for ATVs	No change	Fewer miles but better loops	1.4 fewer miles than Alt. B
Single track motorized trails	4.3 miles	0	0
Issue #3 – Cultural Resources	**A**	**B**	**C**
# of cultural resources adversely affected by project activity	0	5	0
Type and severity of damage to eligible cultural resources	N/A	Level of damage dependent on type of activity	N/A
Potential for mitigation measures to reduce damage to eligible cultural resources	N/A	All sites would have mitigation measures to reduce as much damage as possible	N/A

CHAPTER 3 - AFFECTED ENVIRONMENT & ENVIRONMENTAL CONSEQUENCES

Difference between Draft EIS and Final EIS

Analysis was updated to reflect changes in alternatives described in the Introduction for the FEIS. Specific changes for each resource are described at the beginning of each section.

Introduction

This chapter describes the affected environment and environmental consequences for resources affected by the proposed action and the other alternatives. It provides the scientific and analytic basis for the comparison of alternatives. The regulatory framework and analysis methods are also discussed. It provides information of relevant past, present, and reasonably foreseeable activities that occurred, are occurring, or are proposed to occur within each of the resource cumulative effects areas examined in this analysis. Past and ongoing activities along with natural processes have contributed to creating the current condition, as described in each resource section.

Past, Present, and Reasonably Foreseeable Future Actions

In *Lands Council v. Powell*, the U.S. Court of Appeals for the 9th Circuit held that, under the circumstances presented in the case, proper cumulative impact analysis required some cataloguing of past projects and their effect on the current project area. Furthermore, such cataloguing should provide sufficient detail to allow for analysis of the differences between prior projects and proposed projects, which could provide the information necessary to consider alternatives that might have less impact on the environment. This chapter and the project file for this project provide information of relevant past, present and reasonably foreseeable projects/activities that have occurred, are occurring, or are proposed to occur within each of the resource cumulative effects areas examined in this analysis.

The Council on Environmental Quality (CEQ), whose responsibility it is to coordinate federal environmental efforts and work closely with agencies and other White House offices in the development of environmental policies and initiatives, provided guidance to federal agencies on the consideration of past actions in cumulative effects analysis (ACT-6). CEQ stated that "generally, agencies can conduct an adequate cumulative effects analysis by focusing on the current aggregate effects of past actions without delving into the historic details of individual past actions" (ACT-6 p. 2). Cumulative impact is defined in CEQ's NEPA regulations as the "impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions…" (40 CFR 1508.7). CEQ has interpreted this regulation as referring only to the cumulative impact of the direct and indirect effects of the proposed action and its alternatives when added to the aggregate effects of past, present, and reasonably foreseeable future actions (ACT-6 p. 2).

With respect to past actions, during the scoping process and subsequent analysis of this project, the Forest Service determined what information regarding past actions was useful and relevant to the analysis of cumulative effects. While CEQ found that cataloging past actions and specific information about the direct and indirect effects of a past project's design and implementation could in some contexts be useful to predict the cumulative effects of the proposal, the regulations do not require the Forest Service to catalogue or exhaustively list and analyze all individual past actions (ACT-6 p. 3).

This section lists known past activities and tells where effects from those activities are discussed later in the document. There are marked differences between past and current land management practices and policies. The evolution that has occurred in land management practices is the result of science, our ongoing monitoring actions, and changing public values.

On the Idaho Panhandle National Forests (IPNF), early to mid 20th century road construction activities focused construction mainly through river valleys, riparian areas, floodplains, and adjacent hillsides. The roads efficiently provided access but decreased the land's effectiveness as wildlife habitat and constricted stream channels, while providing a new avenue for erosion and discharge of sediment into streams. Roads on National Forest System lands were often an expansion of existing trails and paths that provided access so that they would accommodate newer equipment and current land uses. In some situations, roads were developed on abandoned railroad beds. In both cases, the location and design were predetermined from the previous use and era. As time progressed roads were "designed" and located to achieve their primary purpose which was to provide access and haul product

at a minimal cost. In the decades following World War II (1950s –'70s), the road network was rapidly expanded to support the domestic need for lumber in housing construction.

Over the last twenty years, both road design and location have evolved as necessary tools to not only provide efficient access; but also to protect valuable watershed resources. Forest Service Best Management Practices (FSH 2509.22 Soil and Water Conservation Practices Handbook) currently incorporated into road construction/reconstruction activities on the forest include:

- Road surfacing (gravel, etc…) was incorporated to not only provide better travel conditions but also to prevent and control erosion from the road surface.
- Road drainage controls are now being incorporated into designs that:
    - Reduce the erosive flows in ditches by providing frequent cross-drains to relieve ditch flows;
    - Avoid water movement down the road by dispersing the drainage quickly by crowning or out-sloping the road surface;
    - Stabilize ditches by lining; and
    - Disperse drainage water (that often carries sediment) onto stable forested slopes before ditches discharge into waterways.
    - Allow new and existing stream crossings to safely pass extreme events (i.e. 100-year flood event).
- Special construction techniques and designs are utilized (i.e., full- or partial-benching of roads to avoid unstable side casting of waste materials; windrowing clearing slash to prevent sediment delivery to streams from construction activities themselves as well as from erosion of road fills and treads that are not yet protected with erosion control vegetation).
- Some roads now are designed to take advantage of the non-uniformities of the slopes they cross by "rolling grades" and grade breaks to prevent the potential for accumulations of water or excessive ditch-flows that have destabilized the road bed or cause surface erosion in the past.
- Designers and planners develop road networks that avoid highly erosive or unstable slopes utilizing the land system inventory, hydrologists, soil scientists, and geotechnical engineers.
- Road crossings are located at more stable sites; and crossing designs are now considering water quality and fish passage as primary design criteria, rather than criteria that just account for costs and traffic efficiency.
- Roads are located well away from streams and their riparian areas wherever practicable; and the number of crossing sites is minimized. These features are in stark contrast to past road locations that sometimes resulted in chronic sources of sediments, extended exposure of streams to direct sunlight resulting in temperature elevations, and nearly permanent reductions of the replacement sources of the structural components of streams and aquatic cover, riparian deadfall.
- In the past, when a road's utility ended, the road was simply abandoned. Some of these abandoned roads created water quality and slope stability issues as they deteriorated, especially without any maintenance. Current practice is to restore key abandoned or no longer useful roads to a "hydrologically neutral" condition where its remnants are self-maintaining and are no longer disturbing slope stability or the movement of slope water, either on or below the soil surface or the natural functions and adjustments of streams, wetlands, and other water bodies.

Impacts to forest water and soil resources from logging practices and road activities have also been reduced over the past 20 years with the introduction of Best Management Practices (BMPs) and Inland Native Fish Strategy (INFS) management direction. Based on research studies, current BMPs and INFS Riparian Habitat Conservation Areas (RHCAs) can reduce sediment yields compared with historical practices (Lee et al 1997, USDA 1995).

In 1972, Section 208 of the Clean Water Act Amendments established the regulatory framework for non-point source pollution control thorough use of BMPs. BMPs are defined in Idaho as a practice or combination of practices determined to be the most effective and practicable means of preventing or reducing the amount of pollution generated by non-point sources (IDAPA 20.02.01). BMP monitoring is conducted annually by the IPNF to validate the implementation and effectiveness of BMPs associated with land management activities. Monitoring results are used to adapt future management actions where improvements in meeting water quality objectives are indicated. Forest monitoring of BMPs indicates that in most cases they continue to function as expected and are meeting their intent (IPNF 2002, 2003, 2004).

At the time the IPNF Forest Plan was approved (1987), the emphasis was on developing a commodity production strategy while minimizing impacts to watersheds and aquatic resources, including fish. The strategy for watershed

management was constructed in the forest plan as a "maintenance" objective. In some situations, thresholds, or "minimum impact" standards defined the criteria for maintenance. To ensure that watersheds and aquatic resources were maintained during forest management activities, BMPs were applied. Despite the existing forest plan standards and BMPs, the condition of fish habitat on the forest was declining, primarily due to timber harvest and road building activities (IPNF 1992).

In 1995, the Forest Plan was amended to include Inland Native Fish Strategy (INFS) management direction (USDA 1995). The implementation of INFS gave greater protection to aquatic resources, especially riparian-dependent systems. The management direction provided by the INFS amendment is designed to protect and maintain the structure and function of riparian and aquatic systems. INFS contains goals for healthy, functioning watersheds, riparian areas, and associated fish habitats; Riparian Management Objectives (RMOs), and performance-based standards and guidelines for land management activities (i.e., timber, roads, grazing, recreation, minerals, fire/fuels, lands, riparian area management, watershed restoration, fisheries and wildlife restoration). Instead of allowing some "acceptable" level of effects on riparian and aquatic systems, INFS aims to protect aquatic resources from detrimental effects. INFS gives riparian-dependent resources priority over other resources in the Riparian Habitat Conservation Areas (RHCAs), so that while RHCAs are not "lock out" zones, activities that occur in them must either benefit riparian and aquatic resources or at least "not slow the rate of recovery below the near natural rate of recovery if no additional human caused disturbance was placed on the system" (USDA 1995). Incorporation of the Inland Native Fish Strategy (INFS) management direction into the forest plan has led to improvement in the condition of aquatic resources by offering greater protections to the critical riparian areas. In addition, INFS allows for and encourages watershed restoration. Restoration has occurred over the years across the IPNF. Over 1,300 miles of roads were decommissioned on the IPNF from 1991-2003 (IPNF 2003).

Harvest methods and removal of timber products from the national forest changed substantially over time. Early harvest methods (1950s, '60s, and '70s) focused primarily on financial objectives of providing low-cost wood products. Harvest placement often occurred in the highest volume, easily accessible stands and often occurred within riparian areas and adjacent to streams. Most of the harvest prescriptions were primarily designed to produce healthy young stands with shorter rotation ages.

Modern timber harvest prescriptions and design emphasize desired conditions of the forest after the harvest. This usually results in the retention of various amounts of trees in a post-harvest stand, addressing objectives that may include wildlife habitat, watershed conditions, hazardous fuels, visual quality, soil productivity, forest health and others. On sites determined suitable for timber production, timber harvest may also produce timber products on a regulated basis while compatible with these other resource objectives and values. Some examples where timber production and resource objectives can be achieved simultaneously are:

- Managing tree canopies and ladder fuels to limit fire spread from the forest floor to the tree crowns;
- Designing harvest patterns across the landscape to facilitate wildlife movement, such as providing corridors and preserving travel routes for ungulates. Also, using harvest prescriptions and landscape patterns as part of a wildfire hazard reduction strategy;
- Increasing the amount of native western white pine, western larch and ponderosa pine, which generally are insect- and disease-resistant and are long-lived, as well as increasing western redcedar in valley bottoms, where it historically was more abundant than today;
- Using variable retention harvests to meet scenic quality objectives and wildlife habitat objectives.

Other elements of modern harvest prescriptions that address specific resource objectives include retention of snags for cavity nesters, retention of down wood for soil nutrition and wildlife habitat, maintaining sediment filtering vegetation near riparian areas, and maintaining vegetation diversity through hardwood retention and protection of rare plants.

Increased environmental awareness has also lead to improvements in logging systems that we use to remove trees from the forest. Early harvests emphasized cheap, labor-intensive logging methods, such as railroad, horse, short distance jammer systems, and tractor logging. Logging systems were selected primarily by the least expensive method to transport the trees from the forest to the mill. This sometimes involved harvesting on steep slopes, creating excessive soil disturbance and increasing the risk of erosion. Streams were sometimes used as a method to transport logs from the harvest site, causing impacts to the aquatic system and adjacent riparian habitat. Road systems were sometimes dense (10 miles per square mile) to facilitate rapid and inexpensive removals, in some cases compromising water quality.

Today's logging systems recognize and reduce the threat of environment harm in a number of ways. Tractor logging generally occurs on slopes 35% or less, and is limited to designated locations, reducing soil impacts. Skyline and other cable yarding systems are used on steeper slopes, which greatly reduces the amount of soil disturbance. Increasingly, helicopter logging is used, which extends yarding distances and thereby reduces road densities. Tractor dozer piling was once a common practice. Monitoring showed that it resulted in heavily disturbed soils, so dozer piling is no longer used to treat fuels. Instead, the Forest Service uses grapple piling which results in less soil disturbance (see *Soils* section). A suite of best management practices and forest plan standards and guidelines aids in the development of the least impactive design possible. Monitoring during and after harvest provides a valuable feedback loop that identifies and corrects variances should they occur.

The forest ceased regeneration harvest of allocated old growth stands a number of years ago. Presently, our focus is on maintaining the old growth stands that we have and allocating additional stands for future old growth as they mature.

For the above stated reasons (changes in road construction/reconstruction and maintenance practices; implementation of INFS management direction and watershed BMPs; and changes in harvest practices and objectives) an individual analysis of past projects cannot be clearly compared to analysis of the proposed actions. However, the incremental effects of proposed action when added to the effects of the past, present, and reasonably foreseeable actions is displayed and provides a complete assessment of cumulative effects.

Analysis of cumulative effects presented in this chapter consider past, present, and reasonably foreseeable activities that could affect the issues pertinent to this analysis. Reasonably foreseeable actions include those management activities that are on-going or scheduled to occur and that we have developed a proposed action. These activities may occur regardless of which alternative is selected for implementation.

Past, present, and reasonably foreseeable future activities were identified from aerial photographs from different years, information from databases (Timber Stand Record System and FACTS), the District Fire History Map, physical evidence in the project area, information provided by Potlatch Corporation, information provided by the public, and the interdisciplinary team's knowledge of the area.

Following is a description of activities identified by resource specialists as being pertinent to some resource(s) for analysis of cumulative effects for the Bussel 484 Project. The present and reasonably foreseeable activities would continue no matter which alternative the responsible official chooses.

Table 3-1 Past, Present, and Reasonably Foreseeable Future Activities

Activity	Past	Present	Reasonably Foreseeable
NFS Lands: Past, Present and On-Going Activities			
Grandmother Mountain Land Exchange		X	
Timber harvest:	X		
Railroad construction	X		
Splash dams	X		
Log drives	X		
White pine blister rust control	X		
Mechanical site preparation	X		
Prescribed burning	X		
Tree planting	X		
Road construction	X		
Road maintenance	X	X	X
Precommercial thinning	X		
Pocket gopher control	X		X
Transmission line maintenance	X	X	X
Trail maintenance	X	X	X
Firewood gathering	X	X	X
Camping	X	X	X
Berry picking	X	X	X
Christmas trees (personal-use)	X	X	X
Motor vehicle use: full-size, ATV, motorcycle, and snowmobiles	X	X	X

Activity	Past	Present	Reasonably Foreseeable
Fire Suppression	X	X	X
Wildfires	X	X	unknown
Weed control under the St. Joe Noxious Weed EIS	X	X	X
Potlatch Corporation (2,454 acres in project area)			
Timber harvest	X	X	X
Road construction	X	X	unknown

Grandmother Mountain Land Exchange: A decision to acquire a 40-acre parcel in Section 33, T44N, R2E was signed on October 16, 2007 (ACT-1). The land transfer has not been finalized. This is considered in the analysis for **fisheries, old growth, water,** and **wildlife**.

Timber Harvest: The timber stand data base includes records for timber harvests beginning in the early 1960s (ACT-2, ACT-3, ACT-4), but harvests occurred prior to that time. We know this from historical accounts and aerial photography. Past timber harvests by decade according to the FACTS database for activities on the 12,192 acres of National Forest System lands in the project area are listed below.

Decade	Regeneration Harvest Acres	Intermediate Harvest Acres	Total Harvest Acres
1960s	635	130	765
1970s	310	108	418
1980s	554	52	606
1990s	242	3	245
Total	1,741	293	2,034

Effects of past timber harvest, including timber harvest prior to the 1960s, are considered in the analysis for **fire and fuel, fisheries, forest vegetation, noxious weeds, old growth, plant species at risk, soils, visual quality, water,** and **wildlife**.

Road Construction: Road were constructed most recently on National Forest System lands within the project area in 1992 when 2.0 miles were built for the Bussel Creek Timber Sale. Some of the National Forest System lands in the Bussel 484 Project Area are “acquired lands,” which means there were other landowners prior to the land being acquired for the National Forest. Land ownership patterns have continued to shift through land exchanges and acquisitions from the early settlement days to the present. A few exchanges have occurred to consolidate ownerships of various timber companies and the National Forest System. The land ownership patterns influenced the development of the road system, roads locations, and road construction standards. Roads were often built to avoid crossing ownerships. The effects of past road building are considered in the existing condition and in the analysis for **fire and fuels, fisheries, noxious weeds, plant species at risk, soils, transportation, visual quality, water,** and **wildlife**.

Road Maintenance: Routine road maintenance is likely to occur as needed on existing roads in the project area. This includes the ongoing upkeep of roads necessary to retain the approved road management objective. The overall condition and standards of the roads are adequate for the anticipated uses. Maintenance of existing roads and newly constructed roads within Forest Service jurisdiction and on NFS lands are designed to minimize resource disturbance, as required by the Forest Plan. Maintenance includes blading, drainage improvements, culvert maintenance, and surfacing. Effects of ongoing road maintenance are considered in the analysis for **air quality, economics, fisheries, forest vegetation, noxious weeds, old growth, soils, water,** and **wildlife**.

Railroad Construction: Railroad grades were constructed to facilitate timber harvest in the early 1900s before and after the big fires in the area. These activities removed vegetation, and in some cases, caused the straightening of some stream channels. Many of the historic features in the project area are related to the rail systems used to harvest timber. Effects of past railroad construction are considered in analysis for **cultural resources, fisheries, forest vegetation, noxious weeds, water,** and **wildlife**.

Splash Dams and Log Drives: Splash dams were constructed in the early part of the 1900s to facilitate transportation of logs during log drives. Effects of the splash dams and log drives are considered in the analysis for **fisheries, noxious weeds, recreation,** and **water**.

Camps for White Pine Blister Rust Control: White pine blister rust control efforts in the natural range of western white pine consisted of crews removing *Ribes* plants from the forest. *Ribes* are an alternate host for the rust that affects white pine. These crews lived in camps throughout the forest in the first half of the 1900s. The blister rust control camps are discussed in the analysis for **cultural resources**.

Mechanical Site Preparation and Fuel Treatments: Mechanical site preparation and fuel treatment includes slash piling, chipping, and yarding unmerchantable material. These treatments were used in timber sale areas in the 1960s and 1970s, Toles Creek Timber Sale (TS) in 1990-1993, Toles Buyout TS in 1983-1985, Bear Creek TS in 1987, Lin-Nor Divide TS in 1989, and Hobus TS in 1985. The effects of past mechanical fuel and site preparation treatments are considered in analysis for **forest vegetation, fisheries, plant species at risk, soils,** and **water.**

Fireline construction: Firelines are sometimes construction to suppress wildfires. Effects of fireline construction are considered in the analysis for **plant species at risk** and **soils**.

Prescribed burning: Prescribed burning was used for fuels treatments and site preparation for timber sales in the early 1960s and 1974, Toles Creek Timber Sale (TS) in 1991-1992, Lin-Nor Divide TS in 1989-1992, Hobus TS in 1985-1986, Bear Creek TS in 1986-1989, Toles Buyout TS in 1984-1990, and Red Norton TS in 1995. Effects of previous prescribed burning are considered in the analysis for **air quality, fire and fuels, fisheries, soils,** and **water**.

Tree Planting: Trees were planted after timber harvest on 1,155 acres in the 1960s and 1970s, Toles Buyout TS in 1985 and 1992, Toles Creek TS in 1994, Lin-Nor Divide TS in 1990-1994, Red Norton TS in 1995, Hobus TS in 1985-1989, and Bear Creek TS in 1987-1990. Some areas (764 acres) were replanted to increase stocking levels in Toles Creek TS in 1995-2001, Toles Buyout TS in 1987, Lin-Nor Divide TS in1995-1998, Blackwell-Olson TS in 1980, Red Norton TS in 1997, and Bear Creek TS in 1994-2001. Previous tree planting is discussed in the analysis for **cultural resources, fire and fuels, fisheries, forest vegetation,** and **soils**.

Precommercial Thinning: Precommercial thinning was done in 29 stands for a total of 826 acres beginning in 1972 and continuing through 2004. Past precommercial thinning is considered in the analysis for **fisheries**, **forest vegetation,** and **wildlife.**

White Pine Pruning: White pine pruning was done in 17 stands for a total of 383 acres between 1998 and 2004. Effects of white pine pruning are considered in the analysis for **forest vegetation**.

Pocket Gopher Control: Pocket gopher control has been used on 570 acres within the Bussel Creek Drainage to protect natural and planted seedlings (ACT-7). Pocket gopher control to protect regeneration is proposed to continue on 40 acres of these previously harvested areas within the Bussel 484 Project Area (ACT-8). Effects of gopher control are considered in the analysis for **fisheries, forest vegetation, noxious weeds, old growth,** and **wildlife**.

Transmission Line Maintenance: Tall trees and shrubs will be controlled under the transmission line, and the right-of-way will be maintained as an opening. Slash resulting from maintenance activities will normally be lopped and scattered. Effects of continuing transmission line maintenance are considered in the analysis for **fisheries, forest vegetation, old growth, soils, transportation, water,** and **wildlife**.

Trail Maintenance: The Lines Creek Trail is maintained yearly, and when the Bussel Creek Trail is converted to a foot trail it would be maintained every other year. Effects of trail maintenance are considered in the analysis for **fisheries, noxious weeds, old growth, plant species at risk,** and **wildlife**.

Public Activities Likely to Occur: Firewood cutting is likely to continue along open roads. Recreation use will continue including driving open roads, snowmobiling, hunting, riding ATVs and motorcycles, camping, hiking, and berry picking. Maintenance of the Lines Creek Picnic Area will continue. This area is popular for snowmobiling.

The Forest Service, State of Idaho, and Shoshone County have a cost share agreement allowing snowmobile use grooming on approximately ten miles of designated routes. No changes are proposed for winter use. Effects of ongoing recreational activities are considered in the analysis for **cultural resources, fire and fuels, fisheries, forest vegetation, noxious weeds, old growth, plant species at risk, recreation, soils,** and **wildlife**.

Fire Suppression: Consistent with current policy, efforts will be made to suppress all fires which occur within the project area. Effects of past and continuing fire suppression are considered for air quality, **fire and fuels, fisheries, forest vegetation, noxious weeds, old growth, plant species at risk, soils, water,** and **wildlife.**

Wildfires: Records show that there were two large mixed-severity fires impacting the majority of this project area in 1922 and 1931. These fires involved several thousand acres. There have been numerous small fires throughout this project area since the 1922 and 1931 fires. The most recent fire in the project area, the Elm Street Fire, burned during the summer of 2007. It was a mixed-severity fire having a highly varied mosaic of effects due to variable pre-fire fuel loads. The largest opening created by the fire is approximately 15 acres where the fire burned with high enough intensity to consume the crowns of the overstory trees. The perimeter is approximately 1.9 miles long and is surrounded by approximately 1.5 miles of dozer line with the remainder comprised of existing roads. All dozer lines were rehabilitated using an excavator to pull the berm back into the line and to place coarse woody debris over the line. The dozer lines were also seeded. Effects of wildlfires are considered for **air quality, fire and fuels, fisheries, forest vegetation, noxious weeds, soils, water,** and **wildlife.**

Weed Control: Spraying to control noxious weeds may occur within the Bussel 484 Project Area under the St. Joe Noxious Weed Control Project EIS and associated ROD, dated 10-6-99. Effects of ongoing weed control are considered in the analysis for **air quality, fisheries, forest vegetation, noxious weeds, old growth, plant species at risk, soils,** and **water.**

Activities on Other Lands: Road construction and road decommissioning on corporate lands owned by Potlatch Corporation has occurred (ACT-5). The Idaho Forest Practices Act and State water quality standards apply. Harvest activities will most likely eventually occur on all corporate lands within the Bussel 484 Area. The Forest Service obtained the following information about Potlatch Corporation's activities, and effects from activities on Potlatch lands are considered in the analysis for **fisheries, forest vegetation, old growth, plant species at risk, transportation, water,** and **wildlife**. Effects of activities on lands outside the project area are considered in the analysis for **air quality**.

Table 3-2 Past and Reasonably Foreseeable Future Timber Harvest on Potlatch Lands

Treatment	Past Acres	Reasonably Foreseeable Acres
Precommercial Thin	**505**	**152**
Overstory Removal	**-**	**247**
Shelterwood	**541**	**-**
Seed Tree	**876**	**131**
Commercial Thin	**-**	**63**
Clearcut	**853**	**474**
Total	**2775**	**1067**

Air Quality

Differences between Draft EIS and Final EIS

Particulate matter estimates were updated based on changes to the alternatives.

Regulatory Framework

Current direction to protect and improve air quality on national forests is provided by: 1) the Forest and Rangeland Renewable Resources Act of 1974 (16 U.S.C. 1601), as amended by the National Forest Management Act (16 U.S.C. 1602); 2) the Federal Land Management Policy Act of 1976 (43 U.S.C. 1701); and 3) the Clean Air Act amendments of 1977, 1990, 1999 (42 U.S.C. 7401-7626). The Clean Air Act (Section 110) requires states to develop State Implementation Plans (SIPS), which identify how states will attain and maintain air quality standards.

The Clean Air Act amendment of 1977 set up a process that includes designation of Class I, II, and III areas for air quality management. Airshed classifications are defined in Table 3-3. A map of the Idaho and Montana airsheds and designated restricted areas is available on the following web page: http://www.smokemu.org/map.php

Table 3-3 Airshed Classification Definitions

Class I – These area include all international areas and National Parks greater than 6,000 acres, and national wildernesses greater than 5,000 acres, that existed on August 7, 1977. This class provides the most protection to pristine lands by severely limiting the amount of additional man-made air pollution, which can be added to these areas. The nearest federally designated Class 1 areas are the Cabinet Wilderness, the Selway-Bitteroot Wilderness, and the Flathead Tribal Reservation. The intrusion of smoke into Class I airsheds from prescribed burning operations in the Bussel 484 Project Area would be minimal due to distance, the smoke dispersion, and the prevailing southwest to northeast air flow.
Class II – These areas include all other areas of the country. These areas may be upgraded to Class I, pending further legislation. A greater amount of additional man-made air pollution may be added to these areas, as opposed to Class I airsheds. All National Forest System lands that are not designated Class I are Class II airsheds. All of the lands in the Bussel 484 Project Area are designated Class II.
Class III – These areas have the least amount of regulatory protection from added air pollution. To date, no Class III areas have been designated in the country.

The Clean Air Act requires the Environmental Protection Agency (EPA) to identify pollutants that have adverse effects on public health and welfare and to establish air quality standards for each pollutant. The EPA has issued National Ambient Air Quality Standards (NAAQS) for sulfur dioxide, carbon monoxide, ozone, nitrogen dioxide, lead, and particulate matter less than or equal to 10 microns (PM 10). Idaho and Washington also have standards for these pollutants. Particulate standards were originally defined in terms or Total Suspended Particulate (TSP). In recent years the EPA has changed the particulate standard to apply to small particulates less than 10 microns in diameter (PM 10) and less than 2.5 microns in diameter (PM 2.5). This change was made because PM 10 and PM 2.5 are too small to be effectively filtered by the human respiratory system and much of it penetrates deep into the lungs. These particulates can cause respiratory problems, especially in smoke-sensitive people such as the young, elderly, or those predisposed to respiratory ailments. The Act defines NAAQS as levels of pollutant above which detrimental effects on human health and welfare could occur. An area that is in violation of NAAQS is called a “non-attainment area”. Pollution sources in these areas are subject to tighter restrictions. Spokane, Washington; Libby, Montana; Pinehurst, Idaho; and Sandpoint, Idaho are federally designated non-attainment areas, because of an excess of PM 10. A portion of Kootenai County, Idaho (Coeur d’Alene) is a proposed non-attainment area for PM 10.

Airshed groups in northern Idaho and Montana work cooperatively to “minimize or prevent” accumulation of smoke in Idaho and Montana to such a degree as necessary to meet state and federal ambient air quality standards when prescribed burning is necessary to conduct accepted forestry practices (i.e. hazard reduction, site preparation, and wildlife habitat improvement) (MOA 1090). As monitoring units, the airshed groups may limit burning, cease burning in specific areas, or cease entirely when meteorological or existing air quality conditions so warrant. Forest

management burning is thereby regulated during the months of March through November (North Idaho Cooperative Smoke Management Plan). The Idaho Panhandle National Forests, including the St. Joe Ranger District, is a member of the North Idaho Memorandum of Agreement and adheres to the North Idaho Smoke Management Plan (Design Feature 1).

Burning during any time of the year is regulated by the Idaho Department of Environmental Quality which may issue burning closures when necessary to protect air quality. The Forest Service cooperates with the State by requesting approval to burn through the Montana/Idaho Airshed Management System in compliance with the Idaho State Implementation Plan.

Analysis Area

The project area is the analysis area for direct, indirect and cumulative effects.

Analysis Methods

Smoke from burning forest vegetation contains emissions that are regulated in accordance with the National Ambient Air Quality Standards by the Department of Environmental Quality. Particulate matter and carbon monoxide are the major emissions of concern in wood smoke because of the large quantities produced and potential health effects. Elevated particulate matter is generally the cause of violations of ambient air standards in the regional non-attainment areas (see Affected Environment below). Thus, estimated $PM_{2.5}$ (particulate matter less than 2.5 microns in diameter) and PM_{10} (less than 10 microns in diameter) particulate emission levels from the various burning activities are assessed. $PM_{2.5}$ is the portion of smoke that is most easily inhaled into the lungs as it is the smallest and constitutes the majority of visible smoke by volume. $PM_{2.5}$ particles can build up in the respiratory system, aggravate mucus glands, and lead to a variety of health problems or aggravate existing health problems. The production of $PM_{2.5}$ and PM_{10} also contributes to potential effects on visibility. Production of $PM_{2.5}$ corresponds with the amount of fuel consumed. The differences in production are due to burn types and volumes of fuel consumed.

The First Order Fire Effects Model (FOFEM) predicts the amount of $PM_{2.5}$ production from selected fuel models using specified fuel moistures, fuel loadings and expected fire behavior (Reinhart and others 1997).

Fuel models are determined by cover type and dominant species, and the FOFEM includes typical default values for fuel components (duff, litter, live and woody down fuels, etc.) associated with the cover type unless altered to better represent known conditions. All proposed site preparation/hazard reduction burns for timber harvest areas were analyzed with the default typical values. The proposed prescribed burns were analyzed using expected spring moisture conditions or fall conditions, depending on the fuel reduction activity proposed. Drier summer conditions were analyzed for potential wildfire smoke production.

The wildfire scenario assumes that crown fire would occur in this project area. The total potential of wildfire smoke from all proposed activity acres is displayed for Alternative A. This represents the potential smoke production in lieu of any management. The total estimated smoke emissions for the action alternatives includes all acres of prescribed burning, as proposed by each action alternative. Estimates of smoke emissions for the action alternatives were modeled using typical prescribed burning fuel moisture conditions.

Literature related to the application of herbicides for weed control was reviewed to provide supporting information for the cumulative effects analysis.

Affected Environment

The Clean Air Act designates Class I, II, and III areas for air quality management. There are no Class I or Class III areas within the IPNF: all areas are designated as Class II. Class II areas have good air quality with no additional air quality restrictions other than NAAQS. Class I areas are the most pristine areas which receive special visibility protection. The Cabinet Wilderness and the Flathead Indian Reservation are designated Class I areas and lie approximately 80 miles northeast and 80 miles to the north-northeast respectively. The Selway-Bitteroot Wilderness is a designated Class I area that lies approximately 70 miles south of the St. Joe Ranger District.

The EPA designates air quality sensitive sites as "non-attainment areas" because of violations of a NAAQS. Airshed 12B has no non-attainment areas within its boundaries. The nearest non-attainment areas are Pinehurst, Idaho and Thompson Falls, Montana which are approximately 28 and 52 miles northeast and which is miles to the north. These areas occasionally are in violation of the PM_{10} standard during periods of winter inversions. The

North Idaho and Montana Smoke Management Plans establishes "impact zones" around the non-attainment areas to include areas where emissions from prescribed burning could significantly impact the non-attainment area. There are no non-attainment areas in Airsheds 12A or 12B.

The air quality of the Bussel 484 Project Area is good throughout the majority of the year due to good air dispersion. Human caused and natural events inside and outside the project area do occasionally affect air quality. Human influences such as stationary industrial pollution sources, camp fires, vehicle exhaust, and road dust in the area are low; however, regional haze occasionally occurs due to agricultural dust, agricultural field burning, and forest slash burning. Natural events such as dust storms and wildland fires have contributed to reduced air quality at times.

The wind direction in northern Idaho is generally from the southwest to west. Smoke dispersion is to the east and northeast. Long-duration, low-intensity frontal systems commonly occur from late fall to spring aiding atmospheric mixing and improving air quality.

The effects of smoke within this project area and surrounding areas are dependent upon a number of factors such as season, topography, atmospheric conditions and time of day of the burning.

Spring and early summer seasons have the best dispersion and mixing atmospheric conditions. Daytime heating lifts smoke high into the atmosphere, and seasonal instability disperses smoke down wind. Daytime heating lifts smoke out of valley inversions but can be difficult under stable, high-pressure systems. Inversions in the fall can potentially create the worst smoke problems of prescribed burning. Fall is the season monitored and regulated by the North Idaho Airshed Group. Cold winter months, however, are when the air quality can be poorest because of inversions. Prescribed burning rarely occurs during this season and is regulated by the States.

The topographic location of a prescribed fire will either aid smoke dispersion if it is high on the ridge and exposed to free air wind, or conversely increase the potential of smoke impacts if it is down in a valley bottom. Smoke produced low on the slope and not lifted up an out of the valley can become subject to nighttime downslope winds trapped by nighttime inversion and contribute to valley smoke pooling until the next daytime heating. Wildfire smoke has naturally been a part of the project area ecosystem due to the frequent fire-return intervals of the drier ponderosa pine forests to the west, local wildfires surrounding the project area, and the severe- and mixed-severity fire regimes within the project area. Wildfire smoke has been reduced in the Bussel 484 area where fires were kept small and quickly extinguished. The project area atmosphere was often smoky and had a general haze from nearby fires as well as fires elsewhere in the Northern Rocky Mountains. Fire researchers have stated that northern Idaho is perhaps unmatched by other regions for forest conflagrations of similar magnitude, frequency, or degree of destruction (Barrett 1982). The amount of smoke generated from wildfires began to decrease in the 1930s due to the advent of effective fire suppression. Prior to this time the northern Rocky Mountains probably had 1,500-2,000 fires burning annually. Before modern fire suppression these fires burned until wet weather extinguished them which included periods of up to 4 months. Journals from early explorers and newspaper articles from the late nineteenth century often mention smoky conditions in western Montana and northern Idaho. More recently, very large fires in the Great Basin, Pacific Northwest, and Northern Rockies regions of the USFS have again become common annually during the summer months.

Prescribed fire from both inside and outside the project area has generated smoke during the spring and fall. Agricultural burning restrictions on the Palouse in Washington and Idaho west of the St. Joe Ranger District have reduced levels of regional haze.

Environmental Consequences

Table 3-4 shows estimated particulate emissions from each action alternative and the potential wildfire smoke production for Alternative A in lieu of harvest or prescribed fire (AQ-1). For comparison purposes, the acres of a potential wildfire are equal to the number of acres that require pile, broadcast, and/or jackpot burning as described in Alternative B. Fuel models used for the wildfire simulation represent existing fuel conditions. The model showed that greater amounts of PM_{10} and $PM_{2.5}$ would be generated in a wildfire as would be generated by the prescribed burning proposed in Alternatives B or C. Air quality standards are assumed to be met through the regulatory process for planned prescribed fire, however, reduced visibility and air quality degradation would occur temporarily during times that burning is conducted.

Table 3-4 Estimated PM_{10} and $PM_{2.5}$ Emissions

Type of Emissions	Alternative A	Alternative B	Alternative C
Total Tons PM_{10}	340*	290	274
Total Tons $PM_{2.5}$	289*	246	233
Total Tons	629*	536	507

** Simulated wildfire in proposed treatment units*

Alternative A

Direct and Indirect Effects

There would be no immediate adverse effect on air quality. Current management activities in this area contribute little additional pollutants. The primary source of pollution would be from vehicle exhaust, wood smoke, and dust from traffic. Air quality would remain good.

The wildfire scenario in treatment units of Alternative A would not be regulated and could result in nearly twice the particulate production per acre and more severe concentrations without fuel treatment and hazard reduction through timber harvest or prescribed fire, during poor dispersion conditions. In the long term, this area is characterized by very large stand-replacing fires on average every 100-200 years.

The potential for air quality degradation and reduced visibility may increase with Alternative A compared with the other alternatives. Fuel accumulation from ongoing tree mortality in the analysis area would potentially increase fire intensity and severity if a wildland fire were to occur within the analysis area. Consumption of increased fuel loads and understory biomass would increase the amount of smoke emissions. These emissions may remain in the local and surrounding airsheds for a period of a few days to several weeks depending on fire size and intensity. Research has found that emissions are greater from contemporary fires, even though they have burned fewer acres annually than fires historically did. This trend occurs because consumption of fuel per unit area burned has been greater in the current period than that of the preceding historic period (USDA, USDI 1997).

Cumulative Effects

The noxious weed treatment that may occur under the St. Joe Weed Control Project EIS and ROD would have short-term, localized impact on air quality because of the drift of spray particles. Generally the greatest part of this drift would settle within 25 feet of the site, although small amounts could carry greater distances (USDA Forest Service 1993). The smell of chemicals such as 2,4-D may also persist at a spray site for several days following spraying. Human inhalation environmental exposures of 2, 4-D, would be less than occupational exposures since spray operators, involved with activities on the spray units, are more likely to be subject to spray mist than is a casual visitor. A casual forest visitor would be expected to receive an inhalation exposure of less magnitude than that of a backpack sprayer (USDA Forest Service 1984).

All other activities (present and reasonably foreseeable) would have no measurable effect on air quality in the project area. Pollution from vehicle exhaust, camp fires and road dust in the area are light.

Smoke from wildfires from outside the project area would add some accumulations to the air quality within the project area during the summer months.

Table 3-5 Approximate Fuel Treatment Acres

Treatment	Alternative A	Alternative B	Alternative C
Broadcast/Jackpot Burning	0	596	602
Grapple Pile*	0	230	175
Lopping	0	1742	1766
Slashing	0	181	145
Yard Tops	0	316	273

** Includes 65 acres of landing piles.*

Alternatives B and C

Direct and Indirect Effects

Broadcast burning is done when there are no overstory trees to preserve or there are relatively few overstory trees to preserve that are predominantly fire tolerant. Occasionally live trees may be retained in a harvest area with the intent of creating snags by killing them with the subsequent broadcast burn that is meant primarily for site preparation and/or hazard reduction. If very few trees remain and/or crown scorch is a minor concern, a higher-intensity surface fire with a well defined convection column can be developed. This improves combustion efficiency and vertical lifting of smoke into transport winds aloft, thereby improving dispersion.

The objective of jackpot burning (as opposed to broadcast burning) is to reduce surface fuel loading, concentrations of fuels in particular, while having a minimal impact on the remaining overstory trees. Jackpot burning is generally carried out with a lower intensity or slower than broadcast burning. These factors may not allow good dispersion locally. Jackpot burning is usually conducted under wetter conditions resulting in less fuel consumption than dryer conditions of broadcast burning.

Slash would be piled in landing areas and in grapple pile units. Piles burn with high efficiency and can be scheduled in late fall when unstable atmospheric conditions, associated with frontal passages, and good dispersion exist. Substantial rain and/or snow are prerequisite for fall pile burning. Fall rain and/or snow events that elevate fuels moistures (outside of piles) above the moisture of extinction provide containment of fire and consumption of fuels to the immediate vicinity of the individual piles.

The smoke emissions from prescribed burning activities could adversely affect air quality. In addition, dust may increase from road construction, maintenance, and stabilization as well as project-associated vehicular traffic. Dust is generally a very temporary and local problem. Road dust is primarily a minor local nuisance settling near the source. Dust is also generated at differing times than prescribed fire activity and not considered a significant cumulative impact.

Results of the FOFEM emissions modeling predicted annual $PM_{2.5}$ and PM_{10} standards are shown in Table 3-4. In Alternatives B and C predicted emissions range from 507 to 536 total tons. However, accomplishment of the proposed prescribed burning would likely occur over at least a five-year time period and would be conducted only when atmospheric conditions are judged favorable. Given a five-year time frame for fuel activities, the annual expected smoke emissions would be between roughly 101 and 107 tons per year, depending upon the alternative selected. The proposed burns would result in less smoke produced per acre than wildfire and reduce the wildfire risk on those acres treated. Alternatives B and C include prescribed burning that would occur in both fall (pile burning) and the spring (site preparation/hazard reduction). Broadcast and understory burning would be accomplished as much as practical in the spring and early summer with spring-like conditions (Design Feature 1.B.). Scheduling prescribed fires for spring-like conditions reduces emissions by as much as 54%, and burning slash in clean piles rather than broadcast burns reduces emissions by 25-50% (Radke and Ward 1991).

Proposed activities may temporarily affect air quality within the Bussel Creek watershed, portions of the lower Marble Creek watershed, and other adjacent areas to the northeast. Visitors using the developed and undeveloped campgrounds within Bussel Creek, lower Marble Creek, and middle St. Joe River corridors may be affected by smoke because they are down canyon and/or down wind from the project area. Effects would be from the down-canyon winds at night bringing smoke into the area until daytime lifting of the smoke occurs. Diurnal temperature inversions within the drainage may allow pooling of smoke to affect these sites. Smoke produced from prescribed fire would be dispersed generally to the northeast by prevailing winds over unpopulated forest lands. The smoke that reaching populated areas to the northeast such as Calder and Avery, Idaho and St. Regis, Montana would be lifted high in elevation and would primarily contribute to general regional haze.

Cumulative Effects

Idaho's Department of Environmental Quality and the Montana/Idaho Airshed Group monitor air pollutants and issue guidance that is intended to minimize burning during times when such activities would result in violations of the State standards, including unacceptable impacts to non-attainment areas. The Forest Service, as a participating partner of the Montana/Idaho Airshed Group, voluntarily ceases burning operations to avoid violations of State standards whenever such guidance is provided by local air quality regulators. The monitoring of air pollutants during prescribed burning periods has not recorded any violations of the State standards within Airshed 12B to date.

Broadcast and jackpot burning of activity-created fuels would occur primarily in early spring when regional smoke production from all wildland sources has been historically low. Piles (grapple and/or hand piles) would be burned

late fall early winter. Smoke and particulate matter would flow to the northeast and would dissipate rapidly during good to excellent dispersion days.

Prescribed fire from both inside and outside the project area has generated smoke during the spring and fall months. Agricultural burning restrictions on the Palouse have reduced levels of regional haze since restrictions were implemented.

Pollution from vehicle exhaust, camp fires, and road dust in the area are low.

Wildfires from outside, as well as those from inside the project area generate smoke during the summer months. Wildfire smoke has been reduced in the Bussel 484 Area where fires were kept small and quickly extinguished.

Noxious weed spraying would have a short-term, localized effect in the area of spraying. The area may be sprayed for noxious weeds according to the St. Joe Noxious Weed Control Environmental Impact Statement. The impact from spraying would be very minimal to the air quality in the project area. The proposed weed treatment would have short-term, localized impact on air quality because of the drift of spray particles. Generally the greatest part of this drift would settle within 25 feet of the site, although small amounts could carry greater distances (USDA Forest Service 1993). The smell of chemicals such as 2,4-D may also persist at a spray site for several days following spraying. Human inhalation environmental exposures would be less than occupational exposures since spray operators, involved with activities on the spray units, are more likely to be subject to spray mist than is a casual visitor. A forest visitor should be expected to receive an inhalation exposure orders of magnitude less than that of a backpack sprayer (USDA Forest Service 1984).

Consistency with the Forest Plan and Regulatory Framework

An implemented alternative would be monitored and controlled by airshed regulations to avoid violation of air quality standards, in compliance with the North Idaho Smoke Management Plan, as directed in the Idaho Panhandle Forest Plan.

Requirements of the North Idaho/Montana State Airshed Group (notification of planned burning one day in advance) allows the Idaho Department of Environmental Quality to place restrictions on or prevent burning if it determines that air quality standards can not be met, which meets the Clean Air Act.

Since the annual production of $PM_{2.5}$ and PM_{10} for the Bussel 484 project is less than 100 tons, non conformity determination is required to meet the Clean Air Act.

Cultural Resources

In accordance with the National Historic Preservation Act of 1966, as amended, this documents the procedures used in identifying and evaluating cultural resources within the Bussel 484 Project Area.

Differences between Draft EIS and Final EIS

Consultation with the State Historic Preservation Office and Native American Groups was completed in accordance with the NHPA (CR-1).

Regulatory Framework

The Idaho Panhandle National Forests (IPNF) Forest Plan requires systematic cultural resource inventory prior to ground-disturbing activities and the preservation of significant cultural resources in place whenever possible. The IPNF Forest Plan also requires consultation with the State Historic Preservation Officer to determine significance of historic properties. This site evaluation process is outlined in the Programmatic Agreement among the United States Department of Agriculture, Forest Service, Northern Region, The Advisory Council on Historic Preservation, and the Idaho State Historic Preservation Officer regarding Cultural Resources Management on Region 1 National Forests in the State of Idaho. This includes consultation with Native American groups to determine if sites of religious or cultural significance are in the area.

Analysis Area and Analysis Methods

The analysis area for cultural resources is the Bussel 484 Project Area. The project area has been systematically surveyed for cultural resources through fourteen previous projects. In addition to the field surveys; historic records, maps, and photos were reviewed for confirmation of known sites and to possibly identify new sites. Some areas in the Bussel 484 Project were reexamined and some known sites were monitored and re-evaluated for eligibility for this supplement based on information obtained during field review. These surveys along with information on known and newly discovered sites have been documented and recorded in past and current inventory reports. In addition to the field surveys; historic records, maps, and photos were reviewed for confirmation of known sites and to possibly identify new sites. Site location information is exempt from mandatory disclosure pursuant to the Freedom of Information Act, 5 USC 552(b)(5). Additional surveys for any newly discovered sites would be documented in accordance with established Forest procedures. There has been adequate inventory coverage on all potential impact areas within the project area. Consultation with the State Historic Preservation Office and Native American Groups has been completed as in accordance with the NHPA.

Affected Environment and Environmental Consequences

A great deal of development has occurred in the Bussel 484 Project Area. Euro-American settlement increased with the logging industry and construction of a network of logging railroads in the early 1900s. Land management involved settlement, agriculture, logging, tree planting, fire protection, building roads and trails, range allotments for cattle and sheep and blister rust control. The community of Clarkia became an important center and “jump – off” point in the region. Most sites identified within the project area date to the historic period and are related to turn of the century settlement, railroad construction, logging, and Forest Service (fire protection, Civilian Conservation Corp camps and blister rust control) activities. No sites of cultural or religious significance to federally recognized affected American Indian Tribes have been identified. The entire project area is within the Marble Creek Historic District, and has a high concentration of historic sites. A total of 74 sites have been recorded within the Bussel 484 Project Area. Of these 74 sites, 51 are eligible to the National Register of Historic Places (CR-8).

Alternative A

Direct and Indirect Effects

Under Alternative A, current management practices would continue. This would result in no effects to the majority of the historic sites within the Bussel 484 Project Area. The potential for some sites in the project area to be adversely affected by unauthorized ATV routes would be increased under this alternative.

Cumulative Effects

Cumulative effects occur when past, present and foreseeable activities overlap with the proposed activities. In this case, the no-action alternative does not include an effective method of preventing unauthorized ATV riding. The past effects of unauthorized ATV use coupled with the likely continuation of such activity would cumulatively increase the potential for adverse effects to some sites.

Alternatives B and C

Direct and Indirect Effects

The action alternatives include timber harvest, road reconstruction, road construction, reforestation activities including planting and pocket gopher control, and timber stand improvement work including pre-commercial thinning and pruning. Project implementation would also include a change in road/trail access management. All ground-disturbing activities can potentially cause adverse effects to cultural resources. The preferred method for conservation of these resources is avoidance, and this is proosed for most sites in both of the two action alternatives.

Timber harvest units have been designed to avoid cultural resources. Those stands that have an eligible cultural resource within or immediately adjacent to the stand boundary will have a buffer of at least one tree length marked for no activity around the site. The appropriate Zone or Forest Archaeologist will accompany marking crews to ensure a sufficient buffer is established (Design features for cultural resources in Chapter 2). Reforestation activities (planting, pocket gopher control, and timber stand improvement work) would occur only in units that had been previously harvested or are proposed for harvest and would therefore already have the protection buffers described above established. The road construction and reconstruction activities proposed for this project would not affect any cultural resources under Alternative C, however one cultural resource would be adversely affected by reconstruction activities under Alternative B. Travel management changes under the proposed action would cause an adverse effect to one eligible cultural resource. Eligible cultural resources that would be adversely affected by the proposed activity are discussed in detail below.

A project is considered to have an adverse effect when the effect diminishes the integrity of the property's location, design, setting, materials, workmanship, feeling or association. An analysis of the cultural resources in the Bussel 484 Project Area concluded that there are five cultural sites that would not be avoided by one or both of the action alternatives, causing adverse effects to those sites. Eligible cultural resources that would be adversely affected would be managed and mitigated through a Memorandum of Agreement (MOA) between the Idaho Panhandle National Forest, the Idaho State Historic Preservation Office, and The Advisory Council on Historic Preservation, should they choose to participate. These resources are:

a) 10SE1317 - Historic Railroad Grade: This linear historic site includes a network of logging railroads including; The Incline, The Norton Creek Railroad Grade, and The Lines Creek Railroad Grade. The Norton Creek Railroad Grade, and the Lines Creek Railroad Grade would be designated as an ATV route under Alternative B. Alternative C also would designate the railroad grade as an ATV route, but excludes one segment of The Norton Creek Grade. The railroad grade is eligible to the National Register of Historic Places, and would be adversely affected under Alternative B. One segment of the grade has already been converted for use as an ATV trail and is used as the Lines Creek Historical Loop. The grade along this segment is in remarkably good condition, and the historic sites along it have not been adversely affected even with the heavy motorized use. Other portions of the grade that are not currently being used as an ATV trail have a high degree of historical integrity. There are many railroad and logging related artifacts along the grade, and some areas have intact railroad ties and portions of rails still in place. Use of these segments of the grade as an ATV trail would require some construction to get them to a rideable standard. This construction could destroy or damage the intact ties and artifacts, causing the historical feel of the railroad to be compromised. Under Alternative B, the adverse effect to this historic property would be mitigated by data recovery under the MOA. Alternative C would not cause an adverse effect to the historic railroad grade as the segment with intact ties and a high concentration of artifacts would not be a designated ATV route.

Both action alternatives include preventative measures for areas identified as having unauthorized ATV access which is damaging cultural and natural resources. This would result in a beneficial effect to sites that are currently being damaged in this manner, since no further damage would be caused to them. The Incline Railroad segment would not be designated as an ATV route, and would be effectively blocked from ATV use preventing continued damage due to erosion and traffic on the steep sections of the Incline.

The railroad grade would also have some timber sale activity taking place along it. This would not cause an adverse effect to the grade as the timber sale would be designed to implement directional felling in order to avoid damaging the grade, and no logs would be dragged or skidded over the grade (Design features for cultural resources in Chapter 2).

b) 10SE362 - Camp 26: This camp is one of the larger, if not the largest of the camps associated with the Incline Railroad. It is immediately adjacent to the railroad grade along a segment that would be converted to a designated ATV route under Alternative B. This site also lies partly within the boundary of a proposed timber harvest unit. The camp's proximity to the designated ATV route along with its gentle topography could be inviting for ATV riders. If vehicles were to enter the camp, they would cause damage to its features and also may leave it vulnerable to vandalism and looting. Mitigation for these effects would include data recovery of a sample of the remains and monitoring of construction activities by a professional archaeologist under the MOA.

The timber sale activity would not be damaging to the site as a buffer of at least one tree length would be established. The appropriate Zone or Forest level archaeologist would accompany the marking crew to ensure that a sufficient buffer is created (Design features for cultural resources in Chapter 2).

c) 10SE1318 - Wagon Road: This road was at one time a major transportation route between Clarkia and Camp 3. Alternative B would reconstruct the road into a haul route to be used for timber sale purposes, and then convert it to a designated ATV route. Alternative C would forego using this road as a haul route, but would designate the road as an ATV route. Reconstruction of the wagon road into a haul route is an adverse effect to the historic feel of the road. This road is narrow and envelopes the character of a historic wagon road. In order to be used as a haul route, the road would need some widening and grading which would diminish its integrity. Designation as an ATV route would not have an adverse effect on the wagon road, since the road is currently used by ATVs and is in a relatively stable condition.

d) 10SE357 - Steam Donkey: Under Alternative B this site would be adversely affected by road reconstruction. The steam donkey is located on the east side of the road but associated artifacts are located on either side. Reconstruction activities have the potential to damage the artifacts around the steam donkey. Mitigation would include data recovery under the MOA. This site would not be adversely affected under Alternative C, which does not propose road reconstruction at this location.

e) 10SE1230 - Camp and Steam Donkey Remains: Alternative B has the potential to adversely affect this site due to the ATV designation within a portion of the historic railroad grade that has not been used by motorized vehicles. There are a number of artifacts on or immediately adjacent to the grade and traffic along it would damage them and the features associated with the camp. The damage to this site would be mitigated by data recovery of a sample of the remains and monitoring of construction activities by a professional archaeologist through an MOA. The camp also falls within a timber sale unit boundary but would be avoided by a buffer of at least one tree length. The appropriate Zone or Forest level archaeologist would accompany the marking crew to ensure a sufficient buffer is created (Design features for cultural resources in Chapter 2). This site is along the historic railroad grade, and many of the artifacts associated with it are located directly on the grade. Under Alternative C this site would not be adversely affected by the ATV activity since that segment would not be designated as an ATV trail under this alternative. Timber sale mitigations for Alternative C would be identical to those stipulated under Alternative B.

Cumulative Effects

Cumulative effects occur when past, present and foreseeable activities overlap with the proposed activities. In this case, the effects to cultural resources are all included in the above discussion of direct and indirect effects. The known past, present and foreseeable actions in this area are not expected to cause additional effects to known cultural resources.

Cultural Resource Discovery

There is potential for finding additional sites during project implementation. If additional sites are discovered, the sites would be recorded and then protected if found to be of historic significance. The decision to avoid, protect, or mitigate impacts to these sites would be in accordance with the National Historic Preservation Act. The timber sale contract provision *C6.24 # Protection of Cultural Resources* would be included in the timber sale contract to ensure protection of cultural sites located during project implementation. With site avoidance being the method to preserve cultural resources for the majority of the sites in the project area the proposed actions are basically the same as no action in terms of effects to those cultural resources.

Consistency with the Forest Plan and Regulatory Framework

Systematic inventory and reports are complete for this project area, and the Idaho Historic Preservation Office and Native American groups have been given the opportunity to comment. The area of potential effect included areas of previous projects that were inventoried for cultural resources. In accordance with the Programmatic Agreement among the United States Department of Agriculture, Forest Service, Northern Region (Idaho), The Advisory Council on Historic Preservation, and the Idaho State Historic Preservation Officer regarding Cultural Resources Management on National Forests in the State of Idaho and the related Site Investigation Strategy 2001 of the Idaho Panhandle National Forests. All alternatives comply with the National Historic Preservation Act and the Idaho Panhandle National Forests Forest Plan.

Economics

Differences between Draft EIS and Final EIS

Differences between Draft EIS and Final EIS are the result of changes in the alternatives as described in the Introduction for the FEIS. This resulted in changes in the PNV of both the timber harvest activities and proposed ecosystem projects.

Introduction

The management of the Idaho Panhandle National Forests (IPNF) has the potential to affect local economies. People are an important part of the ecosystem. Use of resources and recreational visitation to the Forest generate employment and income in the surrounding communities and counties and generate revenues that are returned to the federal treasury. This section presents concepts used to delineate an affected area and methods used to analyze the economic effects of the project, including the project feasibility, financial efficiency, and economic impacts.

Regulatory Framework

NEPA requires that consequences to the human environment be analyzed and disclosed, based on issues. NEPA does not require a monetary benefit-cost analysis. If an agency prepares an economic efficiency analysis, then one must be prepared and displayed for all alternatives [40 CFR 1502.23].

OMB Circular A-94 promotes efficient resource use through well-informed decision-making by the federal government. It suggests agencies prepare an efficiency analysis as part of project decision-making. It prescribes present net value as the criterion for an efficiency analysis.

The development of timber sale programs and individual timber sales is guided by agency direction found in Forest Service Manual (FSM) 2430. Forest Service Handbook (FSH) 2409.18 guides the financial and, if applicable, economic efficiency analysis for timber sales.

Analysis Area

The analysis area for the efficiency analysis is the Idaho Panhandle National Forests. The analysis area for the affect on jobs and income is comprised of Boundary, Bonner, Kootenai, Benewah, and Shoshone Counties in Idaho.

Affected Environment

The combination of small towns and rural settings, larger towns such as Coeur d'Alene, Idaho, and the urban area of Spokane, Washington create a diverse social environment for the geographical region around the Idaho Panhandle National Forests. Local residents pursue a wide variety of life-styles, but many share a common theme, an orientation to the outdoors and natural resources, especially within the smaller communities. This is evident in both vocational and recreational pursuits including employment in logging and milling operations, outfitter and guide businesses, hiking, hunting, fishing, camping and many other recreational activities.

Timber, tourism and agricultural industries are important to the economy of local areas. Despite the common concern for, and dependence on, natural resources within the local communities, social attitudes vary widely with respect to their management. Local residents hold a broad spectrum of perspectives and preferences ranging from complete preservation to maximum development and utilization of natural resources.

Timber management activities within the project area have the potential to impact the economic conditions of local communities and counties. To estimate the potential effect on jobs and income, a zone of influence (or impact area) was delineated. Counties were selected based on commuting data suggesting a functioning economy and where the timber is likely to be processed (log flows). Recent data on log flows from the IPNF was provided by the University of Montana's Bureau of Business and Economic Research. The zone of influence for this project is comprised of Boundary, Bonner, Kootenai, Benewah, and Shoshone Counties in Idaho.

A comprehensive socio-economic analysis and social assessment was completed during the revision of the forest plan. See the social and economics section of Chapter 2 of the Analysis of the Management Situation for the revised Forest Plan (March 2003) and the Social Assessment for the Idaho Panhandle National Forests (Parker and others 2002) for a description of the employment, income and social composition of the counties comprising the analysis area and the impact on each county from management of the Idaho Panhandle National Forests. These assessments indicate the counties within the analysis area are affected by timber management on the forest.

Analysis Methods

Project salability relies on the Region 1 Transaction Evidence Appraisal (TEA) System. The TEA uses regression analysis of recently sold timber sales to predict bid prices. The most recent appraisal model for the area of interest was used to estimate the stumpage value (expected high bid resulting from the timber sale auction) for the timber project. The estimated stumpage value for each alternative was compared to the base rates (revenues considered essential to cover regeneration plus minimum return to the federal treasury) for that alternative. The project is considered to be feasible if the estimated stumpage value exceeds the base rates. If the feasibility analysis indicates that the project is not feasible (estimated stumpage value is less than the base rates), the project may need to be supplemented with contributed funds if actual bids do not exceed base rates. There would also be an increased risk that the project would not attract bids.

Financial efficiency considers anticipated costs and revenues that are part of Forest Service monetary transactions. Present net value (PNV) is used as an indicator of financial efficiency and presents one tool to be used in conjunction with many other factors in the decision-making process. PNV combines benefits and costs that occur at different times and discounts them into an amount that is equivalent to all economic activity in a single year. A positive PNV indicates that the alternative is financially efficient.

Economic efficiency uses the cost and revenue estimates included in the financial analysis and adds other economic costs and benefits that are not part of Forest Service monetary transactions. This analysis considers the quantifiable market and non-market benefits and costs associated with implementing each alternative. As with financial efficiency, a PNV is calculated to determine efficiency. An example of a non-market benefit or cost is an increase or decrease in recreation. A value for recreation visitor use would be derived from local or regional studies. An economic efficiency analysis is not required (FSH 2409.18, 30), and would only be included in this analysis if it was a public issue and there are predicted changes to quantifiable non-market benefits or costs from the project.

Many of the costs and benefits associated with a project are not quantifiable. For example, the benefit to wildlife from habitat improvement or the cost associated with the degradation of visual quality from a project is not quantifiable. These costs and benefits are described qualitatively, in the individual resource sections of this document. Title 40, Code of Federal Regulations for NEPA (40 CFR 1502.23) indicates "For the purposes of complying with the Act, the weighing of the merits and drawbacks of the various alternatives need not be displayed in a monetary cost-benefit analysis and should not be when there are qualitative considerations."

Management of the forest is expected to yield positive benefits, but not necessarily financial benefits. Costs for various vegetation, recreation, wildlife, road and burning activities are based on recent experienced costs and professional estimates. Non-harvest related costs are included in the PNV analysis, but they are not included in appraised timber value.

Environmental Consequences

Project Salability

The estimation of project salability was based on a transaction evidence appraisal model, which took into account logging systems, timber species and quality, volume removal per acre, lumber market trends, costs for slash treatment, and the cost of specified roads, temporary roads and road maintenance (E-7). The estimated high bid (stumpage value) for each alternative is displayed in Table 3-6. The estimated high bid for Alternatives B and C indicate that the project is feasible. The revenue estimates from the salability analysis are used in the financial efficiency analysis discussed below.

Financial and Economic Efficiency

The financial efficiency analysis is specific to the timber harvest and ecosystem management activities associated with the alternatives (as directed in Forest Service Manual 2400-Timber Management and guidance found in the Forest Service Handbook 2409.18) Costs for sale preparation, sale administration, regeneration, and ecosystem restoration are included. The specialists on the project interdisciplinary team developed all costs, timing, and amounts. The expected revenue for each alternative is the corresponding estimated stumpage value from the transaction evidence appraisal equation (Table 3-6). The PNV was calculated using Quicksilver, a program for economic analysis of long-term, on-the-ground resource management projects (E-10). A four percent discount rate is used over the seven year project lifespan (2008-2014). For more detailed information on the itemized cost and benefits see the project file (E-2).

This analysis is not intended to be a comprehensive benefit-cost or PNV analysis that incorporates a monetary expression of all known market and non-market benefits and costs that is generally used when economic efficiency is the sole or primary criterion upon which a decision is made. Many of the values associated with natural resource management are best handled apart from, but in conjunction with, a more limited benefit-cost framework. These values are discussed throughout this document, for each resource area.

Changes to resources like fisheries habitat, wildlife habitat, soils and hydrology were measured using changes to conditions and are not described in financial or economic terms for this project. See the *Fisheries*, *Wildlife, Soils, and Water* sections of this document. Recreation levels are expected to change, are discussed in the recreation section of this document, and were not included in the economic efficiency analysis.

Planning costs (NEPA) were not included in any of the alternatives since they are cost that are incurred no matter which of the alternatives are chosen.

Table 3-6 summarizes the project feasibility and financial efficiency, including the estimated stumpage value, total revenue, and PNV for each alternative. Because all costs of the project are not related to the timber sale, three PNVs have been calculated. One PNV indicates the financial efficiency of the timber sale, including all costs and revenues associated with the timber harvest. The second PNV includes all costs for proposed ecosystem projects including precommercial timber stand improvement, riparian planting, and culvert replacement. The third PNV includes all costs for each alternative, including desired ecosystem management projects that would occur in conjunction with the timber sale.

Table 3-6 indicates Alternative B is financially efficient for the timber sale and all proposed ecosystem management costs. The No-Action Alternative, Alternative A, has no costs or revenues associated with it. Of the action alternatives, Alternative B has the highest timber sale PNV at $1,852,712 and the highest PNV for the timber sale plus other proposed ecosystem management costs, at $1,103,256. Even though Alternative C does not include road construction, it has a negative PNV for timber sale plus other proposed ecosystem management costs, due to the increased acreage of helicopter yarding which is the more expensive yarding method.

A reduction of financial PNV in any alternative as compared to the most efficient solution is a component of the economic trade-off, or opportunity cost, of achieving that alternative. The No-Action Alternative would not harvest timber, plant trees, or take other restorative actions and, therefore, incur no costs. As indicated earlier, many of the values associated with natural resource management are non-market benefits. These benefits should be considered in conjunction with the financial efficiency information presented here. These non-market values are discussed in the various sections this document.

Cumulative Effects

Many factors influence and affect the local economies, including changes to industry technologies, economic growth, international trade, and the economic diversity and dependency of the counties. This project is not expected to have any cumulative effect. However, the jobs and income associated with the action alternatives may bring the local economy some increased relative stability during the life of the project. Alternatives B and C are anticipated to create woody biomass that would be available for the use of the Heyburn Elementary – Forest Woody Biomass for Energy project.

Table 3-6 Project Feasibility and Financial Efficiency Summary (2008 dollars)

		Alternative B	Alternative C
Timber Harvest Information	Acres	2,144	2,144
	Volume (CCF)	49,353	49,353
	Predicted High Bid ($/CCF)	$37.54	$13.70
	PNV	$1,852,712	$676,136
Proposed Ecosystem Projects	PNV	-$749,455	-$749,455
Timber Harvest & Proposed Ecosystem Projects	PNV	$1,103,256	-$73,319

Environmental Justice Executive Order 12898

No disproportionate impacts to minority or low-income populations were identified during scoping or during any other portion of public involvement over the course of this analysis. District Ranger, Chuck Mark, discussed the project with representatives of the Coeur d'Alene Tribe during meetings on March 24, 2006; February 22, 2007; and March 18, 2008 (PI-57, PI-63, PI-83A). They did not express concerns about the project. All alternatives comply with Executive Order 12898.

Fisheries

Differences between Draft EIS and Final EIS

- Clarified analysis area boundaries and added discussion on determination and relativity of area to surrounding drainages
- Added clarification and discussion to the "Determination of Limiting Factors to the Fisheries Resource" section
- Clarified and corrected citations, references, numbers, etc.
- Added clarification and discussion to the road density "rating" analysis/uses and applicability as it relates to fisheries and clarified types of road used in analysis
- Added discussion to existing fish population characteristics "life history types"
- Clarified and discussed the limitations and variability of using INFS RMOs as a "cook book" for making reference condition assumptions and comparing existing elements (LWD/pools) to INFS targets
- Added discussion and citation on the importance of LWD in the formation pool habitat, the importance of pool habitats; effectiveness and proposal of LWD placement and pool habitat formation and subsequent fisheries enhancement; and the effectiveness of INFS buffers, BMPs and mitigations for short-term effects
- Included information from literature review about how roads and types of roads more specifically affect fish
- Clarified how much riparian area has been affected by ATV activity in Bear/Little Bear Creek
- Enhanced the cumulative effects discussion for Alternative A

- Reanalyzed direct and indirect effects of Alternative B due to the elimination of the stream crossing
- Added discussion of effects from timber stand improvement work proposed in RHCA and referenced designed features

Introduction

This section discusses the regulatory framework, analysis methods, the cumulative effects area, and environmental consequences for the fisheries resource in the Bussel 484 Project Area. This document provides a comparison of potential direct, indirect and cumulative effects between the three alternatives. It also serves as the biological evaluation (BE) that documents the analysis and effects determination of the proposed action on sensitive species. Listed fish species will be addressed in a separate biological assessment (BA) when an alternative is selected.

Regulatory Framework

Four standards are listed in the Idaho Panhandle National Forests (IPNF) Forest Plan (USDA Forest Service 1987, F-2) for fisheries and additional guidelines are described in the Inland Native Fish Strategy (USDA 1995 Inland Native Fish Strategy DN and FONSI, F-2) which are applicable to the fisheries resource. The Inland Native Fish Strategy (INFS) specified riparian goals and riparian management objectives (RMOs). To achieve these goals and objectives, standards and guidelines were developed.

Section 7 of the 1973 Endangered Species Act (ESA) includes direction that federal agencies will not authorize, fund, or conduct actions that are likely to jeopardize the continued existence of any Threatened or endangered species or result in the destruction or adverse modification of their critical habitat.

Executive Order 12962 (June 7, 1995; F-2) states objectives "to improve the quantity, function, sustainable productivity, and distribution of U.S. aquatic resources for increased recreational fishing opportunities by: (h) evaluating the effects of Federally funded, permitted, or authorized actions on aquatic systems and recreational fisheries and document those effects relative to the purpose of this order."

Additional regulatory requirements that relate to fisheries resources (*e.g.* Clean Water Act and Idaho Water Quality Standards, Idaho 303(d) list) are addressed in the *Soil* and *Water* sections.

Analysis Area

In order to determine the project's contribution to "cumulative effects," a "fisheries analysis area" was determined based on selecting an area that contains all potential project activities and defines the largest watershed area that allows for the greatest level of resolution at various geographic and temporal scales. Known past activities which occurred in the analysis area that may have had an affect on the fisheries resources and may residually be affecting the fisheries resources were considered (see beginning of Chapter 3).

For this analysis, the resource area of the larger Bussel Creek Watershed (14,662 acres), which is a 6th level HUC, was subdivided into smaller manageable units referred to as "subwatersheds", which are 7th level HUC's (F-3). See Map 18 in Appendix A. These units are smaller components to the larger watershed. If habitat were maintained in these smaller subwatersheds there would be limited and potentially no effect to the fisheries resource on the larger watershed. One unit, found outside the project area boundary and termed as a "Segment of Marble Creek"; which is a main-stem stream segment found in the lower portion of the 91,160 acre Marble Creek Drainage and is approximately 8 miles long and is not broke out as a "sub-watershed". However, because the project area subwatersheds flow into Bussel Creek, which flows into lower Marble Creek, this 8-mile segment is included in the analysis area because management upslope (in the Bussel Creek Watershed) may have an indirect short term effect on the fish habitat and migrating or resident fish in this stream segment due to the stream network. The 8-mile segment of Marble Creek, included in the analysis area, starts at its confluence with Bussel Creek and ends at the confluence with the St Joe River to allow an analysis area for species with larger migratory home ranges such as bull trout and cutthroat trout.

The scale and location of the Bussel 484 Project Area within the Bussel Creek Watershed (14, 662 acres) in relation to the much larger Marble Creek Watershed (91,160 acres) tends to render most effects to the much larger adjacent watershed quantitatively immeasurable beyond the temporal and spatial boundaries of the analysis area. Assessment of the 8-mile section of the river found down stream of the project area are analyzed mostly

qualitatively to more adequately and reasonably depict potential effects of the proposed alternatives to the fisheries resource down stream of the project area.

The following analysis area discussions focus on the fisheries resource within the subwatersheds of the Bussel 484 Project Area and the previously mentioned segment of Marble Creek and collectively hereafter are referred to as the "fisheries analysis area" (F-3). These discussions are arranged in the following order:

1) *Bussel Creek Subwatershed*
2) *Lines Creek Subwatershed*
3) *Norton Creek Subwatershed*
4) *Toles Creek Subwatershed*
5) *Bear Creek Subwatershed*
6) *Little Bear Creek Subwatershed*
7) *8-mile Segment of Marble Creek*

The selection of the analysis areas was based on the fact that these drainages contain fish habitat and because activities proposed in the Bussel 484 Project area could potentially affect fish habitat in these areas (F-3). The project area is NOT within a "Priority watershed" as defined in INFS (USDA 1999 Internal Memo: Key and Priority Watershed Task Team Report; F-3). Priority watersheds are watersheds that have excellent habitat or strong populations of inland native fish (with a priority on bull trout), watersheds that could provide those, or degraded watersheds with high restoration potential.

Analysis Methods

Methodology Used in Assessment & Description of Affected Environment

The affected environment describes the current condition of the fisheries resource within the project area. It is used to display and describe the fisheries conditions, which have the potential to be affected by the proposed action.

The proposed activities and their potential effects to water quality or changes to stream channels and fish habitat are the main concerns related to the fisheries resources.

Literature and Office Review

The assessment of existing conditions is critical to an environmental analysis because it describes the current condition of the Bussel 484 Project Area and provides a basis for comparing the effects of management alternatives. Information for the fisheries analysis was compiled using data from the field, observations, and data collected from 2002 to 2007 (F-4). Additional information was gathered from the Bussel 484 *Water* and *Soils* sections; district files, historical records, aerial photographs, and published scientific literature.

GIS Technology

Geographical Information System (GIS) technology was used to combine existing databases, proposed activities and data taken from aerial photos to create maps and summary tables of existing conditions. Landtype maps and descriptions were input into GIS layers to evaluate the existing condition and for the effects analysis. Stream miles are approximations based on GIS and map analysis (F-4).

Field Review

Project area streams were quantitatively and qualitatively assessed for habitat quality, habitat quantity, and fish species presence or absence and abundance (F-4). Perennial crossings where known fish presence occurred were inventoried and evaluated for fish passage using R-1 protocols for road-stream crossings (Clarkin and others 2003).

Management Indicator Species (MIS) Selection

The analysis of direct, indirect, and cumulative effects to fish is based on effects to sensitive and management indicator fish species (MIS). Under this concept, larger groups of organisms or communities are believed to be adequately represented by a subset of the group. The Forest Plan (IPNF 1987) identifies westslope cutthroat trout

and bull trout as potential Management Indicator Species (MIS) for fisheries (Forest Plan Appendix L). Currently, westslope cutthroat are known (Electro fishing Survey results) (F-4) to utilize streams within the Bussel Creek Project Area for spawning, rearing, over-wintering or migration. Marble Creek is considered to have occasional usage by bull trout (St. Joe BA). Furthermore, these two species have similar habitat needs. Consequently, westslope cutthroat and bull trout have been selected as appropriate MIS for the fisheries analysis of this project.

Determination of Limiting Factors to the Fisheries Resource

The deviation from the desired environmental conditions affecting fisheries in the analysis area is called a limiting factor. A limiting factor is a factor that limits or reduces the ability of an area to produce the desired product (Everest and Sedell 1984). In this case the desired products are fish. Therefore, the identification of a limiting factor is developed by comparing the desired conditions to the current condition. Due to site variability, each of the subwatersheds and the Marble Creek stream segment in the Bussel 484 Project Area was analyzed as its own analysis area using a limiting factor assessment, which was conducted to focus analysis efforts on those factors, which are most important. The context of the larger Bussel Creek Watershed, which encompasses the smaller subbasins and potentially affected stream downslope (Marble Creek Stream Segment described above), was analyzed based on the combination of limiting factors found throughout the analysis area and was used to determine the cumulative effects of the project alternatives to the fisheries resource.

The USFWS (1998) developed a list of indicators and measurement parameters (Table 3-7), which can be used to characterize fish habitat elements and assist in the determination of limiting factors. Some of these indicators and measurement parameters are shown in Table 3-7 and are described in the existing condition section but were not selected for use in assessing subwatershed or segment condition or for analyzing alternatives quantitatively, because there was insufficient historic data for use in meaningful quantitative analysis or because they are elements that would not be altered by any proposed activity (i.e. the amount of the watershed at a certain elevation will not be altered by any proposed activity). However the relative concepts of all indicators shown in Table 3-7 are discussed throughout this report at least qualitatively (which include references to the soils and water reports) as they relate to the condition of and effects to the fisheries resources.

Table 3-7 Indicators Considered in Limiting Factor Assessment

Indicator	Measurement Parameters
Population Characteristics	Population size, growth and survival, diversity, isolation, persistence
Stream Channel Conditions	Width to depth ratio, stream bank condition, floodplain connectivity
Flow / Hydrology	Change in peak/base flows, increase in drainage network
Watershed Condition	Sensitive landtype, road density, riparian harvest, disturbance regime, disturbance history
Water Quality	Temperature, sediment, chemical contaminants / nutrients
Habitat Access	Physical barriers
Habitat Elements	Substrate embeddedness, large woody debris, pool frequency and quality, large pools, off channel habitat, refugia

The following indicators and subsequent measurement parameters were selected for use in analyzing the existing condition for limiting factors and determining the effects of the alternatives on the fisheries resource and habitat elements in the analysis area. The indicators and measurement parameters which were most useful and objective in determining if there are indeed limiting factors of the fisheries resource in the fisheries analysis area were selected from Table 3-7 and are listed in Table 3-8 below.

Table 3-8 Indicators & Measurement Parameters for Determining Limiting Factors: Indicators Chosen for Limiting Factor Assessment

Indicator	Measurement Parameters
Population Characteristics	Population size, fish assemblage (life history) diversity, persistence
Stream Channel Conditions	Stream bank condition, floodplain connectivity
Flow / Hydrology	Change in peak/base flows
Watershed Condition	Road density, riparian harvest
Water Quality	Sediment, chemical contaminants / nutrients, temperature
Habitat Access	Physical barriers
Habitat Elements	Large woody debris, Pools

Methodologies and Measure Parameters used in Determining Existing Condition and Effects to the Fisheries Resource

This section further discusses the methods used to measure and analyze key components or "indicators" of the fisheries resource within the cumulative effects area. These measurements are important because they help to describe the current condition, indicate limiting factors and can give insight to the overall changes from a reference condition. A clear understating of the current condition and the limiting factors of the fisheries resource will ultimately help to determine direct, indirect, and cumulative effects to the existing condition from the alternatives.

Population Characteristics

Fish Population Size: Fish population sizes in the project area streams can be characterized by the following rates; < 3 fish/100 m^2 is considered low density and > 12 fish/100 m^2 is considered excellent. This methodology and rates for determining population sizes, recommended by Joe Dupont, IDFG, was used for this project. Existing presence and distribution were determined based on electro-fishing surveys, spawning surveys and incidental sightings during habitat surveys (F-4).

Fish Assemblage Diversity: Existing presence and distribution were determined based on electro-fishing surveys, spawning surveys and incidental sightings during habitat surveys (F-4).

Persistence (trend): Persistence is addressed at the conclusions and determination sections of this "Biological Evaluation" (BE) for westslope cutthroat and the "Biological Assessment" (BA) for bull trout. For westslope cutthroat trout a conclusion shown in Table 3-37 is made based on the analysis of potential effects from the alternatives to the fisheries resource in which a determination is made. One or more of the following determinations on effects to westslope cutthroat is made for each alternative:

NI = No Impact
MIIH = 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
WIFV = Will Impact Individuals Or Habitat With A Consequence That The Action May Contribute To A Trend Towards Federal Listing Or Cause A Loss Of Viability To The Population Or Species

BI = Beneficial Impact

For bull trout (Federally listed species) in the Biological Assessment BA, a determination is made, based on the analysis of potential effects using the "Bull Trout Matrix/Checklist for Documenting Environmental Baseline and Effects of the Proposed Action(s) on Relevant Indicators" of the "Selected Alternative" to the fisheries resource (F-5). One or more of the following determinations on effects to bull trout is made for each action alternative:

1. No Effect
2. May Affect, Not Likely to Adversely Affect
3. May Affect, Likely to Adversely Affect
4. Beneficial Effect

Stream Channel Conditions

Stream Bank Condition: Existing conditions for this parameter are based on qualitative information (*Water* section; field notes and aerial photo interpretations (F-4)).

Floodplain Connectivity: Existing conditions for this parameter is based on qualitative information provided in the, field notes and aerial photo interpretations (*Water* section; F-4).

Flow / Hydrology

Peak Flows: Existing conditions for this parameter is based on qualitative information provided in the Bussel 484 Project *Water* section. USGS gauged data from the St. Joe River annual-series of peak flows was used and extrapolated for the project area *(Water* section*)*. The WATSED model was used to estimate increases in water yield (which can affect peak flows) *(Water* section*)*.

Watershed Condition

Road Density: Road density was determined based on miles of road (road prescriptions: open, gated and barriered) by acres within the individual drainages. These road prescriptions were selected for the road density calculation because they have a potential to produce negative effects to the stream. The remaining road prescriptions, long-term storage and decommission (re-contouring), create hydrologically inert roads and reduce sediment loss and therefore are not included in the road density calculation (Switalski and others 2004; IPNF Forest Plan Monitoring Report 2004, page 94; USDA June 1996). The influence of road density to the fisheries resource was based on research conducted for the Interior Columbia Basin Ecosystem Management Project (ICBEMP) (Lee and others 1997). That research found that the "status of four non-anadromous salmonid species (which include bull trout and westslope cutthroat trout) are less likely to use "moderate" to "highly" roaded areas for spawning and rearing and if found are less likely to be at strong population levels" (Lee and others 1997 p. 1347). Table 3-9 provides the ICBEMP definitions for road density ratings (Quigley and others 1996 p. 67) which were used as a baseline for describing the existing density of roads within the analysis area and their impacts on the fisheries resource.

Table 3-9 Total Road Density Ratings

Rating	Very Low	Low	Moderate	High	Extremely High
Densities	0.02-0.1 mi/mi^2	0.1-0.7 mi/mi^2	0.7 – 1.7 mi/mi^2	1.7 – 4.7 mi/mi^2	4.7 + mi/mi^2

Encroaching road density and RHCA road density: These parameters utilize the same mi/mi^2 rating system as total road density (Table 3-12) and are used as a baseline for describing the existing density of roads that are within 50 feet from any stream bank and their impacts on the fisheries resource.

Riparian Harvest: Riparian harvest can cause stream banks to become destabilized, reduce shade (increase stream temperatures), and reduce LWD recruitment potential. These effects can thus reduce water quality and fish habitat quality. Acres of "past riparian harvest" were determined by overlaying harvest history information with relevant riparian habitat (RHCA) widths. Riparian habitat widths are based on INFISH categories: 300 feet perennial fish bearing, 150 feet perennial non-fish bearing, and 50 feet intermittent.

Water Quality

Chemical Contaminants / Nutrients: Analysis of this parameter is based on information provided in the *Water* section. Chemical contaminants and nutrient levels would not appreciably change with the proposed activities.

Sediment: The TMDL and WATSED models are used to estimate sediment additions and reductions (*Water* section).

Temperature: Temperature data was collected on several of the streams within the fisheries analysis area using automated Onset temperature recorders (F-5). The criteria used for temperature is based on Idaho State criteria (Idaho DEQ 2005), Table 3-10. A stream is considered to be temperature impaired if the temperature standard is exceeded greater than 10% of the specified time period (Pettit, personal communication F-5).

Due to the inability to deploy stream temperature monitors in early spring because of snow packs and lack of access, only some of the specified time periods for spring spawning of salmonids and juvenile rearing for bull trout were monitored. Therefore it is difficult to get accurate "days of exceedance" percentages. However, there is enough data to show temperature trends throughout the critical summer and fall months. See the individual sub-basin description section below for more detail on current stream temperatures.

Table 3-10 Temperature Criteria Standards

Metric	Spring Salmonid Spawning	Bull Trout	
Dates	April 15 – July 15	Juvenile 6/1-8/31	Spawning 9/1-10/31
Maximum Daily Maximum Temperature (MDMT)	13 °C		
Maximum Weekly (7- day average) Maximum Temperature (MWMT)		13 °C	
Maximum Daily Average Temperature (MDAT)	9°C		9°C

Habitat Access

Physical Barriers: Culverts or dams can create migration barriers, which decrease the opportunity for dispersal of fish species. Waterfalls, channel flow intermittency, and some debris jams are part of the reference conditions. In 2004 existing culverts in the analysis area were surveyed. Culverts suspected of having existing accessibility issues were evaluated based on *Region 1 Passage Through Crossings Assessment* (F-4) (See Existing Conditions sections for results). The analysis of this factor determines if there would be a change to the number of physical barriers and the overall effect of the existing barriers to the fisheries resource. In the Bussel 484 Project Area high gradient stream reaches in headwater locations were likely the predominant form of natural barriers historically.

Habitat Elements

LWD (large woody debris) and Pools: The description of LWD and pools is based on quantitative surveys conducted between 2002 and 2004 according to procedures outlined in the Region 1 Fisheries Habitat Evaluation Handbook (FSH 2609.23) or the R1/R4 methodology (Overton and others 1997), woody debris inventory (F-4), a 1991 habitat surveys for Bussel Creek and Little Bear Creek (field reviewed in 2003 and 2006 respectively F-4), historical records, aerial photographs review, review of information in the *Water* section, discussions with Idaho Department of Fish and Game (IDFG) and U.S. Fish and Wildlife Service (USFWS).

Quantitative information collected on LWD and pools are compared to the INFS riparian management objectives (RMOs) to help analyze the overall condition of fish habitat in the analysis area.

The INFS Interim riparian management objective for LWD in forested systems is: >20 pieces per mile (3.8 per 1000 feet); >12 inch diameter; > 35 foot in length. Due to the fact that not all ecosystems are the same and site conditions vary widely throughout the INFS zone of influence, caution must be used in assessing LWD conditions using the RMOs as a guideline or comparison tool.

The INFS Interim riparian management objective for pools in forested systems is shown in Table 3-11 below.

Table 3-11 Pool Frequency Objectives

Wetted Width (Feet)	10	20	25	50	75	100	125
Pools Per Mile	96	56	47	26	23	18	14

**Pools per mile are converted to pools per feet for display of data.*

The interim RMOs for stream channel conditions provide the criteria against which attainment or progress toward attainment of the riparian goals are measured. Interim RMOs (as a tool) can provide the target or goal toward which managers aim as they conduct resource management activities across the landscape (INFS EA 1995).

Methodology for Summarizing the Limited Factor Assessment

Following the descriptions of the individual drainages is a summary of the limiting factors to the fisheries resource identified for the cumulative effects area. The number and type of limiting factors are then considered in the determination of the overall condition of the fish habitat. Due to the overall negative affects that roads typically have on watersheds and fish populations (Lee and others 1997), "high" road densities will be considered a limiting factor and "extremely high" road densities will be an even greater weighted limiting factor. For the purpose of this analysis the overall condition of the fish habitat is categorized as follows:

- Unaltered: Fish habitat is considered to be "unaltered" if no limiting factors are identified.
- Adequate: Fish habitat is considered to be "adequate" if no more than two limiting factors are identified (but neither are extremely high road density).
- Moderately Altered/Moderate Risk: Fish habitat is considered to be "moderately altered" from the historic range of variability and/or at moderate risk of further undesirable change if no more than three limiting factors are identified (including extremely high road density) or if no more than four limiting factors are identified (none being extremely high road density).
- Highly Altered/High Risk: Fish habitat is considered to be "highly altered" from historic range of variability and/or high risk of further undesirable change if extremely high road density and three limiting factors are identified or more than four limiting factors are identified.

Table 3-12 Limiting Factor Assessment Summary for Cumulative Effects

Subwatershed or Stream Segment	Limiting Factor Assessment Summary
Bussel Creek	Highly Altered/High Risk
Bear Creek	Highly Altered/High Risk
Little Bear Creek	Highly Altered/High Risk
Toles Creek	Moderately Altered/Moderate Risk
Norton Creek	Highly Altered/High Risk
Lines Creek	Highly Altered/High Risk
Lower Marble Creek Segment (approx. 8 miles)	Highly Altered/High Risk

The scale of the Bussel 484 Project Area within the Bussel Creek Watershed (14, 662 acres) in relation to the much larger Marble Creek Watershed (91,160 acres) would tend to render most effects to the much larger adjacent watershed quantitatively immeasurable beyond the temporal and spatial boundaries of the analysis area. Indicators considered in the limiting factor assessment for the large Marble Creek Watershed, as it relates to the 8-mile section of the river found down stream of the project area are analyzed mostly qualitatively to more adequately depict potential effects of the proposed alternatives to the fisheries resource down stream of the project area.

Desired Future Condition

The desired future condition for the fisheries resource is based on several sources: desired condition, as identified in the Idaho Panhandle National Forests Forest Plan, that the fisheries habitat will be improved (USDA 1987 Idaho Panhandle National Forests Forest Plan p. II-22); reference conditions; the Bear Bussel Ecosystem Analysis at the Watershed Scale; Inland Native Fish Strategy (INFS) guidelines 1995; literature reviews; and communication with Idaho Department of Fish and Game.

Cumulative Effects Determination

While impacts can be differentiated by direct, indirect, and cumulative, the concept of cumulative impacts takes into account all disturbances since cumulative impacts result in the compounding of the effects of all actions over time. Therefore, in order to determine the project's contribution of cumulative effects to analysis area, past activities,

present activities and reasonable foreseeable activities, which occurred or may occur, are considered for their effect to the fisheries resources in the area.

Affected Environment

Reference Condition

The following summarizes the reference conditions, which were known to exist, or which were expected in the Bussel 484 Project Area before modern human management activities began. Very little specific information is available for the project area because detailed descriptions were not completed prior to the beginning of management activities in the early 1900s. Reference conditions are therefore inferred based on the physical conditions, which could occur in areas with topography, geology, rainfall, etc similar to the project area. INFS riparian management objectives (RMOs) can also give some quantitative guidance to what typical forested ecosystem streams in a reference condition may have had in terms of LWD quantity and quality and pool quality and abundances. There are some limitations in using INFS RMOs as guidance or a “cook book” for quantitative stream habitat needs or condition because of variability in site-specific conditions. However, INFS RMOs can and will be used throughout this analysis as a guidance tool. Reference conditions are also based on the known and documented habitat needs of the native species of the project area.

Population Characteristics

Fish Population Size

Bull Trout (*Salvelinus confluentus*): There is no historic quantitative data that would indicate a population size for the St. Joe River System. Bull trout are native to the St. Joe River system and historically utilized habitat in the Marble Creek Drainage (Maclay 1940; Fields 1935), possibly even in the Bussel Creek Drainage because Bussel Creek flows into Marble Creek, which flows directly into the St Joe River, which is inhabited by an adfluvial (fish that live in lakes and migrate into rivers or streams to spawn) population of bull trout. There are no barriers that would prevent bull trout from accessing Marble Creek or Bussel Creek from the St. Joe River. However, not all the stream reaches in the project area would have had suitable habitat for fluvial (fish that spawn in streams or rivers and overwinter or live year-round in streams or rivers) or adfluvial bull trout because they are small, high-gradient streams that are not typically associated with quality pools for resting and riffles with appropriate substrate for spawning, which are requirements for bull trout persistence.

Westslope Cutthroat Trout (*Oncorhynchus clarki lewisi*): There is no historic quantitative data that would indicate a population size for the St. Joe River System. Westslope cutthroat trout are native to the St. Joe River system and have been well documented (Maclay 1940, Fields 1935). It is assumed, based on physical stream channel conditions, westslope cutthroat trout populations used the tributary streams and subbasins selected for as the fisheries analysis area prior to human disturbances. Although the historic distribution of westslope cutthroat in the tributaries within the Bussel 484 Project Area is speculated, ‘natural’ main stem barriers would have limited access especially due to high headwater stream gradient.

Fish Assemblage Diversity: Historically, Bussel Creek and many of its tributaries may have had seasonal fluvial or adfluvial usage of all native St. Joe River Basin fish species, which included sculpin, bull trout, and westslope cutthroat trout. This is because the analysis area tributaries are directly connected to the St Joe River, which was and is inhabited by adfluvial and fluvial populations of these native species; and there are no major barriers that would have prevented these species from accessing the Marble Creek or Bussel Creek drainages or permanently isolating fish from accessing suitable habitats across the landscape. However, waterfalls, channel flow intermittency, high stream gradients and some debris jams are part of the reference conditions that naturally and continually fragment and isolate aquatic habitats for various periods of time.

Persistence: Individuals likely used all available suitable habitats for a variety of life stages and life history strategies. Viable populations of species likely thrived in pre-management (Reference Conditions) throughout the St Joe river basin.

Stream Channel Conditions

Stream Bank Condition: Biologically preferred conditions of bull trout and westslope cutthroat trout also provide insight into reference conditions (such as streambanks and stream channels) for aquatic resources in the Bussel 484 Analysis Area. The preferred habitat of bull trout and westslope cutthroat trout can be generalized as cold,

clear streams that possess rocky, silt-free riffles for spawning and slow, deep pools for feeding, resting, and over-wintering (Young 1995; Reel and others 1989). Stable undercut streambanks likely provided cover and protection to salmonids. Streambanks were likely very stable, vegetated and functioning appropriately within a natural range of variability as limited disturbances, other than wildfires, would have significantly impacted riparian vegetation and thus streambanks.

Floodplain Connectivity: Prior to the beginning of management activities in the early 1900s the influence of roads and riparian activities on floodplains was nonexistent because roads were not yet built. Floodplains and stream channels would have interacted functionally in accordance with natural processes because watersheds were undisturbed (*Water* section).

Flow / Hydrology

Peak Flows: Water yields, which can affect sediment yields, were in balance through natural process, such as fire, mass failure and climatic events (*Water* section).

Watershed Condition

Watershed Road Density / Encroaching Road Density and RHCA Road Density: Prior to the beginning of management activities in the early 1900s the influence of road density to the fisheries resource was nonexistent, as roads were not yet built (See *Water* and *Soils* sections for overall watershed reference condition).

Water Quality

Each subwatershed or stream segment would historically have had natural amounts levels of nutrients, bacteria, pH, dissolved gas, toxic substances, dissolved oxygen, temperature, ammonia, habitat, sediment, and turbidity levels that supported aquatic life.

Chemical Contaminants / Nutrients: Each subwatershed or stream segment would historically have had natural amounts nutrients.

Sediment: Each subwatershed or stream segment would historically have had natural amounts sediment inputs.

Temperature: Prior to the beginning of management activities in the early 1900s the influence of roads and riparian activities on riparian areas was nonexistent. Stream temperatures within the project area would have been within the natural range of variability.

Habitat Access

Physical Barriers: Fish would have had unimpeded access to all suitable habitat. However, waterfalls, channel flow intermittency, high stream gradients and some debris jams were part of the reference conditions that naturally and continually fragmented and isolated aquatic habitats and fish species for various periods of time.

Habitat Elements

Large Woody Debris and Pools: Several studies have linked bull trout density in stream reaches to local-habitat features such as pool frequency, amount of large wood and fine sediments, water temperature, and the presence of groundwater (Saffel and Scarnecchia 1996; Watson and Hillman 1997). Salmonids generally require cool, clear water; clean gravel substrates; well-vegetated banks for shading and bank stability; abundant instream cover such as boulders, logs, and undercut banks; and unobstructed migratory corridors (Bjornn and Rieser 1991). Stream habitats would likely have been influenced by woody debris constrictions and local confinement, which typically produce scour pools and riffles. Large woody debris in streams forms pools and retains sediment and other particular organic matter (Beechie 1997).

In-stream woody debris and long-term periodic large woody debris recruitment is a key component to stable streambanks and quality fish habitat. Due to the forested nature of the ecosystem and stream gradients within the project area, aquatic habitats would likely have included a diverse mix of fast and slow water habitats depending greatly on the abundance of in-stream LWD and periodic recruitment of LWD. It is also expected that beaver activity would have had an influence on channel morphology and associated habitat conditions in the area.

Biologically preferred conditions of bull trout and westslope cutthroat trout also provide insight into reference conditions for aquatic resources in the Bussel 484 Analysis Area. The preferred habitat of bull trout and westslope

cutthroat trout can be generalized as cold, clear streams that possess rocky, silt-free riffles for spawning and slow, deep pools for feeding, resting, and over-wintering (Young 1995; Reel and others 1989). Therefore it is inferred that habitat elements preferred by bull trout existed in the reference state.

Existing Condition

This section further discusses and analyzes the existing condition of key components or "indicators" of the fisheries resource within the cumulative effects area. These indicators are important because they help to describe the existing condition, indicate limiting factors and can give insight to the overall changes from a reference condition.

Analysis of effects from historical activities (federal and/or non-federal) is important in determining causes of the existing condition and can help determine potential cumulative effects of present and future activities (federal and/or non-federal)on the fisheries resources in the analysis area. A list of historic activities and their potential effects to the environment which have contributed to the development of the existing condition of the fisheries resources in the analysis area is found below in Table 3-13 and in Chapter 2. Some historical activities have had little effect on existing conditions of the fisheries resources and others have had significant effects. Historical activities that have had a significant effect on the current condition of the fisheries resources are discussed in more detail in the following Existing Condition section of this document. Incremental and collective effects from past, present and reasonably foreseeable federal and/or non-federal activities to the fisheries resources are discussed in the Cumulative Effects sections below.

Table 3-13 Historical Activities that Occurred in the Area

Historic Activity	Potentially Effects To Stream or Fish Habitat	References
Railroad construction	Increased stream temperature (loss of shade), sedimentation, stream bank degradation	*Water* section
Splash dams	Stream channels and stream banks degraded, Habitat loss (i.e. pools and LWD), Sedimentation	*Water* section
Log drives	Stream channels and stream banks degraded, Habitat loss (i.e. pools and LWD), Sedimentation	*Water* section
Mechanical site preparation	Increased stream temperature (loss of shade in RHCAs), Stream Channels degraded, Habitat loss (i.e. pools and LWD), Sedimentation if done in RHCAs	
Prescribed burning	Potential sedimentation if done within RHCA	*Water* section
Tree planting	No Indication of past effects. Some planting may have occurred in the RACA thus helping to reduce stream temperatures long term.	n/a
Road construction	When construction occurred within RHCAs Increased stream temperature (loss of shade in RHCAs), Stream Channels degraded, Habitat loss (i.e. pools and LWD, physical fish barriers), Sedimentation, diminished quality of spawning gravels channel network loss, Floodplain/channel disconnection may have occurred.	*Water* section
Road maintenance	Minimal sedimentation if done within RHCAs.	Road Maintenance BMP St Joe Ranger District Road Maintenance BA.
Precommercial thinning	Stream channels, habitat (i.e. pools and LWD), Precommercial thinning done in RHCA could have increased the health and growth rates of trees and stands that will eventually fall in streams creating cover and habitat for fish from LWD.	
Pocket gopher control	No effects	St. Joe Ranger District, Pocket Gopher Control, monitoring report 2002.

Historic Activity	Potentially Effects To Stream or Fish Habitat	References
Transmission line maintenance	No Indication of past effects	n/a
Firewood gathering	No Indication of past effects. Removal of potential LWD in RHCAs may have occurred but is not known.	n/a
Camping	Minimal effects if any	n/a
Berry picking	No Indication of past effects	n/a
Christmas trees (personal-use)	No Indication of past effects	n/a
Motor vehicle use: full-size, ATV, and motorcycle	Where occurrence is inside RHCAs stream channels and stream banks degraded, sedimentation can occur.	*Water* section
Fire Suppression	Minimal effects for the 2007 Elm Street Fire. Earlier suppression efforts reduced effects of natural fire frequency leading to heavier fuel load which may have increased the potential for higher severity fires.	*Fire and Fuels* section
Wildfires	Increased stream temperature (loss of shade), sedimentation, stream bank degradation (i.e. loss of pools and LWD). Historically (pre 1900s) fires would likely have had effects that were within a natural rage of variability and local fauna and flora would have been adapted.	*Water* section *Fire and Fuels* section
Weed control under the St. Joe Noxious Weed EIS	No Indication of past effects	n/a
Timber Harvest	For the entire Bussel Creek Watershed 2,034 acres have been harvested since 1960 (400 acres within RHCAs), Harvest within RHCAs increased stream temperature (loss of shade in RHCAs), degraded stream channels, Habitat loss (i.e. pools and LWD), Sedimentation, Floodplain/channel disconnection may have occurred.	*Water* sections Appendix A Map 15

Population Characteristics

Fish Population Size

Bull Trout: Bull trout *(Salvelinus confluentus)* is listed as "sensitive" by Region 1 of the USDA Forest Service and as "species of special concern" by the State of Idaho. The U. S. Fish and Wildlife Service (USFWS) lists bull trout as a fish species that occur, potentially occur, and/or habitat exists within the St Joe River portions of the Idaho Panhandle National Forests (Biannual Species List for the Idaho Panhandle National Forests; FWS Reference List 1-9-08-SP-0067 (105.0100), April 9, 2008). The coterminous United States population of the bull trout (*Salvelinus confluentus*) was listed as threatened on June 10, 1998 (64 FR 58910).

Bull trout population status reviews have found considerable reductions in the distribution and abundance throughout their historic range (USDA Forest Service 1996a, An assessment of the conservation needs of bull trout; Rieman and McIntyre 1993). However, the IPNF Forest Plan monitoring reports indicate that bull trout populations appear to be stable throughout most of northern Idaho (USDA Idaho Panhandle Forest Plan Monitoring and Evaluation Reports 1998, 2000, 2002 and 2003).

Genetic analysis has shown bull trout populations in the St. Joe River system to be a unique stock though they are closely linked to the upper Columbia River clad - one of three major groupings of bull trout throughout the Columbia and Klamath River drainages (Williams, unpublished). In a status review of bull trout on the Idaho Panhandle

National Forests stocks from the St. Joe River system were considered to be at moderate risk of extinction (Cross 1992).

Currently, bull trout are known to occupy habitat in the St. Joe River and many of its tributaries. Occasional bull trout presence is probable for Marble Creek (St. Joe River/NF Clearwater Basins B.A.). This is because Marble Creek is a direct tributary to the St Joe River, which is inhabited by an adfluvial population of bull trout, and there are no barriers that would prevent bull trout from accessing Marble Creek. There are no historic records of bull trout occurring in Bussel Creek or any of its tributary streams found within the project area. No bull trout were located during recent surveys of the streams found within the project area.

Westslope Cutthroat Trout: Westslope cutthroat trout are listed as "sensitive" by Region 1 of the USDA Forest Service and are listed as a "species of special concern" by the State of Idaho. In addition, the U.S. Fish and Wildlife Service (USFWS) list westslope cutthroat trout as a "species of concern" with respect to section 7(c) of the 1973 Endangered Species Act (ESA; USDI 2002).

Population status reviews of the westslope cutthroat trout (WCT) within the United States, determined that currently WCT occupy an estimated 59% of the historically occupied habitat, and in Idaho populations occupy almost 96% of the historical range (Shepard and others 2003). Idaho Fish and Game summarized 20 years of snorkeling data on four streams (including the St. Joe River) in Idaho which indicates "westslope cutthroat trout have maintained or increased their population abundance over a very large area within the state of Idaho during the past 15-34 years" (Idaho Fish and Game 2003 p. 2). Idaho Fish and Game surveyed the St. Joe River from 1969 until present, except for several years during the 1980s. These surveys indicated that current populations are lower than the peak years in 1977 and 1980, but higher than the earliest years of the survey (Idaho Fish and Game 2003 p. 43).

IPNF Forest Plan monitoring reports indicate that westslope cutthroat trout populations appear to be stable throughout most of northern Idaho (USDA Idaho Panhandle Forest Plan Monitoring and Evaluation Reports 1998, 2000, 2002 and 2003). Relative abundance of westslope cutthroat trout densities was determined for the Bussel 484 Project Area using electrofishing surveys. Abundance information was not collected on the Marble Creek 8-mile stream segment. The average westslope cutthroat trout density for the proposed project area is considered to be above average (11-fish/100 square meters) (F-4). See individual subbasin descriptions below for more detailed information on fish populations.

Fish Assemblage Diversity: Bussel Creek and many of its tributaries likely have seasonal fluvial or adfluvial usage of sculpin and westslope cutthroat trout and possibly bull trout (although they have not been documented in the project area). This is because the analysis area tributaries are connected, by Marble Creek, to the St Joe River which was and is inhabited by adfluvial and fluvial populations of these native species, and there are no major barriers that would have prevented these species from accessing the Marble Creek or Bussel Creek Drainages or permanently isolating fish from accessing suitable habitats across the landscape. However, waterfalls, channel flow intermittency, high stream gradients and some debris jams are part of the reference conditions that naturally and continually fragmented and isolated aquatic habitats for various periods of time. Even though it is possible for bull trout to access the analysis area streams other than Marble Creek, they likely do not use these streams due to elevated stream temperatures and other watershed conditions described below.

Persistence: Persistence is addressed at the conclusions and determination sections of this "Biological Evaluation" (BE) for westslope cutthroat and the "Biological Assessment" (BA) for bull trout.

Non-native species: Rainbow trout were planted in the St. Joe within the segment of river adjacent to the project area in the 1960s. Recent surveys have not located rainbow trout within any of the tributaries of the project area (F-4).

Stream Channel Conditions

Streambank Condition: Recent habitat data shows that most of the major tributaries in the analysis area currently have a high percentage of stable "undercut streambank" which can indicate excellent fish habitat (F-4). Some existing streambank and channels in the analysis area were likely degraded by historical dam and bridge construction. Stream channels may have been cleared and/or flooded which would have destabilized or eliminated streambanks. Quantitative and qualitative field surveys from 2002 to 2006 confirmed some marginal stream habitat conditions reported following 1991 surveys within some of the drainages. Stream habitat conditions in 1991 included predominately low gradient riffle habitat (70 percent area surveyed within the uppermost reach of Bussel Creek in 1991). This condition may be due to stream bank and channel degradation, from log drives and riparian harvest, which can decrease sinuosity, increase sediment (which fill in pools) and thus straighten and homogenize

the stream channel. 2002-2006 qualitative and quantitative surveys revealed that large woody debris abundance was considered very low in some analysis area streams and moderate to high in others. Stream banks may have also been degraded due to a lack of bank and channel stabilizing LWD.

Recent surveys indicate a need to improve stream habitat and riparian conditions in selected streams and reaches within the fisheries analysis area because some stream channels and riparian conditions (stream banks) have likely been altered by human activity (i.e. riparian harvest, log drives and road construction) (F-4). The reduction of mature forests within riparian areas of some streams from wildfire, timber harvest and road building within the RHCA has reduced the potential for recruitment of large woody debris which influences stream bank stability. The change and reduction in the quality and quantity of stable streambanks as well as other in-stream habitats from past activities has possibly impacted the density and diversity of the fish populations in these streams.

Beaver dams were noted on 1998 field maps (SW-37). More recent beaver activity was noted in the analysis area in 2003 (*Water* section; F-5). Therefore, it is assumed that beavers are potentially persistent in the analysis area. Beaver dams may naturally affect streambanks because they trap sediment, flood channels and cause aggradations in the upstream vicinity of the dam.

Comparisons of historical (1933, 1965, 1979) and recent aerial photographs were used to determine that channel and riparian (stream banks) conditions have improved since 1933, and the historic log drives *(Water* section*)*. The inherent result of past log drives likely degraded stream channels and streambanks in some sections *(Water* section*)*.

The 1933 aerial photographs show a managed and burned landscape, creek valley bottoms heavy with depositional areas, and a relatively wide stream channels (in the larger streams) that are braided or have multiple channels and degraded streambanks. Overall, vegetation on streambanks was sparse in 1933, either from fire or harvest or both. There was almost no riparian vegetation present in some stream reaches according to the 1933 photos.

The 2002 aerial photographs show that the riparian area is well vegetated and the stream channels are generally a single thread with adjacent vegetated floodplain and stream bank in the valley bottom. Field crew photographs also document the well-vegetated riparian area. The landscape, riparian zone and streambanks are recovering from the sparse vegetative conditions present in 1933. The stream channels and streambanks appear stable in the 2002 photos with no evidence of substantial deposition based on comparing the 1933 to the 2002 photos. Splash dams were built to facilitate moving logs downstream (log drives) and are visible in 1933 aerial photographs. Remnants of the splash dams are still visible in 2007. Splash dams interrupted sediment transport processes and stored sediment upstream of their location. These aggraded areas are currently riparian meadows where some channel and streambank adjustment may still be occurring. Vegetated meadows currently exist where splash dams were located in 1933. The resilience of the stream and landscape is evidenced in the 2002 photos and 2004 NAIP image compared to 1933 conditions. In 2002 valley walls no longer exhibit signs of erosion and appear vegetated or are stable slopes *(*See *Water* section for more detail on the 1933, 2002 aerial photo comparisons*)*.

Floodplain Connectivity: Channel depth cannot be determined from aerial photographs. The photo analysis did not show large areas of current deposition as would be expected if substantial entrenchment were occurring. Developed floodplains are found on many streams in the Bussel 484 Analysis Area. These floodplains are generally narrow, well vegetated, and have good lateral connectivity to the stream. However, the moderately confined nature of the valleys limits extensive floodplain development. The largest floodplains are located upstream of old splash dams where large amounts of sediment are stored behind the dams. These larger floodplains are approximately 100-150 feet wide. Minimal floodplain widths are in the higher headwater elevations or where bedrock constriction creates a narrow valley bottom like at Bussel Creek cross-sections 6 and 7 *(Water* section*)*. Some stream channels have been disconnected and confined from their floodplains in areas due to high riparian road densities. See *Water* section for more information on floodplain connectivity.

Flow / Hydrology

Peak Flows: Many peak flows in northern Idaho are associated with mid-winter rain-on-snow events and rain-on-spring-snow events with peaks that are usually higher and of shorter duration than normal spring high flows (MacDonald and Hoffman 1995). These types of peak events can be difficult to predict because their frequencies are random, and they do not occur on an annual basis. They are dependent on certain climatic conditions such as air temperature, snowpack characteristics, rain-on-snow elevations, and intensity and duration of precipitation (Berris and Harr 1987; Kappesser 1991). A review of discharge (relatively short term) records from the Calder,

Idaho gauging station on the St. Joe River and extrapolated data for Bussel Creek indicates that peak flows are not appreciably changing *(Water* section*)*. Water yield and peak flows may have subtly increased since timber harvest and road-building activities began, because of decreased transpiration and increased water delivery by road collection and drainage features. Openings created by timber harvest may have increased snow accumulation. Increased water yield or changes in peak flows has the ability to increase sediment transport (Leopold and others 1964).

It is likely that a decrease in water yield and peak flows would occur over time (relatively long term) as the vegetation within these watersheds becomes denser and utilizes more soil moisture and the canopy intercepts more precipitation. Increased water yield or changes in peak flows has the ability to increase sediment transport (Leopold and others 1964).

Watershed Condition

Road Density (Encroaching Road Density and RHCA Road Density): Roads built in the Bussel Creek watershed were historically used for forest management activities such as fire suppression and timber harvest. Analysis of 1933 photos showed trails or roads across the landscape and some that ended at the valley bottoms.

The influence of road density on the fisheries resource was based on research conducted for the Interior Columbia Basin Ecosystem Management Project (ICBEMP) (Lee and others 1997). That research found that the "status of four non-anadromous salmonid species (which include bull trout and westslope cutthroat trout) are less likely to use moderately to highly roaded areas for spawning and rearing and if found are less likely to be at strong population levels" (Lee and others 1997 p. 1347)

Roads primarily influence salmonid by obstructing fish passage and degrading spawning, incubation, and juvenile rearing habitat (Furniss and others 1991).

A study done by *Young and others (1991)* found that watersheds that had higher total road density, roads in use and road stream crossings exhibited higher percentages of fine sediment.

High road density can compromise an area's ability to support fish by increasing the potential for disturbance by humans, habitat fragmentation, sedimentation, and encouragement of OHV use in adjacent or nearby riparian areas.

The total road density rating, based on Table 3-9, for the fisheries analysis area is "High" with an average of approximately 4.6 miles of road per square mile. There is about 104 mile of road within the entire Bussel Creek watershed, which includes all subwatersheds.

The highest road density is in the Norton Creek Subwatershed at 6.05 mi/mi^2 and the lowest road density is found in the Lines Creek Subwatershed at 2.24 mi/mi^2.

Among other watershed conditions, Table 3-14 below displays the road densities for the individual subwatersheds, as well as the total road density for the entire fisheries analysis area (which includes road o private land) (F-5) but not including the road density in the Marble Creek Drainage (which is considered "high" in the lower drainage). Table 3-9 above gives the basis for road density "ratings".

Watershed Conditions and Habitat Access for the Marble Creek 8-mile section of stream found below the project area were analyzed qualitatively to adequately depict the existing condition and potential effects of the alternatives to the fisheries resource. See the Individual Subwatershed/Segment Existing Condition Discussion and Limiting Factor Assessment below.

Riparian Harvest: The 1933 aerial photographs show a managed and burned landscape with sparse vegetation even within the riparian zones of the analysis area. There was almost no riparian vegetation present in some stream reaches according to the 1933 photos (which is in part due to an unknown amount of riparian harvest). Table 3-14 above show the amount of recorded riparian harvest per subwatershed since 1960. The amount of riparian harvest that has occurred since 1960 appears to be minimal.

The 1933/2002 aerial photograph comparisons indicate that the riparian vegetation in the areas that had past riparian harvest is recovering well *(Water* section*)*.

Table 3-14 Watershed Conditions and Habitat Access

Drainage Name	Drainage Area (Acres)	Sensitive landtypes (Acres)	Total Road Density[1] (mi/mi^2)	Total Road Density Ratings	Encroaching Road Density[2] (mi/mi^2)	RHCA Road Density[3] (mi/mi^2)	Past Harvest in RHCA (acres)	Human Caused Physical Barriers[4]
Bussel	4,919	413	5.1	Extremely high	.17	.90	180	N
Bear	1,198	120	4.98	Extremely high	.08	2.2	38	N
Little Bear	878	111	5.86	Extremely high	.05	1.0	39	N
Toles	2,432	183	2.62	High	.04	.4	76	N
Norton	3190	293	6.05	Extremely high	.1	.90	50	2H
Lines	2,045	175	2.24	High	.05	.23	17	N
Bussel Watershed Totals	14,662	1,295	4.5	High	.10	.69	400	2H

All numbers are approximate and are derived from IPNF GIS information queries (F-4).
1 = Based on total watershed acres; 2 = Based on encroachment into 50' stream buffer
3 = Based on encroachment into RHCA buffers; N = No Barrier; H = Human created

Water Quality

Chemical Contaminants/Nutrients: Chemical Contaminants and nutrients are currently not an issue within the project area (*Water* section).

Sediment: Sediment yield is expected to be above reference conditions because of road construction, stream crossings and routing to the stream system. Sediment movement within stream channels likely increased with the removal of LWD that once provided stability over decades (Montgomery and Buffington 1998). Removal of LWD during log drives of the early 1900s probably changed channel morphology from LWD forced step pool to plane bed, which decreased aquatic habitat diversity (Marble Creek: Ecosystem Analysis, unpublished FS document). The DEQs TMDL model identifies a relative estimated current sediment level of 387 tons/year (DEQ 2003 p. 42). The WATSED model identifies a relative estimated current sediment level of 548 tons/year *(Water* section*)*. Past burning within the Bussel Creek watershed may have caused high sediment delivery to stream channels (Macdonald and Coe 2007 pp. 154-155) due to massive loss of vegetation. This also may have caused some of the aggradation evident in the 1933 aerial photographs *(Water* section*)*. Although in a reference state, sediment yields were in balance through natural process such as fire, mass failure and climatic events.

The 1998 DEQ, 303(d) list had Bussel Creek tributaries (Little Bear and Bear Creeks) identified as non-supporting beneficial uses because of sediment and temperature. Bussel Creek is listed on Idaho's 2002, 303(d) list of Water Quality Limited Water Bodies. The pollutants of concern are temperature and sediment. Bussel Creek is a tributary to Marble Creek, which is not listed for sediment. The Bussel 303(d) listing applies to the entire Bussel Creek Watershed. TMDLs were developed for Bear and Little Bear Creeks within the Bussel Creek watershed. The Bear and Little Bear sediment TMDL calls for reducing sediment by 14 tons/year from National Forest System (NFS) lands and 7 tons/year from non-NFS (private and state lands) (SW-PF).

Temperature: The 1998 and 2002 DEQ, 303(d) list had Bussel Creek tributaries (Little Bear and Bear Creeks) identified as non-supporting beneficial uses because of temperature *(Water* section*)*. Stream temperatures in both streams currently exceed federal (10 degree Celsius seven-day running average from May 1-September 1) and state (9 degree Celsius daily maximum spawning standard from September 1-October 31) bull trout temperature standards (DEQ, 2003). Bussel Creek is a tributary to Marble Creek, which is also listed for temperature. The Bussel Creek 303(d) listing for temperature applies to the entire Bussel Creek Watershed.

The temperature TMDL calls for increasing shade canopy over the stream channels by 20-80% in Bear and Little Bear Creeks *(Water* section*)*. Past riparian timber harvest and fires may have had negative effects to stream

temperatures by reducing canopy and thus exposing channels to solar radiation. See the individual subbasin description section below for more detail on current stream temperatures.

Habitat Access

Physical Barriers: In the Bussel 484 Project Area high gradient stream reaches in headwater locations are the predominant form of natural barriers. There are also two human-caused fish barriers in the Bussel 484 Project Area on road 1900. Approximately 3 miles of fish habitat is not currently being fully seeded due to these two migration barriers.

Habitat Elements

Large Woody Debris: Wildfire burning 48% of the Bussel Creek watershed may have caused a reduction in LWD long-term recruitment while in some cases wildfires may have increased LWD inputs from the residual dead and windfall trees.

Fisheries field crews collected recent data on the woody material associated with stream channels. Large woody debris data was collected in the main stems of Lines Creek, Toles Creek, Norton Creek, Bear and Little Bear Creek. Only 1991 qualitative data exists for Bussel Creek itself (F-4). See individual subwatershed discussion section below for summarized LWD data.

The overall average for all the reaches surveyed in the fisheries analysis area is approximately five pieces of LWD per 1,000 feet which is above the INFS standard of >3.8 pieces per 1000ft; >12 inch diameter; >35ft long**.** Several reaches were below INFS standards and several reaches were well above the standards for LWD abundance. See individual subwatershed descriptions section below for more details on LWD for each subwatershed.

Several stream reaches throughout the analysis have a low abundance of LWD relative to INFS RMO target that is likely due to historic removal of LWD from stream channels, riparian harvest (which reduces recruitment availability), log drives (which can destroy or remove riparian vegetation) and road building.

Pool Habitat: Removal of LWD during log drives of the early 1900s probably changed channel morphology from LWD forced step pool to plane bed, which decreased aquatic habitat diversity (*Water* section).

Some stream channels and riparian conditions have been altered by human activity i.e. riparian harvest, log drives, road construction. The reduction of mature forests within riparian areas of some streams in the project area reduces the potential for recruitment of large woody debris which influences instream cover, and pool habitat. Wildfire in 48% of the Bussel Creek watershed may also have reduced LWD within riparian areas, which likely would have reduced pool habitat dependent on wood for its formation. The reduction in the quality and quantity of the instream habitat i.e. pools, impacted the density and diversity of the fish population in these streams. Pool frequency can also be affected by sediment delivery to the stream channels as inputs of sediment can cause aggradations and pool filling. This type of affect to stream channels occurs in natural landscapes i.e. affects from wildfire or beaver activity, and in managed landscapes i.e. affects from logging or road building.

Spawning and rearing habitat is created by a diversity of habitat characteristics (Baltz and others 1991; Moore and Gregory 1988; Rieman and Apperson 1989; Campbell and Neuner 1985). Habitat diversity is determined based on the percentages of the different habitats present in the stream. A very high percentage of one habitat type reduces the amount of diversity in that reach.

The majority of the reaches surveyed from 1991 to 2005 in the fisheries analysis area did not meet the INFS RMO target objective for pool frequency (F-4). Although some reaches were close to meeting the target, others were not. See the Individual Subwatershed/Segment Existing Condition Discussion below for more detail.

Habitat Elements Summary: In general Bussel Creek reaches were found to have the lowest pool frequencies relative to the INFS RMO target frequencies. Little Bear Creek was found to exceed INFS RMO target frequencies for pools in two of its three reaches and was only slightly below in the other reach. The lowest reach has the least amount of large woody debris (4 pieces/1000 feet), but it does meet the INFISH objective of 4 pieces/1000 feet. The remaining reaches all exceed the INFISH woody debris objective, ranging from 5 – 8 pieces/1000 feet.

Individual Subwatershed/Segment Existing Condition Discussion and Limiting Factor Assessment

Bussel Creek Subwatershed

Bussel Creek is an Undesignated Surface Waters (IDAPA 58.01.02.110.11). Beneficial uses applied to undesignated waters are cold water aquatic life, and primary or secondary contact recreation (IDAPA 58.01.02.101.01.a).

Bussel Creek is a large tributary to Marble Creek fed by various unnamed tributaries along with Bear, Little Bear, Toles, Norton and Lines Creek. The Bussel Creek subwatershed is approximately 4,919 acres. During 1991 a stream survey was conducted to inventory habitat on Bussel Creek. In 2003 a field review indicated the in stream habitat had not notably changed. Bussel Creek is approximately 10 miles long with several small, high gradient, perennial and intermittent non-fish-bearing tributaries totaling to about 30 miles of perennial and non-perennial stream in the drainage (F-4). Bussel Creek exhibits low sinuosity and would be classified as straight to meandering pool-riffle or plane bed (Montgomery and Buffington1998) or higher gradient (A) headwater channels and moderate gradient (B) to lower gradient (C) and (E) stream channels (Rosgen 1994) *(Water* section*)*.

Historically Bussel Creek had two splash dams used for the transportation of logs. LWD was removed from the channel, and riparian areas were affected. Private timber harvest has and will likely continue to occur in the headwater sections of Bussel Creek. A large Bonneville Power Administration (BPA) transmission line crosses Bussel Creek. Since 1960, approximately 180 acres of timber harvest has occurred within the RHCAs as well as 1,888 acres of commercial harvest or burn within the Bussel Creek and Lines Creek subwatersheds (F-5). Bussel Creek Subwatershed has also experienced historic activity (See Table 3-13).

Aerial photographs show that Bussel Creek is moderately confined by valley walls with little opportunity for extensive floodplain development. Extensive human activity occurred throughout the watershed prior to the 1933 aerial photographs *(Water* section*)*.

Bussel Creek Population Characteristics

Fish Population Size: Single pass electrofishing revealed current populations of cutthroat and sculpin where Road 758 crosses Bussel Creek. The westslope cutthroat trout densities found in Bussel Creek are about 1.5 fish/100m^2, which indicates a low abundance of fish (F-4). Fish numbers for this subwatershed are likely to remain at low levels due to the lack of pools, LWD and riparian cover.

Fish Assemblage Diversity: Bussel Creek and many of its tributaries likely have seasonal fluvial or adfluvial usage of sculpin and westslope cutthroat trout and possibly bull trout (although they have not been documented in the project area). This is because the analysis area tributaries are connected by Marble Creek to the St Joe River which was and is inhabited by adfluvial and fluvial populations of these native species, and there are no major barriers that prevent these species from accessing the Marble Creek or Bussel Creek Drainages or permanently isolate fish from accessing suitable habitats across the landscape.

Persistence: Fish numbers for this subwatershed are likely to remain at low levels due to the lack of pools, LWD and riparian cover.

Bussel Creek Stream Channel Conditions

Stream Bank Condition: The 1991 habitat data and 2002 field verification shows that very little of the stream bank in Bussel Creek is considered “undercut” which can limit fish habitat if other forms of cover are not available. Overall the 1933/2002 aerial photo comparisons indicate that streambanks within Bussel Creek have become well vegetated and stable over time *(Water* section*)*.

Floodplain Connectivity: Developed floodplains are found in the Bussel Creek Subwatershed. These floodplains are generally narrow, well vegetated, and have good lateral connectivity to the stream. However, the moderately confined nature of the valleys limits extensive floodplain development and connectivity. The largest floodplains are located upstream of old splash dams where large amounts of sediment are stored behind the dams. These larger floodplains are approximately 100-150 feet wide. Minimal floodplain widths are in the higher headwater elevations or where bedrock constriction creates a narrow valley bottom like at Bussel Creek cross-sections 6 and 7 *(Water* section*)*. Some stream channels reaches have been disconnected and confined from their floodplains in areas due to high riparian road densities.

Bussel Creek Flow / Hydrology

Peak Flows: The *Water* section identifies that water yield is not currently an issue in the project area, nor the Bussel Creek Subwatershed.

Bussel Creek Watershed Condition

Road Density (Encroaching Road Density and RHCA Road Density): Total road density for this subwatershed is considered "Extremely High" and "Moderate" within the RHCA and the encroaching road density is "low" (Table 3-9). Currently there are about 39 miles of road within the subwatershed. Most of the roads in the Bussel Creek Subwatershed are found in the head waters of Bussel Creek.

Riparian Harvest: Records show that since 1960 timber harvest has occurred within approximately 180 acres of the Bussel Creek RHCA Buffer (F-5). This riparian harvest has likely decreased shade by reducing canopy cover within the drainage.

Bussel Creek Water Quality

Chemical Contaminants/nutrients: There are no identified point source pollutants within Bussel Creek Subwatershed.

Sediment: Bussel Creek is listed on Idaho's 2002; 303(d) list of Water Quality Limited Water Bodies for sediment concerns. The 2008 Draft 303d list has Bussel Creek "fully supporting" beneficial uses (*Water* section FEIS).

Temperature: Bussel Creek is listed on Idaho's 2002, 303(d) list of Water Quality Limited Water Bodies for temperature concerns. Temperature monitoring was conducted just below the confluence of Bussel and Bear Creek from spring to fall during 2002-2004. As shown on Table 3-15, it is very likely that temperatures exceeded the standard greater than 10% of all the specified time periods (Apr 15 - Oct 31) in 2002, 2003 and 2004. The data indicates that stream temperatures are not meeting water quality standards in Bussel Creek.

Lack of shade within the Bussel Creek Subwatershed is likely the main factor affecting stream temperatures in Bussel Creek. Canopy and riparian cover within and near the upper Bussel Creek stream channel between the Lines Creek confluence upstream to the USFS boundary was noted to be very poor (10 percent in lower reach section) to moderate (30 percent in upper reach section) during stream surveys and site reviews in 2003. It was noted that young conifers are slowly becoming established in the upper reach however few trees are present between the Lines Creek confluence and FS Road 758 bridge crossing (F-4).

Table 3-15 Bussel Creek: Days of Temperature Exceedance/Days Deployed

	Year Collected		
Temperature Standards	**2002**	**2003**	**2004**
Spring Salmonid 13 C Instantaneous (Apr 15-July 15)	N/A	24 of 41	23 of 28
Spring Salmonid 9 C Daily Average (Apr 15-July 15)	N/A	33 of 41	25 of 28
Juvenile Bull Trout 13 C Instantaneous (Jun 1-Aug 31)	32 of 45	63 of 88	62 of 75
Bull Trout Spawning 9 C Average (Sept 1-Oct 31)	9 of 38	12 of 35	7 of 41

Bussel Creek Habitat Access

Physical Barriers: There are no known human created fish barriers in the Bussel Creek Subwatershed.

Bussel Creek Habitat Elements

Pool Abundance: During 1991 a survey was used to inventory habitat and pools. This survey was field verified in 2003.

Table 3-16 Bussel Creek Pool Frequency Information

Reach	# of Pools	Length of Reach	#/1000 feet	INFS RMO # / 1000 feet
1	3	1390	2.2	8.9
2	3	1798	1.7	4.9
3	5	5025	1.0	4.9
4	11	6169	1.8	10.6
5	5	3001	1.7	10.6
6	1	2406	0.4	10.6
7	28	4883	5.7	10.6
8	39	4708	8.3	18.18

Table 3-16 indicates that all of the reaches surveyed within the Bussel Creek Subwatershed did not meet the INFS RMO's target objective for pool frequency.

Large Woody Debris: Adequate information on LWD was not collected during the 1991 survey. During other field verification in 2003 it was noted that LWD abundance was low in Bussel Creek (F-4).

Bussel Creek Summary

Based on the above information the following are limiting factors: 1) Extremely high road densities 2) Low number of pools throughout Bussel Creek 3) Low abundance of LWD in Bussel Creek 4) High stream temperatures 5) Sediment impaired 6) low abundance of fish. The overall condition of the fish habitat in Bussel Creek is considered to be *Highly Altered/High Risk*.

Bear Creek Subwatershed

Bear Creek is a tributary to Bussel Creek. The 1,198-acre Bear Creek Subwatershed has had past logging and road building activities. The roughly 200 acres of privately owed land (see chapter 2 for locations) in the headwaters has been heavily clearcut in the past and has high road density. Some illegal ATV use has been noted in the subwatershed which has caused riparian degradation in areas totaling about two acres throughout the Bear and Little Bear Subwatersehds (F-5). This degradation has caused only minor sedimentation and vegetation disturbance issues to this point (F-5). However if ATV traffic in these subwatersheds increases larger areas of riparian degradation could occur. Some illegal ATV use has been noted in the subwatershed. Records show that timber harvest has occurred within approximately 38 acres of the Bear Creek RHCA Buffer (F-5). Since 1960 only 610 acres have been harvested in the Bear Creek Subwatershed and the adjacent Little Bear Creek Subwatershed combined (F-5). Bear Creek is designated by the State of Idaho as "water quality limited" for sediment and temperature and has a TMDL. There are approximately six miles of fish bearing and non-fish bearing stream within the Bear Creek Subwatershed.

Bear Creek Populations Characteristics

Population Size: A single pass electrofishing survey in Bear Creek revealed current populations of cutthroat and sculpin in 2002. In the reach surveyed, 10 westslope cutthroat were captured in 70 m^2. The data indicates that excellent densities of cutthroat may be present in Bear Creek (F-4).

Fish Assemblage Diversity: Bear Creek likely has seasonal fluvial or adfluvial use by adult and juvenile sculpin and westslope cutthroat trout. This is because this stream is connected, by Marble Creek, to the St Joe River which was and is inhabited by adfluvial and fluvial populations of these native species; and there are no major barriers that would prevent these species from accessing the Marble Creek or Bear Creek Drainage or permanently isolate fish from accessing suitable habitats across the landscape (F-4).

Bear Creek Stream Channel Conditions

Stream Bank Condition: Bear Creek is a Rosgen Type E channel. In 2003, the stream channel was very stable with very little bank cutting or sloughing. 90-95 percent of the stream Bank was estimated to be stable. Undercut

banks, grasses/sedges, and, alder were providing 95 percent of the riparian cover in the proposed project area. Overhead cover from standing timber within riparian areas is non-existent within much of the area (F-4). Overall the stream bank conditions in Bear Creek appear to be stable.

Floodplain Connectivity: Developed floodplains are found on Bear Creek. These floodplains are generally narrow (with some open meadow), well vegetated, and have good lateral connectivity to the stream. However, the moderately confined nature of the valleys limits extensive floodplain development and connectivity. Very few stream channel reaches have been disconnected or confined from their floodplains within Bear Creek, due to "very low" encroaching road densities.

Bear Creek Flow / Hydrology

Peak Flows: The Water section identifies that water yield is not currently an issue in the Bear Creek Subwatershed.

Bear Creek Watershed Condition

Road Density (Encroaching Road Density and RHCA Road Density): There are 9.32 miles of road within the subwatershed. Based on road densities shown on Table 3-9, the total road density rating for this subwatershed is considered "Extremely High." However, the majority of this road is in private land near the ridge tops and headwaters of the Subwatershed: not near the streams. RHCA road density is rated as "High" and encroaching road density is rated as "Very Low" (F-4).

Riparian Harvest: Records show that since 1960 timber harvest has occurred within approximately 38 acres of the Bear Creek RHCA Buffer (F-5). This is a relatively low amount and likely has not decreased shade enough to increase stream temperatures to appreciable levels within the drainage.

Bear Creek Water Quality

Chemical Contaminants/Nutrients: Chemical contaminants/nutrients are not an issue in this subwatershed (Soils section FEIS).

Sediment: Bear Creek is identified as non-supporting beneficial uses because of sediment and is 303 (d) listed. The Bear Creek sediment TMDL calls for reducing sediment by 14 tons/year from National Forest System (NFS) lands and 7 tons/year from non-NFS lands.

Temperature: Bear Creek is also on the 303 (d) list as not supporting beneficial uses because of temperature. The temperature TMDL calls for increasing shade canopy over the stream channels by 20-80% in Bear Creek. TMDL load reductions are required for support of beneficial uses (fish). According to 1993 DEQ data stream temperatures in Bear Creek exceeded federal and state bull trout temperature standards (DEQ 2003). The federal standard is 10 degree Celsius seven-day running averages from May 1-September 1, and the state standard is 9 degree Celsius daily maximum spawning standards from September 1-October 31. Temperature monitoring was conducted just below the Bussel Creek Trail #258 crossing spring to fall during 2003-2004.

Table 3-17 Bear Creek: Days of Temperature Exceedance/Days Deployed

	Year Collected	
Temperature Standards	**2003**	**2004**
Spring Salmonid 13 C Instantaneous (Apr 15-July 15)	0 of 41	0 of 28
Spring Salmonid 9 C Daily Average (Apr 15-July 15)	22 of 41	21 of 28
Juvenile Bull Trout 13 C Instantaneous (Jun 1-Aug 31)	0 of 88	0 of 75
Bull Trout Spawning 9 C Average (Sept 1-Oct 31)	3 of 34	1 of 41

As shown on Table 3-17, it is very likely that temperatures did not exceed the temperature standard greater than 10% of all the specified time periods in 2003 and 2004. The data indicates that stream temperatures are not meeting water quality standards for spring salmonid daily average. In general the data collected by the FS in 2003 and 2004 indicates that temperatures in Bear Creek are indicative to what salmonids need based on DEQ

standards for most of the spring, summer and fall. Improved riparian conditions may be resulting in cooler 2003 and 2004 temperatures than the earlier (mid 1990s) DEQ temperature data shows.

Bear Creek Habitat Access

Physical Barriers: No human-created migration barriers were located on Bear Creek. Natural and temporal migration barriers exist in the upper drainages. FS Field investigations determined that there are about 20 stream crossings in Bear/Little Bear Creeks *(Water* section*).* None were found to be migration barriers.

Bear Creek Habitat Elements

Pool Abundance: Bear Creek was surveyed using the R1/R4 method during 2002 to collect pool information. As shown in Table 3-18, the INFS target RMO pool frequency for Bear Creek was met in Reach 1 only. The longest reach (#3) had less than half the target RMO for pools recommended by INFS. Predominate stream habitat included runs (58 percent area surveyed in 2002), pools (35 percent area surveyed in 2002), and low gradient riffle (6 percent area surveyed in 2002). In general Bear Creek is not meeting RMOs for pool habitats.

Table 3-18 Bear Creek Pool Frequency Information

Reach	# of Pools	Length of Reach	#/1000 feet	INFS RMO # / 1000 feet
1	17	676	25.1	18.18
2	51	3587	14.2	18.18
3	54	7130	7.6	18.18
4	3	692	4.3	18.18

Large Woody Debris: Riparian harvest that reduces stream shading can cause increases in temperature, reduce the amount of potential woody debris recruitment and can cause stream bank instability (Chamberlin and others 1991; Lee and others 1997). Approximately 38 acres of past harvest within the RHCA has occurred in the Bear Creek Subwatershed. As shown in Table 3-19, Reach 1 has the least amount of all types of woody debris and the least amount of large woody debris of all reaches. This may be a result of some past timber harvest or wildfire in the riparian zone. However, most of Bear Creek is a Rosgen E type channel flowing through meadows which typically have limited LWD available and can be viewed as a continuous pool in many sections. RMOs may be an inappropriate guidance tool for both pools and LWD in this drainage given the predominant channel type.

Table 3-19 shows the total number of wood for each reach within the INFS wood standard size limitations per 1000ft. Reach 4 is the only reach that meets the INFS wood objective.

Table 3-19 Pieces of Qualifying LWD per 1000 Feet

Reach #	# / 1000 feet
1	0
2	0.279
3	0.14
4	4.3

Bear Creek Summary

Based on the above information the following are limiting factors: 1) Lack of LWD; 2) Extremely High total road density; 3) Lack of pool habitat; 4) 303d temperature listing and TMDL; 5) 303d sediment listing and TMDL. Based on the factors listed above the overall condition of the fish habitat in Bear Creek is considered to be *Highly Altered/High Risk.*

Little Bear Creek Subwatershed

Little Bear Creek is a small tributary to Bear Creek and is about 676 feet from the confluence of Bear Creek and Bussel Creek. The 878-acre Little Bear Creek Subwatershed has had past logging and road building activities. Privately owed land in the headwaters has been heavily clearcut in the past and has high road density. Records show that timber harvest has occurred within approximately 39 acres of the Little Bear Creek RHCA Buffer (F-4).

Little Bear Creek is designated by the State of Idaho as “water quality limited” for sediment and temperature. Total maximum daily loads (TMDL) load reductions are required for support of beneficial uses.

There are approximately four miles of fish bearing and non-fish bearing stream within the Little Bear Creek Subwatershed. In the lower two reaches this stream is a small meandering low gradient channel. It is highly entrenched with undercut banks typical of E-type channels. Low flow is common throughout the summer months. Vegetation consisting mainly of alder and grasses are very dense along most of the stream.

Little Bear Creek Population Characteristics

Fish Population Size: Westslope cutthroat trout were found in the lower portion of Little Bear Creek during a 2002 electrofishing survey. The single pass survey revealed current populations of cutthroat and sculpin. In the reach surveyed, 13 westslope cutthroat were captured in 80 m^2. The data indicates that excellent densities of cutthroat may be present in Little Bear Creek (F-4).

Fish Assemblage Diversity: Little Bear Creek likely has seasonal fluvial or adfluvial use by adult and juvenile sculpin and westslope cutthroat trout. This is because this stream is connected, by Marble Creek, to the St Joe River which was and is inhabited by adfluvial and fluvial populations of these native species; and there are no major barriers that would have prevented these species from accessing the Marble Creek or Little Bear Creek Drainages or permanently isolating fish from accessing suitable habitats across the landscape.

Little Bear Creek Stream Channel Conditions

Stream Bank Condition: Little Bear Creek is an open meadow Rosgen Type E channel. In 2003, the stream channel was very stable with very little bank cutting or sloughing. Undercut banks, grasses/sedges, and alder were providing 95 percent of the riparian cover in the Little Bear Creek main stem. Overall the stream bank conditions in Little Bear Creek appear to be stable (F-4).

Floodplain Connectivity: Developed floodplains are found on Little Bear Creek. These floodplains are generally narrow, well vegetated, and have good lateral connectivity to the stream. However, the moderately confined nature of the valleys limits extensive floodplain development and connectivity. Very few stream channel reaches have been disconnected or confined from their floodplains within Little Bear Creek due to “Very Low” encroaching road densities.

Little Bear Creek Flow / Hydrology

Peak Flows: The *Water* section identifies that water yield is not currently an issue in the Little Bear Creek Subwatershed.

Little Bear Creek Watershed Condition

Road Density (Encroaching Road Density and RHCA Road Density): There are about eight miles of road within the subwatershed. As indicated by road densities shown in Table 3-14, the total road density rating for this subwatershed is considered “Extremely High.” However, the majority of this road is in private land near the ridge tops and headwaters of the subwatershed, which are not encroaching on the streams. RHCA road density is rated as “moderate” and encroaching road density is rated as “Very Low” (F-4).

Riparian Harvest: Records show that since 1960 timber harvest has occurred within approximately 39 acres of the Little Bear Creek RHCA Buffer (F-5). This is a relatively low amount and likely has not decreased shade at significant levels within the drainage.

Little Bear Creek Water Quality

Chemical Contaminants/Nutrients: Chemical contaminants/nutrients are not an issue in this subwatershed *(Water* section*).*

Sediment: Little Bear Creek is 303 (d) listed by DEQ for non-support due to sediment (*Water* section). The sediment TMDL that calls for reducing sediment by 14 tons/year from National Forest System (NFS) lands and 7 tons/year from non-NFS lands applies *(Water* section*).*

Temperature: Little Bear Creek is 303 (d) listed by DEQ for non-support due to temperature concerns (Water section). The TMDL that calls for increasing shade canopy over the stream channels by 20-80% applies *(Water*

section). Temperature monitoring was conducted in a section of steam just above the confluence with Bear Creek from spring to fall during 2003-2004 (F-4).

Table 3-20 Little Bear Creek: Days of Temperature Exceedance/Days Deployed

Temperature Standards	Year Collected	
	2003	2004
Spring Salmonid 13 C Instantaneous (Apr 15-July 15)	0 of 41	0 of 28
Spring Salmonid 9 C Daily Average (Apr 15-July 15)	22 of 41	21 of 28
Juvenile Bull Trout 13 C Instantaneous (Jun 1-Aug 31)	0 of 88	0 of 75
Bull Trout Spawning 9 C Average (Sept 1-Oct 31)	11 of 35	3 of 41

As shown in Table 3-20 it is very likely that temperatures did not exceed the state temperature standards greater than 10% in the specified time periods of (Apr 15 –July 15 at 13 C instantaneous) (June 1- Aug 31 at 13 C instantaneous) in 2003 and 2004 as well as (Sept 1-Oct 31 9 C daily average) in 2004. The data indicates that stream temperatures are not meeting water quality standards only from April 15 to July 15 for 9 C daily average and Sept 1-Oct 31 9 C daily average for 2003. In general the data indicates that temperatures in Little Bear Creek are indicative of what salmonids need based on DEQ standards for most of the spring, summer and fall.

Little Bear Creek Habitat Access

Physical Barriers: No human-created migration barriers were located on Little Bear Creek. Natural and temporal migration barriers exist in the upper drainages. FS Field investigations determined that there are about 20 stream crossings in Bear/Little Bear Creeks *(Water* section*)*. None were found to be migration barriers (F-4)

Little Bear Creek Habitat Elements

Pool Abundance: Little Bear Creek was surveyed in 1991 and was field reviewed in 2006. No significant changes from the 1991 surveys for fish habitat (pools) were noted in 2006 (F-4).

Table 3-21 Little Bear Creek Pool Frequency Information

Reach	# of Pools	Length of Reach	# / 1000 feet	INFS RMO # / 1000 feet
1	31	1337.5	23.2	18.18
2	61	2569	23.7	18.18
3	7	886	7.9	18.18

As shown in Table 3-21, the INFS RMO pool frequency target for Little Bear Creek was exceeded in Reaches 1 and 2, which are the longest reaches. The shortest reach (#3) had less than half the standard for pools recommended by INFS. In general, Little Bear Creek is meeting RMOs for pool habitats for most of the main stem surveyed.

Large Woody Debris: Adequate information on LWD was not collected during the 1991 survey. During a 2006 field review it was noted that wood abundance was moderate to low.

Little Bear Creek Summary

Based on the above information the following are limiting factors for the Little Bear Creek Subwatershed: 1) Lack of adequate LWD 2) Extremely High total road density 3) 303d temperature listing and TMDL 4) 303d sediment listing and TMDL. Based on the factors listed above the overall condition of the fish habitat in Little Bear Creek is considered to be *Highly Altered/High Risk*.

Toles Creek Subwatershed

The 2432-acre Toles Creek Subwatershed which drains directly into Bussel Creek has had past logging and road building activities. Since 1960 only 622 acres have been harvested in the Toles Creek Subwatershed (F-5). Trail 258, which runs up the stream from the 758 road crossing, is causing relatively low levels of impact to riparian vegetation and stream channels within RHCAs. Toles Creek is one of the bigger drainages in the project area with many fish-bearing tributaries. There are approximately 12 miles of fish bearing and non-fish bearing stream within the Toles Creek Subwatershed (F-4).

Toles Creek Population Characteristics

Population Size: An electrofishing survey in the middle portion of Toles Creek conducted in 2002 found westslope cutthroat trout. The single pass survey revealed current populations of cutthroat and sculpin. In the reach surveyed, 11 westslope cutthroat were captured in 165 m^2. The data indicates that "good" but not "excellent" densities of cutthroat may be present in Toles Creek (F-4).

Fish Assemblage Diversity: Toles Creek likely has seasonal fluvial or adfluvial use by adult and juvenile sculpin and westslope cutthroat trout. This is because this stream is connected, by Marble Creek, to the St Joe River which was and is inhabited by adfluvial and fluvial populations of these native species; and there are no major barriers that would prevent these species from accessing the Marble Creek or Toles Creek Drainage or permanently isolating fish from accessing suitable habitats across the landscape.

Toles Creek Stream Channel Conditions

Stream Bank Condition: Toles Creek has sections of open meadow Rosgen Type E channel and a moderate gradient B channel in the main stem. Small, higher gradient tributaries are A and B type channels. Although there has been some harvest within the RHCAs, field notes and aerial photo interpretation indicates that Toles Creek stream channels are very stable and have very little bank cutting or sloughing. Undercut banks, grasses/sedges, conifers and alder provide 95 percent of the riparian cover in the Toles Creek main stem *(Water* section*).* Habitat data shows that roughly 60 percent of the stream bank in Toles Creek is considered "undercut bank" which can indicate excellent fish habitat. It was also noted in 2003 field surveys that the upper reaches are more heavily timbered (F-4). Overall the stream bank conditions in Toles Creek appear to be stable.

Floodplain Connectivity: Developed floodplains are found on Toles Creek. These floodplains are generally narrow, well vegetated, and have good lateral connectivity to the stream. However, the moderately confined nature of the valleys limits extensive floodplain development and connectedness *(Water* section*).* Very few stream channel reaches have been disconnected or confined from their floodplains within Toles Creek due to "very low" encroaching road densities.

Toles Creek Flow / Hydrology

Peak Flows: According to the Water section, water yield is not currently an issue in the Toles Creek Subwatershed.

Toles Creek Watershed Condition

Road Density (Encroaching Road Density and RHCA Road Density): There are about 10 miles of road within the subwatershed. Based on the densities shown in Table 3-14, the total road density rating for this subwatershed is considered "High." RHCA road density is rated as "low" and encroaching road density is rated as "very low" (F-5).

Riparian Harvest: Records show that since 1960 timber harvest has occurred within approximately 76 acres of the Toles Creek RHCA Buffer (F-5). This is a relatively low amount and likely has not decreased shade at significant levels within the drainage.

Toles Creek Water Quality

Chemical Contaminants/Nutrients: Chemical contaminants/nutrients are not an issue in this subwatershed (*Water* section).

Sediment: Because Toles Creek is within the Bussel watershed the 303d listing for Bussel Creek applies to Toles Creek also *(Water* section*).*

Temperature: Because Toles Creek is within the Bussel watershed the 303d listing for Bussel Creek applies to Toles Creek also *(Water* section*).* Temperature monitoring was conducted in a section of stream just above Trail 258 spring to fall during 2003-2004.

Table 3-22 Toles Creek: Days of Temperature Exceedance/Days Deployed

Temperature Standards	Year Collected		
	2002	2003	2004
Spring Salmonid 13 C Instantaneous (Apr 15-July 15)	N/A	0 of 41	1 of 28
Spring Salmonid 9 C Daily Average (Apr 15-July 15)	N/A	28 of 41	23 of 28
Juvenile Bull Trout 13 C Instantaneous (Jun 1-Aug 31)	0 of 46	12 of 88	0 of 75
Bull Trout Spawning 9 C Average (Sept 1-Oct 31)	5 of 26	12 of 34	3 of 41

It is very likely that temperatures did not exceed the DEQ state temperature standards greater than 10% in the specified time periods of (Apr 15 –July 15 at 13 C instantaneous in 2003 and 2004) (June 1- Aug 31 at 13 C instantaneous in 2002 and 2003) and (Sept 1-Oct 31 9 C daily average) in 2003 and 2004. The data indicates that stream temperatures are not meeting water quality standards for exceedance from April 15 to Aug 15 for 9 C daily average and Sept 1-Oct 31 9 C daily average (see Table 3-22).

Toles Creek Habitat Access

Physical Barriers: No human-created migration barriers were located on Toles Creek. Natural temporal migration barriers may exist in the upper drainage.

Toles Creek Habitat Elements

Pool Abundance: Toles Creek was surveyed using R1/R4 methods during 2002.

Table 3-23 Toles Creek Pool Frequency Information

Reach	# of Pools	Length of Reach	# / 1000 feet	INFS RMO # / 1000 feet
1	91	8,961.8	10.2	18.18
2	20	2391	8.4	18.18
3	8	2274	3.5	18.18

The INFS target RMO for pool frequency in Toles Creek was not met in any of the reaches (Table 3-23). However, the data indicates that 43% of the habitats surveyed for all reaches were pools (F-4). This could mean that the number of individual pools is low but the size (length) of the pools is relatively large in this stream, which could indicate, good for fish. Or, this could be due to lumping of habitat types during the survey, which could reduce the total number of individual pools. According to the data Toles Creek is not meeting RMOs for pool habitats for most of the main stem surveyed however pool habitat is more predominant in this stream than the data indicates (F-4). Pools are likely at appropriate levels for this type of stream environment and channel type.

Large Woody Debris: Table 3-24 below shows that reach 2 has the least amount of woody debris due to fact it is a meadow section typically with limited sources. LWD is likely at appropriate levels for this type of stream environment and channel type. Reach 1 meets INFS RMO targets for LWD Table 3-24.

Table 3-24 Pieces of qualifying LWD per 1000 feet

Reach #	# / 1000 feet
1	4.46
2	0.42
3	2.2

Toles Creek Summary

Based on the above information the following are limiting factors for the Toles Creek Subwatershed: 1) Temperature 303d listing applies 2) Sediment 303d listing applies 3) High Road Densities. Based on the factors listed above the overall condition of the fish habitat in Toles Creek is considered to be *Moderately Altered/Moderate Risk*

Norton Creek Subwatershed

The 3190-acre Norton Creek Subwatershed, which drains directly into Bussel Creek, has had past logging and road building activities. Since 1960, 1,188 acres have been harvested in the Norton Creek Subwatershed (F-5).

Norton Subwatershed is the largest drainage flowing into Bussel Creek within the analysis area. According to the aerial photos, most of the past logging and road building activity within this drainage has occurred in the headwater areas. The old Norton Creek Railroad Grade along the stream currently has some sporadic ATV use. There are approximately 11.5 miles of fish bearing and non-fish bearing stream within the Norton Creek Subwatershed (F-5).

Norton Creek Population Characteristics

Fish Population Size: The main stem of Norton Creek and several of its tributaries have populations of westslope cutthroat. Single pass electrofishing was conducted on a major tributary and on the main stem at Road 1900 and at Road 758 revealing current populations of cutthroat and sculpin (2002). In Reach 1 at Road 758, 23 westslope cutthroat were captured in 350 m^2. In Reach 2 at Road 1900, 21 westslope cutthroat were captured in 175 m^2. In Reach 3, an upper watershed major tributary, 27 westslope cutthroat were captured in 110 m^2. The data indicates that "good" to "excellent" densities of cutthroat may be present in Norton Creek Subwatershed (F-4).

Fish Assemblage Diversity: Norton Creek likely has seasonal fluvial or adfluvial use by adult and juvenile sculpin and westslope cutthroat trout. This is because this stream is connected, by Marble Creek, to the St Joe River which was and is inhabited by adfluvial and fluvial populations of these native species, and there are no major barriers that prevent these species from accessing the Marble Creek or Norton Creek drainage or permanently isolating fish from accessing suitable habitats across the landscape.

Norton Creek Stream Channel Conditions

Stream Bank Condition: Norton Creek periodically changes from an open meadow Rosgen Type E channel to a moderate gradient B channel in the main stem. Small, higher gradient tributaries are A and B type channels. Although there has been some past harvest within the RHCAs, field notes and aerial photo interpretation indicate that Norton Creek stream channels are currently stable and have very little bank cutting or sloughing *(F-4)*. Undercut banks, grasses/sedges, conifers and alder provide a large percentage of the riparian cover in the Norton Creek main stem. Habitat data shows that roughly 50 percent of the stream bank in Norton Creek is considered "undercut" which can indicate excellent fish habitat (F-4).

Floodplain Connectivity: Very few stream channel reaches have been disconnected or confined from their floodplains within Norton Creek due to "very low" encroaching road densities.

Norton Creek Flow / Hydrology

Peak Flows: The Water section (DEIS page 213) identifies that water yield is not currently an issue in the project area, nor the Norton Creek subwatershed.

Norton Creek Watershed Condition

Road Density (Encroaching Road Density and RHCA Road Density): There are about 30 miles of road within the Norton Creek Subwatershed. The total road density rating for this subwatershed is considered "Extremely High." RHCA road density is rated as "low" and encroaching road density is rated as "moderate" (Table 3-14).

Riparian Harvest: Records show that since 1960 timber harvest has occurred within approximately 50 acres of the Norton Creek RHCA Buffer (F-5). This is a relatively low amount and likely has not decreased shade at significant levels within the drainage.

Norton Creek Water Quality

Sediment: Because Norton Creek is within the Bussel watershed the 303d listing for Bussel Creek applies to Norton Creek as well *(Water* section*).*

Temperature: Because Norton Creek is within the Bussel watershed the 303d listing for Bussel Creek applies to Norton Creek also *(Water* section). Temperature monitoring was conducted from spring to fall during 2002-2004 in a section of stream just below Road 758 and in a pool just above where Road 1900 crosses a tributary to Norton Creek.

As shown on Table 3-25, it is very likely that temperatures did not exceed the DEQ state temperature standards greater than 10% in any specified time periods in 2002 in the Norton Creek main stem. The data shows that temperatures did exceed the DEQ state temperature standards greater than 10% (Apr 15 –July 15 at 9 C daily average in 2003 and 2004) (June 1- Aug 31 at 13 C instantaneous in 2003 and 2004) and (Sept 1-Oct 31 9 C daily average) in 2003 and 2004.

Table 3-25 Norton Creek: Days of Temperature Exceedance/Days Deployed

	Year Collected		
Temperature Standards	**2002**	**2003**	**2004**
Spring Salmonid 13 C Instantaneous (Apr 15-July 15)	0 of 20	4 of 7	3 of 36
Spring Salmonid 9 C Daily Average (Apr 15-July 15)	0 of 20	7 of 7	23 of 36
Juvenile Bull Trout 13 C Instantaneous (Jun 1-Aug 31)	0 of 67	41 of 54	27 of 83
Bull Trout Spawning 9 C Average (Sept 1-Oct 31)	0 of 28	12 of 20	3 of 33

Table 3-26 Upper Norton Creek Tributary: Days of Temperature Exceedance/Days Deployed

	Year Collected
Temperature Standards	**2003**
Spring Salmonid 13 C Instantaneous (Apr 15-July 15)	0 of 7
Spring Salmonid 9 C Daily Average (Apr 15-July 15)	0 of 7
Juvenile Bull Trout 13 C Instantaneous (Jun 1-Aug 31)	0 of 54
Bull Trout Spawning 9 C Average (Sept 1-Oct 31)	1 of 34

For the upper Norton Creek Tributary the data indicates that stream temperatures did not exceed the DEQ state temperature standards greater than 10% in any specified time periods during 2003 (the only year data was collected by the USFS) (Table 3-26).

Chemical Contaminants/Nutrients: Contaminants/nutrients are not an issue in this stream segment *(Water* section*).*

Norton Creek Habitat Access

Physical Barriers: There are two physical man made barriers on the main stem of the Norton Creek in the upper watershed. These physical barriers are blocking migration for cutthroat trout and limiting access to approximately three miles of suitable habitat.

Norton Creek Habitat Elements

Pool Abundance: Norton Creek was surveyed using R1/R4 methods in 2003 (F-4). The table below shows the 2003 summarized pool data for the main stem.

Table 3-27 Norton Creek Pool Frequency Information

Reach	# of Pools	Length of Reach (feet)	# / 1000 feet	INFS RMO Pool # / 1000 feet
1	160	17,392	9.2	10.6
2	13	1,095	11.9	18.18

The INFS target RMOs for pool frequency in Norton Creek was not met in either of the reaches surveyed. The data, however, indicates that in the very large Reach 1, pools are prevalent and very close to meeting the RMO. In Reach 2, pool abundance was at 60 % of the RMO (Table 3-27). Almost 70 % percent of the habitat types within both reaches were classified as "runs" which can often be confused with long pools in E type channels due to that fact that they typically have very low width to depth rations. So there may be more pool habitat than the data shows. Pools are likely near appropriate levels for this type of stream environment and channel type.

Large Woody Debris: Table 3-28 shows the total number of pieces of LWD that meet the ROMs for piece size limitations. Both reaches exceed INFS standard for LWD.

Table 3-28 Pieces of Qualifying LWD per 1000 feet

Reach #	# / 1000 feet
1	19.84
2	18.26

Norton Creek Summary

Based on the above information the following are limiting factors for the Norton Creek Subwatershed: 1) Temperature 303d listing applies 2) Sediment 303d listing applies 3) "Extremely High" road densities 4) Fish migration barriers exist. Based on the factors listed above the overall condition of the fish habitat in Norton Creek is considered to be *Highly Altered/High Risk*.

Lines Creek Subwatershed

The 2045-acre Lines Creek Subwatershed, which drains directly into Norton Creek, has had past logging and road/railroad building activities. There are approximately 10 miles of fish bearing and non-fish bearing stream within the Lines Creek Subwatershed. Since 1960 1,188 acres were harvested in the Lines Creek Subwatershed (F-5). Much of the past logging and road building activity within this drainage occurred in the headwater areas. The old railroad grade/trail along the stream currently has some sporadic ATV use. The trail system crosses Lines Creek and some of its tributaries in many places. This was originally a hiking trail but has recently been used by ATVs as well.

Lines Creek Population Characteristics

Population Size: In 2002 a single pass electrofishing survey was conducted on Lines Creek in a section below and above Road 758 revealing current populations of cutthroat and sculpin (F-4). In the reach surveyed, 5 westslope cutthroat were captured in 100 m^2. The data indicates that "low to moderate" densities of cutthroat may be present in Lines Creek.

Fish Assemblage Diversity: Lines Creek likely has seasonal fluvial or adfluvial use by adult and juvenile sculpin and westslope cutthroat trout. This is because this stream is connected, by Marble Creek, to the St Joe River, which was and is inhabited by adfluvial and fluvial populations of these native species, and there are no major barriers that would prevent these species from accessing the Marble Creek or Lines Creek Drainages or permanently isolating fish from accessing suitable habitats across the landscape.

Lines Creek Stream Channel Conditions

Stream Bank Condition: Lines Creek main stem periodically changes from a Rosgen Type C channel to a moderate gradient B channel in the main stem. Small higher gradient tributaries are A and B type channels. Although there has been some past harvest within the RHCAs, field notes and aerial photo interpretation indicate that Lines Creek stream channels are currently stable and have very little bank cutting or sloughing. Undercut banks, grasses/sedges, conifers, and alder provide a large percentage of the riparian cover in the Lines Creek main stem *(Water* section*)*. Habitat data shows that roughly 60 percent of the stream bank in Lines Creek is considered "undercut" which can indicate excellent fish habitat. Overall, the stream bank conditions in the Lines Creek Subwatershed appear to be stable (F-5). ATVs, however, have caused some isolated stream bank disturbance in Lines Creek (F-5).

Floodplain Connectivity: Developed floodplains are found on Lines Creek. These floodplains are generally narrow, well vegetated, and have good lateral connectivity to the stream. However, the moderately confined nature of the valleys limits extensive floodplain development and connectivity *(Water* section*)*. Some stream channel reaches have been disconnected and confined from their floodplains in areas due to "Moderate" encroaching road densities.

Lines Creek Flow / Hydrology

Peak Flows: Water yield is not currently an issue in the Lines Creek Subwatershed (*Water* section).

Lines Creek Watershed Condition

Road Density (Encroaching Road Density and RHCA Road Density): There are about 7 miles of road within the Lines Creek Subwatershed. The total road density rating for this subwatershed is considered "High." RHCA road density is rated as "Moderate" and encroaching road density is rated as "Low" (Table 3-14).

Riparian Harvest: Records show that since 1960 timber harvest has occurred within approximately 17 acres of the Lines Creek RHCA Buffer (F-5). This is a relatively negligible amount.

Lines Creek Water Quality

Sediment: Because Lines Creek is within the Bussel Watershed the 303d listing for Bussel Creek applies to Lines Creek as well.

Temperature: Because Lines Creek is within the Bussel watershed the 303d listing for Bussel Creek applies to Lines Creek also *(Water* section*)*. Temperature monitoring was conducted in a section of stream just up from the confluence with Norton Creek from spring to fall during 2003-2004. The results are shown below. As shown in Table 3-29 it is very likely that temperatures in Lines Creek did not exceed the DEQ state temperature standards greater than 10% in the specified time period of (Apr 15 –July 15 at 13 C instantaneous in 2004) and (Sept 1-Oct 31 9 C daily average in 2004). The data shows that temperatures did exceed the DEQ state temperature standards greater than 10% (Apr 15 –July 15 at 9 C daily average in 2003 and 2004) (June 1- Aug 31 at 13 C instantaneous in 2003 and 2004) and (Sept 1-Oct 31 9 C daily average) in 2003.

Table 3-29 Lines Creek: Days of Temperature Exceedance/Days Monitors Were Deployed

Temperature Standards	Year Collected	
	2003	2004
Spring Salmonid 13 C Instantaneous (Apr 15-July 15)	2 of 4	1 of 36
Spring Salmonid 9 C Daily Average (Apr 15-July 15)	4 of 4	18 of 36
Juvenile Bull Trout 13 C Instantaneous (Jun 1-Aug 31)	34 of 51	16 of 83
Bull Trout Spawning 9 C Average (Sept 1-Oct 31)	11 of 20	1 of 33

Chemical Contaminants/Nutrients: Contaminants/nutrients are not currently an issue in this subwatershed *(Water* section*)*.

Lines Creek Habitat Access

Physical Barriers: No human-created migration barriers were located on Lines Creek. Natural temporal migration barriers may exist in the upper drainage.

Lines Creek Habitat Elements

Pool Abundance: Lines Creek was surveyed using R1/R4 methods during 2003 (F-4). Pool frequency results are shown below.

Table 3-30 Lines Creel Pool Frequency Information

Reach	# of Pools	Length of Reach (feet)	# / 1000 feet	INFS RMO # / 1000 feet
1	37	4107	9.0	18.18
2	32	3450	9.3	18.18

The INFS target RMO for pool frequency in Lines Creek was not met in either of the reaches surveyed. The data indicates that in both reaches pool abundance was at 50 % of the RMO indicating some habitat exists but not at optimum levels (Table 3-30).

Table 3-31 Pieces of Qualifying LWD per 1000 feet

Reach #	# / 1000 feet
1	3.4
2	2

Large Woody Debris: Table 3-31 shows the total number of pieces of LWD that meet the RMOs for piece size limitations per 1000 feet. The data shows that both reaches are close to the INFS RMOs for LWD.

Lines Creek Summary

Based on the above information the following are limiting factors for fish production in the Lines Creek Subwatershed: 1) Temperature 303d listing applies 2) Temperature 303d listing applies 3) Low abundance of fish 4) Low abundance of pools 5) High road densities. Based on the factors listed above the overall condition of the fish habitat in Lines Creek Subwatershed is considered to be *Moderately Altered/Moderate Risk*.

Marble Creek "8-Mile Stream Segment"

This segment of Marble Creek is not within the project area but is within the fisheries analysis area because it is directly down stream of the Bussel Creek Watershed and could be affected by the project. For the purposes of this analysis the Marble Creek segment to be discussed starts at the mouth (confluence with the St. Joe River) and ends directly above the confluence with Bussel Creek.

Habitat and electrofishing data from 2003 and 2004 in the Bussel Creek Watershed, which is a large tributary to Marble Creek, found no bull trout. Bull trout historically utilized habitat in the Marble Creek Drainage (Maclay 1940; Fields 1935). There have been no recent surveys but occasional bull trout presence is "probable" for Marble Creek (St. Joe River/NF Clearwater Basins B.A.). This is because Marble Creek is a direct tributary to the St Joe River, which is inhabited by an adfluvial population of bull trout and there are no barriers that prevent bull trout from accessing Marble Creek.

Population and Habitat Condition Summary

The St. Joe Subbasin Assessment and Total Maximum Daily Loads (DEQ 2005; SW-16) is effectively a cumulative effects analysis (MacDonald 2000 p 300). This assessment includes Marble Creek and concludes that the "entire [Marble Creek] watershed is 42.2% above the background sedimentation rate, and is below the threshold of concern." Additionally though, it is identified that Marble Creek should be subject to further investigation before additional decisions are made concerning its water quality (DEQ 2005; SW-16 p 39). Marble Creek is listed for impairment from temperature on the 2002 303(d) list (SW-17). The Draft 2008 Integrated 303(d)/305(b) Report (http://www.deq.state.id.us/water/data_reports/surface_water/monitoring/2008.cfm) does not list Marble Creek for sediment impairment but lists temperature impairment. It is not known if Idaho DEQ conducted further analysis to determine if beneficial use is supported since the approval of the 2002 303(d) list.

Marble Creek is a large drainage, covering about 91,160 acres or 142.4 sq. miles. There is mixed ownership within this basin, with Forest Service jurisdiction of approximately 50% of the land (St. Joe River/NF Clearwater Basins B.A.). Headwater elevations range from 6000-6800 feet, and the mouth is at about 2400 feet (Lower Marble EA 1997). The lower half of Marble Creek is primarily a large Rosgen B type channel with stream gradients averaging between 2 and 5 %. The average channel width is about 60-80 feet. Much of the lower half of Marble Creek (Including the 8-Mile segment found in the analysis area) is aggraded, lacking pools and lacking LWD (Lower Marble EA 1997). The upper portions of Marble creek, has a mix of C, B and A type channels. Marble Creek has significantly changed from its reference condition. The Marble Creek contribution to the fisheries resource was addressed in the fisheries summary of the St. Joe Geographic Area (Cross, unpublished document). This document included Marble Creek within the portion of the St. Joe drainage which has modified by human activity. The document reported that the channel conditions and associated fish habitat of this section are presently on a downward trend of mixed severity and pose a risk to the metapopulation structure of the native fish community (Cross unpublished document). Marble Creek does have populations of cutthroat trout throughout the entire drainage. Overall fish densities in the Marble Creek Drainage are likely reduced from historic conditions due to the loss and depredation of complex habitat. The DEQ currently has Marble Creek listed as impaired below Hobo Creek due to temperature. Fish habitat within Marble Creek has been influenced by natural events such as fire and floods, as well as human activities such as mining, timber harvest, road construction, splash dams, log drives and the removal of in-stream large woody debris (Lower Marble Creek EA) which have caused channels to become destabilized, riffles elongated and in many cases extended through former pool locations resulting in loss of pool volume which can be detrimental to adult bull trout because they rely on cool deep water habitats. Splash dams and surface erosion have played a major role in changing reaches of lower and middle Marble Creek from a transport system to a depositional system and therefore decreasing the quality and quantity of pools (Lower Marble EA 1997). The 8 mile segment in the cumulative effects area is within this lower and middle segment of Marble Creek. Riparian (~ 3.7+ mi/mi^2) and watershed (~ 3.9+ mi/mi^2) road densities are considered high within the entire Marble Creek Drainage. Most of the road exists in the Lower portions of Marble Creek (in the analysis area) where rd # 321 runs parallel to the stream channel within much of the RHCA. Very little road is found in the upper portions of the Marble Creek Watershed (Lower Marble EA 1997).

Based on the above information the following are limiting factors for fish production in the Marble Creek Stream Segment: 1) Temperature 303d listing 2) “High” RHCA road densities; 3) Degraded stream bank condition 4) Low LWD abundance 5) Low abundance of pools

The overall condition of the fish habitat in the Marble Creek Stream Segment is considered to be *Highly Altered/High Risk*; therefore, fish habitat is considered to be *Highly Altered* from the historic range of variability and/or at moderate risk of further undesirable change.

Environmental Consequences

No Action (Alternative A)

Direct and Indirect Effects

In the No-Action Alternative, no new management-induced effects (detrimental or beneficial, direct or indirect) would occur in the fisheries analysis areas; therefore, there would be no appreciable change to the existing population characteristics, stream channel conditions, flow/hydrology, watershed condition, water quality, habitat access, habitat elements as described in the existing condition section or beneficial uses. Although there may be a decrease in water yield as vegetation becomes denser and utilizes more soil moisture and intercepts more precipitation. Wildfire may increase sediment and water yields, but fire suppression will likely continue which can reduce the overall the severity of wildfire thus reducing the amount of potential sedimentation and water yield increases.

Fish Population Characteristics

Population Size: No measurable immediate change in fish populations is expected with the No-Action Alternative. Over time (long-term) elements of riparian habitats and RHCAs would continue to improve and stabilize. Studies on habitat preferences of salmonids suggests that Improved riparian areas and associated instream habitat complexity and diversity could lead to improved usage and survival by fish therefore population sizes and age class diversity may increase in the future (Young 1995; Reel and others 1989).

Fish Assemblage Diversity: No measurable immediate change expected. Over time riparian habitats would continue to improve and stabilize, therefore fish assemblage diversity may change in the future.

Persistence: No immediate change expected. Species populations would remain at existing levels in the St. Joe River Basin and within the analysis area. Over time riparian habitats in the entire St. Joe River Basin would continue to improve and stabilize, therefore fish persistence would be maintained and may improve in the future.

Stream Channel Conditions

Stream Bank Conditions: Overall stream channel conditions would likely improve over time as streamside vegetation continues to grow stabilizing streambanks and providing structure in the long-term through large woody debris recruitment.

Floodplain Connectivity: The vegetative recovery of Bussel Creek riparian areas and floodplains since 1933 (SW-26) indicates that river-floodplain dynamics are evolving since historic fires and log drives occurred in the 1920s-1930s. Little change is expected in the current lateral hydrologic connectivity of the stream to the floodplain because frequency of inundation would not diminish from proposed activities (see *Water Yield* discussions DEIS pg 217-223 and 210), no levees are proposed, and no appreciable channel incision is expected (see *Channel Form and Process* discussions Page 223) (Kondolf and others 2006 p. 2). Floodplain connectivity would likely improve over time as streamside vegetation continues to grow stabilizing stream banks and providing structure (LWD). However, streamside roads would continue to limit floodplain connectivity.

Flow/Hydrology

There may be a decrease in water yield as vegetation becomes denser and utilizes more soil moisture and intercepts more precipitation (*Water* section). The *Water* section also indicates the possibility of short-term increase in water yield and peak flows due to timber harvest.

Watershed Conditions

Road Densities: No change expected. There would be no change to total watershed road density; it would remain in the “high” category for the fisheries analysis area. Encroaching and RHCA road density ratings would remain a “low” for the entire fisheries analysis area.

Riparian Harvest: No change expected. Idaho Forest Practices Act and Water Quality standards do not allow riparian harvest.

Water Quality

Sediment: There would likely be no significant change to sediment delivery from the current condition. However *not removing* chronic, perpetual sediment sources, which often exist at stream crossings (culverts), could cause long-term degradation (sedimentation), in listed 303d sediment impaired watersheds (*Water* section).

Chemical Contaminants/Nutrients: No change to existing conditions is expected(*Soils* section).

Temperature: Temperature would improve slowly over time as conifers within the riparian zone, grow and provide shading to the stream. However, riparian planting proposed in Alternative B and C would enhance and improve riparian shade and vegetation sooner than if no planting occurred as with Alternative A.

Habitat Access

Physical Barriers: Identified human-created barriers would remain. Resident westslope cutthroat trout in the area would have limited access to habitat beyond the culvert barriers (approximately three miles of habitat total for both barriers). This limitation of access may reduce cutthroat seeding and density capabilities of the inaccessible habitat.

Habitat Elements

LWD: This would improve slowly over time as the conifers within the riparian zone, grow and naturally fall into the stream.

Pools: This would improve slowly over time as the conifers within the riparian zone, grow and fall into the stream thus creating new pool habitat and greater complexity. Large woody debris in streams forms pools and retains sediment and other particular organic matter (Beechie 1997).

Alternative A Cumulative Effects

Future activity on private land could affect stream habitats. Extremely high road densities in the private land would continue to cause sedimentation unless they are removed and the landscape restored. Streamside roads on private and NFS land would continue to cause sedimentation and shade reduction although this type of road is limited. Road densities would remain in "high" category for the fisheries analysis area. Encroaching and RHCA road density ratings will remain a "low" for the entire fisheries analysis area. Chronic and perpetual sediment sources from roads would continue to hamper water quality and beneficial uses.

Proposed activity *on privately owned land*, as disclosed by landowners within the Bussel 484 analysis area*,* includes 497 acres of regeneration timber harvest. The Water *section* indicates that harvest activities proposed on p*rivate land would increase short*-term sediment and water yield*.* Increased sediment could have an overall negative effect to fish habitat quality (Gucinski *and others 2001)* within the analysis area. However, activities on non-*NFS* land are regulated by the State of Idaho by administrative rules such as the Forest Practices Act and water quality standards that are designed to protect the environment and decrease sediment generation. Table 3-13 discusses historical activities and Table 3-32 discusses present and ongoing activities. Both tables display their potential effects to fish habitat. Historic activities, described in this document, have negatively affected fish habitat and indicators which has led to limiting factors for the fisheries resources in the described subwatersehds and the Marble Creek 8-mile stream segment (Individual Subwatershed/Segment Existing Condition Discussion and Limiting Factor Assessment) (see Table 3-12 for summary of limiting factor assessment).

Present and on-going activities common to all alternatives would have limited effects to the existing conditions. Fish habitats would be protected by RHCA buffers which maintain and improve shade (over time) and decrease the potential for sedimentation and erosion. Illegal ATV use in RHCAs could continue to cause site-specific riparian damage but would not reduce fish population densities or persistence throughout the analysis area. Expected road maintenance could potentially increase sedimentation, temperature and chemical contamination and decrease large woody debris; however, the Programmatic Road Maintenance BA (2004) indicated this activity may affect but is not likely to adversely affect bull trout (MIS species). Cumulatively, based on the above discussion there would likely be only small negative effects to fish habitats at site-specific areas where RHCA buffers do not exist (i.e. encroaching roads, or ongoing activates near streams). Fish populations or persistence of these populations would likely not be negatively affected (See *Effects on Species Diversity and Distribution on the IPNF* below). Fish populations and persistence may improve over time as RHCA and watershed vegetation improves and systems recover from past activities and natural events.

Alternative (B)

See Chapter 2 for a detailed description of the Alternative B.

Direct and Indirect Effects

The direct and indirect effects of the proposed treatments are discussed with respect to the (1) fish population characteristics, (2) stream channel condition, (3) peak flows/hydrology, (4) watershed condition, (5) water quality (6) physical barriers (7) habitat access, and (8) habitat elements. As previously discussed, analyzing potential changes to these indicators or elements that may occur due to the proposed management is key in determining the overall affects to the fisheries resource in the fisheries analysis area. For this discussion the effects to the individual sub watersheds and stream segment within the fisheries analysis area are discussed collectively. However, effects to the individual subwatersheds and stream segment are summarized in Table 3-33.

Fish Population Characteristics

Effects to population characteristics are displayed in the biological evaluation (BE) table and the biological assessment document (Appendix C).

Implementation of RHCA buffers on project activities would ensure that riparian areas and stream channels are not subjected to any direct effects from harvest or other treatment activities such as road building and road decommissioning. Indirect effects would also be substantially moderated by the presence of these buffers as large woody debris would be retained aiding in stabilizing stream banks, reducing sediment delivery potential to streams, maintaining riparian shade, maintaining habitat-forming large woody debris and protecting fish habitat (INFS EA 1995 and McCaffery and others 2007). Utilizing BMPs to minimize adverse effects on the aquatic environment is consistent with the Clean Water Act (40 CFR 232.3(c)) and Idaho water quality standards (IDAPA 58.01.02.350).

***Timber Harvest:* (see Maps 3 and 4)** Timber harvest would not occur within the riparian habitat conservation area (RHCA) (Design Feature 9A, Chapter 2 FEIS) in any of the subwatersheds within the fisheries analysis area. Some sediment could be generated in the short term (~2 years) from the harvest units (Water section). Although modeling predicts increased sediment from harvest activities, the *Soils* section shows all harvest units have low surface erosion hazard ratings and explains that soil erosion is not expected within harvest units. Furthermore, monitoring reports have shown that RHCA buffers were highly effective in preventing harvest unit sediment from moving towards streams (Forest Plan Monitoring Report 2006, Bitterroot National Forest). INFS documents that RHCA buffers are generally effective for reducing sediment in non-channelized flow from reaching stream channels (INFS 1995 p. A-5). Therefore, no appreciable direct or indirect effects to fish population characteristics are expected from timber harvest activities because habitat and water quality would not be significantly affected.

New Road Construction: (See Map 4) The proposed road construction would not even temporarily change the current watershed road density "rating" (see methods for rating system in Table 3-9) for any of the individual Subwatersheds or the Marble Creek Section. A short-term increase in sedimentation could occur from new road construction (*Water* section). RHCA buffers would likely prevent sediment from reaching any stream channels. The direct/indirect results of the proposed new road construction on fish populations would not likely increase the overall impact roads are currently having on fish populations and would likely have no significant effect on species assemblage diversity throughout the fisheries analysis area because habitat would not be significantly affected.

No new stream crossings would be built and no new construction would occur within RHCAs. When harvest-associated work is completed the new system roads would be placed into long-term storage (Rx C) for future use and would not be designated for motorized vehicle use. Roads placed into long-term storage (Rx C) would be much less impactive to fish populations as these types of roads typically produce less sediment than "Open" roads (McCaffay and others 2007). In Road Rx C, parts of the road would be outsloped and the drainage structures would be removed.

The 0.5 mile of temporary road would be fully recontoured to the natural slope when yarding operations and the need for the road are complete (by 2015). It would be impassable to motor vehicle traffic and would be revegetated. The *Water* section indicates that short-term effects from temporary road construction would be mitigated by BMPs.

Road Reconstruction: (See Map 4) 6.7 miles of road reconstruction would occur because some existing roads would require upgrading to allow for safe timber haul, improve drainage, and improve water quality. Reconstruction would include the installation of drain dips and culverts, grading, clearing, dust abatement, and resurfacing. GIS queries (F-5) show that .07 miles (spread out evenly over three drainages) of the road reconstruction would occur within encroaching stream segments (less than 50 feet from stream). Sediment from construction, use, and the crossing is expected to be short term because it would likely settle out and be stored behind existing LWD immediately down stream of the crossing as described in (Foltz and others 2007). Large woody debris in streams forms pools and retains sediment and other particular organic matter (Beechie 1997). Short term sediment may displace individual salmonids near project areas for short periods but there would not be any detrimental effects to long populations or habitat long term.

Access Management: (see Map 8) Currently, ATV use causes risk to riparian zones within the fisheries analysis area because the use is unmanaged (see Bear Creek description above). Field notes and site visits reveal riparian degradation to stream channels and riparian vegetation due to ATVs in undesignated areas (F-5). Alternative B would reduce motorized access on roads and trails by approximately 26 miles. This reduction would be an overall improvement to the fisheries resource as less impact to riparian areas would likely occur.

The conversion of the Bussel Creek Trail 258 (6.5 miles) to non-motorized use would be an improvement to the current situation of ATVs causing riparian damage.

The official designation of any ATV trail, specifically the Lines Creek Trail and Norton Creek Railroad Grade Trail, for motorized vehicles < 50" would not change the existing condition to the fisheries resource, as ATVs currently use portions of this trail system. However before proposed ATV trails are officially designated for ATV use they would be reconstructed to trail standards (Design Feature), meet BMPs, and conform to the 2004 IPNF Trail Maintenance BA. Current conditions of the trail/riparian interfaces would be improved. Vegetation regrowth on the roads and trials would reduce fine sediment in streams and thereby have positive effects on stream habitat (McCaffay and others 2007).

The construction of 0.2 miles of new trail for motorized vehicles < 50 inches wide between Roads 1901C and 3590A would not occur within the RHCA and would have no effect on fish.

Stream Crossing Removals and Recontouring: Following Road Rx D implementation, 10.7 miles of road would be removed from the National Forest Road System. Road recontouring and removal of stream crossings are expected to increase sediment in the short term but reduce sediment dramatically in the long term (*Water* section) (McCaffay and others 2007). Road recontouring and specifically, removal of stream crossings, would temporarily increase primarily fine materials to the stream channels (*Water* section; McCaffay and others 2007). The primary concern from this type of material would be the direct effects to incubating eggs; however, the timing of the road removal work would occur only after fry emerge (after July 15th) therefore there would be no significant impacts to fish (Design Feature).

Long-term stream crossing removals and recontouring would reduce the total existing "encroaching" (most impactive) road length by 1.1 miles and the total existing RHCA road miles by 1.8 miles. Most of the encroaching mileage would be reduced in the Toles Creek, Norton Creek and Bear Creek subwatersheds. Removal of chronic, perpetual sediment sources such as stream crossing and roads may cause a limited temporary exceedance in turbidity but is not likely to negatively affect fish population characteristics (Foltz and others 2007). The short-term sediment increases may displace some cutthroat trout for a period but would not reduce the population densities throughout the area. Overall the activity would reduce the road density in the project area even with the proposed new road construction and should substantially improve beneficial use support long term (*Water* section) and specifically benefit fish populations and diversity assemblage.

Fuels Reduction: Fuel reduction activities are prescribed in accordance with silvicultural prescriptions and are intended to facilitate the achievement of silvicultural objectives while fulfilling the requirements of Forest Plan protection standards. Fuel treatment activities have the ability to generate sediment which could degrade fish habitat and thus effect population. However, fire effects to ecosystems are related to their frequency, severity and timing of occurrence which are, in turn, affected by climate conditions, vegetation type, fuel loads and landscape features (Agee1993; Pine and others 1996). Fuel treatments would not occur within the riparian habitat conservation area (RHCA) (Design Feature 9 (A)) in any of the subwatersheds within the fisheries analysis area. RHCA buffers would greatly reduce the risk of sediment, generated by fuels treatment activities, reaching stream channels. Field monitoring shows that RHCA buffers were highly effective in blocking sediment from burned areas from moving towards streams and that the vegetative components stayed unaltered (Forest Plan Monitoring Report 2006, Bitterroot National Forest). Fuel treatments such as lop-and-scatter, grapple piling and burning, and broadcast burning are not likely to reduce canopy cover (*Fire and Fuels* section).

***Pocket Gopher Control*:** It is expected that design features would prevent effects to the water resource, including fish populations, from the placement of rodenticide. Past monitoring reports indicate that RHCA buffers were effective in protecting water quality with this activity (F-4) (F-5: St. Joe RD Pocket Gopher Control, Fisheries BA 2008*)*. The EPA documents effects from rodenticide application *(Water* section*)*. Design features for gopher poisoning include following manufacturer's recommendations for use and no gopher baiting treatment within RHCA buffers, in areas with saturated soil, or during periods of or forecasted periods of heavy precipitation. See *Design Features* in Chapter 2.

Timber Stand Improvement (see Map 6): Precommercial thinning would occur in previously harvested immature stands to improve or accelerate diameter growth and to improve the average form of the trees retained in the stand. On NFS lands the tree and stand size classes in intermediate harvest areas are expected to increase due to retention of larger tree classes combined with improved growth and vigor of trees and stands (*Forest Vegetation* section). Thinning and pruning within RHCA buffers would benefit the stream by enabling healthy and vigorous growth of shade giving vegetation (decreased temperatures sooner in time) and enhance a source of future LWD (for creating pools) which would benefit fish. No felled trees would be removed from the RHCA and no thinning would occur within 50 feet (to maintain bank stability) of any streambank (see *Design Features* in Chapter 2). No substantial change in precipitation interception or infiltration is expected because all thinned vegetation remains on-site. No consequential increase in water yield is expected from this activity because residual trees and other existing vegetation have the ability to utilize any increased soil moisture. No appreciable change to wetlands is expected. No appreciable increase in sediment is expected from this activity because there would be no soil disturbance (*Water* section).

Riparian Planting: Planting native conifers and shrubs in Little Bear and Bear Creek drainages, where reestablishment is needed and as described in the *Existing Condition* section, would enhance and restore

riparian areas by increasing shade (thus reducing stream temperatures), stabilizing stream banks and ensuring future large woody debris recruitment. It is expected that riparian plantings would assist in reaching the long-term target of increased streamside shade in Bear and Little Bear Creeks by 20-80% as the TMDL requires.

Large Woody Debris Placement: Large woody debris (LWD) in streams enhances the quality of habitat for salmonids and contributes to channel stability (Bisson and others 1987). Large woody debris in streams forms pools and retains sediment and other particular organic matter (Beechie 1997). It creates pools and undercut banks, deflects stream flow, retains sediment, stabilizes the stream channel, increases hydraulic complexity, and improves feeding opportunities (Murphy 1995). By forming pools and retaining sediment, LWD also helps maintain water levels in small streams during periods of low stream flow (Lisle 1986 *in* Murphy 1995). Placement of up to 200 cover logs in Bear Creek and 200 cover logs in Bussel Creek stream channels would increase the quantity and quality of critical pool habitat and increase the amount of cover as well as the stream's ability to trap fine sediment. A log source has not been identified. Logs would not be attained from RHCA buffers. Cull logs outside of RHCA buffers would be attained for LWD placement. Because the current condition of the habitat within these areas would be improved and more habitats would be available, it is likely the fish population densities would increase, survival rates would increase and higher seeding rates would occur in other reaches throughout the larger Bussel Creek Watershed.

Fish Migration Barrier Removal: The proposed action is to replace two culverts on Road 1900 that are currently barriers to fish passage. The replacement of these two human-created migration barriers would allow improved migration access to approximately three miles of fish habitat and would improve overall fish population seeding and densities throughout the watershed. The replacement of these two human-created barriers would likely cause minimal site-specific short-term stream bank disturbance and sedimentation during construction. Straw bales would be used to mitigate effects of culvert removals (see Fisheries Design Features in Chapter 2). Mitigation consisting of two straw bales placed in the stream at removal sites caused a significant reduction in fine sediment yield from an average of 67kg to an average of 1.6kg (Foltz and others 2007). The primary concern from this type of work would be effects to incubating eggs from short-term sediment The timing of the removal would occur only after fry emerge (after July 15th), therefore there would be limited impacts to fish.

Stream Channel Condition

Little change is expected in the current lateral hydrologic connectivity of the stream to the floodplain because frequency of inundation would not diminish from proposed activities (see *Water Yield* discussions page 222 DEIS), no levees are proposed, and no appreciable channel incision is expected (see *Channel Form and Process* discussions page 223 DEIS) (Kondolf and others 2006 p. 2).

Timber Harvest: Would not occur within the RHCA area (See Fisheries Design Features) in any subwatersheds within the fisheries analysis area. No effects to stream channels is expected from timber harvest due to the effectiveness of RHCA buffers.

New Road Construction: Streamside roads are likely to be the most impactive road segments (Dose and Roper 1994). No new road construction would occur within the RHCA buffers. No streambank disturbance would occur from this activity.

Road Reconstruction: 6.7 miles of road reconstruction would occur because some existing roads would require upgrading to allow for safe timber haul, improve drainage, and improve water quality. Reconstruction will include the installation of drain dips and culverts (8), grading, clearing, dust abatement, and resurfacing. Short-term negligible streambank disturbance would occur at site-specific locations where culverts are installed. Effects would be mitigated by seeding and mulching this area when activity is complete. Seeding and mulching can be very effective in stabilizing disturbed stream banks (F-5 2006-2007 Gold Center Creek Restoration Project effectiveness monitoring). Utilizing BMPs for this work to minimize adverse effects on the aquatic environment is consistent with the Clean Water Act (40 CFR 232.3(c)) and Idaho water quality standards (IDAPA 58.01.02.350).

Access Management: The proposed access management would create more protection to riparian areas. The reduction in access and management of the access would be an overall improvement to the fisheries resource as less impact to riparian areas and stream banks would likely occur.

The conversion of the Bussel Creek Trail 258 (6.5 miles) to non-motorized use would be an improvement to the current situation of ATVs causing stream bank damage. This would improve the current condition of the trail/riparian interface thus improving the current condition of fish habitat and would likely have positive effects

on steam channels (less degradation). Vegetation regrowth on the roads and trials would reduce fine sediment in stream which would have positive effects on stream habitat (McCaffay and others 2007).

The construction of 0.2 miles of new trail for motorized vehicles < 50 inches wide between Roads 1901C and 3590A would not occur within the RHCA and would have no effect on stream channels.

Fuels Reduction: Fuel treatments would not occur within the riparian habitat conservation area (RHCA) in any of the subwatersheds within the fisheries analysis area. RHCA buffers would greatly reduce the risk of impacts to stream channels from fuel treatments that can cause sedimentation channel stabilizing vegetation would be maintained (Forest Plan Monitoring Report 2006, Bitterroot National Forest). No direct or indirect effects to stream channels expected.

Pocket Gopher Control: No effects to the streambanks or floodplains are expected from the placement of rodenticide if design features are followed. The EPA documents effects from rodenticide application *(Water* section). Design features for gopher poisoning include: Follow manufacturer's recommendations for use; and no gopher baiting treatment within INFS RHCA buffers, in areas with saturated soil, or during periods of or forecasted periods of heavy precipitation. See *Design Features* in Chapter 2.

Timber Stand Improvement (see Map 6): Thinning and pruning within RHCA buffers would benefit the stream by enabling healthy and vigorous growth of shade-giving vegetation (decreased temperatures sooner in time) and enhance a source of future LWD (for creating pools) which would benefit fish. No felled trees would be removed from the RHCA and no thinning would occur within 50 feet (to maintain bank stability) of any streambank (see *Design Features* in Chapter 2). Stream bank conditions would improve in the long term.

Stream Crossing Removals and Recontouring: It is expected that any stream bank disturbance caused by culvert removals and recontouring would be short term (*Water* section). As stream channels, streambanks, and recontoured areas reseed and become stabilized a long-term net sediment reduction would likely occur (*Water* section).

Short-term effects of stream bank disturbance caused by culvert removals and recontouring would be reduced by the implementation of BMPs. There would likely be an overall long-term improvement to floodplain connectedness in some areas were encroaching road is recontoured.

Riparian Planting: Native conifers and shrubs would be planted in some portions of the riparian areas along approximately 1.8 miles of Bear and Little Bear Creeks and in portions of the riparian areas in other parts of the Bussel Creek Drainage (F-3). This would be accomplished over a period of 10 to 15 years. Riparian vegetation would enhance and help restore riparian areas by stabilizing streambanks and improving channel and thus floodplain interactions (Boon and others1992 p. 267).

Large woody debris placement: Large woody debris placement in the stream channel of Bear Creek and upper Bussel Creek would have minimal negative effect on the condition of streambanks. Where streambanks and soils are disturbed during placement of LWD, native seeding, riparian shrub planting and mulching would ensure bank stabilization and minimize sedimentation (F-5 2006-2007 Gold Center Creek Restoration Project effectiveness monitoring). The overall effect of the aquatic habitat improvement would also improve the current condition of the streambanks and floodplains within Bear, Little Bear and Bussel Creek.

Fish Migration Barrier Removal: Two culverts on Road 1900 that are currently barriers to fish passage would be replaced. The replacement of these two human-created migration barriers would likely cause minimal site-specific, short-term stream bank disturbance during construction. To minimize effects disturbed streambanks will be seeded and mulched after activity is complete.

Flow/Hydrology

Timber Harvest: Harvest activity (including harvest-generated fuels treatment) and new road construction are modeled by WATSED. The results shown in (*Water* section) indicate a slight increase in flows over the next several years.

New Road Construction: No appreciable changes in water yield or peak flows from the new road construction are expected (*Water* section).

Road Reconstruction: 6.7 miles of road reconstruction would improve drainage, and improve water quality. It is not likely that this activity alone would directly change water yield or peak flows appreciably throughout the analysis area (*Water* section).

Access Management: No appreciable changes in water yield or peak flows from the access management activities are expected.

Fuels Reduction: Fuel treatments would not occur within the riparian habitat conservation area (RHCA) in any of the subwatersheds within the fisheries analysis area. Appreciable changes in water yield are not expected with this activity.

Pocket Gopher Control: No effect to the water yield or peak flows is expected from the placement of rodenticide due to design features. See *Design Features* in Chapter 2.

Timber Stand Improvement (see Map 6): No substantial change in precipitation interception or infiltration is expected because all thinned vegetation remains on-site. No consequential increase in water yield is expected from this activity because residual trees and other existing vegetation have the ability to utilize any increased soil moisture. No appreciable change to wetlands is expected. No appreciable increase in sediment is expected from this activity because there would be no soil disturbance (*Water* section).

Stream Crossing Removals and Recontouring: No appreciable changes in water yield or peak flows from the stream crossing removals and recontouring activities are expected because of the small areas being treated in relation to the overall size of the subdrainages affected.

Aquatic Habitat Improvement: No appreciable changes in water yield or peak flows from riparian planting and large woody debris placement activities are expected because no trees would be cut. No appreciable changes in water yield or peak flows from the fish migration barrier removal activities are expected because this is a site-specific action that will not change hydrology.

Watershed Conditions

Timber Harvest: Timber harvest would not occur within the RHCA (See design features) in any subwatershed within the fisheries analysis. Timber harvesting would not change road densities in the project area. However, road construction would occur to facilitate harvest activity.

New Road Construction: Based on the methods previously described for determining road density ratings as they relate to fisheries the new road construction would not change the road density rating for any of the individual subwatersheds. Road density ratings in the fisheries analysis area are currently “high.” With the proposed new road construction, the road density rating would increase to the lowest end (4.7 mi/mi^2) of the “Extremely High” category (F-5). However, following Road Rx D implementation, 10.7 miles of road would be removed from the National Forest Road System in the project area, so there would be a net reduction of 4.7 miles of road and a reduction in total road density to 4.3 mi/mi^2 in the project area with this alternative. Furthermore, in this case because streamside roads are likely to be the most impactive road segments (Dose and Roper 1994) and no new road construction would occur within the RHCA buffers (F-5) except for the one stream crossing previously discussed, it is not expected that road construction and road density increase would appreciably change the current condition of the watershed and subwatersheds and their impacts to the fisheries resources. When the harvest-associated work is completed the 5.5 miles of the new system road would be placed into long-term storage (Rx C) for future use and would not be designated for motorized vehicle use making them even less impactive. Once these stored roads become vegetated and hydrologically stabilized, they would become relatively inert from a watershed condition standpoint (Switalski and others 2004). Placing these new roads into long-term storage would greatly reduce effects form this new road by decreasing the potential for disturbance by humans, habitat fragmentation, sedimentation, and encouragement of ATV use (McCaffery and others 2007). Temporary roads would be fully recontoured to the natural slope when yarding operations served by that road are complete.

Road Reconstruction: 6.7 miles of road reconstruction would improve drainage, and improve water quality on the current road system. Road reconstruction does not change road density ratings in the analysis area. Overall the effects would be an improvement to the water quality within the subwatersheds affected by road reconstruction.

Access Management: Access management will not have an effect on road density and there would be no harvest in RHCA due to access.

Fuels Reduction: Fuel treatments would not occur within the riparian habitat conservation area (RHCA) in any of the subwatersheds within the fisheries analysis area. RHCA buffers would greatly reduce risks of impacts to existing watershed condition.

Pocket Gopher Control: No effect to road density and no riparian harvest will occur from this action.

Timber Stand Improvement (see Map 6): Thinning and pruning within RHCA buffers would benefit the stream by enabling healthy and vigorous growth of shade-giving vegetation (decreased temperatures sooner in time) and enhance a source of future LWD (for creating pools) which would benefit fish. No felled trees would be removed from the RHCA and no thinning would occur within 50 feet (to maintain bank stability) of any streambank (see *Design Features* in Chapter 2). No appreciable increase in sediment is expected from this activity because there would be no soil disturbance (*Water* section).

Stream Crossing Removals and Recontouring: The total reduction in sediment due to the proposed stream crossing removals and recontouring and reduction in system road and the increase in stored road within the fisheries analysis area would be an overall large improvement to the high road density situation (lowered road density). There would be an overall benefit to fish habitat and fish populations as well as an improvement to a (303d listed) sediment impaired watershed.

Aquatic Habitat Improvement: Riparian vegetation planting would enhance and restore riparian areas by increasing shade (thus reducing stream temperatures), stabilizing stream banks and ensuring long-term LWD recruitment, which would counteract some of the past impacts of riparian road and riparian harvest in these areas. Fish migration barrier removal would not change or cause effects to road densities and would cause no riparian harvest.

Water Quality

Timber Harvest:

Sediment: Timber harvest would not occur within the RHCA (design features) in any subwatershed. The *Soils* section explains that all proposed harvest units have low surface erosions hazard ratings and that soil erosion is not expected within harvest units. Also the adequacy of buffers in preventing sediment delivery to stream channels needs to be considered, because even if sediment is generated, there may be no sediment delivered to stream channels. INFS documents that RHCA buffers are believed to prevent sediment in non-channelized from reaching stream channels (INFS 1995 p. A-5).

Temperature: Timber harvest would not occur within the RHCA (design features) in any subwatershed within the fisheries analysis area except for a small amount to facilitate road construction through one stream crossing over a non-fish-bearing stream. Tree removal at this one crossing is not expected to change stream temperatures throughout the analysis area and would only cause short-term, site-specific shade reduction which would be mitigated by planting riparian vegetation. Overall the protection and retention of riparian vegetation, would allow for the continued recovery and vegetative growth within riparian zones, which would continually provide shade to the stream channels. This shade would reduce stream temperatures as overall cover increases over time.

Chemical contaminants or nutrients: are not expected to have any effects on fish or fish habitat within the analysis area. BMPs would be required if chemicals would be used (See Appendix B). BMPs and design features should prevent any type of fuel contamination; therefore, timber harvest activities would have no effect on the water quality by increasing chemical contaminants. These BMPs include:

- PRACTICE 11.07 - Oil and Hazardous Substance Contingency Planning
- PRACTICE 11.11 - Petroleum Storage and Delivery Facilities and Management
- PRACTICE 15.11 - Servicing and Refueling of Equipment

New Road Construction:

Sediment: Streamside roads are likely to be the most impactive road segments (Dose and Roper 1994). No new road construction would occur within the RHCA buffers. The TMDL model identifies an estimated short term sediment increase from this activity. However effects to water quality from the new road construction would be minimal because RHCA buffers would effectively protect streams from sedimentation. Roads would be stored or recontoured after use and therefore they would less impactive to the water quality long term.

Temperature*:* No new road construction would occur within the RHCA buffers. No measurable change in stream temperatures are expected as a result of proposed road construction activities.

Chemical Contaminants: No Chemical contaminants or harmful nutrient levels are expected from this action (see above).

Road Reconstruction:

Sediment: 6.7 miles of road reconstruction would improve drainage, and improve water quality. Proposed road reconstruction would include reinstallation of eight culverts that were previously removed (SW-42). Utilizing BMPs to minimize adverse effects on the aquatic environment is consistent with the Clean Water Act (40 CFR 232.3(c)) and Idaho water quality standards (IDAPA 58.01.02.350).

Temperature*:* No measurable change in stream temperatures are expected due to the road reconstruction activities as no stream shade or canopy would be removed.

Chemical Contaminants: No Chemical contaminants or harmful nutrient levels are expected from this action (see above).

Access Management:

Sediment: If the proposed action were implemented, there would be an overall improvement to the fisheries resource, as less impact from sedimentation would likely occur relative to the existing condition. Specifically, the conversion of Bussel Creek Trail 258 (6.5 miles) to non-motorized use would be a major improvement to the current situation that has caused sedimentation to streams by ATVs. To ensure future riparian protection, these trails would be designed and reconstructed to meet standards for the specified use before they are designated for ATV use. This would improve the current condition of the trail/riparian interface thus decreasing the potential for sedimentation relative to the current condition.

Temperature: Field notes and site visits revealed riparian degradation to stream channels and riparian vegetation due to ATVs in undesignated areas. Specifically the proposal to convert Bussel Creek Trail 258 (6.5 miles) to non-motorized use would be a major improvement to the current situation that has caused riparian vegetation damage by ATVs. To ensure future riparian protection, these trails would be designed and reconstructed to meet standards for the ATV use before they are designated for ATV use. This would improve the current condition of the trail/riparian interface thus minimizing the current impacts to the riparian vegetation important for stream shading.

Chemical Contaminants: No chemical contaminants or harmful nutrient levels are expected from this action (see above).

Fuels Reduction: Fuel treatments would not occur within the riparian habitat conservation area (RHCA) (Design Feature) in any of the subwatersheds within the fisheries analysis area. RHCA buffers would greatly reduce risks of impacts to the existing water quality within the analysis area. No increase in stream temperatures and no appreciable increase in sediment are expected with this activity. See BMPs (Appendix B) for control of chemical contaminants.

Pocket Gopher Control: No effect to the temperature, sediment or from chemical contaminants is expected from the placement of rodenticide due to design features. See *Design Features* in Chapter 2.

Timber Stand Improvement (see Map 6): Thinning and pruning within RHCA buffers would benefit the stream by enabling healthy and vigorous growth of shade-giving vegetation (decreased temperatures sooner in time) and enhance a source of future LWD (for creating pools) which would benefit fish. No appreciable increase in sediment is expected from this activity because there would be no soil disturbance (*Water* section).

Stream Crossing Removals and Recontouring:

Sediment: According to the TMDL model, road recontouring and removal of stream crossings proposed in Alternative B are expected to substantially reduce sediment yield potential to streams after a small sort term in crease in sediment. Ultimately, stream crossing removals and recontouring would reduce the total existing encroaching road length by 1.10 miles and the total existing RHCA road length by 1.8 miles which reduce long-term sediment delivery to streams (F-5). Most of the encroaching mileage would be reduced in the Toles Creek, Norton Creek and Bear Creek Subwatersheds (F-5) *(*See Map 4*).*

Temperature: Recountoring would allow for increased vegetation on old road beds which could positively affect adjacent stream channel temperatures by increasing shade.

Chemical Contaminants: No chemical contaminants or harmful nutrient levels are expected from this action (see above).

Riparian Planting and Large Woody Debris Placement: Riparian vegetation planting would enhance and restore riparian areas by increasing shade (thus reducing stream temperatures), stabilizing streambanks (reducing risks of sedimentation) and ensuring long-term LWD recruitment, which would counteract some of the past impacts of high road densities and road densities within riparian areas. The overall effect of the aquatic habitat improvement on stream temperatures and sedimentation would be long-term improvement. Effects from short-term stream bank disturbances and sedimentation caused by placement of LWD, would be reduced by, seeding and mulching disturbed sites after activity is complete.

Fish Migration Barrier Removal: The replacement of two human-created fish migration barriers would likely cause minimal site-specific, short-term bank disturbance and sedimentation during construction. To minimize effects disturbed sites around the culverts will be seeded and mulched after activity is complete to ensure minimal impact from sedimentation. Dewatering may occur to minimize turbidity levels and sedimentation.

No chemical contaminants or harmful nutrient levels are expected from this action (see above).

Habitat Access

Timber Harvest: This action would have no effect on fish habitat access.

New Road Construction: No new road construction would occur within the RHCA buffers. New road construction action would not cause a migration barrier to fish.

Road Reconstruction: Reconstruction will include the installation of drain dips and culverts, grading, clearing, dust abatement, and resurfacing. This includes the replacement of two human-created migration barriers on Road 1900 which would allow improved migration access to approximately three miles of fish habitat.

Access Management: No access management action would cause a migration barrier to fish.

Fuels Reduction: Fuel treatments would not occur within the riparian habitat conservation area (RHCA) (Design Feature) in any of the subwatersheds within the fisheries analysis area. No change to the existing condition of habitat access would occur from this action.

Pocket Gopher Control: No change to the existing condition of habitat access would occur from this action.

Stream Crossing Removals and Recontouring: No stream crossing removal or recontouring would cause a migration barrier to fish.

Aquatic Habitat Improvement: Riparian planting and large woody debris replacement would not cause a migration barrier to fish. The replacement of two human-created migration barriers on Road 1900 would allow improved migration access to approximately three miles of fish habitat and would improve overall fish population seeding and viability throughout the watershed.

Habitat Elements

Implementation of RHCA buffers on project activities would ensure that riparian areas and stream channels are not subjected to any direct effects from timber harvest or road building activities. Indirect effects would also be substantially moderated by the presence of these buffers as large woody debris would be retained to stabilize streambanks, reduce sediment delivery potential to streams, maintain riparian shade, maintain habitat forming LWD and protect fish habitat.

Timber Harvest: Timber harvest would not occur within the RHCA (design feature) in any subwatershed within the fisheries analysis area. This action would have no effect on future LWD recruitment to fish streams or the amount and/or quality of pool habitats.

New Road Construction: No new road construction would occur within the RHCA buffers. This action would have minimal effect on future LWD recruitment and no effect on the amount and/or quality of pool habitats to fish streams because fish do not occur in the area where this work would happen.

Timber Stand Improvement (see Map 6): Thinning and pruning within RHCA buffers would benefit the stream by enabling healthy and vigorous growth of shade-giving vegetation (decreased temperatures sooner in time) and enhance a source of future LWD (for creating pools) which would benefit fish. No felled trees would be removed from the RHCA, and no thinning would occur within 50 feet (to maintain bank stability) of any streambank (see *Design Features* in Chapter 2).

Road Reconstruction: Reconstruction will not change the existing conditions of the habitat elements i.e. pools and LWD would not be affected.

Access Management: To ensure future riparian protection, these trails would be designed and reconstructed to meet standards for ATV use before they are designated for OHV use. This would improve the current condition of the trail/riparian interface thus improving the current condition of fish habitat in these areas. Proposed changes to access management would not reduce LWD or pools within The RHCAs. However there may be an improvement to pool quality in some areas as sedimentation is reduced.

Stream Crossing Removals and Recontouring: Proposed stream crossing removals and recontouring would not reduce LWD or pools within the RHCAs. However, there may be an improvement to pool quality in some areas as sedimentation is reduced.

Fuels Reduction: Fuel treatments would not occur within the riparian habitat conservation area (RHCA) (Design Feature) in any of the subwatersheds within the fisheries analysis area. No change to the existing condition of habitat elements would occur from this action.

Pocket Gopher Control: No change to the existing condition of habitat elements would occur from this action.

Riparian Planting: Riparian vegetation planting would enhance and restore riparian areas by increasing shade (thus reducing stream temperatures), stabilizing stream banks and ensuring forming LWD recruitment long term.

Large Woody Debris Placement : Large woody debris placement of 100-200 cover logs in the stream channel of Bear Creek and 100-200 cover logs in Bussel Creek would restore and enhance fish habitat, increase stream cover, increase the quantity and quality of pools and large woody debris with emphasis on meeting Inland Native Fish Strategy (INFS) objectives for large woody debris as defined in INFS p. A-4, Table A-1 (>12 inches in diameter and >35 feet in length).

Fish Migration Barrier Removal: Proposed fish migration barrier removal would not reduce LWD or pools within the RHCAs. However, this action would allow pool habitats above the existing migration barriers to become fully utilized by migrating fish.

Alternative C

Direct and Indirect Effects

Direct and indirect effects discussed in Alternative B are also applicable to Alternative C though somewhat lessened because there would be no new road construction.

Analysis has shown that in Alternative B proposed treatments are not expected to detrimentally affect the fisheries resource. The same would be true for Alternative C. Alternative C has fewer risks to the watershed condition than Alternative B, although both alternatives have minimal potential for detrimental effects due to the proposed design features and BMPs (Chapter 2).

Alternative A, B & C Cumulative Effects

Effects Common to All Alternatives

Table 3-32 lists the present and on-going activities, which are common to all alternatives. Some of these activities are Forest Service authorized activities others are general uses which do not require specific authorization. This table provides a summary of the direct and indirect effects from the individual activities. These activities and their effects were taken into consideration during the cumulative effects analysis.

Table 3-32 Present and On-Going Activities Common to All Alternatives

Activity	Present	Reasonably Foreseeable	Type of Potential Effect	Direct/Indirect Effects	Reference
NFS Lands: Present and On-Going Activities					
Grandmother Mtn. Land Exchange	X		Minimal	Minimal	Grandmother Mountain Land Exchange EIS 2007
Road Maintenance	X	X	Increase sedimentation, temperature and chemical contamination, decrease in large woody debris	yes	Programmatic Road Maintenance BA 2004 Bull Trout Determination: May affect, not likely to adversely affect.
Pocket Gopher Control		X	Chemical contamination	Not likely	2002 monitoring data, St. Joe Ranger district Pocket Gopher Control BA 2008
Transmission Line Maintenance	X	X	sedimentation	No effect	
Firewood Gathering	X	X	Potential for reduction in LWD recruitment	Minimal	Firewood permit specifies no firewood cutting within 300' of a stream. Programmatic Road Maintenance. BA, 2004 Determination: May affect, not likely to adversely affect.
Camping	X	X	Alteration of streambanks and increased nutrient loading	Minimal	St. Joe River/NF Clearwater Basins BA, July 1998
Berry Picking	X	X	Primarily due to influence of roads and trails	Minimal based on road and trail locations	St. Joe River/NF Clearwater Basins BA, July 1998. Programmatic Road Maintenance. BA, 2004 Determination: May affect, not likely to adversely affect.
Christmas Tree Cutting (personal-use)	X	X	Potential for reduction in LWD recruitment	Minimal	Permit specifies no cutting within 300' of a stream. Programmatic Road Maintenance. BA, 2004 Determination: May affect, not likely to adversely affect.
Motor Vehicle Use: Full-size, ATV, and Motorcycle	X	X	Alteration of streambanks and increased nutrient loading, sedimentation	yes	Bussel watershed Field observations 2006. Programmatic Trail Maintenance. BA 2004 Bull Trout Determination: May

Activity	Present	Reasonably Foreseeable	Type of Potential Effect	Direct/Indirect Effects	Reference
					affect, not likely to adversely affect.
Trail Maintenance	X	X	Increased sediment, temperature & chemical contamination; decreased LWD	Minimal	Programmatic Trail Maintenance. BA, 2004Bull Trout Determination: May affect, not likely to adversely affect.
Fire Suppression	X	X	Reduction of shading due to felling of hazard trees in RHCA, chemical contamination	Minimal based on implementation of INFS Guidelines.	St.Joe River/NF Clearwater Basins BA, July, 1998
Wildfires	X	unknown	Reduction of shading in RHCA, chemical contamination, sedimentation	Unknown based on severity	Contingency plans St Joe Ranger District
Weed Control Under the St. Joe Noxious Weed EIS	X	X	Chemical contamination	No Effect	St. Joe Noxious Weeds EIS, Oct 1999
Non- NFS Lands: Present and On-Going Activities					
Timber Harvest			497 acres of regeneration timber harvest		

Cumulative Effects Summary

To recap, the evaluated effects of the proposed action, there would be a net reduction of sediment long term through road recontourning and road closures. There would be a net reduction in open roads and total road densities would be reduced. Approximately 5.1 miles of new system road (closed after project use) and 0.5 miles of temporary road would be constructed on National Forest System lands and approximately 0.2 miles of road would be constructed on Potlatch Corporation lands under the Merry Creek Cost Share Supplement to facilitate the timber harvest on National Forest System lands. However no new road construction would occur within the RHCA buffers. 6.7 miles of road reconstruction would occur because some existing roads would require upgrading to allow for safe timber haul, improve drainage, and improve water quality. Reconstruction would include the installation of drain dips and culverts, grading, clearing, dust abatement, and resurfacing. GIS quarries shows that only .07 miles (spread out evenly over three drainages) of the road reconstruction would occur within encroaching stream segments (less than 50 feet from stream).

The proposed action would ultimately reduce motorized access on roads and trails by approximately 26 miles. Following Road Rx D implementation, 10.7 miles of road would be removed from the National Forest Road System. Long-term the proposed stream crossing removals/recontouring would reduce the total existing “encroaching” (most impactive) road length by 1.10 miles and the total existing RHCA road miles by 1.8 miles. Road recontouring reduces long term sediment delivery to streams (McCaffery et al. 2007).

Fuel treatments would not occur within the riparian habitat conservation area (RHCA) in any of the subwatersheds within the fisheries analysis area. RHCA buffers would greatly reduce the risk of sediment, generated by fuels treatment activities, reaching stream channels. Field monitoring has shown that RHCA buffers were highly effective in blocking sediment from burned areas from moving towards streams and that the vegetative components stayed unaltered (Forest Plan Monitoring Report 2006, Bitterroot National Forest).

There would be an estimated increase in water yield of 2% from proposed private-land activities (SW-25). The estimated 2% water yield increase would result from activities proposed from 2007-2014. Combined with WATSED’s estimated three percent for National Forest activities, there would be a cumulative total 5% water yield increase. The cumulative 5% increase is not expected to substantially alter channel form, pattern or process for the same reasons identified in the direct and indirect effects for Alternative B.

Although modeling estimates indicate increased sediment from the proposed timber harvest, (Water report DEIS) explains that all proposed harvest units have low surface erosions hazard ratings and that soil erosion is not expected within harvest units. Also the adequacy of buffers in preventing sediment delivery to stream channels needs to be considered, because even if sediment is generated, there may be no sediment delivered to stream channels.

No adverse effects are expected to the water resource including fish populations from the placement of rodenticide due to design features. Past monitoring reports indicate that RHCA buffers were effective in protecting water quality with this activity (*St. Joe RD Pocket Gopher Control, Fisheries BA 2008).*

Approximately 821 acres of pre-commercial thinning is proposed to improve the growing conditions of the selected trees by eliminating competition for light and nutrients. Thinning and pruning within RHCA buffers would benefit the stream by enabling healthy and vigorous growth of shad giving vegetation (decreased temperatures sooner in time) and enhance a source of future LWD (for creating pools). No felled trees would be removed from the RHCA and no thinning would occur within 50 feet (to maintain bank stability) of any streambank.

Planting native conifers and shrubs (time period) in Little Bear and Bear Creek drainages, where reestablishment is needed and as described in the existing condition section, would enhance and restore riparian areas by increasing shade (thus reducing stream temperatures in 303d listed streams), stabilizing stream banks and ensuring future large woody debris recruitment. It is expected riparian plantings would assist in reaching in the long term the target of increased streamside shade in Bear and Little Bear Creeks by 20-80% as the TMDL requires.

Placement of up to 200 cover logs in Bear Creek and 200 cover logs in Bussel Creek stream channels would increase the quantity and quality of critical pool habitat and increase the amount of cover for fish as well the stream ability to trap fine sediment.

Two culverts on Road 1900 in the Upper Norton Creek Subwatershed that are currently barriers to fish passage would be replaced and would allow improved migration access to approximately three miles of fish habitat and would improve overall fish population seeding and densities throughout the watershed.

All but one of the subwatersheds and the Marble Creek stream segment were assessed as being *Highly Altered/High Risk* therefore, fish habitat is considered to be *Highly Altered* from the historic range of variability and/or at high risk of further undesirable change. Lines Creek Subwatershed was assessed as being *Moderately Altered/Moderate Risk.* The conditions of these subwatersheds and the stream segment of Marble Creek are largely due to incremental effects of substantial past management overtime throughout the analysis area as described above. "Limiting factors" or "issue indicators" affecting the fisheries resources are the lack of adequate LWD, extremely "high" total road density ratings, 303d temperature listing and TMDL, 303d sediment listing and TMDL, degraded stream bank condition and low abundance of pools.

As stated in the *Water* section, what is most important to understand in the Bussel Creek sediment budget is that some sediment will be generated in the short-term, but long-term sediment reduction is consequentially large (Table 3-68, SW-A30, SW-A31, SW-A36), which should lead to increased support of beneficial uses (Switalski and others 2004).

Negative effects (described above) from existing roads within the analysis area are well document. However as previously the proposed reduction in miles of FS road, the road recontouring, and access management would help to reduce sediment from 303d listed streams and move conditions toward achieving prescribed TMDLs in the long term throughout the analysis area.

No future or foreseeable road construction is planned by any land owner. However If substantial road building, other than what is proposed in this project, occurs in the analysis area in the future by any land manager there may be an increase in sediment loads and negative effects to fish habitat at some level. It would be difficult to predict effects of any future road construction because quantity and locations are not known. Conversely if existing roads are closed (structures pulled) or recontoured in the future there could be a reduction in sediment a further reduction in long term sediment.

The *Water* section indicates that the reasonably foreseeable timber harvest (497 acres) on private land in the head waters of Bussel Creek would generate some sediment. The report indicates that harvest activities proposed on private land would increase sediment and water yield in the short term. Increased sediment could have an overall negative effect to fish habitat quality (Gucinski and others 2001). However this sediment would be greatly reduced by the implementation of the rules pertaining to the Idaho Forest Practices Act, Title 38, Chapter 13, Idaho Code that are designed to protect the environment and decrease sediment generation.

Furthermore, there may be a decrease in water yield in the future as vegetation becomes denser and utilizes more soil moisture and intercepts more precipitation. The *Water* section indicates that there would be no appreciable cumulative effects from sediment to beneficial uses (fish) do to the implementation of BMPs and State Water Quality Standards to Bussel Creek or the surrounding areas.

Cumulatively in the long term water quality and riparian conditions throughout the analysis area would be improved by the implementation of present and foreseeable activities (LWD placement, Riparian planting, barrier removals, road recontouring and road storage, ATV access management), as well as the implementation of BMPs and State Water Quality Standards which aim to maintain or improve Beneficial uses.

Stream temperatures would continue to decrease over time as trees within riparian zones/INFS buffers continue to grow and create more shading.

In stream LWD debris, which is important in creating excellent fish habitat and pools, would increase overtime as trees within riparian zones/INFS buffers continue to grow and naturally fall into (recruitment) the streams. A short-term sediment increase is identified for the Bussel Creek watershed (*Water* section) from proposed activities (including restoration activities). The *Water* section discusses the indirect effect of this short-term sediment increase in relationship to stream channels in the Bussel Creek watershed.

The Current Condition section of this *Fisheries* section documents the past activities that resulted in the existing condition in Marble Creek (specifically The Marble Creek 8-Mile Stream Segment).

The *Water* section (F-5) indicates that existing and reasonable foreseeable activities in the Bussel Creek watershed would likely have no appreciable negative effects to water quality or beneficial uses (fish) from the proposed activities, and therefore, there would be no appreciable negative effects to water quality or beneficial uses in Marble Creek.

Cumulatively the Marble Creek watershed would continue to have issues with water quality (mainly temperature) until riparian zones and riparian vegetation recovers more fully and roads (mainly riparian) are reduced thus increasing shade and reducing sediment.

Long term through the implementation of BMPs; design features and rules pertaining to the Idaho Forest Practices Act, Title 38, Chapter 13, Idaho Code; the proposed reduction in watershed roads (especially riparian), planting of riparian trees and shrubs; and the placement of LWD within the Bussel Creek Watershed would increase the water quality in the entire analysis area (including Marble Creek) and would benefit native fish species.

Based on the above cumulative effects discussion (including Tables 3-32 & 3-33) and direct and indirect effects, none of the alternatives would cause a net degradation or loss to any of the “indicators” critical for maintaining healthy conditions of the fisheries resources within the fisheries analysis area. Although some appreciable short-tem effects to water quality could occur from sediment from activities. However, collectively, restorative activities in Alternatives B and C would improve some conditions that were identified as limiting factors/issue indicators in the long term and short term. These indicators which would be improved in the long-term are stream temperature, large woody debris, pools, sediment, fish migration barriers, and ultimately fish populations and beneficial uses. Alternatives B and C would move conditions closer to meeting the prescribed TMDLs in the long term.

Table 3-33 Expected Change in Watershed Condition Summary by Alternative

Bussel Creek Subwatershed								
Alternative	**Limiting Factor Assessment Summary**	**Population Characteristics**	**Stream Channel Conditions**	**Flow / Hydrology**	**Watershed Condition**	**Water Quality**	**Habitat Access**	**Habitat Elements**
Existing Condition / Limiting Factor	**Highly Altered/High Risk**	Low abundance of fish	Stable in most reaches	Stable	Extremely high road densities	High stream temperatures, sediment impaired	No culvert barriers	Low LWD, low pool numbers
No Action	**Highly Altered/High Risk**	No change	No change	No change	Long-term improvement	Long-term improvement	No change	Long-term improvement
Alternative B	**Move toward Moderately Altered/High Risk**	Short-term and long-term improvement	Short-term and long- term improvement	No change	Short-term and long term improvement no change in road density rating	Short-term sediment increase / long-term improvement given RHCA buffers; reduced stream temperatures, reduced sediment	No change	Immediate and long-term improvement
Alternative C	**Move toward Moderately Altered / Moderate Risk**	Short-term and long-term improvement	Short-term and long-term improvement	No change	Short-term and long-term improvement	Reduced stream temperatures; reduced sediment	No change	Immediate and long-term improvement

Table 3-33 continued

Bear Creek Subwatershed								
Alternative	**Limiting Factor Assessment Summary**	**Population Characteristics**	**Stream Channel Conditions**	**Flow / Hydrology**	**Watershed Condition**	**Water Quality**	**Habitat Access**	**Habitat Elements**
Existing Condition / Limiting Factor	**Highly Altered / High Risk**	Excellent cutthroat population levels	Stable in most reaches	Stable	Extremely high road densities	High stream temperatures, sediment impaired	No culvert barriers	Low LWD, low pool numbers
No Action	**Highly Altered / High Risk**	No change	Possible negative effects to streambanks from ATVs	No change	Possible negative effects from ATVs/trails	Long-term improvement given RHCA buffers	No change	Long-term improvement given RHCA buffers
Alternative B	**Move toward Moderately Altered / High Risk**	Short-term and long-term improvement and stabilization	Long-term stability	No change	Short-term and long-term improvement	Reduced stream temperatures; reduced sediment	No change	Immediate and long-term improvement
Alternative C	**Move toward Moderately Altered / Moderate Risk**	Short-term and long-term improvement and stabilization	Long-term stability	No change	Short-term and long-term improvement	Reduced stream temperatures; reduced sediment	No change	Immediate and long-term improvement

Table 3-33 continued

Little Bear Creek Subwatershed								
Alternative	**Limiting Factor Assessment Summary**	**Population Characteristics**	**Stream Channel Conditions**	**Flow / Hydrology**	**Watershed Condition**	**Water Quality**	**Habitat Access**	**Habitat Elements**
Existing Condition / Limiting Factor	**Highly Altered / High Risk**	Excellent cutthroat population levels	Stable in most reaches	Stable	Extremely high road densities	High stream temperatures; sediment impaired	No culvert barriers	Low LWD, low pool numbers
No Action	**Highly Altered / High Risk**	No change	Possible negative effects to streambanks from ATVs	No change	Possible negative effects from ATVs/trails	Long-term improvement given RHCA buffers	No change	Long-term improvement given RHCA buffers
Alternative B	**Move toward Moderately Altered/High Risk**	Short-term and long-term improvement and stabilization	Short-term and long-term improvement	No change	Short-term and long-term improvement	Reduced stream temperatures; reduced sediment	No change	Immediate and long-term improvement
Alternative C	**Move toward Moderately Altered / Moderate Risk**	Short-term and long-term improvement and stabilization	Short-term and long term improvement	No change	Short-term and long-term improvement	Reduced stream temperatures; reduced sediment	No change	Immediate and long-term improvement

Table 3-33 continued

Toles Creek Subwatershed								
Alternative	**Limiting Factor Assessment Summary**	**Population Characteristics**	**Stream Channel Conditions**	**Flow / Hydrology**	**Watershed Condition**	**Water Quality**	**Habitat Access**	**Habitat Elements**
Existing Condition / Limiting Factor	**Moderately Altered / Moderate Risk**	Good cutthroat population levels	Stable in most reaches	Stable	"High" road densities	High stream temperatures; sediment impaired	No culvert barriers	Low LWD; low pool numbers
No Action	**Moderately Altered/Moderate Risk**	No change	Long-term improvement given RHCA buffers	No change	Long-term improvement given RHCA buffers; no change in road density	Long-term improvement given RHCA buffers	No change	Long-term improvement given RHCA buffers
Alternative B	**Remain at Moderately Altered/High Risk**	Long-term positive trend	Long-term improvement given RHCA buffers	No change	Short-term and long-term improvement; No change in road density rating	Short-term sediment increase long-term improvement given RHCA buffers	No change	Long-term improvement given RHCA buffers
Alternative C	**Remain at Moderately Altered / Moderate risk**	Long-term positive trend	Long-term improvement given RHCA buffers	No change	Short-term and long-term improvement	Long-term improvement given RHCA buffers	No change	Long-term improvement given RHCA buffers

Table 3-33 continued

Norton Creek Subwatershed								
Alternative	**Limiting Factor Assessment Summary**	**Population Characteristics**	**Stream Channel Conditions**	**Flow / Hydrology**	**Watershed Condition**	**Water Quality**	**Habitat Access**	**Habitat Elements**
Existing Condition Limiting Factor	**Highly Altered / High Risk**	Good abundance of fish	Stable in most reaches	Stable	"Extremely high" road densities	High stream temperatures; sediment impaired	No culvert barriers	Low LWD, low pool numbers
No Action	**Highly Altered / High Risk**	No change	Long-term improvement given RHCA buffers	No change	Long-term improvement	Long-term improvement given RHCA buffers	No change	Long-term improvement given RHCA buffers
Alternative B	**Move toward Moderately Altered / High Risk**	Short-term and long-term improvement	Long-term improvement given RHCA buffers	No change	Short-term and long-term improvement	Short-term sediment increase; long-term reduced stream temperatures; reduced sediment given RHCA buffers	2 migration barriers removed, increased access to 3 miles of habitat	Long-term improvement given RHCA buffers
Alternative C	**Move toward Moderately Altered / Moderate Risk**	Short-term and long-term improvement	Long-term improvement given RHCA buffers	No change	Short-term and long-term improvement	Reduced stream temperatures; reduced sediment given RHCA buffers	2 migration barriers removed; increased access to 3 miles of habitat	Long-term improvement given RHCA buffers

Table 3-33 continued

Lines Creek Subwatershed								
Alternative	**Limiting Factor Assessment Summary**	**Population Characteristics**	**Stream Channel Conditions**	**Flow / Hydrology**	**Watershed Condition**	**Water Quality**	**Habitat Access**	**Habitat Elements**
Existing Condition / Limiting Factor	**Highly Altered / High Risk**	Low abundance of fish	Stable in most reaches	Stable	"High" road densities	High stream temperatures, sediment impaired	No culvert barriers	Low LWD, low pool numbers
No Action	**Highly Altered / High Risk**	No change	Long-term improvement given RHCA buffers, possible negative effects from ATVs/trails	No change	Long-term improvement; no change in road density rating	Long-term improvement	No change	Long-term improvement given RHCA buffers
Alternative B	**Move toward Moderately Altered / High Risk**	Long-term improvement	Long-term improvement given RHCA buffers	No change	Short-term and long-term improvement; no change in road density rating	Short-term sediment increase; long-term reduced stream temperatures; reduced sediment given RHCA buffers	No change	Long-term improvement given RHCA buffers
Alternative C	**Move toward Moderately Altered / Moderate Risk**	Long-term improvement	Long-term improvement given RHCA buffers	No change	Short-term and long-term improvement	Reduced stream temperatures; reduced sediment given RHCA buffers	No change	Long-term improvement given RHCA buffers

Table 3-33 continued

Marble Creek 8-Mile Segment								
	Limiting Factor Assessment Summary	**Population Characteristics**	**Stream Channel Conditions**	**Flow / Hydrology**	**Watershed Condition**	**Water Quality**	**Habitat Access**	**Habitat Elements**
Existing Condition / Limiting Factor	**Highly Altered / High Risk**	Good abundance of fish	Stable in most reaches	Stable	High road densities	High stream temperatures, sediment impaired	No culvert barriers / remnant check dams in upper Marble	Low LWD, low pool numbers
No Action	**Highly Altered / High Risk**	Long-term improvement difficult to predict given multiple land owners	Change difficult to predict given multiple land owners	No change	No change	No change	No change	No change
Alternative B	**Highly Altered / High Risk**	Long-term improvement difficult to predict given multiple land owners	No change	No change	No change	No change	No change	No change
Alternative C	**Highly Altered / High Risk**	Long-term improvement difficult to predict given multiple land owners	No change	No change	No change	No change	No change	No change

Effects on Species Diversity and Distribution on the IPNF

Fish species that may be affected by the project (bull trout, westslope cutthroat trout) are also distributed across the Forest. For example, bull trout are found in eight of 13 (61%) of 4th code HUC watersheds (i.e., large watersheds, such as the St. Joe River) on the IPNF. Cutthroat trout currently occur in 100% of 4th code watersheds on the Forest. There is no connectivity between the St. Joe watershed, which includes the project area, and nine of the other 4th code HUC watersheds on the Forest (e.g., Kootenai River, Lake Pend Oreille, Lower North Fork Clearwater River).

At the smaller watershed scale (6th code HUC watersheds), bull trout are known to inhabit approximately 23% of the 6th code HUC watersheds in the St. Joe watershed. While bull trout have not been detected in the other 77% of watersheds, including those in the project area, rigorous sampling has not occurred.

Westslope cutthroat trout occur in approximately 100% of the 6th code HUC watersheds in the St. Joe watershed. The Bussel 484 project proposed action *may impact individuals or habitat, but is not likely to cause a trend toward federal listing or a loss of viability of the species (*See Table 3-34*).* Based on the limited scope of the effects and the widespread distribution of the species across the forest, no change to species viability at the Forest level is expected on the IPNF.

Sensitive Species Biological Evaluation

Table 3-34 Sensitive Fish Species Conclusion of Effects

Species	No Action (Alternative A)	Proposed Action (Alternative B)	Action Alternative (Alternative C)
Westslope Cutthroat Trout	NI	MIIH	BI

NI = No Impact
MIIH = 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
WIFV = Will Impact Individuals or Habitat with a Consequence that the Action May Contribute to a Trend Towards Federal Listing or Cause a Loss of Viability to the Population or Species
BI = Beneficial Impact

Comments: The Sensitive Fish Species Conclusion of Effects was based on the information provided in the above fisheries analysis area effects summary.

Consistency with Forest Plan and Regulatory Framework

IPNF Forest Plan and INFS Guidelines

Fish Standards 1 and 2 (Fry Emergence) do not apply due to the amendment of the IPNF Forest Plan.

Standard 3 does not apply to this project because none of the streams identified in that standard are located in this project area.

Standard 4 would be met. There is no new road construction that would cross a fish bearing stream. Two migration barriers on Road 1900 would be rectified.

Standard 5 was met. The information contained in this section used fisheries surveys to coordinate activities with other resources and to identify fish habitat improvement opportunities.

Standard 6 was met due to the extensive review of the stream systems and the implementation of standards described in INFS.

Inland Native Fish Standards

The implementation of the proposed action Alternative B or C would comply with INFS (Appendix D).

NFMA Regulations

Alternatives A, B and C would meet NFMA requirements to "provide for diversity of plant and animal communities" in the Plan area (16 USC §1604 NFMA §6 (g)(2) (B)). The alternatives would comply with NFMA by complying with the Forest Plan (see above). Diversity and distribution of MIS would be maintained under all alternatives (*Effects on Species Diversity and Distribution on the IPNF* section above)

ESA Regulations

Alternatives A, B and C would not jeopardize the continued existence of bull trout, the listed species that historically was found in the project area. A biological assessment will be completed when an alternative is selected for implementation.

Executive Orders 11988 and 11990

Alternative A, B, and C would not damage wetlands; and riparian dependent resources such as the fishery would be protected through the implementation of RHCA buffers.

Executive Order 12962

Alternatives A, B and C would maintain habitat and thus would not affect the fishery potential, which in turn would not reduce the potential for recreational fishing opportunities. Recreational fishing opportunities would be maintained and may be improved by activities proposed.

Fire and Fuels

Differences between Draft EIS and Final EIS

Fire management plan direction was updated to include direction from the 2008 IPNF Fire Management Plan.

Literature citations were updated throughout the section.

The discussion of FOFEM outputs on page 64 of the DEIS was removed because the FFE-FVS analysis provided estimates effects on fuel loading and fuel consumption over time based on stand data from stands within the analysis area.

The analysis of fire behavior characteristics using the BEHAVE model was replaced with analysis of potential surface fire flame length, probability of torching, and crowning index using the Fire Fuels Extension of the Forest Vegetation Simulator (FFE-FVS). Limitations and use of the FFE-FVS were included in the FEIS.

Reducing the potential for large, severe wildfire is analyzed as an effect of the project, it is not a purpose of the project. The statement “Reduce the potential for large, severe wildfires while promoting conditions for safe and effective wildland fire management.” was originally listed as a purpose and need during project development. Subsequent analysis of the fire regimes within the analysis area revealed that large and occasionally severe wildfires are not unnatural. The only structures located in or immediately adjacent to the analysis area are an electrical transmission line and an electronic site. It was decided that due to the nature and locations of these structures, in combination with the habitat types and fire regimes, conducting fuel treatments specifically for the purpose of protecting these sites was unnecessary. The statement was unintentionally left in the purpose and need of the DEIS. Therefore reducing the potential for large, severe wildfire was removed from the purpose and need of the project. Effects of no action, and proposed actions on potential fire behavior characteristics at the stand level are discussed and disclosed in this section of the EIS.

Regulatory Framework

Forest Plan Direction

IPNF forest-wide management direction states "Provide efficient fire protection and fire use to help accomplish land management objectives" (USDA Forest Service 1987).

Forest Plan fire management standards state that fire protection and use standards are specified by management area. "Cost effective fire protection programs will be developed to implement management direction based on on-site characteristics that affect fire occurrence, fire effects, fire management costs and fire caused changes in values." Management area standards define requirements for fire protection.

Prescribed fire is utilized in accordance with management area standards to accomplish specific resource objectives, such as to manage wildlife habitat, meet silvicultural objectives as prescribed in the silvicultural prescription or other area objectives. Fire management is a support function integrated with and responsive to the management direction established in the Forest Plan. The use of fire is within predetermined criteria to meet specific management objectives.

Appendix F of the Forest Plan states:

> Fire is a natural force in the ecosystem of the IPNF. The effects of fires will be detrimental or desirable depending on when and where fires occur and nature of the fires relative to management objectives. Prolonged fire exclusion leads to changes in forest composition and distribution patterns, which can also have detrimental or desirable consequences. Ecological principals relative to fire must be integrated into fire use and protection requirements along with requirements for resource protection and efficiency. Fire use and protection standards included in each management area will:
>
> 1. Use prescribed fire where it is the most effective way to achieve ecosystem responses required for management objectives.
> 2. Reduce the total cost of land management by integrating fire protection and fire use in management direction.

Fire Management Plan

The Fire Management Action Plan (FMP) is developed in accordance with and is guided by Forest Plan standards. The standards state that fire will be used to achieve management goals according to direction in management areas. "Activity fuels will be treated to reduce their potential rate of spread and fire intensity so the planned initial attack organization can meet initial attack objectives" (USDA Forest Service 1987 IPNF Forest Plan p. II-38).

The IPNF FMP identifies two fire management units in Bussel 484 Analysis Area. One is Wildland Urban Interface (WUI), which is comprised of the transmission line that runs through the eastern portion analysis area and the microwave electronic site that is located on a ridge top in the southwest corner of the analysis area. No other structures are associated with the identified WUI in the analysis area. Both features described above were identified as part of the wildland urban interface in the Shoshone County Fire Mitigation Plan. The identified WUI extends ½ mile in all directions from each feature. Fire management direction within the defined WUI includes:

> "All wildland fires in the FMU, regardless of cause, are unwanted events and will be managed as suppression events. The goal of suppression is full control using sufficient forces and direct management actions to contain the fire to as small an area and with as little damage or loss to resource values as possible." (IPNF FMP 2008)

The second FMU is the General Forest Zone. Fire management direction for this FMU is:

> "All wildland fires in this FMU, regardless of cause, are unwanted events and an appropriate suppression response will be implemented. In this FMU the values to be protected from fire may allow managers to implement a conditional suppression response that does not include an expectation of full containment and control through direct management actions, and one that tolerates a larger area to be involved by the fire than is the case in the WUI and Mixed Ownership FMU. There are scattered tracts of private lands present within the FMU."

> "An objective of fire suppression in this FMU is to keep suppression costs commensurate with values at risk. Forest Plan Management Area direction is to use suppression strategies appropriate to achieve the best benefit-cost ratio based on timber values and/or appropriate wildlife or other identified resource values as identified by MA direction" (IPNF FMP, 2008).

Forest Service Manual

Forest Service Manual 5130.2 states: "The objective of fire suppression is to safely suppress wildfires at a minimum cost consistent with land and resource management objectives and fire management direction as stated in fire management action plans." Minimum cost considerations usually lead to decisions of aggressive initial attack to keep fires small unless other less aggressive suppression responses to contain or confine wildfire are deemed more cost effective.

Analysis Area

The analysis area for the direct, indirect, and cumulative fire and fuels effects analysis is the same as the vegetation analysis area because the fuels used in the fire and fuels analysis are directly associated with the vegetation within a given stand. The current information and data for vegetation is displayed in this analysis. The analysis area for fire and fuels analysis is the area that includes the stands that fall partly or completely within the Bussel 484 Project Area. It includes approximately 15,118 acres with approximately 12,873 acres on National Forest System lands. The remaining approximate 2,245 acres are privately owned (see Map 1 in Appendix A). This project area is included in the larger area that was used for the Bear Bussel Ecosystem Analysis at the Watershed Scale (EAWS).

Analysis Methods

The information used in this analysis is a combination of available data, research material, literature, field reviews, and assessments. Diagnosis and analysis of stands within the Bussel 484 Project Area were accomplished using stand summary data, basic stand data, stand component data, and stand activity data (*Forest Vegetation* section).

Habitat types were used for the project planning and site-specific considerations in this environmental analysis. *Forest Habitat Types of Northern Idaho: A Second Approximation* (Cooper and others 1991) outlines the classification and characteristics of the habitat types. *Fire Ecology of the Forest Habitat Types of Northern Idaho* (Kapler, Smith, and Fischer 1997) and *Fire History on the Idaho Panhandle National Forest* (Zack and Morgan 1994) were also used to assess the current and historic fire regime of the project area.

Habitat types were grouped to facilitate landscape-level analysis and planning because of similar environments and vegetation characteristics such as productivity, disturbance regimes, stand dynamics, susceptibility to insect and disease, forest cover types, structural stages, and successional pathways. *A Biophysical Classification, Habitat Groups and Descriptions* (USDA 1996) was used for this analysis.

Prescribed fire and fuels treatments are based on existing and desired stand conditions, the proposed harvest and regeneration activities, and the fire history of the analysis area. Proposed treatments were developed to facilitate the achievement of the desired condition over time. Considerations included predicted post-harvest stand composition, stand size class, stand structure, estimates of existing fuel loads, calculated predictions of potential fuel loads, and qualitative estimation of potential fire effects based on modeled trends in fuel loading and literature review.

General guidelines to predicting slash fuel loadings are available through the photographic series *Appraising Slash Fire Hazard in Idaho* (Morgan and Shiplett 1989) and may be utilized after timber harvest is complete to inform final determination of the necessary type and amount of fuel treatment to be implemented on a unit by unit basis.

The effectiveness of fuel treatments, relative to creation or maintenance of fire resilient forests (Agee and Skinner 2005) was considered in the assignment of fuel reduction activities to individual stands. Recent experimental results from the Fire and Fire Surrogate study, which compare the effects of a variety of fuel reduction treatments dry western mixed conifer stands (Stevens and Moghaddas 2005; Agee and Lolley 2006; Youngblood and others 2007) were also considered.

The Forest Vegetation Simulator (FVS) was used to analyze trends in fuel loading, fire intensity, and fire severity over time. FVS is widely utilized by forest managers throughout the United States and Canada to predict the effects of vegetation management action on future forest conditions. The Fire and Fuels Extension to FVS (FFE-FVS) integrates FVS with elements from existing models of fire behavior and fire severity. Model outputs display fuels, stand structure, snags, and potential fire behavior over time and provide a basis for comparing proposed fuel treatments (Reinhardt and Crookston 2003). FFE-FVS was used in this analysis to describe the existing conditions of the forest stands in the Bussel 484 analysis area and to compare the effects of proposed treatments within each alternative.

Information about existing vegetation was obtained from the Field Sampled Vegetation database (FSVeg) that was developed from stand exam information, historical records and aerial photo interpretation. This information was used in FFE-FVS, which was developed to assess the risk, behavior, and impact of fire in forest ecosystems. The FFE-FVS was created in order to link the changes in forest vegetation due to growth, mortality, and management, with changes in fire behavior, using existing models and information wherever possible (Beukema and others 2000).

FFE-FVS was used to assess the risk of fire to a stand with indicators such as potential flame length, fire type (e.g. surface fire or crown fire), the probability of torching, and the critical wind speed required to initiate and/or sustain a crown fire. This model is not intended to predict the probability of fire or the spread of fire between stands (Reinhardt and Crookston 2003). It is used solely to assess the potential fire behavior and fire effects possible considering current and potential future stand conditions.

Three primary indicators of fire hazard were used to evaluate the changes in fire behavior in forested stands. First, the potential flame length (which is related to fuel loading and fuel arrangement) was used to determine the surface fire behavior potential, as well as the trend over time. Suppression tactics are directly related to flame lengths. For example, personnel using hand tools may construct fire lines directly on a fire perimeter if flame lengths are less than 4 feet (National Interagency Fire Center 2005).

The second indicator of fire hazard used in this analysis was the probability of torching. A torching situation is generally defined as one where tree crowns of significantly large trees are ignited by the flames of a surface fire or flames from burning crowns of small trees that reach the larger trees. This index estimates the probability of finding a torching situation in a forest stand. The probability of torching is the proportion of small places where trees are present and torching is possible. To calculate this index, fire conditions such as surface fuels, fuel moisture and wind speed are needed. The probability of torching is sensitive to the flame length and key process in stand development – the development of understory vegetation, the decline of overstory trees, and crown recession. Management actions that modify these key processes modify the predicted value of the probability of torching.

The third indicator of fire hazard used in this analysis was the crowning index. The crowning index is the wind speed, 20 feet above the canopy, at which active crowning is sustained (not necessarily initiated) (Scott and Reinhardt 2001; Reinhardt and Crookston 2003). The crowning index reflects the density of canopy fuels. Active crown fire, sometimes called running or continuous crown fire, occurs when the entire surface and canopy fuel complex are simultaneously involved in flaming combustion; but the crowning phase remains dependent on heat from the burning surface fuels for continued spread through the crowns. Active crown fires are characterized by a solid wall of flame extending from the top of surface fuel bed through the top of the canopy (Scott and Reinhardt 2001). Active crown fires result in complete mortality of the overstory because they consume the crowns of the involved trees. Sites with lower crowning index values are more prone to crown fire than site with higher crowning index values. Although critical wind speeds were used as indices, the site conditions (surface and canopy fuel characteristics, slope steepness), not the weather, are being rated (Scott and Reinhardt 2001).

All of the indices used (flame length, probability of torching, and crowning index) need to be considered in conjunction with one another. For example, increasing the crowning index over time (indicating an associated decrease in crown fire hazard) does not necessarily indicate a positive trend for potential fire suppression activities as surface fire flame lengths may increase, decrease, or not change at all depending on effects to wind reduction and fuel loading amongst other factors.

Affected Environment

Fire has been an important natural disturbance process within the Bussel 484 Project Area. Fire disturbance regularly occurred and the plant, animal, and many of the physical environments were adapted, modified and sustained by fire. Fire history studies indicate that periodic low to moderate intensity, mixed-severity fires occurred on a 25- to 80-year interval. Lethal stand-replacing fires occurred as frequently as 150 years or more in the lower

subalpine fir/spruce and upland warm moist western redcedar, western hemlock, and grand fir habitat types and as infrequently as 330 years or more in the warm/moist and very moist western redcedar and western hemlock habitat types. Collectively these habitat types comprise approximately 87 percent of the NFS lands within the analysis area. Stand-replacing fires were typically very large, often affecting many thousands of acres in a single event (Zack and Morgan 1994; Quigley and Arbelbide 1997).

Successional development of most of the habitat types within the analysis area results in high accumulations of dead woody fuel. Fire was the process primarily responsible for element and nutrient recycling (Zack and Morgan 1994). Non-lethal and mixed severity fires occurred two to three times more frequently than lethal stand-replacing fires. Low-intensity and/or mixed severity fires likely reduced the post fire risk to stand-replacing fire by reducing surface fuels, ladder fuels, and the proportion of fire-intolerant and drought-sensitive tree species within affected stands (Zack and Morgan 1994).

Current stand conditions in stands that have had little or no human management are generally thought to be trending toward higher probabilities of stand-replacing fires (crown fire) than they would have prior to the influence of European settlement (Zack and Morgan 1994; Brown 2000). The reduction of low and/or mixed-severity fire occurrence, selective logging of old fire resistant trees, climatic influences, and wide spread mortality of western white pine due to blister rust have contributed to this trend (Zack and Morgan 1994).

Past forest management included a wildfire exclusion policy intended to facilitate maintenance of a regulated timber supply, increase human safety, and reduce resource losses. Fire suppression efforts to date have been largely successful in maintaining very small, average wildfire size. Large and medium size fires have been reduced by aggressive initial attack of small emerging fires. Fire control, however, cannot continue to be effective because of increasing fuels, the predictable occurrence of lightning and occasional multi-season/multi-year drought conditions. Wildfire suppression statistics of the western United States indicate that large, stand-replacing fire occurrence has greatly increased the last 20 years (Calkin and others 2005).

The Bussel 484 Area has had effective fire suppression for at least the last 60 years. The Marble Creek Drainage has not had a large stand-replacing fire since the 1930s. Fire records show that 35 fires were suppressed on National Forest lands within the Bussel 484 Project Area between 1986 and 2006. The fire records were retrieved via Kansas City Fire Access Software (KCFast) a web-based computer application that simplifies data retrieval from National Interagency Fire Management Integrated Database (NIFMID). KCFast builds the Job Control Language required to query NIFMID for fire and weather data.

These fires were suppressed at small sizes: 26 fires were Class A fires (less than 1/4 acre), and nine were Class B fires (1/4 to 10 acres). Human-caused fires totaled 4 with 2 Class A and 2 Class B. Lightning was the cause of the remaining 31 fires. According to the available data, the current large fire interval within the project area is still within the historic range of variability, as described above, since the last large fire occurred 76 years ago.

The Elm Street Fire Complex burned within the Bussel 484 Analysis Area. The complex started on July 13th, 2007. Most of the acreage affected was burned in the first three to four burn periods. Nine fires were involved, most of which burned less than half an acre each. The majority of the affected acres were burned by the Elm Street Fire, the namesake for the complex. The following discussion is specific to the Elm Street Fire. The Elm Street Fire burned approximately 65 acres and had a perimeter of approximately 1.9 miles. Approximately 1.5 miles of the perimeter were dozer line with the remainder consisting of existing roads. The fire burned with a highly varied mosaic of severity and intensity in subalpine fuels to the north and east of the microwave towers in the southwestern portion of the Bussel 484 Analysis Area. The largest single opening immediately created by the fire was approximately 15 acres where the fire burned with a high enough intensity to consume most of the crowns of the overstory trees. The general fire behavior could be characterized as surface fire with passive crown fire.

Table 3-35 displays the existing fire groups (Smith and Fischer 1997) within the project area and commonly associated fuel models representing natural surface fuel loads. Fuel Model 8 is the timber litter fuel model that burns with the least intensity due to minimal accumulation of dead-down fuel and a compact short needle conifer litter layer. Fuel Model 10 burns more intensely than Fuel Model 8 due to heavy loading of dead-down logs, branch wood, and twigs (Anderson 1982). The amount, distribution, and uniformity of dead down fuels increase as young mixed conifer stands (typically Fuel Model 8) age and progress through stem exclusion stages and seral progression. If mortality occurs rapidly and extensively enough, Fuel Model 10 becomes the prevalent fuel model matrix and Fuel Model 8 occurs as minor inclusions. In the absence of fire, biotic decomposition slowly reduces logs, branches twigs and other litter into duff and soil organic matter. Fuel Model 8 eventually becomes predominate if biotic decomposition occurs more rapidly than dead, down, woody litter accumulation.

Table 3-35 Acres by Fire Group within the Bussel 484 Project Area

Fire Group	Acres	Dead/Down Fuel Loading (Tons/Acre)	Fuel Model
Fire Group 4	45 Acres	2.7 to 12.2	Fuel Models 8 & 10
Fire Group 5	843 Acres	2.4 to 16.8	Fuel Models 8 & 10
Fire Group 7	1,000 Acres	1.3 to 14.8	Fuel Models 8 & 10
Fire Group 8	9,496 Acres	13.1 to 53.6	Fuel Models 8 & 10
Fire Group 9	823 Acres	0.7 to 38.6	Fuel Models 8 & 10
Unidentified	2,453 acres	unknown	unknown

Fuel loading values derived from Smith and Fischer (1997). Corresponding fuel models are from Fischer (1981).

Vegetative Conditions Related to Past Harvest

Much of the land managed by the Forest Service in the Bussel 484 Project Area was acquired in the early to mid 1930s. Few records relating to timber harvest and other management activities are available for that period; however, there is evidence of some early activity such as very old stumps and remnants of skid roads that indicate that some harvest did occur prior to the 1940s. This early activity may have been related to salvage activity and removal of specific products such as large western larch, western white pine, ponderosa pine, Douglas-fir and western redcedar.

Field review as well as the general history of this analysis area indicates that early timber harvest activity occurred. The stand data base does not include those possible harvest activities. The stand history, or activity, data base does record the timber harvest that occurred from 1961 to 1995. Roughly 2,034 acres (16 percent) of the approximate 12,663 acres of National Forest System lands have received some type of commercial timber harvest from 1960 to present. Of this, approximately 86 percent (approximately 1,741 acres) was regeneration harvest (1,388 acres clearcut, 211 acres seed tree, 6 acres shelterwood seed tree and 136 acres liberation cut and regenerated through planting), 14 percent (approximately 293 acres) was treated with an intermediate harvest of sanitation/salvage and liberation/improvement harvest. Stand database records indicate that approximately 687 acres of broadcast and jackpot burning have occurred in association with past harvesting and regeneration activities since 1960.

Timber harvest data related to ownership other than Forest Service within this analysis area is generally not available. Through review of aerial photos and other information, it is estimated that a substantial percentage (greater than 50 percent) of non-NFS land has had some form of commercial timber harvest.

Fire Behavior Factors

Fire behavior is primarily affected by three elements: fuels, weather and topography. The natural dynamic vegetation and fuel conditions of the project area eventually lead to stand-replacing fires when favorable climatic conditions coincide with ignition(s). Dead woody fuel accumulation resulting from limb pruning and mortality of trees and shrubs in the absence of periodic low- to moderate-severity fire can result in intense surface fires and crown fire initiation. Other fuel factors promoting initiation of crown fire are low foliar moisture content (Agee and others 2002) and low ground to live crown base height or ladder fuels (Scott and Reinhardt 2001). Continuous aerial extent of closed canopy contributes to sustained crown fire once initiated (Scott and Reinhardt 2001). Seral stand development generally follows a pattern of increasing ladder fuels as shade-tolerant tree species grow underneath seral dominants unless low-severity fire maintains a single-story structure. Ladder fuels reduce the effective ground-to-live crown base height (distance from ground fuels to the live crown) thereby increasing the potential of surface fire to transition to crown fire (Graham and others 2004).

Environmental Consequences

The following graphs briefly compare the no-action alternative and the action alternatives in terms of three fire behavior indicators: flame length, probability of torching, and crowning index. These figures describe one representative stand for each of the following treatments or groups of treatments: clearcuts (clearcut with reserves and seedtree harvests) (CC), group shelterwood harvests (GSW), commercial thin with lopping only (CT), commercial thin with jackpot burning (CTJP), commercial thin with grapple piling or yarding of tops (CTGP). The solid lines represent the modeled effect of the proposed harvest and fuel treatment(s), while the dashed lines

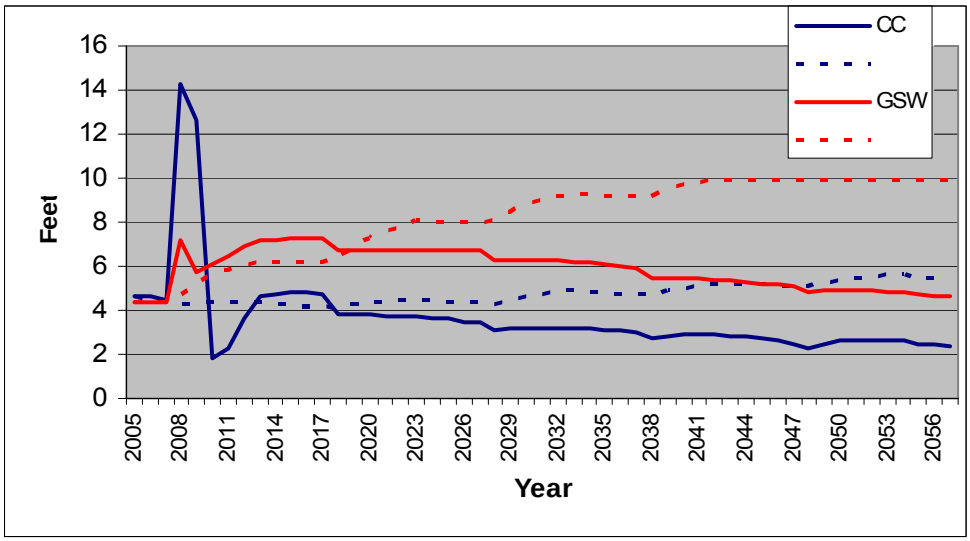
represent the modeled effect of no action. Action versus no action comparisons should be made between solid and dashed lines of like color, as each color represents an individual stand.

Effects vary somewhat between stands depending upon site conditions and other factors. Refer to project file documents FF-12 and FF13 for FFE-FVS modeling details. All of the FFE-FVS results shown were modeled using the default severe weather and fuel moisture scenario in FFE-FVS version 2.02. The software used was downloaded and installed for use on March 19, 2008 from the FVS website located at: http://www.fs.fed.us/fmsc/fvs/software/setup.php.

Flame Lengths

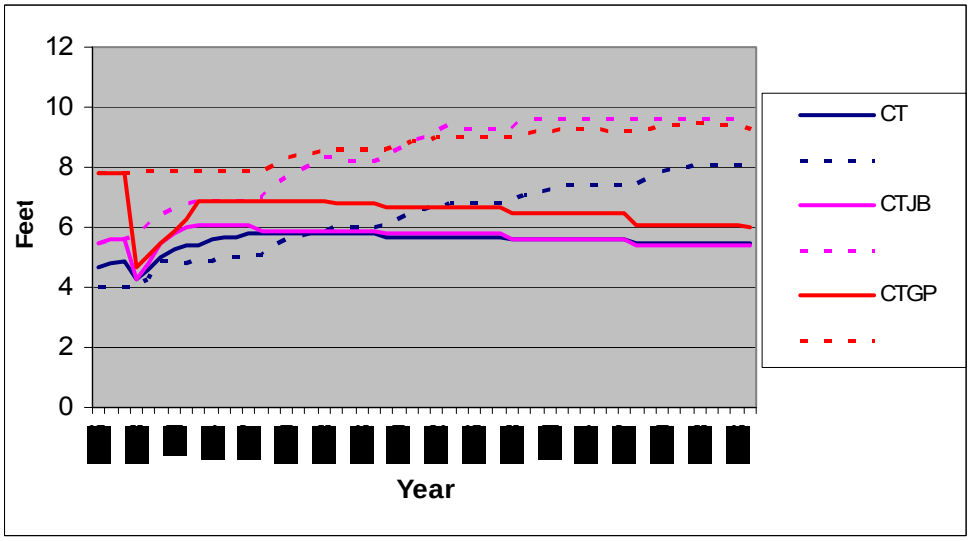
Flame lengths less than four feet can be safely attacked directly using hand crews. Once flame lengths surpass this mark, other suppression tactics must be employed such as using mechanized equipment, and or burning out from roads, natural barriers, or constructed control lines. In addition, as surface fuels and flame lengths increase, the likelihood of a fire climbing into the canopy to initiate crown fire activity increases. Crown fires, particularly active crown fires that result in complete stand replacement, have the greatest immediate and long-term ecological effects (Graham and others 2004).

Figure 3-1 Surface Fire Flame Length Over Time for Regeneration Harvests
Note: Solid lines represent treatment, dashed lines represent no action.



Under the no action alternative, flame lengths increase over time, remaining over 4 feet in response to fuel accumulation. Regeneration harvests show increases in flame length following harvest that decrease after prescribed burning. Flame lengths increase again after burning due to the addition of fuels from mortality caused by the burn and then decrease gradually over the next 50 years near or below 4 feet because of decomposition of dead down fuels.

Figure 3-2 Surface Fire Flame Length Over Time for Commercial Thinning Harvests



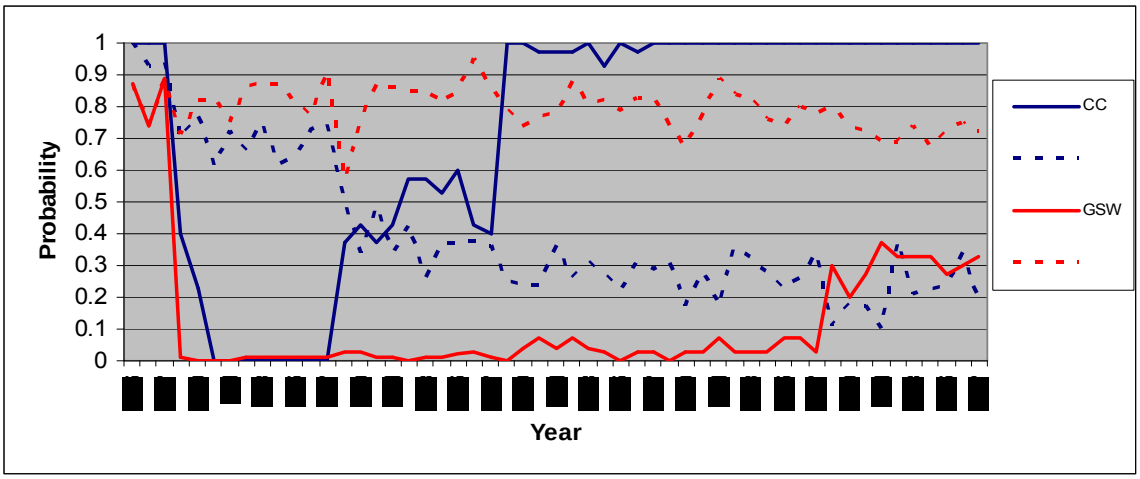
With no-action flame lengths increase over time, remaining over 4 feet in response to fuel accumulation. Commercial thinning causes flame length to increase immediately following harvest. Lopping, jackpot burning, and grapple piling reduce flame lengths below the post harvest values for a short period of time. Flame lengths then rebound, primarily due to growth of seedling and sapling trees, which the model includes in the surface fuel profile when projecting fire behavior.

Although less than the no action, flame lengths for the commercially thinned stands are projected to remain greater than 4 feet throughout the 50 year simulation period.

Probability of Torching

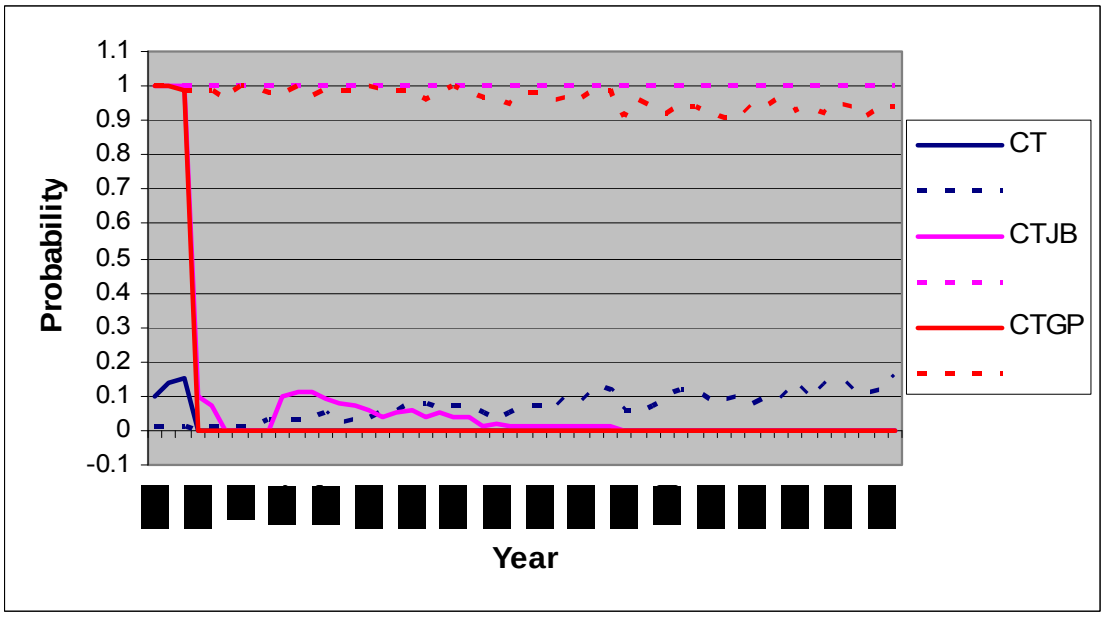
Effects of thinning and regeneration harvests on crown fire behavior are shown in the following figures. The probability of torching is the proportion of small places where trees are present and torching is possible. The higher the probability of torching, the more ladder fuels and the higher the likelihood that the fire will climb into the tree crowns. *Note: Solid lines represent treatment, dashed lines represent no action.*

Figure 3-3 Probability of Torching Over Time for Regeneration Harvests



Both regeneration harvests show a dramatic reduction in the probability of torching following harvest. The clearcut (clearcut with reserves or seedtree harvest) shows a more rapid increase in probability due to the growth of both planted and artificially regenerated seedlings and saplings. Under the no action both stands show some degree of reduction in probability of torching but not as much as is realized following the harvest activities.

Figure 3-4 Probability of Torching Over Time for Commercial Thinning Harvests

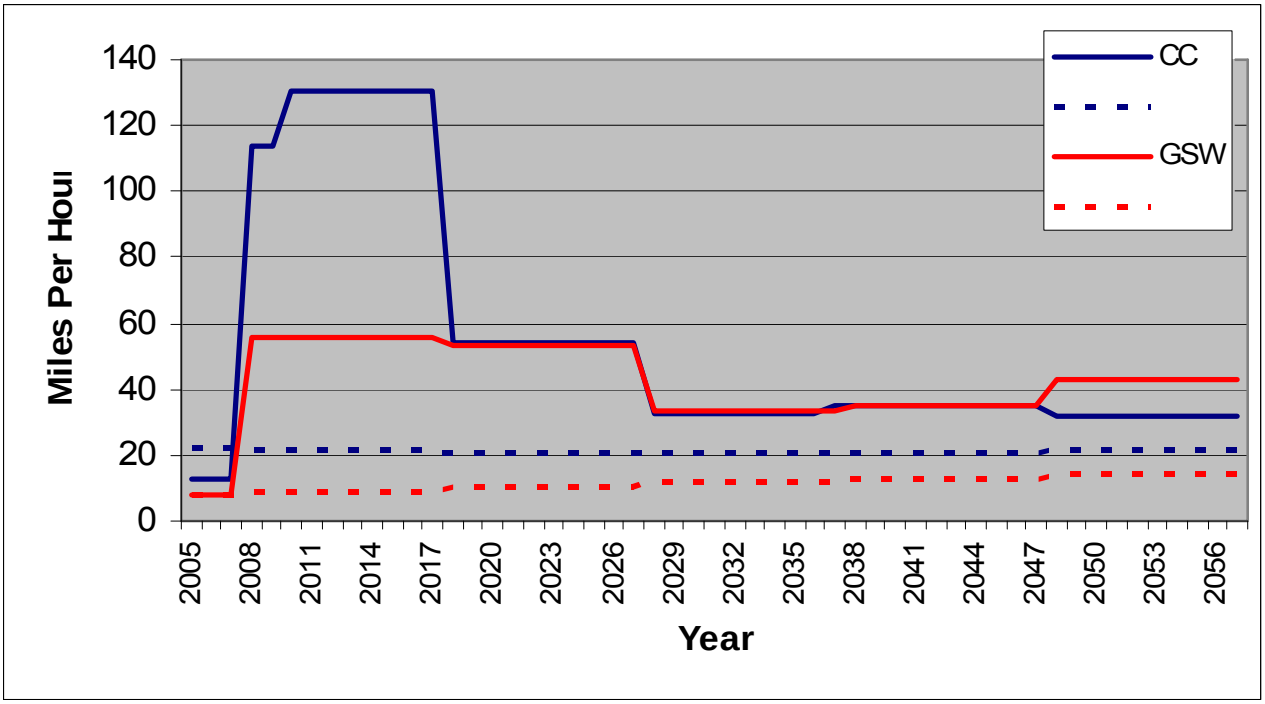


All three commercial thinning harvests maintain very low probability of torching following harvest. The commercial thin with lopping only shows a minor increase in probability over pre-harvest conditions due to increased fuel loading resulting from the harvest. Two of the stands modeled currently have very high probabilities of torching (CTJB and CTGP), while one currently has a very low probability of torching (CT). Under the no-action alternative all three stands maintain values near their initial probability of torching.

Crowning Index

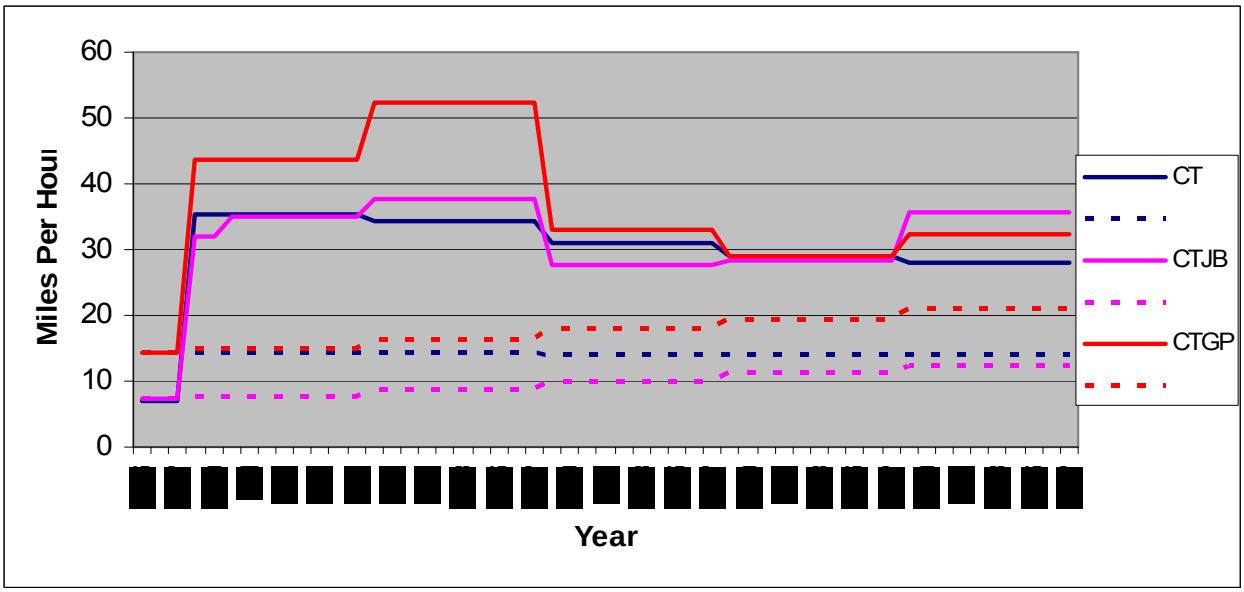
The crowning index reflects the density of the tree canopy and its ability to sustain crown fire. Increasing crown index values indicate increasing difficulty in sustaining crown fire activity. Conversely lower crown fire indices indicate that less wind is required to sustain crown fire. The effects of the proposed harvesting on crowning index are shown in Figures 3-5 and 3-6 below. *Note: Solid lines represent treatment, dashed lines represent no action.*

Figure 3-5 Crowning Indices Over Time for Regeneration Harvests



Both regeneration harvests show substantially increased crowning indices following harvest. Both stands show currently low crowning indices that are maintained over the 50 year period under no action.

Figure 3-6 Crowning Index Over Time for Commercial Thinning Harvests



All three stands show increased crowning indices following harvest. All three stands show currently low crowning indices that are projected to slowly increase over the 50 year period with no action.

The stair stepped appearance of the lines in the figures is a result of, or is enhanced by, the 10-year growth, regeneration, and mortality calculation cycles in the base model, FVS. Growth, mortality, and regeneration in particular, affect the model's choices of representative fuel model, and subsequent modeled fire behavior characteristics/probabilities. The transitions between time-steps are probably much smoother in reality (Reinhardt and Crookston 2003).

Direct and Indirect Effects of No Action

Continued fire suppression in this alternative would result in continued fuel accumulation and increased fire behavior characteristics, which would subsequently reduce the likelihood of keeping unwanted fires small. Continued fire suppression will eventually result in a deviation from the historic range of variability relative to the occurrence of low and/or mixed severity fires. The effects of excluding natural fire since the 1930s has affected the ecosystem by jeopardizing long-term retention of early seral conifers and other early seral plants in a fire created mosaic across the landscape. Harvesting activities occurring since the 1960s that subsequently resulted in the regeneration of western larch and western white pine have contributed to the perpetuation of long-lived early seral species.

Fire suppression efforts within the analysis area cannot be expected to keep all unwanted ignitions small indefinitely. Potential flame lengths are expected to increase in the absence of disturbances such as harvesting, thinning, or fire that change stand characteristics that contribute to crown fire potential. As surface flame lengths increase, potential success of initial attack suppression actions becomes less likely. Figures 3-1 and 3-2 show an increasing trend in flame lengths, remaining at or above 4 feet, over the next 50 years in the absence of management activities for all five stands that were modeled. Figures 3-3 and 3-4 show that three stands currently have, and tend to maintain, a high probability of torching. One stand, CC, currently has a high probability of torching but the probability is projected to substantially decrease over time. One stand, CT, currently has a very low probability of torching and shows a slight increase in probability over time. Figures 3-5 and 3-6 show that all five stands that were modeled currently have and maintain crowning indices below 22 miles per hour and maintain low values (high crown fire potential) over the next 50 years.

For comparative purposes, archived weather data from the Lines Creek remote automated weather station, which is located within the Bussel 484 Analysis Area, recorded only 29 daily weather observations between the months of May 1st and October 31st during the years of 1997 to 2007 that were greater than or equal to 20 miles per hour. The highest recorded wind speed during this time period was 33 miles per hour (PF Doc. FF-14). The wind speeds needed to support crown fire following the proposed harvest activities in the modeled stands occurs infrequently. In comparison, 400 daily weather records with wind speeds between 10 and 20 miles per hour occurred during the same time period (PF Doc. FF-15).

Road access for fire suppression would not be affected relative to present levels of access.

Cumulative Effects of No Action

Alternative A would maintain high crown fire indices for at least the next 50 years. Flame lengths would tend to increase over time. Probabilities of torching would tend to remain high or gradually increase from current levels with a few exceptions. Keene and others (2002) provide a discussion of the ecological effects of fire exclusion that contribute to increased fire behavior characteristics. The following is a summary of Keene and others.

Fire exclusion causes forest composition to change from early-seral, shade-intolerant tree species to late-seral, shade-tolerant species, while stand structure changes from single-layer to multiple-layer canopies. An important stand characteristic that changes with advancing succession in the absence of fire is the amount of dead and live biomass or fuels, which tend to increase. Fuel loading generally increases in the absence of fire because of a myriad of ecological factors. First, long fire return intervals mean live fuels have longer times to grow and dead fuels have longer periods to accumulate on the ground. Next, crown fuels increase because late-seral, shade-tolerant species tend to have more biomass in the forest canopy due to their high leaf areas and because biomass tends to be well distributed over the height of the trees. Stand leaf area generally increases over successional time because shade-tolerant species generally retain needles longer, have higher leaf area to sapwood ratios, and have more leaf mass in the crown than shade intolerant species. Higher leaf area usually requires additional conducting tissue for support, which means the tree may need to produce more branch and twig wood along greater portions of its stem. Because late seral species are shade tolerant, there are many smaller seedlings and saplings present in the understory to take advantage of any gaps in the canopy. So, the greater crown biomass distributed along greater parts of the stem, coupled with high seedling and sapling densities, can create the ladder fuels that allow flames from surface fires to climb into the forest canopy and result in crown fires.

Surface fuel loading increases in the absence of fire because the greater crown biomass ultimately results in increased leaf and woody material accumulating on the forest floor because the recycling process of fire is absent. Dense crowns also reduce solar radiation attenuated to the forest floor, which may lower soil temperatures resulting in decreased decomposition rates and still higher branch and litter accumulations. Duff and litter depths generally increase proportionate to the crown closure and leaf area because of the additional needle fall and reduced decomposition.

Soil properties change as fires are reduced and succession advances in an ecosystem. Organic matter generally increases with decreased fire frequency and this improves pore space, water-holding capacity, and aggregation. However, when soils with thick organic horizons are burned, some of the volatilized organic matter moves downward and condenses to form a water repellent layer that impedes infiltration and can lead to severe erosion during subsequent precipitation events.

Landscapes tend to become more homogeneous as fire is removed because succession eventually advances all stands to similar communities dominated by shade-tolerant species. Even though late-seral species may differ across a landscape depending on site, the multi-layer structures of these late-seral stands are nearly identical across most biophysical settings. Landscape structure (spatial distribution of patches) also changes with fire exclusion as landscapes generally become less fragmented, have lower patch density, and evolve decreased patch diversity, which often results in more contagion, corridors, and large patches. Larger patches and high homogeneity tend to foster more continuous crown and surface fuels, which can then burn in large fires that create still larger patches.

Activities on private lands such as timber harvesting, prescribed fires, and road construction have and, in the future, would continue to directly reduce the potential for crown fire where they occur, with effects on potential flame length, probability of torching, and crowning index likely similar to the effects of the representative clearcutting stand discussed in this analysis. If human activities associated with recreation increase, then the risk of human-caused ignitions from abandoned camp fires, vehicle exhaust, cigarette smoking, etc. would also increase; however, most fires occurring in the analysis have been caused by lightning.

Alternatives B and C

Direct and Indirect Effects

Fuel modification is one way to enhance fire control efforts. Fuel modification treatments by prescribed fire, mechanical treatments such as chipping, chunking, or piling, and commercial or non-commercial overstory manipulation especially thinning from below can reduce fuel loads or alter fuel arrangement (Graham and others

1999; Graham and others 2004;), reduce potential for high-intensity and/or high-severity burns, create fuel breaks (Graham and others 1999), and provide safety zones.

Fire has always been an agent of disturbance in the habitat types of the Bussel Analysis Area. In moist forest types, such as those found in the Bussel analysis area, the process of structural development in the absence of wildfire reduces stand resiliency to inevitable disturbance. Pre-settlement timber stands had a positive correlation between increased fire frequency and resiliency to fire, drought, and insect stresses. Low, mixed, and high severity fire events contributed to landscape-level vegetative heterogeneity and contributed to the long-term maintenance of early seral species within the landscape (Zack and Morgan 1994; Hessburg and others 2007).

Timber Harvest and Wildfire Potential

The proposed harvest and subsequent activity fuel reduction would affect potential fire characteristics within the treated stands by removing and rearranging existing live and dead fuel loads and by changing the influences of wind, temperature, and relative humidity within the harvested stands (Countryman 1955; Graham and others 1999; Graham and others 2004). The proposed harvesting and fuel reduction activities would facilitate the retention and establishment of long-lived, early-seral tree species. Regeneration harvest with subsequent fuel reduction and site preparation activities would create effective fuel breaks by affecting both surface flame lengths and crown fire indices. Typically the canopy cover and crown bulk density are reduced and the remaining vegetation will not sustain crown fire until conifers reclaim dominance of the canopy. Figure 3-1 shows the effects of regeneration harvesting on two of the stands proposed for regeneration harvests. The stand representing clearcutting with reserves and seedtree harvesting shows an immediate and significant increase in potential flame length to 14 feet. Subsequent prescribed burning for slash disposal and site preparation reduce potential flame lengths to 2 to 5 feet for the rest of the period shown. The stand representing group shelterwood harvest and the stands representing the commercial thinning harvests (Figure 3-2) show a similar, although less dramatic, pattern. The effects of retaining varying amounts of canopy on surface wind speed are clearly displayed by the variation in flame lengths over time in the harvesting scenarios. Clearcutting retains the least canopy, allowing the greatest increase in surface wind speed while commercial thinning retains the most canopy (amongst the harvesting scenarios) allowing comparably greater reduction of surface wind speed which directly influences flame lengths.

The probability of torching is immediately reduced in all harvests (Figures 3-3 and 3-4) through either elimination of canopy (clearcutting) or removal of ladder fuels, increasing crown base height, decreasing fuel bed depth, and/or reducing fuel loading. The effects of regeneration establishment are apparent in the probability of torching projection for the regeneration harvests (Figure 3-3). As regeneration becomes established, around 2017, the model shows a sharp increase in the probability of torching even though flame lengths are decreasing. The decrease in flame lengths is due in part to decomposition of fuels, but most likely to the reduction of surface wind speed due to the establishment of canopy. The probability of torching increases because of the increased area having trees with crowns near the ground that are also considered the primary overstory. This pattern is consistent with discussions of severe burns in young post-disturbance stands reported by Zack and Morgan (1994) and Thompson and others (2007) that were attributed, in part, to the short, dense, and continuous crown cover of the artificially planted or naturally regenerating forest.

Crowning indices are increased by harvesting activities in all five modeled stands and are maintained at values greater than about 28 miles per hour or over the remainder of the fifty years past the simulated harvest and fuel reduction activities.

The action alternatives include site preparation and slash disposal activities using prescribed fire, excavator piling, yarding of tops, and/or lopping. Yarding tops, lopping, and grapple piling would be completed at the time of harvest by the timber sale purchaser. Pile burning and prescribed burning activities would occur within one to five years after harvest activity completion because funding collected from the timber sale must be used to accomplish timber sale related activities such as prescribed burning for site preparation and/or slash disposal within five years of timber sale closure.

Prescribed burning would be conducted under conditions specified in a prescribed fire burn plan, and would follow design features (Chapter 2) and silvicultural prescriptions. Prescribed burning is intended to maximize resource benefits. Prescribed fires would be generally low-severity and low to moderate intensity burns for fire hazard reduction and/or site preparation for regeneration. Burning would occur when conditions are conducive to short-duration fires with little chance of escape. The result would be reduction of fine fuel loads resulting from harvest activities and subsequent fire hazard.

Harvest activity maintains fire suppression access through maintenance of existing roads and by altering fuels and fire behavior within harvested stands and, therefore altering landscape level horizontal and vertical fuel continuity.

Regeneration harvests create a short-term increase in fire hazard until the site preparation and hazard reduction burning is accomplished. Regeneration harvests in may produce up to 30 tons/acres of fine fuel (less than 3 inches diameter). Prescribed burning for site preparation and/or slash disposal generally occurs two to three years after harvest (personal observation).

Timber harvesting on these sites reduces probable near-term accumulations of natural fuels. Harvest activities, as proposed in this project, would immediately increase fuel loading. Subsequent fuel reduction treatments such as grapple piling and burning, jackpot burning, or broadcast burning would reduce the fuel loads within five years of harvest. Alternative B includes 916 acres commercial thinning with lopping as the only slash treatment and 364 acres within the group shelterwood harvests with lopping as the only slash treatment. Alternative C includes 991 acres commercial thinning with lopping as the only slash treatment and 364 acres within the group shelterwood harvests with lopping as the only slash treatment. Slash disposal treatments (yarding tops, grapple piling, or prescribed burning) are not prescribed for these units due to one or more of the following factors: 1) fire intolerant species would still be heavily represented in the stand following harvest, 2) a majority of the species in the stand would be fire tolerant but would be too small to survive prescribed burning, 3) slopes are too steep for grapple piling, 4) there is no road access for mechanized equipment, or 5) retention of slash is desired for the purpose of nutrient cycling.

Direct effects on wildfire potential were analyzed in relation to the proposed harvest and hazard-reduction activities within stand proposed for activity. Harvest activities may decrease or increase potential fire hazard depending on residual stand characteristics and combined pre-existing and activity-generated surface fuel loads. Portions of harvest units where post-harvest fuel loads exceed acceptable levels may have one or more fuel reduction treatments prescribed. The analysis includes silvicultural treatments that propose site preparation/hazard reduction burning or that reduce fuels by yarding tops during harvest, lopping, burning, and/or excavator piling.

Quick shrub growth and conifer regeneration reestablishes solar and wind sheltering of surface fuels within 5-10 years in regeneration harvests (PF Doc. FF-12) which reduce fire behavior potential. In the moist forest type, grass fuels, which have higher potential rates of fire spread than low shrub or litter fuels rarely dominate regeneration harvest areas (Anderson 1982).

Table 3-36 Summary of Fuels Treatment by Alternative

Treatment	Alt. A	Alt. B	Alt. C
Broadcast/Jackpot Burning	0	596	602
Grapple Pile	0	230	175
Lopping	0	1742	1766
Slashing	0	181	145
Yard Tops	0	316	273

Research indicates that reduction of crown bulk density by pre-commercial thinning of the overstory reduces potential for active crown fire initiation and spread, especially when combined with low potential surface fire intensity (Scott 1997). However, slash resulting from pre-commercial thinning activities will increase fire hazard within thinned stands until it is incorporated into the forest floor by snow compaction and decomposition. The increased hazard gradually decreases as the needles and fine twigs fall from the slash, reducing but not eliminating the elevated hazard. Increased fuel loading resulting from pre-commercial thinning slash, by comparison, would be less than for the commercial thinning harvest. This is because the size of the trees felled is much smaller in stands proposed for pre-commercial thinning than it is for those in the stands proposed for commercial thinning. Pre-commercial thinning would occur on 821 acres in both of the action alternatives. Slash resulting from pre-commercial thinning would be lopped to a depth of no greater than 1.5 feet.

Jackpot burns help maintain an open canopy and a high stand-level ground to live-crown base height by removing less fire-resistant conifers from the understory and within the overstory. Jackpot burning may also increase the presence of fire-tolerant shrubs and herbs in the understory that are often favored browse for ungulates.

Commercial thinning (CT) reduces potential fuel accumulation by promoting large tree growth and stand vigor, and by reducing ladder fuels associated with hemlock and true firs through preferential selection of these species for harvest within the proposed units. The fire resiliency of these stands would improve so long as the surface fuel hazard is not substantially increased by the harvest activities or is reduced after harvest activities are complete. CT reduces crown bulk density and can reduce potential crown fire initiation and spread as long as increases in potential surface fire intensity caused by harvesting residue (slash) do not overshadow the gains of crown bulk density reduction. Project design includes yarding of tops, lopping, grapple piling, broadcast burning, and/or jackpot burning to minimize potential increases in post-harvest surface fire intensity and/or severity (see Chapter 2 for type of fuels treatment associated with each unit).

Areas that are commercially thinned and only have lopping prescribed would initially have greater surface flame lengths than they had prior to harvesting (Figure 3-2) due to increased surface fuel loading, increased solar insolation, and decreased wind sheltering due to decreased canopy cover. Lopping does not reduce post harvest activity fuel loading. It does however, reduce the depth of the post harvest fuel bed and increase the compaction, or density, of the activity fuels. Therefore, lopped fuels exhibit less intense fire behavior characteristics than unlopped fuels even though fuel loading is not affected. Lopped fuels should also decompose more readily than unlopped fuels because they are closer to the forest floor where biotic decomposers can more readily affect them. Commercial thinning, regardless of slash treatment method, reduces the probability of torching (Figure 3-4) and increases the crowning index (Figure 3-6).

Timber harvest would promote conditions for safe and effective wildland fire management in the project area by affecting live and dead fuels in ways that are beneficial to fire management. The harvest openings with slash treatment would provide distinct reductions in potential fire behavior, which would provide tactical advantages in managing any kind of fire. Harvested areas would be long-term fuel breaks, providing perimeter control options for fire managers during future wildland or prescribed fires. The thinning and partial cuts would increase possibilities of future prescribed fire application in these areas. Commercial thinning, especially where jackpot burning is included under a residual component of western larch, would mimic low- to moderate-intensity fire effects on structure and composition. Commercial thinning would also reduce live fuel loadings to levels that are more advantageous to future stand maintenance and/or resilience to fire and other pathogens.

The proposed road decommissioning would most likely reduce the potential for human-caused ignitions by reducing accessibility. The proposed road decommissioning may result in an increase of the average cost per acre for fire suppression within the areas affected by reduced motorized access. This would be due to reduced access for engines and water tenders, increased hike-in distance and potential increases in the use of aerial delivery of firefighters and the supplies they need. However, the proposed harvesting may provide opportunities to utilize changes in fuel types as natural barriers to fire spread that may allow managers to more readily reduce suppression costs, reduce disturbance associated with traditional suppression actions, and/or realize resource benefits from wildfires in accordance with fire management plan direction.

Cumulative Effects

Cumulative effects are those that would result from the action alternatives in addition to the incremental impacts of past, ongoing and reasonably foreseeable activities. Fire suppression has been effective in the Bussel 484 Analysis Area for approximately 60 years. The incremental effect of suppressing each small fire in the watershed, over time, promoted late seral species rather than early seral species, thereby changing forest structure and, in turn, changing the way they respond to fires (Zack and Morgan 1994). Past harvesting, the stand-replacing fires of 1922 and 1931, and the impacts of white pine blister rust, in combination have resulted in an under representation of large, old, early-seral species within the analysis area. The improved growth of existing early-seral trees through precommercial and commercial thinning would contribute to the reestablishment of large, old, western white pine and western larch over time.

Because of the reductions in crowning index, flame length, and probability of torching over time, containment and confinement opportunities (where permitted) would improve for fire managers responding to unplanned ignitions in the future. The projected reductions in flame length and probability of torching would also improve opportunities for application of prescribed fire within the treated stands as the growth of trees improves their likelihood of surviving light underburning.

For a listing of past, present, and reasonably foreseeable activities in the project area see the beginning of Chapter 3. The action alternatives would reduce the potential for ignitions from any source to result in undesirable effects within the project area.

Consistency with Forest Plan and Laws

Prescribed burning and mechanical treatment of activity fuels proposed in both action alternatives are consistent with direction in the Forest Plan and the Idaho Forest Practices Act. Continued fire suppression will be conducted in accordance with the guidance provided by the current IPNF Forest Plan and is therefore consistent with the Forest Plan for all alternatives.

Forest Vegetation

Differences between Draft EIS and Final EIS

The difference between the DEIS and FEIS reflects a reduction in the amount of acres proposed for harvest in Alternative B and C: 56 acres of commercial thinning, 34 acres of group shelterwood, and 13 acres of clearcut with reserves. Additional literature citations were also added.

Introduction

The forest vegetation of northern Idaho displays strong diversity in both composition and structure. This diversity is attributable to climate, geology, and disturbance patterns (insects, disease, fire history and extreme weather events). These elements combine to create some of the most varied and productive forest communities found in the Inland Northwest. The most dominant vegetative feature of the northern Idaho forests is trees. The major tree species growing in this area include western hemlock, mountain hemlock, western red cedar, grand fir, Douglas-fir, western larch, western white pine, lodgepole pine, ponderosa pine, subalpine fir, and Engelmann spruce.

This section addresses the purpose and need for vegetation treatment. The forest vegetation in the Bussel 484 Project Area will change through the interaction of plant succession and the influence of disturbances (both natural and human disturbance). Forest vegetation across the landscape will be impacted by these changes. This analysis focuses on the composition, structure, patterns and processes which affect change to forests expressed by the tree component but recognizes that associated layers of vegetation are important parts of the plant communities in the area.

Regulatory Framework

The regulatory framework providing direction for the management of forest vegetation is provided through the *National Forest Management Act* and the *Forest Plan for the Idaho Panhandle National Forests* (USDA Forest Service, 1987). NFMA provides for balanced consideration of all resources. It requires the Forest Service to plan for diversity of plant and animal communities. The Forest Plan, in compliance with NFMA, establishes Forest-wide management direction, goals, objectives, standards and guidelines for the management for forest vegetation and plant communities. Direction concerning implementation of NFMA and the Forest Plan can be found in Forest Service Manuals (FSM) and Handbooks (FSH), as well as various written communications from the Forest Service's Washington Office, Regional Office and the Supervisor's Office for the Idaho Panhandle National Forests.

Analysis Area

A review of the Bussel 484 Project and the updating of data with the most current information were completed. The current information and data for vegetation is displayed in this analysis. The analysis area for the forest vegetation resource is the area that includes the stands that fall partly or completely within the Bussel 484 Project Area. It includes approximately 15,118 acres with approximately 12,873 acres under USDA-Forest Service jurisdiction. The remaining approximate 2,245 acres are privately owned (see Map 1 in Appendix A). This project area is included in the larger area that was used for the Bear Bussel Ecosystem Analysis at the Watershed Scale (EAWS).

Analysis Methods

The information used in this *Forest Vegetation* section is a combination of the available data, research material, literature, assessments and field reviews. Vegetation attributes such as forest cover type, stand size class, as well as habitat group and other information were compiled from the Timber Stand Management Record System (TSMRS) and the FSVeg data base. In addition, field reviews were conducted during the original process of diagnosis and analysis to verify site conditions. New stand exams over a portion of the project area were accomplished in 2005 and 2006 to update data for this project. The stand tables developed from the most current stand data were used in this analysis (V-1).

Large-scale context for the terrestrial vegetation and landscape ecology was provided by the *Integrated Scientific Assessment for the Interior Columbia Basin (*Quigley and others 1996) and the St. Joe Geographic Area assessment titled, *Toward a Forest Ecosystem Approach: An Assessment for the St. Joe Area* (IPNF 1997). This information and the objectives described under the purpose and need section of this document, as well as the IPNF

Forest Plan, were used in evaluating the Bussel 484 Project Area's existing condition for forest vegetation and comparing it to the landscape and desired forest stand conditions.

Forest stands were reviewed for current insect and disease activity, current production (growth rates), productive potential, regeneration potential, species composition and stand structure. Areas unsuitable for timber production were not considered for treatment related to timber production. In addition to field reconnaissance, determining reforestation potential involved review of the reforestation indices for the District and the project area (V-2). These indices display our ability to regenerate these sites within a period of five years as required under NFMA.

Forest stand treatment needs were identified by a silvicultural forester based on insect and disease activity and potential and existing vegetation conditions and desired stand conditions identified in the Purpose and Need, as well as the EAWS for this project area. Desired stand conditions were developed which are ecologically compatible with the site, as well as the current and historic disturbance patterns and successional pathways of the landscape vegetation. These desired stand conditions are also based on the IPNF Forest Plan management area direction for the sites. See management area direction in Table 1-1. Treatment needs were based on a comparison of the existing stand condition to the desired condition and the alternative actions that would move the stands from the existing condition toward that desired condition over time, and generally maintain or improve forest health in this project area. Consideration included stand composition (especially the condition and amount of long-lived early seral species), stand structure, and the potential of the stand to provide mature stand structures with large trees in the future.

Documentation for the general target stands, site-specific stand data and stand diagnosis is in the project file (V-3, V-4 and V-5). A description of the features of various silvicultural systems and their effects are included in Chapter 2 and in the Forest Plan and Forest Plan FEIS.

Affected Environment

Habitat types were used for the project planning and site-specific considerations in this environmental analysis. *Forest Habitat Types of Northern Idaho: A Second Approximation* (Cooper and others 1991) outlines the classification and characteristics of the habitat types. This information was used for stand-level diagnosis and analysis.

Specific field determined habitat types and phases can be found in the St. Joe District's TSMRS (Timber Stand Management Records System) and FSVeg data bases. Additionally, habitat types were grouped to facilitate landscape-level analysis and planning. Habitat type grouping aggregates habitat types that fall within similar temperature and moisture environments. As a result of similar environments and vegetation characteristics, the habitat group can be used to describe similar productivity, fire and other disturbance regimes, stand dynamics, susceptibility to insect and disease, forage and cover potential, rare plant potential, cover types, structural stages and succession pathways. *A Biophysical Classification, Habitat Groups and Descriptions* (USDA 1996) was used for this analysis. The Bussel 484 Project Area includes seven of the forest habitat type groups described in that document. The relative distribution of the habitat type groups occurring in the project area is displayed in Table 3-37 below, and is characterized in the subsequent description. Habitat groups indicate the potential natural vegetation within the area.

Table 3-37 Distribution of Habitat Types on NFS in Bussel 484 Analysis Area

Habitat Group	Potential Vegetation	Temperature and Moisture	% Area
3	Dry Forest	Moderately Warm and Moderately Dry	0.3
4	Moist Forest	Moderately Warm and Moist	4.6
5	Moist Forest	Moderately Cool and Moist	78.9
6	Moist Forest	Moderately Cool and Wet	6.0
7	Cool Forest	Cool and Moist	7.3
8	Cool Forest	Cool and Moist	2.1
9	Dry Forest	Cool and Moderately Dry	0.9

Habitat Group 3 is primarily at lower elevations and occurs on various aspects. This group is transition between the dry and more moist types, and has characteristics of each. This group occurs over less than one percent of the Bussel 484 Project Area.

Habitat Type Groups 4, 5 and 6 are primarily found on lower and mid-slope elevations throughout the Bussel 484 Project Area. Habitat Type Group 4 corresponds to the more moist grand fir habitat type series. It generally occurs on the more southern exposures on the low and mid slope level. Habitat Type Groups 5 and 6 correspond to the western redcedar and western hemlock habitat type series, which are generally present on the other aspects on low and mid-elevation slopes. These three groups are highly diverse, and nearly all conifer species in northern Idaho can occur in these groups. They can be characterized as the sites where western white pine has the capability to thrive and represent a major component of forest stands. It is also where western larch is most productive and capable of growing to large diameter trees sooner than in other habitat type groups. These three groups make up a Moist Forest Potential Natural Vegetation Group and occur over approximately 90 percent of the Bussel 484 Project Area.

Habitat Type Groups 7 and 8 are generally located on the higher elevations slopes and ridges within this area. They correspond predominantly to the subalpine fir and mountain hemlock habitat type series. These two groups make up a Cool Forest Potential Natural Vegetation Group and occur over approximately nine percent of the area.

Habitat Type Group 9 is generally located on the higher elevation slopes and ridges within this area. This group corresponds predominantly to the subalpine fir and lodgepole pine series; however, Engelmann spruce and mountain hemlock habitat type series may occur. This group makes up a Cool and Moderately Dry Forest Potential Natural Vegetation Group and occurs over less than one percent of the area.

Forest Composition

Throughout the Interior Columbia River Basin, there has been a decline in shade-intolerant early-seral species and an increasing dominance of shade-tolerant species (Quigley and others 1996). This same trend is seen at a step down in scale in Idaho. Table 3-38 below displays the trend away from potentially long-lived early seral species (western white pine (WP), western larch (L) and ponderosa pine (PP)) and towards more shade-tolerant and shorter-lived species grand fir (GF), subalpine fir (SAF), spruce (S), lodgepole pine (LP), Douglas-fir (DF) (O'Laughlin and others 1993) from 1952 through 1987 in Idaho.

Table 3-38 Species Composition Changes in Idaho

Idaho Forest Type	WP	PP	GF/SAF	S/ L/ Other	LP	DF
% Change 1952-1987	-60%	-40%	+60%	+30%	+38%	+15%

In stepping down to the St. Joe River Basin we find a similar major decline in long-lived early seral species, particularly western white pine, western larch and ponderosa pine (IPNF 1997).

There are ecological implications of changes in forest composition. Western larch, ponderosa pine and white pine are fire adapted, relatively drought resistant and more root disease resistant than other species, and are capable of dominating the forest stands from establishment to 350 years (Shiplett and Neuenschwander 1994). Additionally, they are capable of producing tall trees of large diameter that serve important ecological functions. Western hemlock and grand fir are two of the more moisture-demanding tree species. They are highly stressed during drought. The increase of these drought-sensitive species at levels substantially higher than historical levels creates increased risk of large-scale insect and disease outbreaks during periodic droughts.

Western hemlock and grand fir are also less adapted to surviving fires than more seral species. As stand composition shifts to greater proportions of fire susceptible species there is an increase in the risk of higher mortality when fires do occur.

Grand fir and Douglas-fir are highly susceptible to root diseases. Conversion of forests to these more shade-tolerant and disease-prone species has contributed to an increase in the incidence of losses and damage associated with armillaria root disease (Byler and Zimmer-Grove 1991). Historically, root pathogens acted more as a thinning agent. Increased dominance of these more susceptible species can change the relationship of root pathogens from one of thinning to a major disturbance agent in forest stands and across the landscape.

Lodgepole pine is a relatively short-lived seral species, especially in the moist forest sites of northern Idaho. Conversion from white pine, western larch and ponderosa pine forest types to Douglas-fir, grand fir, lodgepole pine and western hemlock types trends these sites not only to a reduced species composition (fewer species represented in the stand or area), but also subsequent potential increases in the risk of probable loss when disturbances such as fire, insect outbreaks, drought, etc. do occur. An increased risk of loss affects both the stand and landscape scales.

Table 3-39 displays the current stand composition (defined by the forest type of the species with the greatest basal area represented in the stand) for the historic and the current stand composition for the St. Joe River Basin. It also displays the changes in forest composition (forest type) in this project area as it relates to the current and the historic forest composition for the St. Joe Forest.

Table 3-39 Forest Type Changes in the St. Joe River Basin and Bussel 484 Project Area

Forest Type	PP	WP	WL	DF	GF/ WH	C	LP	SAF/MH/ ES/ WBP
St. Joe Historic Forest	4.3%	24.1%	16.7%	9.4%	9.7%	7.8%	7.1%	20.9%
St Joe Current Forest	2.9%	2.2%	4.8%	22.3%	32.6%	4.3%	14.4%	16.3%
Bussel 484 Project Current Forest	<1%	4%	4%	7%	58%	11%	2%	13%

PP = ponderosa pine *GF = grand fir* *SAF = subalpine fir*
WP = western white pine *WH = western hemlock* *MH = mountain hemlock*
WL = western larch *C = western redcedar* *ES = Engelmann spruce*
DF = Douglas-fir *LP = lodgepole pine* *WBP = whitebark pine*

There have been corresponding increases in the shorter-lived seral species such as lodgepole pine and Douglas-fir and in the more shade-tolerant grand fir and western hemlock. Historic records of the St. Joe National Forest show higher acreages of forest cover types in white pine and western larch than occur today for this area. The early timber inventory methods were plots distributed over large blocks of ground that were not tied to individual stands as done today. The differences in methodology of these timber surveys makes it difficult to do a direct comparison to today's inventories, however, the data does indicate a shift away from the long-lived early seral species and towards grand fir and western redcedar.

Past timber harvest discussed in the 1914 St. Joe NF Land Classification Report and the 1938 Forest Survey Report, reference timber harvest in the early 1900s. This project area is located within the boundaries of these reports. These reports indicate the early logging activities generally focused on removal of the largest-sized trees and the most market-valuable species. These reports indicate that these early harvest activities occurred over much of the project area. Early aerial photos from the 1930s also indicate that harvest occurred throughout this project area. Reviewing the stand exam records, there are references to very old tree stumps and other indications of market selective harvest that occurred during the early part of the 1900s over much of this project area. This early harvest focused on removal of the large, dominant, more valuable western white pine, western larch and ponderosa pine which were preferentially removed over other size classes and species. Large dominant western redcedar was also removed due to its market value. This practice reduced the contribution some species, and particularly ponderosa pine/western white pine/western larch, contribute to the individual stand composition. This reduction in the contribution of these species is seen within the project area and general landscape.

With effective fire suppression for more than 60 years, we have essentially eliminated the primary natural thinning agent which encouraged retention and effective regeneration of shade-intolerant early-seral species; and we subsequently encouraged increased representation of the more shade-tolerant, less fire-adapted species over time. Essentially eliminating natural fire also reduced site preparation which provided appropriate seed bed for germination and establishment of natural regeneration of early-seral species. Additionally, the lack of fire allowed increased stand densities and the natural establishment of more shade-tolerant species such as grand fir, hemlock and Douglas-fir. As these species occupy the site, they increase shading and other competitive conditions, which generally exclude adequate establishment of the shade-intolerant early-seral species such as western larch and ponderosa pine.

When the long-lived, shade-intolerant early seral species (primarily western larch and western white pine and to a lesser extent ponderosa pine) establish early as a strong stand component they are able to maintain a dominant or codominant position in a stand for long periods of time. The risk of total stand loss due to disturbances such as fire,

insects and disease are reduced when these species are able to maintain a dominant or codominant place in a stand for a long time.

The accidental introduction of the exotic white pine blister rust (*Cronartium ribicola*) decimated the white pine component, which was historically a major stand component. Western white pine has a natural rust resistance of less than ten percent (10%), and as a result, there has generally been a loss of ninety percent (90%) or more of the western white pine throughout this project area and over the landscape in general.

The combined effects of these elements resulted in substantial reductions in the representation of these long-lived, shade-intolerant seral species in the overstory, and a substantial reduction in seed source to provide for natural regeneration of these species.

The reduced amount of thinning with subsequent increased establishment of more shade-tolerant species has resulted in an increase in competition and a loss of adequate sites to encourage germination and effective establishment of early seral tree species that may have originated from an already reduced seed source.

Since the late 1950s artificial regeneration and timber stand improvement practices have helped to lessen the trend of reduced representation of long-lived, shade-intolerant, early-seral species. A large percentage of trees planted since the 1950s has been western larch, rust-resistant western white pine and ponderosa pine (where appropriate) and reduced the percentage of Douglas-fir and other species planted. Precommercial thinning, as well as other timber stand improvement and protection activities (gopher control, tree netting etc.) has helped maintain these shade intolerant species in our plantations, assisted in maintaining growth and vigor, and improved our reforestation success in plantations. Although these activities have improved the forest composition, the forest composition for the St. Joe River Basin and within the Bussel 484 project continues to be dominated more by mid- to late-seral shade-tolerant species as compared to historic levels. See Table 3-39 above.

Forest Structure

Forest structure refers to the vertical, horizontal and other spatial characteristic patterns of various components over time. Structure classifications of forest vegetation can be used to reflect processes which operate across landscapes and their component stands. Throughout the Interior Columbia River Basin there has been substantial reduction of older forest structures compared to historic structures (Quigley and others 1996). Over approximately the last 100 years this reduction ranges from 27 to 60 percent from historic levels, depending on the forest type.

During this same period, large residual trees and snags have decreased by about 20 percent. The *Assessment for Ecosystem Management of the Interior Columbia River Basin* indicates that forest composition and structures have become more homogeneous compared to historic conditions. Within the St. Joe River Basin, as well as within the Bussel 484 Project Area, there has been a shift from historic conditions to a more homogeneous structure and species composition. Late seral structures (forests dominated by large, late-seral species including grand fir, western redcedar and western hemlock) and early-seral structures (forests dominated by shade-intolerant, early-seral species including ponderosa pine, lodgepole pine, western larch, western white pine and Douglas-fir) have been declining. There has been an increase in mid-seral structures dominated by grand fir and Douglas-fir, which have become contiguous and created a more homogeneous landscape.

When comparing the structural change within the St. Joe River Basin from mean historical vegetation to the current condition, there are indications of a reduction in large diameter trees, large snags and stands dominated by large old trees (IPNF 1997). There are fewer stands typified by an old, open overstory of large early-seral species with an understory of mixed species of varying shade tolerances. Stands typified by small and medium-sized young trees have increased. These stands are generally more uniform in structure and more densely stocked compared to historic conditions. The primary causal factors influencing this shift have been the commercial harvest of the older and larger overstory, and the efficiency of fire suppression reducing the incidence and extent of mixed severity fires. This same trend in structure change is probably more pronounced on private lands within the St. Joe River Basin and within this project area. This is primarily due to extensive harvest of larger, older, more marketable trees as influenced by the management objectives of the landowners.

Current and historic forest structure, based on size-class groupings, within the St. Joe River Basin is presented in Table 3-40 Also, the current forest structure for the Bussel 484 Project Area, located within the St. Joe River Basin, is also presented in Table 3-40. There is a trend away from mature/old and old growth forest structure, toward smaller trees (IPNF 1997).

Acres in the shrub/seedling/sapling size class are predominantly the result of past regeneration harvests. These areas do have some residual larger trees and snags, however, they are generally under-represented in these past harvest units. Stands which fall into the pole/small/medium sawtimber size class are generally densely stocked with trees where canopies are closed, or nearly closed, and little light reaches the plant communities in the understory. These stands are experiencing competition for growing space (Oliver and Larson 1996) and are developing under strong competition. Many of these stands have relatively small trees for their age and are more susceptible to drought and damage or destruction by wildfire, insects and diseases.

Table 3-40 Size Class Distribution for the St. Joe River Basin and the Bussel 484 Project

Forest Structure	Shrub/Seed/ Sapling	Poles/Small/ Medium	Mature/ Large/OG
St. Joe Basin (all lands) - Mean Historic Vegetation	20%	35%	45%
St. Joe Basin (all lands) - Current Vegetation	28%	50%	22%
Bussel 484 Area (NFS Lands) - Current Vegetation	10%	75%	15%

Stands that are allocated as old growth and old growth recruitment, currently meet or are expected to meet in the near future, the draft minimum criteria for old growth habitat for Region 1 of the Forest Service. Past natural disturbances, primarily wildfire, and past timber harvest practices appear to be the reason that the number of old growth stands with large, old trees is reduced from historical levels on National Forest lands in the Bussel 484 Project Area. The majority of stand ages in this project area are less than 120 years old. White pine blister rust has also had a large effect on reducing the amount of large trees in this landscape. Logging in the early 1900s over much of this area may have removed the mature and old component structure of stands; which if not harvested might be old growth today if they had also survived past wildfire or other major disturbances.

Stand structures in the Bussel 484 Project Area include a few stands that have an open overstory of moderately old, large trees with an understory of younger, smaller trees. These stands appear to be the result of a mixed-severity fire that killed 20 to 80 percent of the previous stand. The relic trees from the previous stand are often western larch, Douglas-fir, western redcedar, and a few scattered ponderosa pine. This stand structure would be more common if not for the past logging practices. In many stands in this project area, medium and large stumps of mostly western larch, white pine, western redcedar and ponderosa pine are found below the dense canopies of pole and small sawtimber stands. These larger trees and snags were logged for their high value in the past. This type of harvest has led to both a more homogeneous stand structure and a decrease in the diversity of tree species within these stands and the reduction of these larger size classes and species as stand components within the project area.

Many of the stands in this project area have a weakly developed three age-class structure and canopy level observed during stand examination (V-1). These stands are trending towards multi-storied structure. The historical condition in this project area was generally even-aged, one- and two-storied stands of moderate to large area.

Stand structures on land other than National Forest in the Bussel 484 Project Area and the St. Joe River Basin are believed to be even more homogeneous and have less large wood than occurs on National Forest lands. Additionally, very little old growth structure is believed to exist on lands other than National Forest. Stand structures in these areas are expected to be maintained in the two smaller size classes (Shrub/Seedling/Sapling and Pole/Small/Medium Sawtimber) in the future by the timber management associated with these ownerships.

The apparent decrease in the amount of large trees; large snags; and stands of mature, large timber and the subsequent increase of the smaller size-class stands has ecological effects. For instance, species that are associated with younger stands benefit and those associated with older stands and larger trees suffer a loss of habitat.

Historically, the landscape of the St. Joe River Basin included openings. These openings ranged in size from small openings of only a few acres, to large openings ranging in size from several hundred acres to greater than a thousand acres in size. The smaller openings were generally the result of low-intensity fires, losses to endemic levels of insects and disease, and localized wind or snow events. The larger openings in the forest were generally created by wildfire. A series of large fires around 1830 burned nearly half of the St. Joe Basin. These fires were not all stand-replacing fires; however, they did create large openings and killed large acreages of forest. The large fire of 1910 burned over half of the St. Joe Basin. The Coeur d'Alene Basin fire study showed that over the last 450 years there was one major stand-replacing fire episode somewhere in the basin every 19 years (Zack and Morgan

1994). Fire created openings in the Bussel 484 Project area. Records show that there were two large mixed-severity fires impacting the majority of this project area in 1922 and 1931 (V-6). These fires involved several thousand acres. There have been numerous small fires throughout this project area since the 1922 and 1931 fires. Due to fire suppression and other activities, the majority of openings created since the 1930s have been created by timber harvest activities, as well as losses due to insects and disease.

The combined effects of these elements have resulted in a substantial reduction in the mature and large tree component. There is a substantial reduction in both the vertical and horizontal structure and an increase in homogeneity within the project area. Along with the general reduction in the size class of stands, there has been a general increase in the relative stand densities (trees per acre) and a reduction in the average tree size and age within stands from historic levels. As a consequence, the risk of large area losses to fire, weather events, insects, disease and other major natural disturbances is increasing compared to historical conditions.

Vegetative Conditions Related to Past Harvest

Much of the land managed by the Forest Service in the Bussel 484 Project Area was acquired in the early to mid 1930s. Few records relating to timber harvest and other management activities are available for that period; however, there is evidence of some early activity such as very old stumps and remnants of skid roads that indicate that some harvest did occur prior to the 1940s. This early activity may have been related to salvage activity and removal of specific products such as large western larch, western white pine, ponderosa pine, Douglas-fir and western redcedar.

Field review as well as the general history of this project area indicates that early timber harvest activity did occur. The stand data base does not include those possible harvest activities. The stand history, or activity, data base does record the timber harvest that has occurred from 1961 to 1995, or approximately the last 40 years. These more intensive timber management activities were not prevalent until the early 1960s. Approximately 2,034 acres (16 percent) of the approximate 12,663 acres of National Forest System lands have received some type of commercial timber harvest from 1961 to 1995. Of this, approximately 86 percent (approximately 1,741 acres) was regeneration harvest (1,388 acres clearcut, 211 acres seed tree, 6 acres shelterwood seed tree and 136 acres liberation cut and regenerated through planting), 14 percent (approximately 293 acres) was treated with an intermediate harvest of sanitation/salvage and liberation/improvement harvest.

Timber harvest data related to ownership other than Forest Service within this project area is generally not available. Through review of aerial photos and information from Potlatch Corporation, it is estimated that a substantial percentage (greater than 50 percent) of non-NFS land has received some form of commercial timber harvest.

Environmental Consequences

Alternative A

Direct and Indirect Effects

Forest Composition

As presented earlier, shade-intolerant, early-seral species have declined and dominance of shade-tolerant species is increasing within the Bussel 484 Project Area. For this area and the associated potential vegetation these early seral species are identified as western white pine, western larch, and on the more dry sites ponderosa pine. Lodgepole pine and Douglas-fir are also regarded as seral species on certain habitats within this project area. One purpose of this proposed project is to encourage species composition towards more historic conditions. This includes encouraging establishment of long-lived serals of western larch, western white pine and where appropriate ponderosa pine. The retention of existing long-lived serals is also important to meet this purpose and need for action.

Alternative A, which proposes no stand treatment, would maintain the existing condition and trends of the forest stands which are proposed for treatment in the other alternatives. This existing condition includes a continued decrease in the percent composition of western white pine, western larch and ponderosa pine within the forest stands.

The loss of white pine is primarily the result of white pine blister rust infections causing mortality. White pine blister rust will continue to infect and kill all or most of the remaining naturally occurring white pine as well as the natural regeneration resulting from these existing seed sources.

Natural resistance to blister rust is generally less than ten percent and available natural seed sources in the Bussel 484 Project Area is relatively low and decreasing as mature white pine continue to die from blister rust infection and other factors. White pine is currently a minor component (less than five percent) in the forest stands considered for treatment in this assessment and would continue to decrease under Alternative A.

The percent composition of western larch and western white pine dominated stands, currently approximately eight percent, in this project area would decrease with Alternative A. The development of western larch is related to its intolerance of shade. Western larch is the most shade-intolerant species in its range, and it is the most resistant to fire (Fiedler and Lloyd 1995). To regenerate, western larch needs fire or other major disturbance to provide appropriate seed bed conditions (Schmidt and Shearer 1995) for effective germination and establishment. To survive in the stand, larch must maintain at least a codominant or dominant position, but preferably a dominant position in the canopy. High stocking levels can even severely suppress height and diameter growth of dominant larch trees.

Historically, low- and mixed-severity fires favored larch by thinning out some of the competition (Arno and Fischer 1995). Alternative A proposes no commercial harvest to encourage retention and/or establishment of western larch within the project area. The current policy to suppress all fires in this area would continue. As a result, the composition of western larch would depend on the survival of existing trees. Western larch does not effectively compete once its position in the canopy is not dominant because it is severely intolerant of shade. In the absence of fire or other thinning agents (natural or human-caused) the more shade-tolerant species would continue to develop and compete with the western larch. In areas where root rot or other forest pathogens are performing a thinning effect, some retention of larch, if present, is expected. In those areas, however, the natural regeneration would continue to be the more shade-tolerant species and thus the impact of competitive trees would continue, and little long-range benefit in retention of western larch is expected. The live crown ratio of existing western larch would generally reduce over time due to both abrasion and shading from the more shade-tolerant species, resulting in decreased diameter and height growth. The existing western larch in the stands considered for treatment in other alternatives is demonstrating a current decline in live crown and growth rate. In the absence of fire or other thinning agents, this decline is expected to continue, and over time western larch would be substantially reduced or even eliminated from these stands under Alternative A.

Ponderosa pine has historically dominated a relatively small percentage (four to five percent) of both the project area as well as the St. Maries and St. Joe River Basins. It generally dominated stands on drier sites typified by dry rocky ridges and on south or west aspects. It was, however, a minor component over much of the area being present on drier inclusions of larger stands and as co-dominants established at the same time as the surrounding trees.

Ponderosa pine, like western larch, is shade-intolerant and relatively fire-resistant. In the absence of fire or other thinning agents the more shade-tolerant species would continue to develop and compete with the ponderosa pine as it does with western larch. Competition for growing space from the more shade-tolerant species is expected to decrease the growth and vigor of the ponderosa pine in these stands. This component, where it exists, would be reduced or potentially be eliminated from these stands.

Current conditions have resulted in much higher proportions of the more shade-tolerant species, especially the grand fir/western hemlock and to a smaller degree the western red cedar forest types, than historically existed in the area. This trend is expected to continue with Alternative A, which would not include timber harvest while current fire-suppression policies continue.

This alternative would result in decreased numbers of western white pine, western larch and to a lesser extent ponderosa pine in the forest stands considered for treatment in this environmental assessment.

Under Alternative A, stand composition is expected to change over time with a continued reduction in the existing component of long-lived, early-seral species and a continued increase in more shade-tolerant mid- and late-seral species. As a result of this shift in species composition, the risk of insect and disease losses in stands would increase. These increased losses would be expected from the existing diseases and insects in these stands (*Armillaria melia, Echinodontium tinctorium, Phaeolus schweinitzii* and *Dendroctous pseudotsugae, Scolytus ventralis, Cronartium ribicola*).

This shift in stand composition to more shade-tolerant species, predominantly grand fir, Douglas-fir and hemlock, would also increase the risk and extent of loss from fire. These species are less adapted to surviving fire than are the more shade intolerant seral species. As these more fire-sensitive species increase as a percent of stand composition, the risk of losing entire stands increases should fire occur.

Precommercial thinning and TSI (timber stand improvement) activities are designed to help maintain the early seral representation in the very young stands through reduction of competitive trees and other vegetation as well as reduce potential losses to insects and disease. These activities help maintain the contribution of long-lived, early-seral species such as western larch, western white pine and ponderosa pine. Under this alternative, no precommercial thinning and TSI activities would be accomplished in the precommercial sized stands. The potential benefits of these treatments would not occur and the effects of competition discussed above would be expected in the stands proposed for these treatments in the other alternatives.

Forest Structure

Alternative A would result in no direct management induced changes to forest structure.

Indirectly, forest structure would change with time in stands in the project area. Forest stands in this project area can generally be classified as stands where the canopy is moderately closed, trees are crowded (heavily stocked), live crowns are generally small to medium with declining widths and heights.

In the majority of the stands the trees are competing for growing space. Competition would result in a decline in the western larch and western white pine over time. Both diameter and height growth is decreasing, and stands are experiencing an increase in susceptibility to disease and insect attack. The small- and medium-size classes are the dominant stand components in these stands. Although growth rates are declining, these stands are expected to continue development towards the mature/large-size class, but would experience little change in vertical and horizontal homogeneity within the next 25 to 30 years.

Forest cover types are determined by the species with the greatest percent composition (by basal area) in the stand. Within this proposal area, approximately 89 percent of the acres are in Douglas-fir, grand fir, western hemlock, western red cedar and subalpine fir forest types.

Douglas-fir and grand fir contribute from 15 to 97 percent, and average 70-75 percent, of the species composition within the stands in this project. These species are the most susceptible to root disease of all the native forest trees in northern Idaho. The majority are in the cedar/hemlock habitat types. A study on the Coeur d'Alene River Basin (Matthews 1995) simulated effects of root disease on mature stands of Douglas-fir and grand fir cover types on these habitat types. Reductions of stand basal area were significant (net decline over 100 years), mean diameters never exceeded nine inches over a 50-year period (without root disease it exceeded 14 inches) and canopy closure decreased from 75 percent to 45 percent and did not regain 75 percent closure for a period of approximately 80 years. This indicates the effects severe root disease can have on these habitat types. Crown closure, average diameters and other stand characteristics recover over time when western redcedar and hemlock become predominant components. This recovery process may take up to 100 years to occur. Although in most situations, native root diseases do not cause irreplaceable loss of entire stands over large areas nor threaten the existence of any host species. However, the change in root rot dynamics may influence growth and succession for centuries (Rippy and others 2005).

The occurrence of root disease is currently at endemic levels within the project area. With declining growth and vigor, these stands are expected to have increasing effects of root disease. Increased mortality from root disease and other agents can be expected in the larger-sized, more susceptible trees. This would create small openings due to losses of individual and small groups of medium and large trees throughout the project area. These openings would regenerate with shade-tolerant species. As larger trees die over time, the vertical structure and mean tree size in these stands would decrease. Over time, this would create a more homogeneous structure, one with fewer crown classes, within the individual stands and the project area in general. Over the next 30 to 50 years, these stands are expected to decrease in mean diameter and decrease in canopy closure resulting from individual tree and small group mortality. This could potentially extend the time needed for these stands to achieve a large/mature size class.

Precommercial thinning and TSI (timber stand improvement) activities are designed to help maintain growth and vigor in these very young stands through reduction of competitive trees and other vegetation in addition to maintaining species representation as discussed above (Daniel 1979). Maintaining growth and vigor helps stands develop larger sized trees over a shorter period of time than would be expected without the activity. Under this

alternative, no precommercial thinning and TSI activities would be accomplished in the precommercial sized stands. The benefits of these treatments to growth and vigor would not occur in the stands where this work is proposed in other alternatives.

Cumulative Effects

Forest Composition and Structure

Alternative A of this project would cumulatively maintain the current composition trends on the National Forest System lands in this project area. The number and extent of western larch, western white pine and ponderosa pine would continue to decrease on almost all National Forest lands in the area. The number and extent of grand fir, western hemlock, Douglas-fir and western redcedar would continue to increase. An exception to this would be those areas that were previously reforested and/or pre-commercially thinned to promote early-seral species composition.

The effects of Alternative A on species composition would only differ by the incremental changes on National Forest System lands. This would be predominantly through losses in the existing western white pine and western larch components, and increases in the grand fir component.

The effects of Alternative A on structure would be an incremental reduction of medium and large sized trees on National Forest System lands. Over the next 25 to 30 years, stands throughout the project would continue to grow bigger trees and move towards larger size classes in the absence of disturbance of fire or other disturbance agents. Due to species composition and the expected increases in the incidence of root disease and insect damage, this trend towards larger tree size is expected to begin a subsequent decline as a result of mortality. Over the longer term, vertical stratification and horizontal differentiation may also be expected to decline by incremental amounts.

On ownership other than the Forest Service within the project area, the decrease of shade-intolerant, long-lived early seral species and the increase of shade-tolerant species is expected to occur more rapidly due to the continued harvest of stands which contain western larch, white pine and areas with ponderosa pine. These harvested areas have historically had little site preparation and planting to favor long-lived, early-seral species. This historical pattern has changed in recent years, with substantial increases in site preparation and planting to assure rapid reforestation and improved species composition when regeneration harvests are applied on these other ownerships.

The management practices on lands other than National Forest System lands historically favored the removal of larger-sized, older trees where intermediate stand treatments were applied, and regeneration harvests were generally applied in mature or overmature stands of larger trees. This trend is expected to continue on these other ownerships. It is anticipated that the stand structures will continue to be predominantly in the brush/seedling/sapling and pole/small/medium size classes, and not much area would develop to the large mature/old growth size class on these lands.

The effects on this project area resulting from management of private lands are expected as only incremental changes in forest composition and structure.

Alternative B and C

Direct and Indirect Effects

Forest Composition

The commercial thinning would maintain and/or increase the percent of long-lived, shade intolerant species in stands proposed for intermediate treatment in both Alternative B and C. There would be a slight increase in early seral representation, predominantly western larch, on approximately 1,091 acres where these species are present but are a minor stand component. On an additional 264 acres, through retention of the existing seral component and reduction in the more shade-tolerant species, the forest type is expected to change from grand fir/Douglas-fir to western larch. Approximately 157 acres of existing western larch forest type proposed for treatment would be maintained in that forest type in the long term through preferential removal of species other than western larch and western white pine.

The seed tree cuts and clearcut w/reserves in Alternative B and C would regenerate 131 acres currently occupied by grand fir and Douglas-fir with potentially long-lived seral species, primarily western larch and western white pine. Openings as a result of these proposed treatments would range from two acres to 40 acres in size. This would result in an increase of 131 acres of long-lived, early-seral species through artificial regeneration (planting).

In the group shelterwood (521 acres), approximately 224 acres would receive a regeneration harvest. This treatment would develop small openings ranging from two to five acres distributed throughout the harvest units and would be regenerated with predominantly western larch and western white pine. An additional estimated 339 acres would receive commercial thinning with retention of early serals, where present. These units would remain in grand fir or Douglas-fir forest types, but the percent of early seral species would be maintained in the thinned areas and would increase for the units overall due to reforestation activities in the openings.

These proposed stand treatments have a relatively low potential to increase the current incidence of root and stem decays within treatment areas. Due to expected improvement in growth and vigor in areas of intermediate harvest treatments and the increased representation of western larch and western white pine, the impact of root and stem decays is expected to remain at or near current endemic levels. The risk of stand loss to insects and other diseases is expected to remain at endemic levels as a result of increased representation of long-lived, early-seral species as well as improved growth and vigor in the areas proposed for treatment under these alternatives.

Under Alternatives B and C timber stand improvement work (pre-commercial thinning and some white pine pruning) is proposed in 39 stands involving 821 acres. Eight of these stands, involving approximately 246 acres, would be thinned and pruned according to the Northern Rockies Lynx Management Direction as discussed in the wildlife section of this document. Species composition in these stands is currently early seral (western larch and western white pine). Through selective thinning, these early seral species would be maintained as strong components on these acres. The white pine pruning for white pine blister rust would also provide for better retention of western white pine on these acres.

In areas receiving artificial regeneration (planting) discussed above, pocket gopher control (gopher baiting) activities are anticipated. These rodents can adversely impact stocking and reestablishment of new stands by foraging on the roots of the new trees and causing increased mortality. When the opportunity exists, these rodents seem to prefer foraging on the roots of the planted early seral western larch, western white pine and ponderosa pine over other species present. These control activities reduce the overall losses to stocking, and in particular the losses of the early seral western larch, western white pine and ponderosa pine. The direct effect of this activity on forest composition is improved retention of these species as a component of the new establishing stand.

Forest Structure

Alternative B and C would directly change forest structure on all proposed harvest units. The change in structure in proposed commercial thin treatment units would reduce stand density by 30% to 50% (averaging 40%) and open the canopy cover by a corresponding amount. This harvest treatment would remove smaller trees and favor retention of larger diameter and more vigorous trees. This treatment would increase individual tree growth and vigor. This would result in developing mature/large-sized trees over a shorter time frame than would be expected with no treatment. The vertical structure would have less variation as a result of the removal of smaller tree classes. Additionally, stand density and crown closure would be reduced. These stand characteristics would increase over time following this proposed activity. Commercial thinning harvest activities would affect up to 1,543 acres. These treatments would not directly change stand size class due to few trees currently in the large/mature size class currently present in these stands.

The areas proposed for group shelterwood harvest would directly change structure of the stands. Vertical structure decreases and horizontal structure increases when openings are created in homogeneous stands. In total this activity would create approximately 224 acres of openings, ranging in size from two acres to five acres in size, scattered throughout the units. These openings would be regenerated with predominantly seral species (western larch and western white pine), and would become brush/seed/sapling size class. The remaining 339 acres within these proposed units would have the same effects as discussed for commercial thinning treatment above.

The areas proposed for seed tree cut with reserves and clearcut with reserves would directly change structure of 131 acres within the project area. This treatment would result in two-aged stands with the larger reserved trees scattered throughout the treatment area as an overstory above the planted and naturally regenerated new age class. The larger trees would remain the dominant structure in these stands. These treatments would directly change stand size class in as much as the primary size class would shift from the pole/small/medium size class to the brush/seedling/sapling size class. These treatments would decrease the vertical structure and increase the horizontal structure on 131 acres through creation of openings (ranging in size from eight acres to 40 acres) in the existing homogeneous stand density.

These proposed stand treatments have a relatively low potential to increase the current incidence of root and stem decays within treatment areas. Due to expected reduction in stand densities and subsequent improvement in growth and vigor in harvest treatment areas, the impact of root and stem decays is expected to remain at, or near, current endemic levels. The risk of stand loss to insects and other diseases is expected to remain at endemic levels as a result of reduced stand densities and subsequent improvement in growth and vigor creating conditions where trees are less stressed and better able to resist attack or infection.

The precommercial thinning activities (approximately 821 acres) would not directly affect forest structure; however, these treatments will maintain growth and vigor of the residual stand. These stands would remain in the brush/seedling/sapling size class after this treatment.

In areas receiving artificial regeneration (planting) discussed above, pocket gopher control (gopher baiting) activities are anticipated. These rodents can adversely impact stocking and reestablishment of new stands by foraging on the roots of the new trees and causing increased mortality. These control activities reduce the overall losses to stocking, and assist in reestablishing a new stand with adequate stocking in a shorter period of time. This activity assists in maintenance of early stocking levels in these planted areas during establishment and early growth. The direct effect of this activity on forest structure is more rapid stand reestablishment due to reduced mortality.

Alternative B and C

Cumulative Effects

Forest Composition Resulting from Stand Treatments (Alternatives B and C)

On National Forest System (NFS) lands the contribution of long-lived seral species to stand composition is expected to increase. This would be the result of preferential removal of species other than long-lived early seral species in intermediate treatment activities and reforestation activities that preferentially select and maintain long-lived early serals within the stands.

On privately owned land, the contribution of long-lived seral species is expected to be static or potentially have a slight increase. This is the result of preferential removal of these species due to market value during harvest. The reforestation activities that incorporate preferential selection and maintenance of long-lived seral species has not been as intensive on other ownerships as on NFS lands. This historic trend is, however, changing and a gradual increase in these species over time is expected on privately owned lands.

Cumulatively, only a small increase (approximately 5 percent) in the contribution of long-lived seral species is expected to result on NFS lands from vegetation management activities within this project area. The cumulative effect on all ownership within this project is expected to be only a small incremental increase.

Forest Structure Resulting from Stand Treatments (Alternatives B and C)

On NFS lands the tree and stand size classes in intermediate harvest areas are expected to increase due to retention of larger tree classes combined with improved growth and vigor of trees and stands. In areas receiving regeneration treatments the tree and stand size classes are expected to decrease due to removal of overstory trees. In areas proposed for precommercial thinning the tree and stand size classes are expected to increase over a shorter period of time due to improved growth and vigor resulting from treatment.

Intermediate harvest activities on ownerships other than Forest Service are expected to occur. On intermediate harvest areas the tree and stand size classes are expected to increase, but at a lesser extent than on National Forest System (NFS) lands. This is due to management strategies that preferentially remove the larger tree classes. The effects of regeneration and timber stand improvement activities on these ownerships would be similar to those on NFS lands.

Cumulatively, only a small incremental increase in tree and stand size class resulting from vegetation management activities within this project area is expected.

The vertical structure complexity is expected to decrease, and horizontal structure complexity is expected to increase on both on NFS lands and other ownerships within this project area. This is due to removal of tree classes (vertical structure) and creation of openings (horizontal structure) related to various management activities. Both of these structural elements would increase in complexity over time. Cumulatively, the decrease in vertical structure and increase in horizontal structure for the project area overall would be small, or incremental.

Root and stem decays are expected to have only a slight increase in intermediate treatment areas, remain at low (endemic) levels in regeneration treatments, and increase in untreated areas of all ownerships within this project area. Losses from insects and diseases other than root/stem decays are expected to decrease on all ownerships due to improved growth and vigor resulting from management activities. An exception to this is losses to western white pine due to blister rust, which is expected to continue at or near the current rate. The effects of slight decrease in tree/stand size class and vertical structure, and a small increase in horizontal structure are expected. This is primarily due to the improvement in growth and vigor, and improvement in species composition throughout the project area. On sites with mixed species composition-- where seral and climax species co-occur with root disease organisms—infection and mortality of susceptible species have the potential to prolong the seral phase (Rippy and others 2005). Cumulatively, the effects of insects and disease on vertical and horizontal structure, as well as tree/stand size class would be incremental. Table 3-41 below summarizes the effects of the alternatives on vegetation in the project area.

Table 3-41 Comparison of Vegetation Components on NFS Lands by Alternative

Measurement Parameters	A		B		C	
Composition in NFS lands:	Acres	%	Acres	%	Acres	%
Long-lived, early-seral tree species; PP/WL/WP forest types	983	8	1,614	13	1,614	13
Stand structure in NFS lands:						
Brush-seedling sapling	1,284	10	1,699	13	Same as Alt B	
Pole-small-medium	9,442	75	9,033	70		
Mature-large	1,937	15	1,828	14		
(Allocated Old Growth(approx. 2,528 acres) is distributed throughout medium, mature and large structure)						
Stand density (acres):						
Reduction in stand density through intermediate harvest	0		1,827		Same as Alt B	
Improve growing conditions for overstocked seedling/sapling stands	0		821			

<u>Cumulative Effects on Vegetation from Other Activities (Alternatives B and C)</u>

Aggressive suppression of wild fires is expected to continue. As a result, the trends in stand structure and composition related to the absence of fire are also expected to continue. The rate of change influenced by the lack of wildfires is relatively slow over time, resulting in expected incremental cumulative effects on the vegetation resource over time.

Field survey and other data gathering would not impact vegetation and would have no cumulative effects on the vegetation resource.

Past and future gopher control in addition to that proposed with regeneration under Alts B & C is expected to have only a small, or incremental, effect on the vegetation resource for this project area. This is due to maintenance of adequate stocking levels and retention of long-lived, early-seral components in these reestablished and future stands.

Weed control would impact populations of noxious weeds, but would not impact trees and other general vegetation in this project area. No cumulative effects on the coniferous vegetation resource are expected from weed control.

Public activities, primarily related to various recreational activities, are expected to have only slight direct and indirect effects, and no cumulative effects on the vegetation resource. Examples of this type of activity are berry picking, hiking, hunting, wood gathering, Christmas tree cutting, and similar activities.

Transmission line and forest road maintenance activities are repetitive and ongoing. These activities generally keep these facilities in a relatively static condition and little to no change occurs over time. As a result, no cumulative effects on the vegetation resource are expected. Potential road construction would impact structure

through incrementally decreasing vertical structure, and incrementally increasing horizontal structure. Cumulatively, this activity is expected to have only slight, or incremental, effect on the vegetation resource for this project area.

Consistency with Forest Plan and Regulatory Framework

Specific goals, objectives and standards for timber management are described in the Forest Plan on pages II-2, II-8 and II-32. All alternatives are consistent with these guidelines. All action alternatives comply with Appendix A, Summary of Timber Information and Vegetation Management, providing direction for silvicultural practices on the Idaho Panhandle National Forests. The activities described for the action alternatives are consistent with this direction.

Proposed management activities are designed to improve stand health and vigor, and maintain or enhance species composition and stand structure. This would minimize risk of stand loss from forest insects and disease as well as reduce risk of stand loss to weather, fire or other disturbances.

All proposed openings are within size limitations directed by NFMA and the Forest Plan. Openings would be naturally or artificially regenerated. Review of regeneration indices for the District and the project area (V-2) display adequate ability to regenerate these openings within the five year period as directed in NFMA and the Forest Plan.

All proposed vegetative treatments integrated other resource needs through project design during alternative development and analysis.

All proposed vegetative treatments are on lands classified as suitable for timber production (V-12, V-14).

Noxious Weeds

Differences between Draft EIS and Final EIS

Numbers were changed to reflect changes in the alternatives described in the Introduction for the FEIS. Analysis of effects from fire were added.

Introduction

Non-native invasive plant species (NNIS) out-compete and displace native plants, interfere with native plant germination and survival, change soil functions, and contribute to a host of other factors that can dramatically alter vegetation composition and structure. When any ground-disturbing activity is proposed, the Forest Service must determine the risk of introducing or spreading noxious weeds associated with the proposed action. Soils disturbed by skidding logs, controlled burning, and constructing roads can provide ideal habitat for invasive plants. Many non-native invasive plant species take advantage of disturbance situations to enter and invade plant communities. Seeds can be carried in soil clinging to machinery or vehicles and be deposited in weed-free areas. Roads can also facilitate NNIS invasion and spread by altering habitat conditions, stressing or removing native species, and allowing easier movement of wild or human vectors. In contrast, some invasive plant species may not require any soil disturbance to invade native ecosystems and can thrive if seeds are simply introduced; in these situations, prevention and monitoring become especially important.

Regulatory Framework

Noxious weeds are plant species that have been officially designated by federal, state or county officials. Direction regarding the development and coordination of programs for the control of noxious weeds and evaluation of noxious weeds in the planning process is found in federal legislation, regulations, and policy. The Federal Noxious Weed Act of 1974 defines a noxious weed as "a plant which is of foreign origin, is new to, or is not widely prevalent in the United States, and can directly or indirectly injure crops or other useful plants, livestock or the fish and wildlife resources of the United States, or the public health" (P.L. 93-629). The Idaho Noxious Weed Law definition is any exotic plant species that is established or that may be introduced in the State, which may render land unsuitable for agriculture, forestry, livestock, wildlife, or other beneficial uses and is further designated as either a State wide or County-wide noxious weed (Idaho Code 24 Chapter 22). Both federal and state definitions pertain primarily to competition with commodity land uses, although, weeds also impact non-commodity resources such as water

quality (Lacey and others 1989), wildlife (Rice and others 1997) and natural diversity (Forcella and Harvey 1983; Tyser and Key 1988; Williams 1997).

The National Forest Management Act (1976) has a goal of providing of a diversity of plant and animal communities and established the disclosure requirements for proposed noxious weed control activities on NFS lands. The Idaho Panhandle National Forests, Forest Plan (1987) and Forest Service Manual (Chapter 2080 as amended 1995) prioritize weed treatments and state that noxious weeds will be controlled with an integrated pest management approach. In addition, the Idaho Panhandle Forest Plan and the Federal Noxious Weed Act of 1974 as amended require cooperation with State, local, and other federal agencies in managing and controlling noxious weeds. The state of Idaho also requires landowners to control weeds on their property under the Noxious Weed Act, Title 22, Chapter 24 Idaho Code.

Geographic Scope

The geographic scope of analysis for noxious weeds in this project is the Bussel 484 Project Area. Geographic scope of potential effects (direct, indirect, and cumulative) is determined by a combination of factors including: geographic location, the scope of the proposed action, resources and species which may be present, consequences and scope of effects, and the ability to measure effects. Scope of the action and potential for adverse effects determines the extent of analysis necessary. Effects from proposed activities within the project area would be difficult to isolate from effects due to activities beyond the Bussel 484 Project Area boundary. Discussion of these effects, such as new ground disturbances and new NNIS populations establishing outside of the project area, would not provide meaningful information about proposed project effects. Weed populations may expand beyond the project area boundary. However, should it occur, the threat posed by expansion is minimal because much of the disturbed habitat outside of the project has already been colonized by weeds.

Analysis Methods

The direct and indirect effects analysis for the NNIS portion of the Bussel 484 Project is bound by the project boundary. The St. Joe Noxious Weed Project FEIS (USDA Forest Service 1999a) lists 34 undesirable species that can be targeted for treatment and their level of infestation on the St. Joe Ranger District (NW-1). Disturbed areas often translate into potential weed habitat. Weed species are adept at colonizing recently disturbed areas particularly if light levels increase. Once established, species can grow and spread quickly and effectively exclude native vegetation from the site. Analysis for the effect of NNIS establishment and spread is done by considering the type and amount of disturbance. In general timber harvesting can impact large areas of land, making them suitable for weed establishment. Burning may also promote weed spread under certain conditions for some species by reducing the density and competitiveness of native species and allowing for weed establishment (Hobbs and Huenneke 1992). Roads and trails are main vectors for invasive species into an area. This analysis area is well intersected by roads and trails, which happen to be the main access routes into the project area. Trail construction or reconstruction would result in less disturbance than road construction. Any activity that either directly or indirectly reduces the presence or threat of introduction of non-native/noxious weeds into an area could be described as beneficial.

Affected Environment

Historic Condition

Historically, it can be assumed that there were no noxious weeds within the project area. The weeds included in the St. Joe Noxious Weed Project FEIS (USDA 1999a) for treatment on the St. Joe Ranger District originate in Europe and Asia. Before widespread human disturbance, travel, and commerce seed sources were not available for these plants. The first recorded sightings in Shoshone County of several currently established weed species on the St. Joe Ranger District noxious weed list (common mullein, St. John's wort, Canada thistle, common tansy, sulphur cinquefoil) date from the 1940s (NW-1). However, when the weeds first appeared in the project area is unknown.

Large mixed-severity fires impacting the majority of this project area between 1910 and 1931. These fires involved several thousand acres. There have been numerous small fires throughout this project area since those fires. Human disturbance likely began in earnest with the start of large scale timber harvests and associated activities, such as railroad construction and log drives, that began approximately 100 years ago.

Existing Condition

Weeds primarily exist along travel corridors, dispersed use areas and other disturbed areas. The St. Joe Geographic Assessment (USDA 1997) indicates that weeds within the project area are likely present in recently disturbed areas and roads. Additional surveys on routes in the Bussel 484 Project Area indicate further weed encroachment. Idaho State listed noxious weeds are present in the Bussel 484 Project Area (the list can be found at: http://www.idahoag.us/Categories/PlantsInsects/NoxiousWeeds/watchlist.php). Inventories completed for the St. Joe Weed EIS (USDA 1999) indicate populations of spotted knapweed (*Centaurea biebersteinii*), bull thistle (*Cirsium vulgare*), common crupina (*Crupina vulgaris),* meadow hawkweed (*Hieracium pratense*), orange hawkweed (*Hieracium aurantiacum),* common tansy *(Tanacetum vulgare),* and sulphur cinquefoil (*Potentilla recta*) within travel corridors, dispersed use areas, and other disturbed areas in the project area. Houndstongue (*Cynoglossum officinale*), Canada thistle (*Cirsium arvense*), and oxeye daisy (*Leucanthemum vulgare*) have also been noted in more recent visits to the project area. St. John's wort (*Hypericum perforatum*) is well established throughout the major road systems of the St. Joe Ranger District. The St. Joe Noxious Weed Control Project FEIS (USDA Forest Service 1999) identifies Road 758 as a potential treatment area in the project area. Additional road surveys in 2006 identified high densities of spotted knapweed (*Centaurea stoebe*) and Canada thistle (*Cirsium arvense*) along Roads 1498, 1498A, 1498B, and 1498C. These areas where treated in 2007 (PF: NW-2).

The Forest Service treated weeds at various locations within the project area manually and through herbicide spraying in 1998 1999, 2002, 2003, 2004, 2005, and 2007. Biological control agents were released in the project area in 2001.

The St. Joe Geographic Assessment (USDA 1997) contains an appendix that classifies the ecological condition for certain landscape areas. The Bussel 484 Project Area is contained within Landscape Analysis Area (LAA) 23 (St. Joe GA p.13). This area is designated as having moderate disturbance and established weed populations throughout the LAA with no realistic opportunity for changing broad landscape pattern. Management of established weeds would focus primarily on limiting their spread and secondarily on reducing infestation levels. New NNIS plants to the Bussel 484 Project Area would be slated for eradication.

The main vectors for weed spread are typically vehicles (road maintenance equipment, OHV, and passenger cars and trucks), although the seeds of many species are also wind-dispersed or animal-dispersed. The vectors are more problematic if the preferred weed habitat is available as well.

Environmental Consequences

Alternative A: No-Action Alternative

Direct and Indirect Effects

Under this alternative, weed populations may have a small decline in some areas as canopy cover increases. Without further disturbance, established weed species in the project area are not expected to rapidly expand in area since many of the suitable areas for weed colonization have already been infested. The greatest threat from noxious weeds under this alternative is from the introduction of new and potential invader species by way of existing roads and trails. The No Action Alternative would not directly or indirectly increase or decrease the spread of NNIS plants in the project or surrounding area.

Cumulative Effects

Cumulative effects are the result of past, present, and future activities within the area. The cumulative effects discussion under the action alternatives is pertinent to Alternative A as well. Past activities such as timber harvest, road and trail construction, and recreational use likely resulted in the introduction of weeds into the area. Current and reasonably foreseeable activities within the project area include firewood collection; recreational use of roads, trails, and dispersed sites; road maintenance, pocket gopher control, and fire suppression. These types of activities could result in new disturbed sites available for colonization by weeds, and they do offer the possibility of introduction of new species of weeds to the watershed. Weed control activities would be scheduled as funding and other priorities allow. Weeds may also be treated in areas not specified in the St. Joe Noxious Weed Control Project EIS by following the adaptive management strategy outlined within that document. Overall, the effect of the No-Action Alternative is expected to result in a static trend or in a slight increase in weed numbers within the area over time if control methods are not employed.

Effects Common to Action Alternatives

Direct and Indirect Effects

The direct effect of ground-disturbing activities on noxious weeds is to increase the area available for weed colonization. The greatest potential for the establishment of weeds comes from activities that disturb the soil and open the canopy to the greatest extent. In this respect new road construction, road obliteration, skid trails, log landings, trail construction and timber harvests have the highest potential to create suitable weed habitat. Road reconstruction, reconditioning, and storage impact areas that are already disturbed; and so at most would create a smaller amount of new potential habitat.

Timber harvest prescriptions and methods differ in the extent to which they might promote noxious weed colonization. In general, the smaller the openings created and the least amount of work done in the stand, the smaller the opportunities for weed colonization. In this respect, commercial thinning would pose the lowest risk of spreading weeds, while clearcuts would pose the highest. Ground-based log yarding may promote the spread of weeds more than any other yarding method due to the greater extent of ground disturbance and use of machinery. Design features such as cleaning road construction and logging equipment prior to entering the project area (Design Feature 4-A, Chapter 2) would help to minimize these effects. Cable yarding would have an intermediate effect, and helicopter yarding the least effect due to the overall level of ground disturbance of the three methods.

To reduce the availability of colonization sites for weeds, all decommissioned roads and landings off of specified roads would be seeded with certified weed-free mixes the year of obliteration (Best Management Practices and Soil and Water Conservation Practices). Any mulching agents would also be certified noxious weed free (Design Feature 4-B, Chapter 2).

Indirect effects of project activities could be the possible establishment of new weed populations or the expansion of existing populations. Established weed populations along right-of-ways and water courses on National Forest System lands may provide a source of seeds for infestation. Effects associated with weed population enlargement may include declines in the palatability or abundance of wildlife and livestock forage (Rice and others 1997), declines in native plant diversity (Forcella and Harvey 1983; Tyser and Key 1988; Williams 1997), reductions in the aesthetic value of the landscape, encroachment upon rare plant populations and their habitats, potential reductions in soil stability and subsequent increases in erosion (Lacey and others 1989), and an overall decline of ecosystem health. The potential for the spread of existing noxious weeds and the introduction of new species exists for all alternatives.

Fuels Reduction

Fuel reduction activities are intended to facilitate the achievement of silvicultural objectives while fulfilling the requirements of Forest Plan protection standards.

Some fuels would be treated using mechanical equipment for grapple piling leading to ground disturbance. Additional activity fuels would be treated by jackpot pile and broadcast burning. All fuel reduction activities have some ground disturbance associated with the treatments. Burning may promote weed spread under certain conditions for some species by reducing the density and competitiveness of native species and allowing for weed establishment (Hobbs and Huenneke 1992). Vegetation removal and soil disturbance from fire and associated suppression activities can create ideal conditions for the spread of invasive weeds, which can significantly alter the native species composition of ecosystems (Ingalsbee 2004). As with harvest activities, mitigations would be taken to reduce spread (see Design Features 5, Chapter 2). There is moderate to low risk for the spread of existing noxious weeds and the introduction of new species in this activity depending on the amount of disturbance.

Biomass Removal

Biomass removal for the St. Maries School District Fuels to Schools Project would be a by-product of the proposed fuel treatment. In units where tree tops would be yarded, that material would be processed and decked separately from timber products. There is a low potential for the spread of existing noxious weeds and the introduction of new species with this activity.

Timber Stand Improvement

Approximately 821 acres of pre-commercial thinning is proposed to improve the growing conditions of the selected trees by eliminating competition for light and nutrients. This includes 555 acres of white pine pruning that would be done in areas that are also thinned. Timber stand improvements (TSI) may have direct effects through physical

disturbance. Noxious weeds are particularly adept at colonizing disturbed areas where light levels have increased. Pruning and thinning may have indirect effects though changes to light and moisture regimes. Most pre-commercial thinning and pruning would be done by hand and would have a low amount of further disturbance. Therefore, TSI has a low risk for the spread of noxious weeds.

Reforestation

Conifer seedlings would be planted on approximately 367 acres in areas proposed for regeneration harvest. Planting would supplement the expected natural regeneration. Reforestation in the form of tree planting is expected to reduce the risk of noxious weeds on the ecosystem over the long term. This would occur as the trees overtop and shade out any other competing vegetation including noxious weeds.

Road Reconstruction, Storage, and Decommissioning

Approximately 5.4 or 6.7 miles (depending on alternative) of road on National Forest System lands would be reconstructed to provide access for timber harvest in action alternatives. Reconstruction may include the installation of drain dips and culverts, grading, clearing, dust abatement, and resurfacing. The indirect effects of road reconstruction would be an increase in the potential for the introduction and expansion of weed species, especially into previously inaccessible areas, with increased access. Direct effects can be mitigated for by employing measures to prevent weed colonization (Design Features 5, Chapter 2).

Roads put into Prescription C (long-term storage) may eliminate motorized access while still permitting stock, bicycle, and pedestrian access. This would reduce opportunities for weed spread in the long-term. The reductions in vehicular access would result in a decreased potential for weed transport.

Table 3-42 Proposed Miles of Road Reconstruction for Alternatives B and C

Road #	1900F	1902	1902B	1902C	1498C	3570A	Total
Alternative B	1.0	0.7	1.0	0.3	2.4	1.3	**6.7**
Alternative C	1.0	0.7	1.0	0.3	2.4	0	**5.4**

Access Management and Trail Maintenance

Approximately 19.9 to 20.3 miles of roads would be open to all licensed vehicles and 18.5 to 19.9 miles of roads and trails would be open to vehicles less than 50 inches wide (depending on alternative). Alternatives B and C would:

- Install effective restriction devices throughout the project area.
- Remove the gate on Road 1498. The road is currently open and the proposed action is to leave the road open, so there is no need for the gate.
- Construct 0.2 miles of new trail for motorized vehicles less than 50 inches wide between Roads 1901C and 3590A.
- Convert Bussel Creek Trail 258 (6.5 miles in and outside of the project area) to non-motorized use, remove culverts, and harden stream crossings.
- Designate Lines Creek Historical Trail as open to motorized vehicles < 50 inches wide (3.0 miles).

Alternative B would repair part of the Norton Creek Railroad Grade and designate that part open to motorized vehicles <50 inches wide (2.9 miles). To address concerns about cultural resources only part of the Norton Creek Railroad Grade would be repaired in Alternative C. The remaining 1.4 miles of the Norton Creek Grade would not be designated for motorized use in Alternative C.

Effects of road and trail repairs and maintenance on weed spread would be low and small in scale because most activities would occur in previously disturbed trail and road prisms. However, 0.2 miles of trail construction and portions of proposed trail reconstruction no longer have tread and would have to be created or recreated. Risks in these sections would be higher. The immediate effect of ground disturbance would be to provide establishment sites for weeds. The indirect effects of trail construction and reconstruction would be an increase in the potential for the introduction and expansion of weed species, especially into previously inaccessible areas, with increased access. Direct effects can be mitigated for by employing measures to prevent weed colonization (see Chapter 2).

The proposed conversion of trail use from motorized to non-motorized may reduce the amount of off highway vehicle (OHV) traffic in the area. Reduction of OHV activities by designation of routes may reduce the risk of introduction and spread of non-native/ noxious weeds into the project area.

Pocket Gopher Control

Baiting would be done to control pocket gophers on approximately 367 acres in areas proposed for regeneration harvests. Little to no ground disturbance would occur in the baiting process leading to no potential for spread of non-native invasive species with this activity.

Effects of Alternative B

Alternative B includes Activities Common to Action Alternatives described above and the following activities.

Timber Harvest: 2,137 acres would be treated with commercial timber harvest. The commercial timber harvest is listed in Table 3-43. Harvesting methods include clearcut with reserves, shelterwood seed cut, group shelterwood cut, and commercial thinning. The majority of units would be harvested by cable-skyline (41%) followed by helicopter (33%) and lastly, ground-based (26%) methods (Chapter 2). Timber harvest can differ in the extent to which it might promote noxious weed colonization. In general, the smaller the openings created and the least amount of work done in the stand, the smaller the opportunities for weed colonization. Ground-based log yarding may promote the spread of weeds more than skyline yarding due to the greater extent of ground disturbance and use of machinery. Design features such as washing off-road construction and logging equipment prior to entering the project area, keeping skid trails to a minimum, skidding over slash, and seeding skid trails would help to minimize these effects (Design Feature 4, Chapter 2). However, even with associated weed control methods weed species may colonize disturbed areas. The extent of weed expansion may be small, but is dependent on so many factors that it is impossible to quantify.

Road Construction: Approximately 5.1 miles of system road and 0.5 miles of temporary road would be constructed on National Forest System lands to facilitate timber harvest. Additional 0.2 miles of road construction is proposed across lands owned by Potlatch Corporation. Risks for NNIS would be high. The immediate effect of ground disturbance would be to provide establishment sites for weeds. The indirect effects of road construction would be an increase in the potential for the introduction and expansion of weed species, especially into previously inaccessible areas, with increased access. Direct effects can be mitigated for by employing measures to prevent weed colonization (Design Features 4, Chapter 2).

Effects of Alternative C

Direct and Indirect Effects

Includes the same timber harvest units with the same silvicultural prescriptions as Alternative B, but there would be no road construction. Some of the yarding methods would be different in Alternative C than in Alternative B. The majority of units would be harvested by helicopter (67%), followed by ground-based (18%) methods and by cable-skyline (15%) (Chapter 2). There would be less ground base activities in alternative C therefore, less potential risk of NNIS invasion/spread. Access changes would be the same in Alternative C as they would be for Alternative B with the exception of the Norton Creek ATV route which would be 1.4 miles shorter in Alternative C.

See the table below that compares proposed activities by alternative.

Table 3-43 Comparison of Proposed Activities by Alternative

Proposed Activity	Alternative B	Alternative C
Timber Harvest	2,137acres	2,137 acres
Ground-based	552 acres	389 acres
Cable/Skyline	873 acres	317 acres
Helicopter	712 acres	1,431 acres
Road Construction (System)	5.1 miles	0
Road Construction (Temporary)	0.5 miles	0
Road Reconstruction	6.7 miles	5.4 miles
Fuels treatment total is more than timber harvest acres because some units have more than one type of treatment		

Proposed Activity	Alternative B	Alternative C
Yard Tops	316 acres	273 acres
Lop	1,742 acres	1,766 acres
Slash	181 acres	145 acres
Grapple Pile & Burn Piles	230 acres	175 acres
Hand Fireline	20.2 miles	20.2 miles
Broadcast Burn	307 acres	307 acres
Jackpot Burn	289 acres	295 acres
Timber Stand Improvement (thinning or thinning & pruning)	821 acres	821 acres

Cumulative Effects

Current infestations of noxious weeds are a result of past and current activities in this area. Any ground-disturbing activities associated with these projects may result in the creation of new habitat for noxious weeds. Design criteria exist to limit the spread of weed seed and establishment of new populations, but they are not expected to halt such spread completely.

St. Joe Noxious Weed Control Project EIS (USDA 1999) identifies Road 758 as a potential treatment area in the project area. Additional road surveys in 2006 identified Roads 1498, 1498A, 1498B, and 1498C (PF: NW-2) as potential treatment area. Weed control activities within this area would be scheduled as funding and other priorities allow. Weeds may also be treated in areas not specified in the St. Joe Noxious Weed Control Project FEIS by following the adaptive management strategy outlined within that document.

Even under the No-Action Alternative weed populations are expected to remain stable at best. Other federal activities have built-in features to control the spread of noxious weeds. The overall effect of all activities is expected to result in the gradual increase in weed numbers within the area over time if control methods are not employed. Such increases may not be discernable within the time frame of this project, and will vary depending upon the extent of disturbances.

Consistency with Forest Plan and Regulatory Framework

According to the Idaho Panhandle Forest Plan (USDA 1987) direction, infestations of many noxious weed species including spotted knapweed and meadow hawkweed are so widespread that control would require major programs that are not possible within expected budget levels (USDA 1987 p. II-7). Forest Plan direction is to "provide moderate control actions to prevent new weed species from becoming established" and to treat noxious weeds with an integrated pest management approach. All action alternatives would meet the intent stated in the Forest Plan for moderate control, through the implementation of Design Features 4 in Chapter 2. Any weed control within the project area shall be done in accordance with the principles of integrated pest management, which is also consistent with the Forest Plan. The key to preventing long-term weed establishment is out-year monitoring after project implementation and early treatment of new weed occurrences. New populations of noxious weeds would be treated in accordance with priorities set by the noxious weed program. New invader species would be slated for eradication immediately upon discovery. Other weed infestations would be treated according to the direction in the St. Joe Noxious Weed Project EIS and district priorities. All weed treatments would be monitored for effectiveness and the need for additional treatments. The No-Action Alternative would also meet the intent of the Forest Plan by not creating new habitat for the introduction of noxious weeds.

Old Growth

Differences between Draft EIS and Final EIS

The Draft EIS used a validation process that calculated stands and trees meeting the criteria listed in *Old-Growth Forest Types of the Northern Region* (Green and others 2005) based on basic stand tables from FSVeg and stand exam data based on data recorded at the time of inventory. The validation process used for the Final EIS, utilized the Region 1 FSVeg Old Growth Report in conjunction with the process used in the Draft EIS. With the use of this validation process, an additional two stands (86 acres) were allocated as old growth. Those stands were proposed for harvest in the DEIS (Units 24 and 212) and were removed from the alternatives in the FEIS.

A change in the proposed action from the Draft EIS to the Final EIS included construction of 473 feet/0.09miles of system road construction through allocated old growth to avoid road construction through an area of high potential for mass failure.

Introduction

This section addresses the current allocated old growth related to the Bussel 484 Project Area. This analysis involves one Old Growth Management Unit (OGMU) on the St. Maries portion of the St. Joe Ranger District. This old growth management unit (OGMU 8) was used as the analysis area for old growth related to this project.

Regulatory Framework

The regulatory framework providing direction for the management of forest vegetation, including old growth, is provided through the National Forest Management Act (NFMA) and the Forest Plan for the Idaho Panhandle National Forests (USDA Forest Service 1987).

NFMA provides for balanced consideration of all resources. It requires the Forest Service to plan for diversity of plant and animal communities. The Forest Plan, in compliance with NFMA, establishes Forest-wide management direction, goals, objectives, standards and guidelines for the management of forest vegetation and plant communities.

Direction concerning implementation of NFMA and the Forest Plan can be found in Forest Service Manuals (FSM) and Handbooks (FSH), as well as various written communications from the Forest Service's Washington Office, Regional Office and the Supervisor's Office for the Idaho Panhandle National Forests.

More specifically, direction in the Forest Plan (page II-5) states that "Approximately 10 percent of the Forest will be maintained in old growth as needed to provide for viable populations of old growth dependent and management indicator species. To obtain the desired distribution, the IPNF will be managed to maintain approximately 5 percent of each old-growth unit as old growth where it exists." As part of a Forest-wide process the District(s) identified stands meeting old growth criteria. Stands were then allocated to old growth management to comply with Forest Plan standards.

The Forest Plan standards related to old growth are found in the Forest Plan (page II-29). Forest Plan standard *10a* incorporates the definitions of old growth developed by the Regional Old Growth Task Force, documented in *Old-Growth Forest Types of the Northern Region* (Green and others 2005). In compliance with Forest Plan old growth standard *10a*, the validation process for the Bussel 484 Project used the definitions as outlined in this Regional old growth guide (OG-1). Compliance with standards *10b-i* is discussed later in this report.

Analysis Area and Methods

Analysis of old growth is done on the total area in Old Growth Management Unit(s) (OGMU) that are totally or partially within a project area. The old growth analysis area for the Bussel 484 project is OGMU 8 (St. Maries, 04). This is appropriate for this project because the project area is entirely within this OGMU.

An old growth validation process was completed for this project and the results are discussed in this report. The validation process used new aerial photography, the most current stand data and the Region 1 Old Growth Report (OG-16). New stand exams were accomplished in 2002, 2005 and 2006. The information from these new exams was used in this old growth validation.

The validation process applied the criteria listed in *Old-Growth Forest Types of the Northern Region* (Green and others 2005) to all stands proposed for treatment, all allocated stands in OGMU 8, and all stands in OGMU 8 that had been given an old growth code but not allocated. This process was used to determine the current old growth allocation for OGMU 8. The validation documentation for individual stands, using the most recent data available, is located in the project file (OG-4). A list of stands in the current allocation is in the project file (OG-2).

All acres used in this report, and associated project file documents, should be considered approximate due to such factors as rounding, scale of analysis, delineation and procedural variance between resources evaluating old growth. These differences are insignificant related to evaluating the current status of old growth in this project.

The assessment of proposed treatment stands involved a review and comparison of the most current stand data (V-1) with the criteria listed in *Old-Growth Forest Types of the Northern Region* (Green and others 2005) (V-17). This data validated that the stands proposed for treatment did not meet criteria for allocation as old growth.

Various special use codes are used to identify allocated and additional old growth. The old growth special use codes identified within this project area related to the old growth validation process were codes 2, 9, 10, 11 and 12. Code 2 are stands that meet minimum criteria for allocated old growth and also meet criteria used to identify Ancient Cedar definitions. Code 9 are stands that are retained in the old growth allocation that have been field examined and meet the minimum criteria or were previously identified by an interdisciplinary team as old growth. Code 10 are stands retained in the old growth allocation which were photo identified as likely to meet minimum criteria, but <u>not</u> field verified. Code 11 are stands identified as Recruitment or step-down stands that are retained in the allocation to create large blocks, corridors, or logical old growth landscape management units. Code 12 are stands identified as Additional Existing Old Growth that has been field examined and meets Old Growth minimum criteria, but <u>not allocated</u> to Old Growth Management under the 1987 Forest Plan strategy.

The validation process and assessment of allocated old growth stands within this OGMU resulted in the following adjustments in the old growth allocation. Three stands previously included in the allocation did not meet current minimum criteria as listed in *Old-Growth Forest Types of the Northern Region* (Green and others 2005) and were removed (approximately 47 acres) from the old growth allocation. Thirteen allocated old growth stands had a change in their old growth classification but were retained in the allocation. Three changed from code 9 to code 11, ten changed from code 11 to code 9. Ten stands that previously had no old growth special use code assigned that met minimum qualifications (approximately 477 acres) were added to the allocation. Additionally, eight stands identified as non-allocated other old growth (approximately 325 acres) are now allocated. As a result of this validation process OGMU 8 had a net increase in allocated old growth of approximately 755 acres (OG-15). The FSVeg and TSMRS data bases were updated to reflect these changes.

Affected Environment

The Bussel 484 Project involves one Old Growth Management Unit (OGMU) on the St. Maries portion of the St. Joe Ranger District, OGMU 8 (St. Maries, 04). OGMU 8 has approximately 13,083 acres in National Forest System lands, with approximately 2,528 acres (19%) of those acres allocated to old growth management. All allocated old growth stands in OGMU 8 are located fully or partially within the project area. See old growth maps (Map 13 and Map 14) in Appendix A.

Validation and monitoring of old growth is an ongoing process. This review and validation process identified additional acres that meet the criteria as described in *Old-Growth Forest Types of the Northern Region* (Green and others 2005) and other acres that were previously allocated but no longer meet the minimum criteria. Changes that were made in the FSVeg and TSMRS databases are documented in the project file (OG-4). No treatment is proposed in stands that are known to meet the minimum criteria for Old Growth. All motorized vehicles have access on 10 miles of open road through or adjacent to allocated old growth stands.

Environmental Consequences

Alternative A - (No Action)

<u>Direct, Indirect and Cumulative Effects</u>

There would be no direct/indirect or cumulative effects resulting from Alternative A, No Action, on either existing allocated old growth or other stands known to meet old growth criteria. Forest Plan standards for old growth retention would continue to be met. All motorized vehicles would still have access on approximately 10 miles of open road through and adjacent to allocated old growth stands.

There would be no direct or indirect effects from current and reasonably foreseeable activities including weed control, road and trail maintenance, pocket gopher control, land exchange, transmission line maintenance, fire suppression, activities on private land and public recreation (i.e. berry picking, hiking, hunting, wood gathering and similar activities). No cumulative effects on allocated old growth are expected as a result of these other activities.

Alternatives B (Proposed Action)

Direct and Indirect Effects

Alternative B of this project would have a direct effect on allocated old growth. This alternative includes the construction of 473 feet or 0.09 mile of system road construction that would affect an estimated 0.4 of an acre or 0.7% of an allocated old growth stand (OG-17). The road would be located to have minimal affect on the allocated old growth stand. Based on the location and length of the road construction, the effect on old growth Patch 11 (595 acres) would be approximately 0.07% and the effect on the allocated old growth within OGMU 8 (2,528 acres) would be approximately 0.02% (OG-17). After the construction and use of this road, it would be placed into Road Management Prescription C (long-term storage). Location of the proposed road construction is shown on Map 17 in Appendix A.

Approximately 4.04 miles of existing road that are currently in Road Management Rxs A, B, and C through or adjacent to allocated old growth would be decommissioned (Road Rx D) (OG-21).

No other activity or timber harvest is proposed within allocated old growth, but road management prescription changes may have indirect effects on old growth. When road management prescriptions are implemented full-size motorized vehicles would have access on five fewer miles of road that are adjacent or through allocated old growth. This may result in the possibility of slightly reduced indirect effects to old growth from fire wood gatherers cutting trees along open roads.

There would be no direct or indirect effects from current and reasonably foreseeable activities including weed control, road and trail maintenance, pocket gopher control, land exchange, transmission line maintenance, fire suppression, activities on private land and public recreation (i.e. berry picking, hiking, hunting, wood gathering and similar activities).

Cumulative Effects

There would be no cumulative effects from reasonably foreseeable activities including weed control, road and trail maintenance, pocket gopher control, land exchange, transmission line maintenance, fire suppression, activities on private land and public recreation (i.e. berry picking, hiking, hunting, and similar activities).

Alternatives C

Direct, Indirect and

No activity or timber harvest is proposed within allocated old growth, but road management prescription changes may have indirect effects on old growth. When road management prescriptions are implemented full-size motorized vehicles would have access on five fewer miles of road that are adjacent or through allocated old growth. This may result in the possibility of slightly reduced indirect effects to old growth from fire wood gatherers cutting trees along open roads. Approximately 4.04 miles of existing road that are currently in Road Management Rxs A, B, and C through or adjacent to allocated old growth would be decommissioned (Road Rx D) (OG-21). Forest Plan standards for old growth retention would continue to be met.

Cumulative Effects

There would be no direct or indirect effects from current and reasonably foreseeable activities including weed control, road and trail maintenance, pocket gopher control, land exchange, transmission line maintenance, fire suppression, activities on private land and public recreation (i.e. berry picking, hiking, hunting, wood gathering and similar activities).

Consistency with Forest Plan and Regulatory Framework

Old growth standard *10a* in the Forest Plan states: "A definition for old growth is being developed by the Regional Task Force and will be used by the Forest when completed." In compliance with Forest Plan old growth standard *10a*, the definitions of old growth developed by the Regional Old Growth Task Force, documented in *Old-Growth Forest Types of the Northern Region* (Green and others 2005) have been incorporated into Forest Plan standard *10a* and were used in the validation and analysis process of old growth in this project.

Old Growth standard *10b* in the Forest Plan directs that we "Maintain at least 10 percent of the forested portion of the IPNF as old growth." The 2004 IPNF Forest Plan Monitoring Report (OG-5) showed approximately 12.1% of the forested acres to be retained as old growth. An assessment (OG-6) of the Idaho Panhandle National Forest in April, 2006, showed approximately 11.8% of the forested lands on the IPNF met old growth criteria using the Forest Inventory and Analysis (FIA) data. This estimate was derived after applying adjustments to years to grow to breast height (4.5 feet) to FIA data (OG-7). In July of 2006, a review of Old Growth Assessments on the IPNF (OG-8) disclosed that FIA data estimated 11.8% of forested acres were old growth, and that mapped allocated old growth stands were 12.1% of the forested acres on the IPNF. In May of 2007, an updated report of estimates of Old Growth in the Northern Region and the component National Forests (OG-9) disclosed that the IPNF had approximately 11.8% old growth. Although these studies were developed at different landscape scales, they demonstrate consistency in estimates of old growth on the IPNF and compliance with Forest Plan Old Growth standard *10b.*

Old growth standard *10c* in the Forest Plan states: "Select and maintain at least five percent of the forested portion of those old-growth units that have five percent or more existing old growth." The Bussel 484 Project involves one Old Growth Management Unit (OGMU): OGMU 8 (St. Maries, 04). An old growth validation was completed for this project, discussed earlier. This old growth management unit has approximately 13,083 acres in National Forest System lands, with 2,528 acres (approximately 19%) allocated to Old Growth Management. The current old growth allocation within this OGMU meets Forest Plan Old Growth standard *10c* for all alternatives.

Old growth standard *10d* states: "Existing old-growth stands may be harvested when there is more than 5 percent in an old-growth unit, and the Forest total is more than 10 percent." Timber harvest is not proposed in any allocated old growth. None of the stands proposed for timber harvest meet minimum criteria for old growth. All alternatives in this project are in compliance with the Forest Plan Old Growth standard *10d*.

Old growth standard *10e* states: "Old growth stands should reflect approximately the same habitat type series distribution as found on the IPNF." Compliance with this Forest Plan standard is disclosed on page 72 in the Old Growth chapter of the 2004 IPNF Forest Plan Monitoring Report (OG-5). The habitat type series for allocated old growth within this OGMU is generally represented by the habitat type series available within this project area. See Table 3-37 in the *Forest Vegetation* section of this document. All alternatives in this project are in compliance with the Forest Plan Old Growth standard *10e*.

Old growth standard *10f* describes desirable patch size stating: "One or more old-growth stands per old-growth unit should be 300 acres or larger…..The remaining old-growth management stands should be at least 25 acres in size. Preferred size is 80 plus acres." Patch size for the OGMU involved with this project is discussed below.

In OGMU 8 (St. Maries, 04) the allocated old growth occurs in eleven patches. These patches range in size from 70 to 595 acres, and average approximately 230 acres. All eleven patches are greater than 25 acres. Of these, nine patches are greater than 80 acres. Of the patches greater than 80 acres, eight are greater than 100 acres. Of those seven patches greater than 100 acres, two are greater than 300 acres. The largest patch in this OGMU is 595 acres. All these patches are comprised of multiple stands, and these stands are all less than one mile from the other stands comprising the patch. As discussed above, OGMU 8 (St. Maries, 04) is in compliance with the Forest Plan Old Growth standard *10f*. A map identifying allocated old growth patches, comprised of one or more stands, is in the project file (OG-10), as well as a list showing component stands of each patch (OG-11). Also see old growth Maps 13 and 14 in Appendix A.

Old growth standard *10g* states: "Roads should be planned to avoid old-growth management stands to maintain unit size criteria." Alternative B includes road construction in allocated old growth. The road would be located to have minimal affect on the allocated old growth stand. This road is being proposed to meet other resource needs of the project. In Alternative C there no new system road construction or temporary road construction is proposed within allocated old growth stands. All alternatives in this project are in compliance with Forest Plan Old Growth standard *10g*.

Old growth standard *10h* states: "Existing grazing allotments will be honored; …..New allotments in old-growth will not be issued." There are no grazing allotments within the Bussel 484 project area, and no new allotments are proposed. All alternatives in this project are in compliance with Forest Plan Old Growth standard *10h*.

Old growth standard *10i* states: "…goals for lands to be managed as old-growth within those lands suitable for timber production are identified in the management area prescriptions." Compliance with this Forest Plan Old Growth standard is disclosed on pages 71 and 72 in the Old Growth chapter of the 2004 IPNF Forest Plan Monitoring Report (OG-5). As disclosed in the Forest Plan Monitoring Report, the IPNF not only is meeting but is exceeding the Forest Plan old growth standard *10i.*

Specific goals, objectives and standards for old growth management as described in the Forest Plan on pages II-5 and II-29 are met with all alternatives in this project.

Plant Species at Risk

Differences between Draft EIS and Final EIS

Numbers were changed to reflect changes in alternatives as described in the Introduction for the FEIS.

Introduction

Activities associated with timber harvest, road construction/reconstruction, controlled burning, watershed rehabilitation, and pre-commercial thinning have the potential to impact Threatened, Endangered, Proposed, and Sensitive (TES) plants. Effects on population viability from disturbance events (natural or human-caused) are hard to quantify with certainty for all TES plant species and species of concern. Specific knowledge of population biology and species ecology is not yet known for several species, particularly the sensitive moonworts and certain orchids. Much of the current knowledge regarding TES plant species is based on observational and even anecdotal information. Literature and monitoring reports for several species, including deerfern (Blake and Ebrahimi 1992), Constance's bittercress (Lichthardt 1998 and 2000), and Idaho barren strawberry (Crawford 1980), provide a greater understanding of the relationship of habitat disturbance to the integrity of species populations.

The risk of adverse effects on TES plants from activities varies with treatment type, timing and extent of treatment, habitat suitability, and the species. Plant surveys and design features are designed to protect populations and suitable habitat. Activities with effects that could lead to loss of population viability or trend toward federal listing would have the highest risks associated with them. Other activities may impact individual plants but are not likely to adversely affect population viability and as such are low to moderate risk activities. Small changes in the light regime, moisture levels, or moderate soil disturbance can impact individuals or populations of species dependent on specific successional habitats, soil fungi (mycorrhizae) associations, or canopy closure. Observations and monitoring information indicate that some activities may have little, or even positive effects on some species, such as deerfern (Blake and Ebrahimi 1992) and Constance's bittercress (Crawford 1980).

The purpose of this analysis is to determine if alternatives would adversely impact TES plants that may occur in the Bussel 484 Project Area, to insure that the alternatives do not contribute to the loss of rare plant population viability, and to insure compliance with Forest Service and other federal policies. Indicators used to measure effects on sensitive plants and suitable habitat include: predicted canopy reduction due to harvest treatments, the extent of ground disturbance, proximity of proposed activities to known occurrences and suitable habitat, and the predicted reduction of fuel loads.

Regulatory Framework

Protection of plant species deemed threatened, endangered, or rare (Forest Service "sensitive") and protection for population viability are determined by federal legislation, regulations, policy, and direction. This regulatory framework includes the National Environmental Policy Act (1969); the Endangered Species Act (1973), as amended; the National Forest Management Act (1976); Forest Service Manual (2672.1 - 2672.43); Idaho Panhandle National Forests, Forest Plan (USDA 1987); and direction from the Washington Office and Regional Watershed, Wildlife, Fisheries, and Rare Plant program.

Analysis Area

The geographic scope of analysis for rare plant species in this project is the Bussel 484 Project Area. Geographic scope of potential effects (direct, indirect, and cumulative) is determined by a combination of factors including: geographic location, the scope of the proposed action, resources and species which may be present, consequences and scope of effects, and the ability to measure effects. Scope of the action and potential for adverse effects determine the extent of analysis necessary. This analysis considers short and long-term management as it may affect known or suspected populations of TES plant species as well as their potential habitat.

Analysis Methods

Plant species can be assigned to one or more rare plant guilds, which are groups based on similar habitat requirements and are useful for the purpose of analysis (Mousseaux 1995). For the St. Joe District, the rare plant guilds are: aquatic, deciduous riparian, peatlands, wet forest, moist forest, dry forest, and sub-alpine. Rock seeps and springs are another habitat that can support certain TES species, but they can occur across all guilds and are not identifiable at a coarse scale. A complete description of all guilds is located in the project file (B-1).

Based on current information regarding preferred habitat and successional state for species within the different guilds, the District TSMRS (Timber Stand Management Record System) database indicates the amount of highly suitable rare plant habitat that may be present in the project area as indicated by the habitat type of each stand. In addition, site-specific information from timber stand examination records, aerial photographs, topographic position, existing habitat and survey information, personal knowledge and professional judgment were used in analysis. Evaluation of known sites for TES and species of concern (SOC) plants was accomplished using District sensitive plant records, and Idaho Department of Fish and Game Conservation Data Center (ICDC) Element Occurrence records.

Field surveys for TES plants were conducted in 2005 and 2006 for the Bussel 484 Project. Regional direction (Leonard 1992) states that the need for and extent of field reconnaissance should be commensurate with the risk associated with the project and species involved and with the level of knowledge already in hand. Field surveys were conducted in all areas identified for project activities that contain high-potential suitable habitat for TES species. Surveyors walked through the proposed activity areas with the potential to contain TES plants during the growing season of those species. A general survey was conducted, with more time being spent in special habitats. When sensitive plant individuals were found, intensive searches were conducted within the area. Species presence is assumed for all highly suitable habitats and field surveys either validate or negate presence.

Affected Environment

The sub-basins of northern Idaho contain varied and diverse habitats and plant communities. Of the estimated 1,200 to 1,500 plant species known or thought to occur here, about ten percent are considered rare or uncommon.

Queries of the district stand database indicate that the only high-potential habitat occurring within areas of proposed activities is within the moist forest and wet forest guilds. High-potential dry forest, sub-alpine, deciduous riparian, aquatic, and peatland habitats do not occur within proposed activity areas. A list of wet and moist forest species and their habitats is included in the project file (B-1) as is a complete list of sensitive species and species of concern (B-2).

Road construction, timber sales, recreational use, vehicular traffic, grazing, and natural events have all contributed to an encroachment of weeds into the area, primarily along roads, in open meadows and in disturbed areas.

Threatened Plant Species

There are no known sites of federally listed plants on the Idaho Panhandle National Forests (IPNF). The U. S. Fish and Wildlife Service (USDI 2006) identifies two threatened plant species that may occur within Shoshone and Latah Counties: water howellia (*Howellia aquatilis* A. Gray) and Spalding's catchfly (*Silene spaldingii* Wats.). A threatened species is any that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range. Water howellia (*Howellia aquatilis*) and Spalding's catchfly (*Silene spaldingii*) are suspected on the District, meaning that these species are believed to have potential to occur, but to date have not been found.

Water howellia - a member of the family Campanulaceae, has the potential to occur on the St. Joe Ranger District. According to the Conservation Strategy for *Howellia aquatilis* (USDA 1994), there are 110 known occurrences of the species. Most occurrences are in Montana and Washington, with only one known occurrence in Idaho in Latah County. Water howellia occurred historically on the Forest but is believed to have been extirpated.

Water howellia is an annual aquatic species restricted to small, seasonal, pothole ponds or the quiet water of abandoned river oxbows. It occurs at elevations from 10 feet in Washington to 4,420 feet in Montana. The species reproduces only by seed. Germination occurs in October, presuming the plant's habitat has dried sufficiently to expose the seeds to oxygen. Because of this restrictive habitat requirement, population numbers in a given year are directly influenced by the extent of pond drawdown at the end of the previous growing season (USDA 1994).

Spalding's catchfly - a member of the family Caryophyllaceae, is suspected to occur in the IPNF. It is known from 52 sites in west-central Idaho, northwestern Montana, eastern Oregon, eastern Washington and British Columbia. The total number of known individuals is around 16,500 (USDI 2001).

Spalding's catchfly is a long-lived perennial species that reproduces only by seed (Lichthardt 1997). Individual plants often exhibit long periods of dormancy (one to three years), and may even experience dormancy within a growing season (Lesica 1997). Its habitat is in dry grasslands and grassland inclusions in ponderosa pine and Douglas-fir forest. Suitable habitat for this species is typically dominated by fescues (*Festuca* species), blue bunch wheat grass (*Pseudoroegneria spicata*) and other bunchgrasses, but also has a high density of forbs. Some sites may have large shrub thickets of *Symphoricapos albus*, *Physocarpus malvaceus*, or *Rosa* spp. Soil types on which it has been found include loam, silty loam, granitic, loamy basaltic and loess (USDI 2000). Soils in its habitat are characterized as deep to moderately deep.

Neither the Water howellia, nor the Spadling's catchfly where found within the Bussel 484 Project Area boundaries.

Sensitive Plant Species

Sensitive species, as determined by the Regional Forester (USDA 2004), are those for which population viability is a concern. This can be indicated by a current or predicted downward trend in population numbers or suitable habitat, which would reduce the species' existing distribution. Twenty-four of these species are known or thought to occur on the St. Joe Ranger District (B-2). Surveys done in 2005 and 2006 discovered over fifty combined sensitive plant occurrences of green bug on a stick moss (*Buxbaumia viridis*) and naked mnium moss (*Rhizomnium nudum*) within the project analysis area. One unit originally proposed for treatment (Unit 137) which had a several occurrences of both species present was dropped during the interdisciplinary process in order to protect the plants. Nineteen occurrences of green bug on a stick moss (*Buxbaumia viridis*) are located adjacent or within proposed treatment units. Nine occurrences of naked mnium moss (*Rhizomnium nudum*) are located within or adjacent to proposed treatment units.

Species of Concern

Along with threatened, endangered, and sensitive plants, the Forest also tracks 23 Forest species of concern (B-2). These species are considered to be secure at the global, Regional, and state levels but may be at risk at the Forest level. While biological evaluations are not required to address species of concern, they are addressed in effects analysis (per the National Forest Management Act) when viability within the planning unit is an issue. No plant Species of Concern occurrences fall within the proposed activities of the Bussel 484 Project Area.

Environmental Consequences

Effects Common to Action Alternatives

Direct and Indirect Effects

Field surveys for TES plants were conducted in 2005 and 2006 for the Bussel 484 Project. In some places, occurrence of *Buxbaumia* shares the same area as one of the *Rhizomnium* occurrences. If one of the action alternatives is selected these occurrences would be avoided with buffers (of one site tree height around the occurrence) during project implementation (see Table 2-18). Impacts from the action alternatives are not expected due to the buffering and avoidance of sensitive species.

Any occurrences that are deemed necessary to ensure species and population viability against a potential trend towards federal listing would be protected. The importance of a population is based on a variety of factors such as

size of population, number of known sites, ranking, and sensitivity to disturbance. These practices are assumed to be an effective conservation strategy. Some isolated individuals or occurrences, not deemed critical to population viability, may be impacted by activities. Occurrences discovered after surveys and prior to project implementation would have mitigation measures designed by the District Botanist to ensure that species and population viability are maintained (see Design Feature 6 in Chapter 2).

High-potential dry forest, sub-alpine, deciduous riparian, aquatic, and peatland habitats do not occur within proposed activity areas. Therefore, there would be no direct or indirect effects on these habitats and their associated rare species.

An indirect effect of project activities may be the expansion of noxious weed populations. Such expansions would likely remain confined to areas of disturbance and high light levels. However, the possibility exists, that if left unchecked they could spread into surrounding habitats and ultimately threaten sensitive plants, should they occur in the area. The Noxious Weed section of this document discusses weed expansion in more detail. Weed treatment and monitoring is likely to occur and would serve to decrease weed populations in size. Noxious Weed treatments would be conducted in accordance with the St. Joe Noxious Weed Control FEIS (USDA 1999). See Design Features 4 (E) in Chapter 2. Known TES plant occurrences would be buffered from weed treatments and are not expected to suffer adverse impacts. Noxious weed treatments are expected to improve or maintain the quality of habitat which may ultimately benefit TES plant species. Timber harvest and road building may also indirectly affect sensitive plant populations by opening up formerly inaccessible or unattractive areas.

Timber Harvesting

Timber harvest may directly eliminate individual plants or populations through physical disturbance and damage or eradicate soil mycorrhizae upon which many plant species depend. Canopy reduction can affect certain TES plants by changing light and moisture regimes. The effects threshold for canopy reduction has not been quantified for most TES plants, but is generally thought to be about 50 percent; below which effects could be minimal and above which effects could be evident. The higher the percent canopy removed, the greater the potential risk to TES plants in suitable habitat. The limited data and observations available indicate that many species in the moist and wet forest guilds are intolerant of major canopy removal (Lichthardt 1998; Greenlee 1997).

Most timber harvest for the Bussel 484 Project would take place in moist forest habitats, so most effects would be confined to moist forest guild species. Design features for all action alternatives would protect documented occurrences and mitigate for new ones discovered prior to implementation (Design Feature 6).

Indirectly, changes in fuel loading, duff levels, moisture regime, and light levels may impact TES plants and their habitat. Site preparation such as controlled burning or slash treatment associated with post harvest activities could also affect TES plants or habitat. While timber harvest has the potential to adversely affect rare plants, it may not always do so. Effects vary according to species, harvest method, and harvest prescription.

Helicopter yarding results in little ground disturbance and poses the least risks to TES plants and habitat of the three yarding systems. Cable-skyline yarding poses intermediate risks, and ground-based yarding and skidding the highest due to direct physical impacts, soil compaction, and soil displacement.

Road Reconstruction, Storage, and Decommissioning

Road reconstruction and reconditioning would take place in both action alternatives. Approximately 6.7 to 5.4 miles of road reconstruction is proposed. Road reconstruction would occur in existing road prisms which are already disturbed and are of very low habitat suitability. Certain TES plant species have the ability to colonize disturbed sites like road cuts from adjacent occupied habitat. However, these occurrences rarely constitute a viable population. Often they are individual plants that are part of, or isolated from, a larger "meta-population" in the vicinity. Therefore, these activities pose low risk to TES species and habitat.

An additional 20.2 miles of long-term storage (Rx C) and 10.7 miles of decommissioning (Rx D) would take place in the action alternatives. These activities are expected to pose a low risk to rare plant species or habitat because they would be occurring in previously disturbed areas.

Fuels Treatment

Some fuels would be treated using mechanical equipment for grapple piling. Machine piling of slash in suitable habitat can range from a low to high risk of effect due to the direct physical disturbance and the concentration of

heat under the piles. However, many of these areas will be disturbed during harvest activities prior to fuel treatments. Additional activity fuels would be treated by jackpot pile and broadcast burning. Jackpot pile and broadcast burning would be a low risk to TES plant species, as long as slash piles were not placed directly on a TES plant occurrence. Low or even mixed severity fire in suitable TES plant habitat can be beneficial to certain TES plants, yet detrimental to others depending upon a variety of factors like fire intensity, the ability of the species to survive the event, and competition in early successional habitat.

Firelines would expose mineral soil for a minimum of 12 inches and a maximum 24-inches along the entire length of the fireline. Much of these areas would be disturbed during harvest activities. Firelines are a low risk to TES plant occurrence due to being in previously disturbed areas and preventing the spread of fire.

Biomass Removal

Biomass removal for the St. Maries School District Fuels to Schools Project would be a by-product of the proposed fuel treatment. In units where tree tops would be yarded, that material would be processed and decked separately from timber products for the Fuels to School Project. As this is a by-product of the fuels treatment it would have no additional risks to TES plants.

Reforestation

Conifer seedlings would be planted on approximately 367 acres in areas proposed for regeneration harvest. Planting would supplement the expected natural regeneration. Planted conifer seedlings would enhance diversity, assure timely reforestation, and contribute to long-term desired habitat conditions. Planting would occur in disturbed area with low TES plant potential. Damage is most likely to occur from trampling during planting. If TES species are found in the affected areas plant sites will be flagged and buffered (see Design Feature 6 in Chapter 2).

Access Management and Trail Maintenance

Approximately 19.9 to 20.3 miles of roads would be open to all licensed vehicles and 18.5 to 19.9 miles of roads and trails would be open to vehicles less than 50 inches wide (depending on alternative). Alternatives B and C would:

- Install effective restriction devices throughout the project area.
- Remove the gate on Road 1498. The road is currently open and the proposed action is to leave the road open, so there is no need for the gate.
- Construct 0.2 miles of new trail for motorized vehicles less than 50 inches wide between Roads 1901C and 3590A.
- Convert Bussel Creek Trail 258 (6.5 miles in and outside of the project area) to non-motorized use, remove culverts, and harden stream crossings.
- Designate Lines Creek Historical Trail as open to motorized vehicles < 50 inches wide (3.0 miles).

Alternative B would repair part of the Norton Creek Railroad Grade and designate that part open to motorized vehicles <50 inches wide (2.9 miles). To address concerns about cultural resources only part of the Norton Creek Railroad Grade would be repaired in Alternative C. The remaining 1.4 miles of the Norton Creek Grade would not be designated for motorized use in Alternative C.

Effects of road and trail repairs and maintenance on plant species at risk would be low and small in scale because most activities would occur in previously disturbed trail and road prisms. Known plant species at risk occurrences would be buffered from treatment and are not expected to suffer adverse impacts. However, 0.2 miles of trail construction and portions of proposed trail reconstruction no longer have tread and would have to be created or recreated. Risks in these sections would be higher. The immediate effect of ground disturbance would be to provide establishment sites for weeds and may impact some isolated individuals or occurrences, not deemed critical to population viability. The indirect effects of trail construction and reconstruction would be an increase in the potential for the introduction and expansion of weed species, especially into previously inaccessible areas, with increased access. Direct effects can be mitigated for by employing measures to prevent weed colonization (see Chapter 2).

The proposed conversion of trail use from motorized to non-motorized may reduce the amount of off highway vehicle (OHV) traffic in the area. Reduction of OHV activities by designation of routes may reduce the risk of introduction and spread of non-native/ noxious weeds into the project area. Also the change from motorized to

non-motorized may reduce the amount of none authorized vehicles into sensitive meadow and riparian areas. These fragile areas are easily damaged by high disturbance activities such as OHV activity. On going research through restoration projects across the Pacific Northwest are presenting data that shows that disturbance in these fragile areas do not naturally restore themselves even after several decades without additional disturbance. One such project in Mount Rainier National Park showed that even 60 years after an activity had stopped occurring in a meadow that some trails and other recreational uses areas "still remain below grade and are easily recognized by topographic or vegetation differences from adjacent areas" (Natural & Cultural Resources Division 2004). Several plant species at risk can be found in meadow habitats and on the fringes of moist seeps areas that mimic meadow conditions. Once damaged the costs and time to restore these fragile areas back to a functional state would take years. According to Kusler, restoration times vary with the types of meadows and soils. Some may be brought back into functionality in as little as three years where others "dependent upon mature soils may take hundreds or thousands of years" (Kusler 2006). The change to non-motorized would give additional protection to these fragile habitats.

If TES species are found in the affected areas plant sites will be flagged and buffered (Design Feature, Chapter 2).

Pocket Gopher Control

Baiting may be done to control pocket gophers on approximately 367 acres that are proposed for regeneration harvests, if needed to protect regeneration. Baiting would include placing either 0.5% strychnine treated oats or 2.0% zinc phosphide oats into pocket gopher tunnels by hand. This treatment would protect both natural and artificial regeneration from pocket gopher damage during establishment. An initial treatment would be followed by additional treatments, if needed, to minimize losses in the regeneration and meet stocking objectives. Research on both treatment methods shows little to no uptake or translocation by plants (B-7: Pocket Gopher Control Biological Evaluation). Pocket Gopher Control is a low risk to TES plant occurrence due to being in previously disturbed areas. However an indirect effect to rare plants would be from trampling. Known sensitive plant sites that fall within the treatment area would be flagged and buffered (Design Feature 6, Chapter 2).

Timber Stand Improvement

Approximately 821 acres of pre-commercial thinning is proposed to improve the growing conditions of the selected trees by eliminating competition for light and nutrients. This includes 555 acres of white pine pruning that would be done in areas that are also thinned. Precommercial thinning would occur in previously harvested immature stands to improve or accelerate growth and form of the trees retained in the stand. Precommercial thinning would generally occur in areas with low probability of providing habitat for sensitive species. Timber stand improvements may directly eliminate individual plants through physical disturbance and damage or eradicate soil mycorrhizae upon which many plant species depend. While it is possible that undetected individuals of *Botrychium* sp. could be impacted, no other sensitive species are expected to occur in such habitat. Effects to *Botrychium* species would likely be restricted to damage of seasonal, above-ground vegetation. There is no evidence that such removal adversely affects individual plants (B-8). Pruning and thinning (TSI) may have indirect effects though changes to light and moisture regimes. The effects threshold for canopy reduction has not been quantified for most TES plants, but is generally thought to be about 50 percent; above which effects could be evident and below which effects could be minimal. TSI work, in most cases will maintain a 50% or greater canopy cover. TSI may also indirectly improve habitat for rare plants by decreasing fuel loads for high intensity fire and increasing the over health of a stand. TSI is a moderate to low risk for TES plant species. If TES species are found in the affected areas plant sites will be flagged and buffered (see Design Feature 6 in Chapter 2).

Aquatic Habitat Improvement: Road Decommissioning, Stream Crossing Rehabilitation, Riparian Planting, Large Woody Debris Placement, and Fish Migration Barrier Removal

Over 60% of the TES plant species in the St. Joe Sub-basin can occur in riparian areas. Full road prism obliteration could affect some TES plants in suitable habitat, especially riparian areas. Direct impacts from equipment can occur above the top of the cut slope and below the bottom of the existing fill as the slope is returned to a stable position. However, the actual amount of habitat affected along any road prism would be small and present little risk for any TES plant species or habitat. Removal of stream crossings and culverts (fish migration barriers) also takes place in previously disturbed sites. Mechanical equipment would be used to place 100-200 cover logs in upper Bussel Creek and 100-200 cover logs would be placed, by helicopter, in Bear Creek to increase stream cover and improve fish habitat where it is appropriate for the channel size. Existing sensitive plant populations in these areas are rarely viable populations and often consist of individual plants that are part of, or

isolated from, a larger "meta-population" in the local vicinity. The long-term effects of these treatments could be beneficial to TES plants due to improved channel stability and riparian community habitat.

Alternative A - No Action

Direct and Indirect Effects

There are no known direct effects from the No-Action Alternative. Indirectly, there may be more risk to TES plants and habitat due to an increasing fire hazard resulting from fuel accumulation. Fires have an array of effects on TES plant species ranging from beneficial to detrimental, depending on factors like fire intensity, the ability of the species to survive the event, and competition in early successional habitat. The ability to analyze these effects for all sensitive plant species is limited given our current knowledge.

A few TES plant species inhabit earlier seral habitats established by fire within the last 50 years, or in habitats that likely had frequent historical fires. It appears that these species are at least tolerant of more open forest conditions, and natural disturbance events such as fire. Species like Idaho barren strawberry, western star flower, and Constance's bittercress are known from more open, mesic forest habitats that may have experienced recent disturbance. Indications are that survival of Constance's bittercress after fire may be dependent on the availability of moist microsites.

Dry, open forest habitats historically have had a higher fire frequency of non-stand-replacing fires, than the moist and wet habitats. Species found within these habitats may therefore have higher survival rates following fire activity.

Clustered lady's slipper can be found in drier habitats (more typical to moist forest) that historically experience a more frequent fire regime. However, this species is threatened from high-intensity wildfire that removes the duff layer. Such fire activity has been documented to extirpate populations of clustered lady's slipper; however, individual plants survived areas that experienced low- to moderate-intensity fire (Greenlee 1997). It was noted that reproduction for this orchid following these events was reduced.

Many moist forest, dry forest, and wet forest guild species have populations in mid and later successional habitats, preferring more closed canopy conditions. Some of these species such as moonworts and orchids have factors such as obligate soil mycorrhizae relationships that are likely to be affected by increased light (canopy reduction) and moderate to intense (duff-replacing) fires. Stand-replacing fires were an important part of ecosystem processes in northern Idaho prior to the beginning of suppression efforts in the 1930s. While not much is known about the historic condition of rare plant communities, it is evident that with the decrease in the quality and amount of highly suitable habitats, and increase in fragmentation due to human activities, that the ability of rare plants to re-colonize following disturbance has been reduced.

Species like maidenhair spleenwort and chickweed monkeyflower, which are found in seasonally moist moss mats and rock seeps are not likely to be affected by stand-replacing fires as their habitat is generally devoid of fuels that can carry a fire.

Cumulative Effects

Under Alternative A, susceptibility of the landscape to stand-replacing wildfire may increase due to increased fuel loading. Such fires would have a detrimental effect on most TES species in the moist and wet guilds as few species are adapted to these types of events. However, the time scale of such events is unpredictable. Therefore, for listed species, this alternative would have no effect, and for sensitive plant species/guilds this alternative would have no impact.

Past activities on federal and other lands including fire, road construction, and timber harvest have likely affected rare plant populations and habitat. Future activities within the project area on other lands are likely to include road construction and associated activities.

All proposed and future ground-disturbing activities on National Forest lands, except wildfire suppression, are evaluated through surveys and biological assessments/evaluations as to their impact on TES plant species.

Alternative B

Direct and Indirect Effects

Field surveys for TES plants were conducted in 2005 and 2006 for the Bussel 484 Project Area. These surveys revealed over fifty combined sensitive plant occurrences of green bug on a stick moss (*Buxbaumia viridis*) and naked mnium moss (*Rhizomnium nudum*) within the project analysis area. Unit 137, originally proposed for treatment had a several occurrences of both species and was subsequently dropped during the interdisciplinary process. Nineteen occurrences of green bug on a stick moss (*Buxbaumia viridis*) are located adjacent or within proposed treatment units. Nine occurrences of naked mnium moss (*Rhizomnium nudum*) are located within or adjacent to proposed treatment units. All of these sites have buffers either marked or proposed (Table 2-18).

Alternative B would directly impact approximately 1,635 acres of moist forest guild habitat and 212 acres of wet forest guild habitat through harvesting (B-1). Harvesting methods within high-potential habitat would include 33 acres of clearcut with reserves (2%), 32 acres of shelterwood seed cut (2%), 635 acres of group shelterwood cut (34%), and 1,148 acres of commercial thinning (62%). The majority of units would be harvested by cable-skyline (39%) followed by helicopter (32%) and lastly, ground-based (29%) methods (Chapter 2).

In addition there would be 5.1 miles of new system road and 0.5 miles of temporary road constructed on NFS land. This construction would go through approximately 3.9 miles of high-potential moist forest habitat and 0.45 miles of high-potential wet forest habitat. The remaining 1.25 miles is proposed through forest habitat not considered high potential for TES species. Road construction in high-potential TES plant habitat poses a high risk due to the amount of ground disturbance involved. No TES plant species where found on those areas proposed for road construction.

In the event that other TES plant populations are found prior to project implementation, the District Botanist would implement the necessary mitigation measures (Design feature 6 in Chapter 2).

Alternative C

Direct and Indirect Effects

Alternative C has the same proposed units as Alternative B. Sensitive plant occurrence buffers would be the same as in Alternative B.

Alternative C would directly impact approximately1,635 acres of moist forest guild habitat and 212 acres of wet forest guild habitat through harvesting (B-2). Alternative C includes the same timber harvest units with the same silvicultural prescriptions as Alternative B. The majority of units, in high potential habitats, would be harvested by helicopter (68%), followed by ground-based (27%) and lastly, cable-skyline (15%) methods (Chapter 2). The increased helicopter yarding in this alternative compared to Alternative B represents a lower risk to TES species and their habitat.

There would be no new road construction on NFS land under this alternative. Alternative C represents a slightly lower risk to TES species in this regard compared to Alternative B.

Alternatives B and C

Cumulative Effects

The cumulative effects area for TES plants and highly suitable habitat was determined to be the Bussel 484 Project Area. Past activities on federal and other lands including fire, road construction, and timber harvest have likely affected populations and habitat. Design criteria would be applied to protect TES plant species and viability for any populations discovered prior to project implementation on National Forest System lands. Current and future activities such as road building, timber harvest, burning, and recreation can be expected to result in habitat modification or plant population loss on these lands.

The cumulative effects on TES plants would be very similar in Alternatives B and C. Both alternatives add to cumulative effects by impacting some high-potential plant habitat. Alternative C poses slightly lower risks to TES species due to less ground-based and cable logging and no new road construction. The overall risks are not expected to be appreciably lower than Alternative B because both alternatives have design features to protect sensitive plants and plant surveys were conducted.

Alternatives B and C would have **no effect** on Water howellia (*Howellia aquatilis*) and Spalding's catchfly (*Silene spaldingii*). Potential habitat does exist within the project area, no plants have been found.

Determination of Effects for All Alternatives

Table 3-44 St. Joe Sensitive Plants by Rare Plant Habitat Guild (revised)*

Species	Common Name	Habitat Guild	Effects
Asplenium trichomanes	maidenhair spleenwort	Moist/Wet Forest rock seeps	NI
Blechnum spicant	deerfern	Moist/Wet Forest	NI
Botrychium ascendens	upswept moonwort	Wet Forest	NI
Botrychium crenulatum	dainty moonwort	Wet Forest	NI
Botrychium lanceolatum	triangle moonwort	Wet Forest/Moist Forest	NI
Botrychium lineare	Slender moonwort	Moist Forest	NI
Botrychium minganense	Mingan moonwort	Wet Forest/Moist Forest	NI
Botrychium montanum	western goblin	Wet Forest	NI
Botrychium paradoxum	paradox moonwort	Wet Forest/Moist Forest	NI
Botrychium pedunculosum	stalked moonwort	Wet Forest	NI
Botrychium pinnatum	northwestern moonwort	Wet Forest/Moist Forest	NI
Botrychium simplex	least moonwort	Wet Forest/Moist Forest	NI
Buxbaumia aphylla	leafless bug-on-a-stick moss	Wet Forest/Moist Forest	NI
Buxbaumia viridis	Green bug-on-a-stick moss	Wet Forest/Moist Forest	NI
Cardamine constancei	Constance's bittercress	Deciduous Riparian/Moist/Wet Forest	NI
Cypripedium fasciculatum	clustered lady's slipper	Moist/Wet/Dry Forest	NI
Grindelia howellii	Howell's gumweed	Dry Forest (St. Joe, basalt breaklands)	NI
Gimmia brittoniae	Britton’s Grimmia	Moist Forest rock outcrops	NI
Hookeria lucens	clear moss	Wet Forest	NI
Mimulus alsinoides	chickweed monkeyflower	Wet/Moist/Dry Forest rock cliffs/seeps	NI
Rhizomnium nudum	Naked Mnium	Wet/Moist Forest	NI
Thelypteris nevadensis	Sierra woodfern	Wet Forest Seeps	NI
Triantha occidentalis spp brevistyla	sticky asphodel	Subalpine Peatlands	NI
Waldsteinia idahoensis	Idaho barren strawberry	Moist and Wet Forest	NI

** based on Regional Forester's TES list, October 2004; NI = No Impact*

Consistency with Forest Plan and Regulatory Framework

The Forest Plan states one management goal as "manage habitat to maintain populations of identified sensitive species of animals and plants" (Forest Plan, II-1). A Forest Plan standard for sensitive species is to "manage the habitat of species listed on the Regional Sensitive Species List to prevent further declines in populations which could lead to Federal listing under the Endangered Species Act" (Forest Plan, II-28). The Forest Plan also identifies the need to "Determine the status and distribution of Threatened, Endangered, and Rare (sensitive) plants on the IPNF" (Forest Plan, II-18). All of the alternatives would meet the intent of the Forest Plan with implementation of design features, and the review and collection of data within the project area.

All alternatives would also meet the intent of the Endangered Species Act and the National Forest Management Act.

Recreation

Changes between Draft EIS and Final EIS

Information was added to the *Analysis Methods* section about a new Idaho Sate Law regarding ATV use on public roads and lands that goes into effective July 1, 2008.

Introduction

The top primary activities on the Idaho Panhandle National Forest according to the results of the National Visitor Use Monitoring (NVUM) study were relaxing, viewing natural features, viewing wildlife, hiking/walking and driving for pleasure (USDA 2004).

Nationally, the number of Off Highway Vehicle (OHV) users has climbed seven-fold in the past 30 years, from approximately 5 million in 1972 to 51 million in 2004. OHV users account for about 11 million annual visits to the national forests and grasslands (USFS 2004). The Forest Service (FS) recognizes the need to keep up with the rapidly rising demand for off-highway vehicle trails and access routes.

Regulatory Framework

Authorities to manage recreation come from the general laws related to National Forest management, e.g., the Multiple Use-Sustained yield Act of 1960, the Wilderness Act (1964), the Wild and Scenic Rivers Act (1968) and the National Forest Management Act (1976) the Land and Water Conservation Fund Act (1964), the Architectural Barriers Act (1968), the Americans with Disabilities Act (1990), National Trails System Act (1968) and the Forest and Rangeland Renewable Resource Act (1974). In addition, many specific federal regulations (Code of Federal Regulations), policies (Forest Service Manuals and Handbooks) and other technical manuals and papers direct management of the recreation resource for the Forest Service.

In November 2005, the Travel Management Rule (commonly referred to as the OHV Rule) was finalized that directs forests to designate routes and areas that are open to motor vehicle use. The designation can be made by vehicle class and/or time of year.

Forest Plan Direction

Forest Plan Goals for the recreation resource are to provide for the projected use of developed recreation areas; and provide for a variety of dispersed recreation opportunities (Forest Plan (FP), Idaho Panhandle National Forests, 1987, page II-1).

A variety of recreation opportunities and settings will be provided, including primitive, semi-primitive non-motorized, semi-primitive motorized, roaded natural and rural. Within these settings a broad spectrum of both dispersed and developed recreation opportunities will be furnished in accordance with identified needs and demands. Opportunities to increase and improve the recreation trail system will be pursued. Dispersed recreation opportunities and management will be emphasized (FP II-3).

Management Area Direction

The management area prescriptions describe the general theme, desired condition and standards and guidelines for the area. The management areas (MAs) and management area direction as it pertains to recreation include:

MA-1: Provide opportunities for dispersed recreation. Manage dispersed recreation primarily for roaded modified and roaded natural Recreation Opportunity Spectrum (ROS) classes. Maintain a diversity of recreation opportunities (FP III-2).

MA-4: Provide for opportunities for dispersed recreation consistent with wildlife habitat needs. Manage dispersed recreation primarily for roaded modified and roaded natural ROS classes. Motorized use is generally restricted to designated routes. Within critical habitat components motorized recreation use may be restricted to provide needed wildlife security (FP III-17).

MA-9: Dispersed recreation management will be managed for roaded natural or semi-primitive ROS recreation experience. Maintain existing improvements. Trail construction in this area is only to access adjacent areas. Existing trails will generally be open (FP III-39).

Recreation Opportunity Spectrum (ROS)

The Recreation Opportunity Spectrum (ROS) is a planning and management tool for recreation. Recreation opportunities are arranged along a spectrum and describe the relationship between activities and settings that produce the recreation experience. Characteristics of an area are defined in terms of their physical, social and management settings (USDA 1982).

Approximately 71% of the project area is classified as Roaded Modified. Roaded Modified is characterized by substantially modified environments except for campsites. Roads, landings, slash and debris may be strongly dominant from within yet remain subordinate from distant sensitive roads and highways. Interaction between users and evidence of others may be moderate on roads, but there is little evidence of others or interaction at camp sites. The area is managed in such a way that few on-site controls may be present except for gated roads. Conventional motorized use is allowed and incorporated into construction standards and design of facilities.

The remaining 29% is classified as Roaded Natural (RN). The physical setting is defined as being within ½ mile of a road and modifications range from being easily noticed to strongly dominant. Structures are generally scattered and may include powerlines, roads and buildings. The social setting is described as moderate to high frequency of visitor contacts on roads and low to moderate on trails and away from roads. The management setting includes onsite regimentation and controls that are noticeable but harmonize with the natural environment.

Analysis Area

The analysis area for the direct, indirect and cumulative effects of the recreation resource is the Bussel 484 Project Area (see Appendix A Map 1).

Analysis Method

This analysis determines consistency with the Idaho Panhandle National Forests Land Management Plan. This analysis is focused on describing the affected environment, comparing the action alternatives to the No-Action Alternative and measuring the post-activity effects of proposed management activities on the full spectrum of recreational access for roads and trails in the project area. The proposed action is explained in detail in Chapter 2.

The access opportunities analyzed include:

- Open road systems (non-paved surfaces)
- Access for ATVs/motorcycles on designated roads and trails
- Access for non-licensed riders on vehicles < 50” in width
- Single track motorized trails

This analysis includes the following assumptions:

- The analysis is based on the post-activity transportation system for each alternative.
- It would likely be 10-12 years before completion of many of the activities within the project area.
- ATVs (all terrain vehicles) include three and four wheeled vehicles less than 50” wide with a saddle type seat and handlebars.
- ATV roads are roads where full-sized vehicle access is prohibited or blocked and motorized vehicles less than 50” wide are allowed.
- Administrative use of full-sized vehicles on some of the ATV roads will occur during sale activities and for post-sale activities such as planting, regeneration survival surveys and monitoring for approximately five years after each timber sale is finished.
- ATV/motorcycle access means those roads or trails open to motorized vehicles less than 50” wide.
- Existing ATV use includes all current use.
- Existing ATV use also includes the roads that are passable by most ATV users (the main ATV roads used). It is recognized that there could be some incidental use on some of the brushed in roads by some ATV users, but use is unknown and is minimal as evidenced by heavy brush and lack of tracks or trails. Only the main ATV routes are analyzed.

- Non-motorized roads are roads where motorized use is prohibited or blocked; and where the road prism is retained. These roads would be passable for pedestrian, stock, or bicycle traffic. Road Management Prescriptions C and D are considered non-motorized.
- When addressing access opportunities, this analysis refers to routes open to the public. (Additional routes could be open to administrative traffic).
- The open road system includes full-size vehicles and ATVs/motorcycles that meet Idaho State Law as stated below.
- Motorized access (roads, trails) are also open to non-motorized use.

Current Idaho State Law riding requirements for ATVs can be broken into three categories:

1. Public highways, paved roads: (valid driver's license, license plate on vehicle, valid liability insurance, valid OHV sticker, headlights and tail lights).
2. Unpaved roads on federal or state public lands: (valid driver's license, valid liability insurance, valid OHV sticker, headlights and tail lights).
3. Off highway: Road and trails open to motorized vehicles less than 50" wide. (Valid OHV sticker required – can be driven by non-licensed drivers).

Effective July 1, 2008 Idaho State Law regarding ATV use on public roads and lands will be changing. Users will be required to purchase an off-highway license plate and registration sticker for travel on unpaved roads on state and federal lands and routes designated for use by vehicles less than 50" in width. Users are still required to carry a valid driver's license and liability insurance to operate on unpaved roads on state and federal lands. Non-licensed riders can ride on routes designated for use by vehicles less than 50" in width.

Affected Environment

The following existing conditions for the project area take into account assumptions listed under Analysis Methods and all past activities that have led up to the current condition. Recreation activities and use that are discussed include access, developed recreation sites, dispersed use and winter recreation.

Recreation activities in the Bussel 484 Project Area include driving for pleasure, ATV and motorcycle riding, hunting, camping, snowmobiling, hiking, fishing, wildlife viewing, gathering forest products (berries, rocks, firewood, mushrooms) and viewing historic sites such as the splash dam on Bussel Creek and the Incline Railroad Grade.

The area and the alternatives provide a spectrum of access opportunities ranging from non-motorized to ATV (motorized <50" in width) to full-size passenger car access. Access to high-quality recreation areas such as along streams, historic sites, and loop drives are available via roads open to all motorized vehicles driven by licensed drivers. The terms ATV (all-terrain vehicle) and OHV (off highway vehicle) are considered interchangeable for this section.

Access

Driving for pleasure is one of the primary recreation activities in the Bussel 484 Project Area as an activity by itself or in conjunction with associated activities such as camping in dispersed sites, hunting, fishing, berry picking, or viewing wildlife. The majority of motorized use is via full-size vehicles, but there is a rapidly increasing use of ATVs. "More than 100,000 OHVs are registered in Idaho today and 10,000 additional OHVs are being registered each year (Idaho OHV Public Outreach Project 2005)."

The Bussel 484 Project Area provides a spectrum of recreational access by providing roads, a single-track trail (Trail 258), and a trail open to ATVs (Lines Creek Historical Trail 246). Roads are open unless closed by a legal restriction. Some roads have a legal restriction order and have effective restrictive devices such as an earthen berm or gate. Other roads have had restrictive devices installed; however, they do not have legal restrictions associated with them.

There are numerous spur roads in the project area open for vehicles less than 50" wide that can accommodate ATV/motorcycle use. However, these roads are fragmented and do not provide many loop opportunities, especially for non-licensed drivers.

Some illegal motorized use occurs in the project area. In some instances, roads with legal restriction orders and restriction devices have been breached. For example, a road with a gate and a legal restriction that would allow ATVs but not full-sized vehicles has had the restrictive device breached and full-sized vehicles are driving the road. Some of the illegal use is caused by confusion about where it is legal to drive due to inadequate signs, maps, or restrictive devices. The forest visitor map does not show all forest roads. This can confuse visitors.

Road 1254 has a legal restriction order closing it to full-size vehicle use east of the power line. The restrictive device has been breached and full-size vehicles are using the road.

The Incline Railroad Grade is a historical feature. ATVs and full-size vehicles are using approximately 1.5 miles of the grade from Road 226 to the intersection with the Lines Creek Trail. The grade is very steep. Rutting and erosion are occurring, causing damage to cultural resources. Cables, ties and other artifacts are exposed along the grade and pose a safety hazard to ATV use.

Roads

Currently there are 31.8 miles of open road, 28.4 miles of roads accessible to vehicles < 50” in width (ATVs) and 6.4 miles of roads that are impassible to vehicle traffic. This table summarizes roads in the project area that are (1) open to all vehicles, (2) open to vehicles less than 50” in width and non-motorized use and (3) roads that exist but are impassable. Notes are included to clarify use and existing condition.

Table 3-45 Existing Road Access

Existing Road Access (miles)				
Road #	**Open**	**Accessible to vehicles < 50”**	**Impassible**	**Notes**
1254	3.65			Year-long legal restriction order, open to <50”. No restrictive device in place. Full-sized vehicles are using road.
1254D		1.0		Road is gated
1254UC	0.41			Open road along transmission line
1441		0.75		Inaccessible to >50”; ATV use
1441A		0.02		Inaccessible to >50”
1470	0.42			Open road
1471	0.42			Open road
1476		0.66		Inaccessible to >50”
1498	1.85			Open road
1498A			0.39	Inaccessible; brushed in
1498B		0.04		Open to ATV
1498C		1.02		Gated.; ATV use
1498CA		0.11		ATV use
1498FA	0.33			Open road
1498FB	0.19			Open road
1498FC	0.11	1.01		Road originates on private land
1498FD		0.15		ATV use
1498FG		0.12		ATV use
1498FI		0.32		ATV use
1498G		0.63		ATV use
1900	3.47	1.44		Open first 3.47 miles. Road has a double earthen berm; ATV use beyond berm (1.4 miles)
1900A		1.18		Inaccessible to >50”
1900B		1.30		Year-long legal restriction order; open to <50”; no restrictive device in place.
1900C		2.15		Inaccessible to >50”
1900CA		0.31		Inaccessible to >50”
1900CB		0.39		Inaccessible to >50”
1900CC		0.44		Inaccessible to >50”
1900D			0.48	Impassable; brushed in
1900E		1.10		Earthen berm; ATV use
1900EA			0.95	Impassable; brushed in

Existing Road Access (miles)				
Road #	**Open**	**Accessible to vehicles < 50”**	**Impassible**	**Notes**
1900F		1.13	0.44	Inaccessible to >50”; ATV use
1900FA		0.55		Inaccessible to >50”; ATV use
1900G		0.12		Inaccessible to >50”; ATV use
1900H		0.55		Inaccessible to >50”; ATV use
1901	0.36		0.85	Open first 0.36 miles; impassable 0.85 miles
1901A	0.53			Open road
1901C			0.47	Impassable; brushed in.
1902	2.10	0.98		Open first 2.1 miles. Earthen berm; ATV use remaining 0.98 mile
1902A		0.57		ATV use
1902B		0.97		ATV use
1902C		0.32		ATV use
1902D		0.20		ATV use
1904	1.73			Open road
1904A		0.18		ATV use
226	1.87			Open road
3332	1.86			Open road
3332UA	0.29			Open road
3332UB	0.29			Open road
3570A		0.82		ATV use
3590	2.46			Year-long legal restriction order, open to <50”; no restrictive device in place; full-sized vehicles using the road
3590A		1.52		Year-long legal restriction order, open to <50”; part of the Road 3590 legal restriction order.
3590B		0.20		Same as 3590A
3591	3.52			Same as 3590
3591A	1.25			Same as 3590
3658		3.93		Year-long legal restriction order, open to <50”; effective gate
3658A		1.29		Year-long legal restriction order, open to <50”; part of Road 3658 closure
3660		0.25		ATV use
758	4.39			Open road
758A	0.05			Lines Creek Historical Trail parking loop
758DA			0.80	Impassible; brushed in
758DB			0.31	Impassible; brushed in
758DC			0.69	Impassible; brushed in
758E			0.85	Norton Cr. Grade; brushed in
758F			0.13	Impassible; brushed in
758G		0.54		ATV use
758GA		0.15		ATV use
758J	0.07			Open road
758K	0.17			Open road
Total Miles	**31.79**	**28.41**	**6.36**	

Trails

Undesirable ATV use is occurring in several areas. ATVs are driving on single-track trails not designed for ATVs and are creating their own ATV routes cross-country. This use is damaging vegetation, cultural resources and bridges that were not designed to accommodate such use. Erosion and rutting are also occurring on old roads and trails with steep grades.

Bussel Creek Trail #258 is managed as a single track motorized trail, but has not been maintained for many years. ATVs are using the first mile of the trail up to Bear Creek. The trail continues as single track from there, but is mostly non-existent from lack of use and maintenance. People using ATVs are leaving the trail and driving cross-country through the riparian area of Bear Creek meadows and Little Bear Creek, causing damage in the meadow and stream. There are 4.3 miles of trail within the project area and an additional 2.2 miles outside the project area for a total length of 6.5 miles.

The Lines Creek Trail is approximately 2.4 miles long and is open to all users. ATV use is occurring on the trail; however, the trail tread and bridges were not designed for ATV use. ATVs are crossing on narrow bridges, causing damage to the bridge or crossing streams that have not been hardened, causing resource damage.

Norton Creek Grade is approximately 4.2 miles long and is brushed in for most of its length. ATV users have cleared some trail and filled wet crossings with logs and rock. The grade bed is in good condition with the exception of some resource damage occurring due to wooden culverts washing out.

Developed Recreation Sites

The Lines Creek Historical Trailhead is the only developed recreation facility within the project area. It includes a toilet, picnic sites and a trail that leads to the site of a 1920s logging camp, railroad grade and trestles. The trailhead is located on Road 758A.

Dispersed Use

Dispersed use includes camping, hunting, hiking, bird watching and other activities not associated with a developed recreation facility. The majority of dispersed use occurs along the forest development road system and any open roads. Dispersed campsites are located along access roads and have developed with repeated use. These sites are not maintained by the Forest Service, do not have any improvements such as tables, fire rings or outhouses other than those created by users. The Forest Service does not keep an inventory of these sites.

Winter Recreation

This area is popular for snowmobiling. The Forest Service, State of Idaho, and Shoshone County have a cost share agreement allowing snowmobile use grooming on approximately ten miles of designated routes. No changes are proposed for winter use. The slope below the microwave station is a popular informal play area.

Environmental Consequences

All Alternatives

Recreation use is expected to increase over time. OHV registrations have more than doubled since 2000. This trend has slowed; however, use and registrations continue to increase. Access is an important factor affecting the recreation resource. Access opportunities can be divided into the following categories:

Open Roads – Those roads open to public use.

Gated Roads (Road Management Prescription A) – These roads restrict public access for full-size motorized vehicles. Vehicles less than 50 inches wide may or may not be restricted.

Roads with Barriers (Road Management Prescription B) – These roads restrict public access for full-sized motorized vehicles. Vehicle less than 50 inches wide may or may not be restricted.

Roads in Long-Term Storage (LTS – Road Management Prescription C) – These roads generally have culverts pulled, some type of barrier or road surface decompaction to discourage all motorized traffic, or some low-level type of obliteration. It is assumed motorized traffic would be restricted on all roads put into long-term storage. The roads would also often be impassable for stock and pedestrian traffic as well.

Road Decommissioned (Road Management Prescription D) – These roads are partially or fully re-contoured and it is assumed that they are closed to all motorized use. They are generally impassable for stock and pedestrian traffic as well.

There would be no impact to the Lines Creek Trailhead, the only developed recreation site within the project area. There would be no effect to snowmobiling or winter recreation as a result of proposed activities. Recreation Opportunity Spectrum classifications would remain the same under all alternatives.

Alternative A – No Action

The existing road system and access would remain the same. Illegal ATV use and use adversely affecting other resources would continue. Access throughout the area would not be designated and would not be consistent with the 2005 Travel Management Rule.

Bussel Creek Trail #258 would continue to be managed as a single track motorized trail and undesirable ATV use would continue. Undesirable use occurring on the Incline Grade would continue, affecting cultural resources and causing rutting and erosion on the grade. Norton Creek Grade would remain impassible to ATV use. ATV use would continue on the Lines Creek Trail. Loop opportunities for unlicensed ATV users would not be created.

Opportunities for dispersed camping and day-use activities would remain the same.

Alternatives B and C

Design Features for Recreation

A: Existing dispersed recreation sites used for harvest operations activities would be restored or rehabilitated if motorized access to the sites would remain available after project implementation.

B: Contractors would follow permit provisions required for camping.

C: Where skid trails approach or intersect open roads or designated ATV routes, restrictive devices or debris such as logs, brush and rocks would be placed to effectively stop vehicle use.

D: Warning signs would be placed to inform visitors of logging activities in areas where logging traffic may interfere with recreational traffic.

Direct and Indirect Effects

Alternatives B and C include trail restoration, trail construction, and installation of restrictive barriers on roads.

Alternative B also includes approximately 6.0 miles of new road construction. Alternative C does not include road construction. Under Alternative B, all new roads would be managed under Road Management Prescription C or D after harvest activities are completed.

Alternative B would provide 19.9 miles of ATV access. Alternative C would provide 18.5 miles of ATV access. Approximately 1.4 miles of Norton Creek Grade would not be designated as an ATV trail with Alternative C.

The activities related to the proposed timber harvest in Alternatives B and C may create temporary conflicts between contractors and recreation traffic. The activities typically occur between June and December. Increased traffic, including logging equipment and support vehicles, could be expected. Visitors might experience temporary delays. Signs would be placed on these roads to inform visitors of logging activities. Undeveloped camping sites near proposed units may be used by contractors (i.e. logging, planting, thinning) with permits during operations for camping beyond the 14-day limit and/or for equipment parking. Any undeveloped recreation sites used for logging or related activities would be restored or rehabilitated as undeveloped sites following use.

The road system and travel management would change from the existing condition for Alternatives B and C. Overall there would be a reduction in motorized access across the project area. Roads open to all vehicles would be reduced by 11.5 miles. Roads open to ATV use would be reduced by 15.3 miles. Roads to be managed under Prescription C or D would have an appropriate restrictive device installed to close the road to all motorized use. See Chapter 2 for complete definitions of the Road Management Prescriptions.

Table 3-46 summarizes the roads within the project area and the proposed access.

Table 3-46 Comparison of Existing and Proposed Road Access

	Existing Access (miles)			Alternatives B and C (miles)			
						No Motorized Access	
Road #	Open	Accessible to vehicles < 50"	Impassable	Open	Accessible to vehicles < 50"	Rx C	Rx D
1254	3.65			2.56	1.09		
1254D		1.00				1.00	
1254UC	0.41			0.41			
1441		0.75			0.75		
1441A		0.02			0.02		
1470	0.42			0.42			
1471	0.42			0.42			
1476		0.66				0.66	
1498	1.85			1.85			
1498A			0.39			0.39	
1498B		0.04			0.04		
1498C		1.02				1.02	
1498CA		0.11					0.11
1498FA	0.33			0.33			
1498FB	0.19					0.19	
1498FC	0.11	1.01		0.11		1.01	
1498FD		0.15				0.15	
1498FG		0.12					0.12
1498FI		0.32					0.32
1498G		0.63				0.63	
1900	3.47	1.44		2.55	2.36		
1900A		1.18				1.18	
1900B		1.30					1.30
1900C		2.15				2.15	
1900CA		0.31					0.31
1900CB		0.39					0.39
1900CC		0.44					0.44
1900D			0.48				0.48
1900E		1.10			1.10		
1900EA			0.95			0.95	
1900F		1.13	0.44			1.57	
1900FA		0.55					0.55
1900G		0.12					0.12
1900H		0.55					0.55
190I	0.36		0.85	0.36	0.85		
1901A	0.53			0.53			
1901C			0.47			0.47	
1902	2.10	0.98				3.08	
1902A		0.57					0.57
1902B		0.97					0.97
1902C		0.32				0.32	
1902D		0.20					0.20
1904	1.73			1.73			

	Existing Access (miles)			Alternatives B and C (miles)			
						No Motorized Access	
1904A		0.18					0.18
226	1.87			1.87			
3332	1.86			1.86			
3332UA	0.29			0.29			
3332UB	0.29			0.29			
3570A		0.82			0.82		
3590	2.46				1.82	0.64	
3590A		1.52			1.52		
3590B		0.20					0.20
3591	3.52				2.75	0.77	
3591A	1.25					1.25	
3658		3.93				3.93	
3658A		1.29					1.29
3660		0.25				0.25	
758	4.39			4.39			
758A	0.05			0.05			
758DA			0.80				0.80
758DB			0.31				0.31
758DC			0.69				0.69
758E**			0.85		0.85		
758F			0.13				0.13
758G		0.54					0.54
758GA		0.15					0.15
758J	0.07			0.07			
758K	0.17			0.17			
Total Miles	**31.79**	**28.41**	**6.36**	**20.26**	**13.97**	**21.61**	**10.72**

Alternatives B and C would provide a non-motorized recreation experience in most of the northern portion of the project area. Road closures are proposed to protect resource values including wildlife, watershed and fisheries. Please refer to those sections for detailed information concerning rationale for road closures. Proposed road closures would effectively create a non-motorized recreation experience in the area north of the Bussel Creek Trail #258 and the Norton Creek Grade. Access would still be available via Roads 1904, 758 and 1498 that run generally north to south through the project area. This area would provide a non-motorized recreation opportunity for hunters and visitors desiring that type of experience.

The southwest portion of the project area (south of the Norton Creek Grade and west of Road 758) would provide ATV access with loop riding opportunities by designating roads that are currently open to all vehicles to ATV use only and by constructing new trail. New ATV trail construction would connect Road 1901 to Road 3590A, creating a five-mile loop.

Under Alternative B, Norton Creek Grade would be opened and designated for vehicles less than 50” wide. Norton Creek Grade would connect Road 3591 and the Lines Creek Trail, providing several loop riding opportunities of varying lengths that would be available to unlicensed riders. Roads 3590 and 3591 that are currently open to all vehicles would be designated for ATV use. This alternative provides the most

Under Alternative C, Norton Creek Grade would be opened and designated as ATV use up to its intersection with Road 3951. The remainder of Norton Creek Grade that connects to the Lines Creek Trail would not be opened and designated for ATV use due to the need to protect heritage resources. This would result in 1.4 fewer miles of ATV trails than would be available with Alternative B. The mileage difference between Alternative B and C is minor; however, the loop riding opportunities would change. The riding opportunities available would be “out and back”

rides, with only the Lines Creek Trail as a true loop riding opportunity for unlicensed riders. Licensed riders would not be as adversely affected by this difference as they could use Road 758 to complete a similar loop.

Road 3591A would be closed to all motorized use and would be managed under Road Management Prescription C. Roads currently open to ATVs in the upper reaches of Norton Creek (Roads 1900B, 1900C, 1900CA, 1900CB and 1900CC) would be closed to all motorized use under Road Prescription Management Prescriptions C and D.

Change in access in the southeast portion of the project area is minor (south of Bussel Creek Trail #258 and east of Road 758). Road 1254D which is currently gated and used by ATVs would be closed to all motorized use and managed under Road Prescription C. This would close approximately 1.0 miles of current ATV access. A restrictive device would be replaced on Road 1254 to prohibit full-size vehicle use in accordance with the legal restriction already in effect. The restrictive device was breached and illegal full-size vehicle use has been occurring. By allowing ATV access only, this would create an ATV loop approximately five miles in length. No other changes in access are proposed in this area.

Open roads and roads accessible to ATVs would be reduced from 60.2 miles to 34.2 miles within the project area. Motorized use would shift out of the northern portion of the project area to areas south of the Norton Creek Grade and Bussel Creek Trail. ATV users that choose to recreate in Bussel Creek would be concentrated in the southern portion of the area. People seeking a non-motorized recreation experience may be discouraged due to ATV use in the area and choose to recreate elsewhere. Riding opportunities in the southern portion of the project area would improve overall with the designation of loop trails open to non-licensed ATV users.

A restrictive device would be installed to effectively close the Incline Railroad Grade to motorized use. Damage is occurring to cultural resources. Erosion and rutting is also occurring due to the steep grade. This grade was never intended to be open for motorized use.

Bussel Creek Trail #258 would be managed for non-motorized use, changing from single-track motorized use. An effective restrictive device would be installed on the ground. The change in use is proposed to protect other resources including wildlife and watershed. Please refer to those sections for detailed information concerning rationale for the change to non-motorized use. Resource damage is also occurring where ATVs are traveling cross-country through wet meadows and creeks.

Resource damage associated with illegal ATV use includes trail proliferation, soil erosion and compaction, destruction of vegetation, introduction of noxious weeds on disturbed ground, disruption of wildlife, impacts to water quality and disturbance to other forest visitors. The magnitude of these types of effects depends on many factors including the level of use occurring, effectiveness of physical closures, law enforcement presence and information available to users about legal riding options. Project Design Feature 9.C. (Chapter 2) describes the methods proposed to close skid trails and temporary roads to illegal ATV use. The project design feature would reduce the impacts of some illegal ATV use; however past experience has shown that it is difficult to completely eliminate illegal use.

Effects of the proposed treatments on dispersed camping can be described as short-term effects from the treatment activities and long term effects resulting from road closures and designating roads to ATV use only. Treatment activities may impact existing dispersed sites if they are used during harvest activities. Changing the vegetation surrounding dispersed sites may change the character of the site. Visitors may choose to camp elsewhere. Visitors may be displaced to other areas during harvest activities.

Proposed road closures and designating roads to ATV use only may make some dispersed sites inaccessible to users. Recreationists, especially hunters, typically use the same dispersed sites year after year. Visitors may be frustrated that their favorite site is no longer available to use.

Cumulative Effects

The cumulative effects discussion considers past, present and reasonably foreseeable actions that occur within the analysis area. These actions include existing, ongoing and planned projects. A list of the past, present and reasonably foreseeable actions considered in this analysis is included at the beginning of this chapter of the environmental impact statement.

Recreational activities are expected to gradually increase over time, forest-wide. ATV (all-terrain vehicle) use has increased rapidly over the last five years, and this trend is expected to continue.

In 2006, a total of 117,576 OHVs were registered in Idaho (83,606 ATVs and 33,970 motorcycles). In Shoshone county, OHV registrations have risen from 1053 to 1870 registrations (an increase of approximately 78%) from 2002 to 2006 (IDPR 2006). Approximately 82% of the registrations were for ATVs and 18% for motorcycles. The number of ATVs and motorcycles not registered is unknown.

The cumulative effects associated with dispersed recreation may be long-term loss of use of some dispersed camp sites due to road closures and designating roads to ATV use only. Other dispersed camp sites may develop as a result of harvest activities along roads that remain open.

There would be no cumulative effects on winter recreation due to treatments. Changes in vegetation may create more opportunities for snow play in dispersed areas.

Consistency with the Forest Plan and Regulatory Framework

All alternatives comply with the management direction for recreation provided in the Idaho Panhandle National Forests Land and Resource Management Plan and federal regulations and policies concerning the recreation resource. All alternatives provide for a diversity of recreational opportunities. Recreation Opportunity Spectrum classes would remain unchanged.

Soils

Differences between Draft EIS and Final EIS

Numbers were changed to reflect change in alternatives described in the introduction for the FEIS. Tables displaying Forest Plan Standard analysis were moved to the project file to reduce repetition of numbers displayed in the FEIS. The documentation below was reorganized for better clarity.

Regulatory Framework

National Forest Management Act

Section 6 of the National Forest Management Act of 1976 (NFMA) charges the Secretary of Agriculture with ensuring research and continuous monitoring of each management system to safeguard the land's productivity. NFMA as amended at 16USC1604 (g)(3)(E) requires the Forest Service to “insure that timber will be harvested from National Forest System lands only where—(i) soil, slope, or other watershed conditions will not be irreversibly damaged”. To comply with NFMA, the Chief of the Forest Service has charged each Forest Service Region with developing soil quality standards for detecting soil disturbance and indicating a loss in long-term productive potential. These standards are built into forest plans.

Forest Plan

Forest Plan direction (Forest Plan, p. II-8) is to manage the soil resource to maintain long-term productivity. The objective is that management activities on forest lands will not significantly impair the long-term productivity of the soil or produce unacceptable levels of sedimentation resulting from soil erosion. The Forest Plan includes three standards for soils.

> Forest Plan Soil Standard #1: Soil-disturbing management practices will strive to maintain at least 80 percent of the activity area in a condition of acceptable productivity potential for trees and other managed vegetation. Unacceptable productivity potential exists when soil has been detrimentally compacted, displaced, puddled, or severely burned as determined in the project analysis.
>
> Forest Plan Soil Standard #2: Projects should strive to maintain sufficient large woody debris to maintain site productivity. Large woody debris is essential for maintenance of sufficient micro-organism populations.
>
> Forest Plan Soil Standard #3: In the event of whole-tree logging, provision for maintenance of sufficient nutrient capital should be made in the project analysis.

Regional soil quality standards (see below) for minimizing soil-disturbing management practices are more stringent than IPNF Forest Plan Standard #1, this analysis assumes that the Forest Plan standard to maintain at least 80 percent of the activity area in a condition of acceptable productivity potential would be met if the Regional soils quality standards are met.

Regional Soil Quality Standards

The Regional soil quality standards (S-1) were revised in November 1999. Manual direction recommends maintaining 85% of an activity area's soil at an acceptable productivity potential with respect to detrimental impacts, including the effects of compaction, displacement, rutting, severe burning, surface erosion, loss of surface organic matter, and soil mass movement. This recommendation is based on research indicating that a decline in productivity would have to be at least 15% to be detectable (Powers 1990). In areas where more than 15 percent detrimental soil conditions exists from prior activities, the cumulative detrimental effects from project implementation and restoration should not exceed the conditions prior to the planned activity and should move toward a net improvement in soil quality. These standards do not apply to intensively developed sites such as permanent roads/landings, mines, developed recreation and administrative sites. The loss of soil productivity on these sites occurred when the roads and landings were constructed and are an irretrievable effect

Analysis Area

The analysis area for direct, indirect, and cumulative effects on soil resources encompasses all land within individual treatment units and associated temporary roads and landings. Existing classified National Forest system roads, trails, and land for transmission line towers are considered dedicated lands for other purposes and, as such, soil quality standards do not apply. System roads are considered, however, when determining if Forest Plan Standard #1 would be met.

Treatment will be conducted on approximately 2,137 acres occurring at elevations of ~3,400 to 5,000 feet at all aspects on slopes ranging from flat to greater than 50%. There are 65 units ranging in size from 8 acres to 69 acres. Harvest activities would be accomplished using ground-based, skyline, and helicopter logging followed by various fuels treatments (Tables 2-3 and 2-7).

The analysis also considers how much area has been devoted to resources where soil quality standards do not apply, such as system roads, developed sites, trails, and transmission line tower bases on National Forest System lands in the Bussel Creek Project Area. Land outside of the analysis area described above is not considered because direct and indirect effects to soils are site specific and would not occur beyond these areas. Cumulative effects to soils are those effects that overlap in time and space, so there would be no cumulative effect where there are no direct or indirect effects.

Analysis Methods

Analysis of the soil resource utilized field surveys, aerial photography, geographic information system (GIS) data, and information from the timber stand database (TSMRS), the roads database, and the IPNF soil disturbance spreadsheet. Acres were calculated by ARCINFO GIS and were rounded, which may result in slight discrepancies from numbers used and displayed elsewhere in this document.

Natural erosion and sediment production hazards were gathered from landtype descriptions in the Idaho Panhandle National Forests Land Systems Inventory (S-2). Landtype mapping is only a representation of on-the-ground conditions. Landtype ratings, such as high surface or subsurface erosion, high sediment delivery potential, or high mass failure potential are precautionary ratings and do not necessarily reflect response to management activities.

Every proposed harvest unit was field reviewed by the District hydrologist or trained members of the hydrology crew (S-3) to verify existing soil conditions by conducting the "Onsite Assessment Method" outlined in Niehoff (2002) (S-4). Forest Service employees received training in field sampling techniques from the IPNF Soil Scientist or from a District Hydrologist trained by the Soil Scientist (S-3). This training adequately prepares employees to accurately sample soil conditions. See soil assessment sheets/data (S-5). The protocol for field investigation of the soil condition involved two procedures: 1) random transects within proposed harvest units with sampling for soil disturbance, large woody debris, and surface organic material; or 2) 'walk-through' verification of past activities with random sampling for soil disturbance and surface organic material. The approximate confidence level (±5 percent) is 90 percent for 89 percent of the monitored units while about nine percent of the remaining field data is at confidence levels between 70 and 80 percent (Page-Dumroese and others 2006; S-43)

Potential disturbance of the soil resource was determined using Niehoff's (2002) guidelines for soil analysis, the Soil Disturbance Spreadsheet Model (S-6, S-7), and field verification (S-5). This analysis includes potential effects from proposed logging systems, temporary roads, landings, and fuel treatments on soils in individual activity areas (proposed harvest units). Information from field surveys was used to determine existing condition.

Two different accounting methods were used for roads within activity areas. The Forest Plan Standard activity areas include proposed new system roads, temporary roads and portions of existing system roads within proposed harvest units (S-7; S-8; Consistency with Forest Plans and Other Regulations section). The Regional standard activity areas include only temporary roads within proposed units because system roads are considered a committed or dedicated resource under the Regional standard and are not included in calculations of disturbance (S-6 and S-9).

The spreadsheet model estimates detrimental disturbance on proposed harvest units for each harvest and fuel treatment method based on empirically derived coefficients (S-10) obtained and averaged from numerous monitored sites throughout the Idaho Panhandle National Forests (Forest Plan Monitoring and Evaluation Reports 1988, 1991, 1993 and 1997). Since the coefficients are based on an average, the areas that have had prior harvest activities could have soil disturbance levels lower or greater then the coefficient's average.

The IPNF soil disturbance spreadsheet accounts for compaction, erosion, severe burning, rutting, and displacement on the soil surface that is the most productive layer and also the easiest to disturb through activities. The model is limited to the logging system and slash disposal methods for which coefficients have been determined, and its coefficients assume that best management practices (BMPs) have been implemented since 1990. The model does not account for changes in soil types or the recovery of soils over time from existing previous harvest activities.

Design features require use of existing skid trails, so it is expected that proposed activities would occur on areas with previous disturbance. The level of disturbance increase also depends on the amount or lack of existing skid trails. Estimates of resulting soil disturbance incorporate existing condition disturbance rather than adding it on to modeled estimates. This is because in units that already contain a network of existing skid trails, little to no increase in disturbance is expected because equipment would re-use existing skid trails and move on slash mats whenever possible. However, activity units that have had little prior disturbance will show a greater incremental increase in potential detrimental disturbance.

An additional precaution was added to Unit 224 because the existing disturbance patterns are localized so that equipment will not be able to utilize all existing skid trails since trails may not be in a feasible or advantageous location to use. An additional 1% of disturbance (based on professional judgment by the Forest Soil Scientist) was therefore added to account for potential disturbance in this unit beyond the expected level generally used for ground-based harvest (S-4). To further ensure compliance in this unit, skid trail decompaction is scheduled and would be monitored post-harvest to determine if impacts exceed the allowable levels set by Forest Plan and Regional standards (Chapter 2, Site-specific Design Features).

Detrimental disturbance, large woody debris, organic matter, the potential for erosion and mass movement, and nutrient levels (based on foliar sampling related to geologic formations and rock types) are considered to discuss effects on soil productivity.

The area that would be affected by system road construction and decommissioning was estimated using 4.5-acres per mile (37-foot road width that includes a 14-foot wide running surface and cut and fill slopes). However, on gentle ground, the road width is usually less (~12 ft.). To determine effects from trails, an average width of six feet was assumed (0.73 acres per mile of trail). This is wide for foot trails, but it is narrow for some ATV trails.

Direct effects on soils from proposed activities were measured by analyzing the effects of compaction, erosion, burning, rutting, and displacement on the soil surface that is the most productive layer and also the easiest to disturb through activities. Potential impacts are based on the type of logging system and fuel treatments used and also include areas disturbed due to the construction of temporary roads.

Compaction, rutting, displacement, and severe burning can affect the soils physical, chemical, and biological properties, which indirectly can affect the growth and health of trees and other plants. Compaction and rutting reduces soil permeability and infiltration, which can cause soil erosion. Displacement reduces plant growth where topsoil and organic matter are removed. Severely burned soils can become hydrophobic (water repellent) and lead to increased erosion, runoff, and/or reduced productivity.

Ground-based, helicopter, and skyline/cable logging systems would be utilized under the Proposed Action. Roads and landings that are to remain on the landscape for future use can cause detrimental effects on productivity as those lands become "dedicated" lands. Those roads that are temporarily needed for project work and are planned for decommissioning have initial detrimental effects, but rehabilitation efforts (ripping, incorporation of woody material etc.) would initiate a long-term recovery sequence (S-12).

Generally, detrimental effects on soils are not permanent and depend primarily on soil texture, parent material, aspect, and level of disturbance, i.e. compaction. Vegetative recovery time is approximately 30 to 70 years as the

second growth timber becomes established around the disturbed areas and develops enough crown foliage to intercept and move moisture through evapotranspiration (Dykstra and Curran 2002; Froehlich and others 1983 and 1985).

Acres of detrimental disturbance were calculated by multiplying activity area size by the disturbance coefficient derived from monitoring reports. Coefficients used for proposed logging systems are displayed in Table 3-47

Table 3-47 Potential Detrimental Disturbance Coefficients Used for Logging & Prescribed Fire Scenarios

Tractor Harvest	Detrimental Disturbance Coefficients (%)
With grapple piling or underburning	13
Aerial Harvest	
Skyline & helicopter with underburning	0 - 2
Skyline & helicopter with grapple piling	8

Indirect effects may include the loss of site productivity due to the removal of vegetation and nutrients. Large woody debris is essential for maintenance of sufficient microorganism populations and long-term site productivity. Research indicates that potassium (among other nutrients) is an important element for site productivity and may be deficient among certain Belt Supergroup formations (Garrison-Johnston and others 2007).

Foliar analysis was conducted on various geologies on the St. Joe Ranger District (S-13, S-14, S-15, S-16, S-17) to determine nutrient levels. This information is used for proposed harvest units in Bussel Creek. Design features (see Chapter 2) are incorporated into the activities to meet the management of large woody debris and organic matter as detailed in the research guidelines contained in Graham and others (1994). These recommendations emphasize tons per acre and are defined as any woody residue larger than three inches in diameter. Conservation of nutrients is also proposed by allowing slash to over winter where yarding tops is not proposed (Garrison and Moore, 1998) before treatment of excessive activity fuels takes place. In most harvest units tree tops, foliage, and branches would be left to over-winter, which allows potassium to leach out of these materials (Baker and others 1989; Barber and Van Lear 1984; Edmonds 1987; Garrison and Moore 1998; Laskowski and others 1995; and Palviainen and others 2004).

Cumulative effects include the anticipated cumulative impacts of the direct and indirect effects added to other past, present and reasonably foreseeable future activities. Effects can occur in site-specific locations, or across a broader landscape area; thus they have a spatial scale. They can also occur over a period of time; thus having a temporal scale. Since direct and indirect effects on soils are measured within the activity areas, the cumulative effects analysis area for the soil resource consists of the cumulative impacts within each activity area. One exception is a review of land adjacent to the activity area in regards to slope stability.

Affected Environment

Soils in the Bussel Creek project area are generally formed in volcanic ash-influenced loess overlying weakly to highly weathered subsoil and substratum material derived from the underlying bedrock. Under the predominant timber stands, a silt loam textured ash capped soil has developed. The volcanic material accumulated from several of the Cascade volcano eruptions with most of the ash originating from Mt. Mazama (Crater Lake) in Oregon about 7,600 years ago. The uppermost part of the ash is usually enriched with organic matter that is incorporated into this part of the soil and has high water- and nutrient-holding capacities, both of which are important for soil productivity. The subsoils are not as fertile.

Criteria used to assess existing conditions for soil resources include:

1. Landtype ratings (mass failure, erosion, sediment delivery potential, and soil productivity) for the Idaho Panhandle National Forest
2. Productivity (soil disturbance, amount of large woody debris and organic matter, and nutrients from geologic formations)
3. Area dedicated to roads, trails, and transmission line towers where soil productivity is not maintained.

Landtypes and Associated Ratings

The proposed harvest units cover 34 different landtypes (S-27). Forty-four landtypes were identified and mapped in the project area (S-19). Descriptions of each landtype (S-20), detailed acreages for alternatives (S-18), and maps displaying landtypes (S-21) are in the project file. Landtype mapping is only a representation of on-the-ground conditions. Landtype ratings are precautionary ratings and do not necessarily reflect response to management activities. Ratings were compiled and are listed in subcategories for:

- mass failure
- surface erosion potential
- subsurface erosion potential
- sediment delivery potential
- soil productivity

These are rated as low, moderate, or high for each landtype (Table 3-48, S-2, S-18, S-20).

Table 3-48 Landtype Subcategories Associated with Harvest Activities for Alternatives B & C*

Surface Erosion Hazard				Subsurface Erosion Hazard			Mass Failure Potential		
Rating	**Low**	**Mod**	**High**	**Low**	**Mod**	**High**	**Low**	**Mod**	**High**
Acres	2229	19	0	977	620	652	1340	909	0
Percent of Harvest Area	99.1%	0.9%	0%	43.4%	27.6%	29.0%	59.6%	40.4%	0%
Sediment Delivery Potential				**Productivity Potential**					
Rating	**Low**	**Mod**	**High**	**Low**	**Low-Mod**	**Mod**	**Mod-High**		**High**
Acres	1052	1153	43.8	107	90	332	1076		644
Percent of Harvest Area	46.8%	51.3%	1.9%	4.8%	4.0%	14.7%	47.9%		28.6%

**Proposed harvest activity acres are identical for Alternatives B and C. The main difference between Alternatives is a variation in roads and the resulting changes in logging systems due to access constraints.*

Mass Failure Potential is the relative probability of downslope movement of masses of soil material. Besides natural failure, landslides or slumping can be triggered by a number of mechanisms, including harvest activities, severe burning, and related road building. Within the proposed harvest activity areas in Alternatives B and C, 60 percent of soils have a low mass failure potential, 40 percent have a moderate mass failure potential, and 0 acres have a high mass failure potential (Table 3-48; S-18). Harvest is not proposed on areas with high mass failure potential. Alternative B proposes 0.2 mile of road construction on high mass failure potential totaling 0.2 acres of disturbance (S-40). Specific design feature for construction of road on sensitive landtypes is included in Chapter 2.

Landtypes that exhibit moderate mass failure potential are located primarily on dissected rolling uplands, mountain sideslopes, and stream breaklands. Landtypes that exhibit high mass failure potential (HMFP) are located primarily on lower side slopes, toe slopes, and stream bottoms of weakly to moderately incised drainages within highly weathered rolling uplands (S-21).

Removal of forest canopy and cover from either clearcutting or wildland fire may increase landslide occurrence (Gray and Megahan 1981; Megahan and others 1978). This is primarily due to root decay, soil disturbance, increased snow accumulation and altered melting rates, and soil water increases from reduced interception and transpiration.

Little research has been conducted to determine if partial cutting affects landslide rates. Megahan and others (1978) found that landslide occurrence increased only slightly when overstory canopy was reduced from 100 percent to 11 percent, but increased dramatically when canopy closure went below 11 percent. They also found that crown cover from shrubs affected landslide occurrence after 80 percent crown removal and indicated that landslide occurrence is more sensitive to shrub removal than tree crown removal. Megahan and King (2004 p. 207-208) identify that mass failure from harvest activity is not a serious problem in this geographic area.

Surface Erosion Potential is a rating of the relative susceptibility of exposed soils to sheet and rill erosion. Within the proposed harvest activity areas in Alternatives B and C, 99 percent of soils have a low surface erosion potential, one percent has a moderate surface erosion potential, and 0 acres have a high surface erosion potential (Table 3-48; S-18). The potential for soil erosion is not so much associated with harvest treatments as with existing

roads (Cacek 1989). The dominant erosion process on roads is surface erosion from bare soil areas including the cutslope, fillslope, and travelway.

Revegetation of cut slopes and fill slopes is often difficult because of lack of soil moisture and organic material, low productivity potential, and desiccation of seeds and seedlings, especially on south-facing slopes. On moist slopes revegetation efforts are more successful and erosion of road cut slopes and fill slopes is generally lower.

Road erosion and sediment yield usually decline after construction (Jones 2000; Switalski and others 2004) but can provide a chronic, long-term source of sediment to streams within the project area. Periodic large pulses of erosion may occur during intense water yield and overland flow events in interaction with road drainage systems. Roads and their associated impacts are analyzed in detail in the Water section.

Subsurface Erosion Potential is a rating of potential soil erosion from exposed subsurface mineral soil. This rating is related to activities which expose subsurface mineral soil such as in road cut slopes. Typically, road design features (such as mulching, seeding and 1:1.5 or 1:2 cut slopes) minimize subsurface erosion. Harvest and fuels activities do not expose subsurface mineral soil. Proposed road construction crosses 0.9 miles of high subsurface erosion potential landtypes, 3.1 miles of low subsurface erosion potential, and 1.9 miles of moderate subsurface erosion potential (S-18).

Sediment Delivery Potential is a rating of the probability of eroded soil reaching a stream channel. By using slope gradient, slope shape, and distance to channel, a rating of low, moderate, or high potential is determined. Within the proposed harvest activity areas in Alternatives B and C, 47 percent of soils have a low sediment delivery potential, 51 percent have a moderate sediment delivery potential, and two percent have a high sediment delivery potential (Table 3-48; S-18).

The landtypes that exhibit moderate sediment potential are situated at low- to mid elevation on mid- to lower side slopes and adjacent to incised drainages. The landtypes in the project area that rated as having a high sediment delivery potential to stream channels vary in their topographic setting from wide, low elevation stream bottoms to mid-elevation lower slopes/breaklands on deeply incised drainages and stream headlands. Small portions of Units 84, 110, 137, 143, 170, 182, 197, 254, and 268 are located on high sediment delivery potential landtypes, which total 45 acres (S-19). Because drainage courses and riparian zones would be buffered and would not be entered or logged, the potential for increased sediment delivery from the moderately and highly rated landtype units is minimal (INFS p A-5).

Roads are considered a potential source for sediment delivery and the documentation of the detailed analysis is included in the *Water* section of this chapter.

Productivity Potential is a rating of the relative capacity or ability of a soil to produce and sustain biomass. Within the proposed harvest activity areas in Alternatives B and C, five percent have low productivity potential, four percent have low to moderate productivity potential, 15 percent have a moderate productivity potential, 48 percent have a moderately high productivity potential and 29 percent of soils have a high productivity potential (Table 3-48; S-18).

Soils susceptible to reduced productivity potential are generally those located on shallow, rocky steep slopes on southerly aspects. Removal of canopy can affect soil moisture content in several ways. Precipitation may enter previously intercepted areas and provide existing or establishing vegetation with additional needed moisture and increase decomposition rates. Conversely, rain events may increase erosion on the now exposed soil, especially if the potential is high, and reduce the availability of a growing medium. Furthermore, increased sunlight may also support plant growth or heat up soils to the extent that vegetation is inhibited.

When soils have adequate moisture conditions to retain their biological, chemical, and physical integrity, effects from the loss of forest floor can be minimized (Barnett 1989; Frandsen and Ryan 1985; Hungerford and others 1991; McNabb and Cromack 1990). Direct effects of prescribed burning and pile burning could potentially remove woody debris that would otherwise provide nutrients to the soil as the decay process occurs (Page-Dumroese and others 2006). To minimize potential impacts, burning during high soil moisture would help maintain coarse woody debris requirements (Niehoff 1985 and 2002; Design Features).

However, on an unpredictable site-specific basis, some drier sites may burn at a severity level that removes all of the protecting duff and litter layers, even under managed fire conditions. The duff and litter layer is important in protecting the soil horizons, both as reducing erosion potential and in maintaining soil moisture. Litter prevents the breakdown of soil aggregates and reduces the velocity of overland flow, thereby reducing the erosion potential (Beschta 2004). Project design features and mitigation measures are expected to minimize this effect.

Soil Productivity

Timber management practices can have long-lasting impacts on the soil resource if precautions are not taken. Three design and management criteria relate to soil productivity in the project area. They include:

- Soil disturbance
- Amount of large woody debris and organic matter
- Nutrients from geologic formations

Existing Soil Disturbance within Activity Areas (related to IPNF Soils Standard #1)

Detrimental soil impacts are defined as the proportion of an activity area that may be subjected to displacement, compaction, erosion, or severe burning due to a particular management activity.

Soil disturbance (Niehoff 2002) is described by three different disturbance classes:

- Class 1 is a natural condition with no disturbance. Other classes are compared against this class.
- Class 2 represents slight soil disturbance. There is evidence of previous ground activities, but the observable soil characteristics do no meet detrimental soil damage criteria defined in Regional Soil Quality Standards.
- Class 3 represents detrimental soil disturbance. There is evidence of previous entries and the observable soil characteristics indicate that the site meets detrimental soil damage criteria defined in the Regional Soil Quality Standards.

The soils in an activity area are considered detrimentally disturbed when the following soil conditions exist as a result of forest practices:

Displacement: Soil displacement results in the loss of either one inch of or half of the humus-enriched surface layer (A-soil horizon), whichever is less. The loss of the litter layer alone could be detrimental on some marginal sites. Displacement removes the most productive part of the soil resource. Road construction, ground-based yarding, dozer piling, and cable yarding (corridors) are the major contributors to displacement.

Compaction: Soil are considered compacted when activities result in 15 percent or more increase in bulk density or a 50% reduction in water infiltration rates typical for volcanic ash influenced surface soils. Soil compaction reduces the supply of air, water and nutrients to plants. Road construction and ground-based yarding and piling are the major contributors to compaction.

Surface erosion: Surface erosion is indicated by rills, gullies, pedestals, and soil deposition and should be kept within tolerable limits by retaining enough ground cover, depending with onsite conditions.

Severity of burns: Fires may consume most woody debris and the entire duff and litter layer, exposing mineral soil. White or red ash indicates that much of the carbon was oxidized by fire (Burned-Area Emergency Rehabilitation Handbook FSH 2509.13). Burns that create very high temperatures at the soil surface when soil moisture content is low result in an almost complete loss of surface and upper soil horizon organics. Many of the nutrients and ectomycorrhizae associated with these organics can be lost to the atmosphere through volatilization and removed from the site in fly-ash (Garrison and Moore1998) or lost to high ground temperature flux (Harvey and others 1986 p. 7).

Existing soil conditions within every proposed harvest unit were determined through random sampling. Table 3-49 below shows proposed units where field sampling found existing detrimental disturbance. Two field methods were used to calculate soil disturbance as described in the Soils Analysis Methods section. Either random sampling with transects placed within the proposed unit or a random walk with sampling was conducted throughout the units to field-verify evidence of past activity. The most recent timber harvest overlapping with any proposed units occurred in only one area (Unit 100) that was treated in 1983 (Map 15). Previous logging in other proposed units occurred prior to the 1960s and no record exists in the data base regarding those activities.

Existing detrimental disturbance in Unit 224 is at 14%, which is approaching the threshold for exceeding soil quality standards. The majority of this detrimental disturbance is attributed to a compacted area near the top of the unit (S-6). Old stumps indicate the area was logged quite a long time ago, but no exact cause of the compaction was determined. Existing conditions for all other units are displayed in Tables 3-55 and 3-57.

Table 3-49 Proposed Units with Existing Detrimental Disturbance

Unit #	Unit Acres	Acres of Detrimental Disturbance	% Detrimental Disturbance	Unit #	Unit Acres	Acres of Detrimental Disturbance	% Detrimental Disturbance
14	39	1.0	2.6	232	54	1.0	1.9
70	38	1.0	2.6	233	14	0.9	6.4
100	8	0.1	1.3	248	69	5.5	7.8
156	31	0.6	1.9	251	25	1.5	6.0
170	41	0.8	2.0	254	50	2.0	4.0
176	62	1.0	1.6	271	27	1.0	3.7
209	29	1.0	3.4	273	22	1.0	4.5
224	25	3.5	14.0	283	61	1.0	1.6
225	56	2.0	3.6	322	40	2.0	5.0
226	19	0.4	2.1				

Large Woody Debris and Organic Matter (Related to IPNF Soils Standard #2)

The second soil productivity criterion relates to the management of coarse woody debris and organic matter and follows research guidelines contained in Graham and others (1994). Retaining coarse woody debris and organic matter is important to maintaining the soils most productive layer. Coarse woody debris is defined as material derived from tree limbs, boles, and roots greater than three inches in diameter and in various stages of decay and performs many physical, chemical, and biological functions in forest ecosystems and is a key habitat component for many wildlife species and for stream ecology (Graham and others 1994). Because coarse woody debris is such a valuable part of a functioning ecosystem, a portion of the material must be maintained to ensure that organic matter is recycled for long-term productivity. Nevertheless, in natural systems organic matter fluctuates with forest growth, mortality, fire, and decay.

The average optimum level of fine organic matter is 21 to 30 percent (Graham and others 1994), which equates to one to two inches of surface litter and humus. Optimum levels of fine organic matter relate to ectomycorrhizae fungus, which is a good indicator of healthy forest soil. In moist western hemlock and cedar habitat types, strong levels of ectomycorrhizae exist when organic levels exceed 30 percent. Soil survey data indicates that most forest sites have adequate organic matter levels to support strong ectomycorrhizae populations.

The soils found in the Bussel 484 Project Area owe their productivity to excellent nutrient-holding capacities and other favorable characteristics provided by an ash layer that can extend to over two feet deep in certain locations. However, these generally young and poorly developed soils can experience long-term deficiencies when insufficient biologically essential elements, like organic matter and coarse woody debris, are not available.

Organic matter content varies throughout the project area (S-22). Its variability and depth is natural and usually correlates to habitat type and aspect with excessive needle cast often decreasing the establishment of a more herbaceous cover. Exclusion of fire has also contributed to increased duff accumulations.

Coarse woody debris was found to be variable as well (S-22) and ranged from 3.76 tons/acre to 39.30 tons/acre (S-5; S-22). Some stands contain higher amounts of downed wood, generally on moist north-facing slopes while south-facing slopes have lower coarse woody debris levels that can reflect drier growing conditions. Decomposition may also be affected due to light and moisture variations under different canopy densities.

The existing level of surface organic matter (duff layer) and coarse woody debris varies between units but generally showed to be low to optimal. Monitored units had organic matter (OM) that ranged from below 0.75 inches to greater than 1.75 inches (S-5; S-22) and, just like CWD, can primarily be associated with habitat type, aspect, and past fire history.

Nutrients from Geologic Formations (Related to IPNF Soils Standard #3)

The geology of the area encompasses a mixture of residual parent material, primarily metasedimentary Belt Supergroup formations such as the Upper Wallace (siltite and argillite), Middle and Lower Wallace (quartzite, siltite and argillite), Proterozoic schist and quartzite, and small areas of other geologic formations that include amphibolite and orthogneiss (S-25). Because the GIS geology map layer includes *either* rock formations or rock type, the rock type was correlated to similar formations to compare foliar nutrient distribution. The following table displays geologic formation or rock type identified in proposed harvest units, the associated acreage, and correlated formations ('Rock type formation match') that had foliar nutrient sampling (S-13, S-14, S-15; S-16, S-17).

Table 3-50 General Geology and Rock Types of Proposed Harvest Units

Formation or Rock Type	Acres	Rock Type Formation Match	Foliar Sampling for Nutrients
Lower, Middle Wallace	1398	Lower and Middle Wallace	yes
quartzite	200	Lower and Middle Wallace, St. Regis	yes
amphibolite / schist	650	Upper Wallace	yes

Timber harvest results in the removal of nutrients that have been accumulated in trees over time. Of increased concern is the role of potassium in forest health, especially susceptibility to insects (Garrison-Johnston and others 2003) and a possible link between potassium deficiency and the lack of tree resistance to root disease (Garrison-Johnston 2003). Research (Garrison-Johnston and others 2003 and 2007; Moore and others 2004a; 2004b; Shen and others 2001) suggests a complex balance between underlying geology and the natural deficiency of potassium in northern Idaho. In comparison, soil nitrogen can be replenished more rapidly than potassium through nitrogen fixation or atmospheric deposition. Potassium mostly weathers from rocks or is recycled from vegetative material.

Whole-tree yarding and removal of treetops can lead to the direct loss of potassium (Morris and Miller 1994). On some sites 45 percent of the available potassium is retained in trees with the remainder being held in subordinate vegetation, forest floor, and soil pools. Within the trees, about 85 percent of the potassium is held in the branches, twigs, and foliage (Garrison and Moore 1998). It is therefore vital to recycle as many nutrients as possible before removal, which can be done by over-wintering small-sized debris to leach out potassium (Baker and others1989; Barber and Van Lear 1984; Edmonds 1987; Garrison and Moore 1998; Laskowski and others 1995; and Palviainen and others 2004).

Under most natural circumstances, potassium returns to the soil when the tree dies. Unlike many other soil nutrients, potassium is otherwise derived primarily from underlying geologic formations and is a product of slow weathering processes. Most of the Bussel Project Area's underlying bedrock formations are the Precambrian metasedimentary Belt series group, primarily the Lower and Middle Wallace Formations.

Foliar analysis was conducted to determine nutrient levels that are present in soils derived from various geologic formations on the St. Joe Ranger District (S-13, S-14, S-15, S-16, S-17). Foliar analysis was previously conducted on Upper, Middle and Lower Wallace Formations and the St. Regis Formation. The result of this analysis indicates that the potassium level is *above* the critical level (Garrison and Moore 1998; S-13, S-14, S-15) for the Lower Wallace Formation. For the Upper Wallace formation, the potassium level is *below* the critical level (Garrison and Moore 1998; S-13, S-14, S-15). Nitrogen and sulfur are above the critical level on the Upper Wallace, but below the critical level (Garrison and Moore, 1998; S-13, S-14, S-15) on the Lower Wallace formation. The nutrient levels of phosphorous, calcium, magnesium, manganese, zinc, copper, iron, and boron are all above the critical level (Garrison and Moore, 1998; S-13, S-14, S-15).

The Intermountain Forest Tree Nutrition Cooperative (IFTNC) continues to research potassium contents within tree species and different rock types in order to establish specific minimum thresholds for retention and to determine effects of potassium on tree growth and resistance to root diseases (Mika 2005 and 2008; Shaw 2005). Until these minimum thresholds are developed through research, the Idaho Panhandle National Forests are using management recommendations from the IFTNC (Garrison and Moore 1998) as a guideline for maintaining sufficient potassium on a site. These measures are incorporated into the design features (Chapter 2) for this project.

Area Dedicated to Roads, Trails, and Transmission Line Towers

Approximately 297 acres of National Forest System lands within the Bussel 484 Project Area are dedicated to the 66 miles of system roads. The area affected by existing system roads was estimated using 4.5-acres per mile (37-foot road width that includes a 14-foot wide running surface and cut and fill slopes). Approximately five acres of land are dedicated to trails on 6.6 miles of existing trails. On gentle ground trail width is usually less (~12 ft.). To determine effects from trails, an average width of six feet was assumed (0.73 acres per mile of trail). Approximately one acre (reflecting the actual physical disturbance from all towers on the ground) is dedicated for transmission line towers along the Dworshak-Taft Transmission Line.

A total of approximately 303 acres of land are dedicated to other uses and are no longer in a productive state. That equates to approximately 2.5% of National Forest System lands in the project area. Regional soil quality standards do not apply to these areas.

Environmental Consequences to Soils

Effects to Soils with Alternative A (No-Action)

Under this alternative, no new management-induced detrimental soil impacts would occur in the Bussel 484 Project Area. Stands would not be treated, roads and trails would not be built, roads would not be decommissioned, and fire suppression would continue. Fire suppression would increase buildup of fuels, which may increase the risk of severe wildfire that could result in severe burning, erosion, and loss of soil nutrients. The introduction of weeds and unwanted flora following a fire could lead to higher competition between less desirable and native vegetation. In the absence of such a hot fire, nutrients would be retained on site.

No direct effects to the soil resource would occur under the No-Action Alternative since there would be no road construction, logging, or fuel treatment activities. Existing roads would not be decommissioned, and no change in road mileage located in riparian areas would occur. Soil would not be returned to the productive land base.

There would be no compaction or displacement beyond what currently exists. Throughout the forested landscape, tree mortality from pathogens and weather events would continue as in the past, which has a direct influence on the area's recycling of organic matter and changes in fuel loading. In moist habitat sites, the increase in organic matter is a benefiting function to overall soil productivity because it fosters formation of ectomycorrhizae that enhances nutrient and water uptake (Graham and others 1994). In dry habitat types, increases of organic matter may result in a negative response because organic materials are likely too dry for ectomycorrhizal growth and can reduce natural regeneration of dry sites species adapted to a habitat with shorter fire return intervals (Graham and others 1994).

Effects of Wildfire with All Alternatives

Given the decades of fire suppression in the project area, the chance of a severe wildfire occurring could be high if an ignition starts in an untreated area during extreme dry weather conditions. The proposed vegetation treatments in the project area would not necessarily prevent severe wildfires from occurring, but would increase the ability to suppress such a fire should the ignition occur in the treated areas.

The probability of a high severity fire is not certain to occur within the project area during a given timeframe. The fact, however, is that when a fire breaks out, the chances for high severity fire effects on soils can be much higher in untreated areas with excessively heavy fuel loads compared to those that have successfully completed treatment, including post-harvest logging slash (Certini 2005; Cram et al. 2006; Graham et al. 2004; Gorman 2003; Keane et al. 2002). Timber harvest and activity fuels treatments would reduce the chance that a wildfire could have as severe of an effect on the soils in treated areas as it could in untreated areas because there would be a reduction in the amount of fuels available for build-up on those treated sites.

The occurrence of a high-intensity wildfire would have a high potential for impacts to soils and soil productivity in severely burned areas, especially since the risk of soil erosion increases proportionally with fire intensity (Megahan 1990 p. 146). Ashes that have burned white or a reddish color indicate that much of the organic carbon was oxidized and is no longer available to the soil. Other effects would include the loss of organics, loss of nutrients, and a reduction of water infiltration (Wells and others 1979 p. 26). Burns that create very high soil surface temperatures, particularly when soil moisture content is low, result in an almost complete loss of soil microbial populations, woody debris, and the protective duff and litter layer over mineral soil (Hungerford 1991; Neary and

others 2005). Nutrients stored in the organic layer (such as potassium and nitrogen) can also be lost or reduced through volatilization and as fly ash (DeBano 1991 pp. 152-153; Amaranthus and others 1989 p. 48).

Fire-induced soil hydrophobicity is presumed to be a primary cause of the observed post-fire increases in runoff and erosion from forested watersheds (Huffman and others 2001). Though hydrophobicity is a naturally occurring phenomenon that can be found on the mineral soil surface, it is greatly amplified by increased burn severity (Huffman and others 2001; Neary and others 2005).

Soil hydrophobicity usually returns to pre-burn conditions in no more than six years (DeBano 1981). Dyrness (1976), and other studies have documented a much more rapid recovery of one to three years (Huffman and others 2001). The persistence of a hydrophobic layer depends on the strength and extent of hydrophobic chemicals after burning and the many physical and biological factors that can aid in breakdown (DeBano 1981). This variability means that post-fire impacts on watershed conditions are difficult to predict and to quantify.

Table 3-51 Comparison of Proposed Activities by Alternative

Proposed Activity	Alternative A	Alternative B	Alternative C
Timber Harvest	**0**	**2,137 acres**	**2,137 acres**
Ground-based	0	552 acres	389 acres
Cable	0	79 acres	20 acres
Skyline	0	795 acres	297 acres
Helicopter	0	712 acres	1,431 acres
Road Construction	**0**	**5.8 miles**	**0**
System	0	5.1 miles	0
Temporary	0	0.5 miles	0
On Potlatch land with a cost-share agreement	0	0.2 miles	0
Road Reconstruction	0	6.7 miles	5.4 miles
Fuels Treatment: Total is more than timber harvest acres because some units would have more than one type of treatment			
Yard Tops	0	316 acres	273 acres
Lop	0	1,742 acres	1,766 acres
Slash	0	181 acres	145 acres
Grapple Pile & Burn Piles	0	230 acres	175 acres
Hand Fireline	0	20.2 miles	20.2 miles
Broadcast Burn	0	307 acres	307 acres
Jackpot Burn	0	289 acres	295 acres
Timber Stand Improvement (precommercial thinning or precommercial thinning & pruning)	**0**	**821 acres**	**821 acres**

Direct and Indirect Effects of Alternative B

Detrimental Soil Disturbance

Design features to protect soil and site productivity (Design Feature 10) would be implemented as part of the action alternatives to ensure that activities are consistent with Forest and Regional standards in terms of soil compaction, displacement, and nutrient retention. See Chapter 2 for details of proposed activities.

The effects of the action alternatives on the soil resource were assessed based on their potential to create detrimental impacts and to affect soil productivity. Table 3-55 shows soil disturbance levels for Alternative B. Standard and site-specific Best Management Practices (BMPs) and soil and conservation practices as described in the Soil and Water Conservation Practices (SWCP) Handbook FSH 2509.22 are included as design features (FEIS Appendix B) and would be applied during timber harvest and road decommissioning, construction, maintenance and reconstruction to minimize soil erosion and maintain acceptable soil productivity (Seyedbagheri 1996; Lynch and Corbett 1989, 1990; Idaho DEQ 2001; USDA 2002; S-24, S-25, S-26, S-27). The Soil and Water Conservation Practices Handbook outlines BMPs that protect the soil and water resources at a higher level than do existing Idaho Forest Practices rules and regulations, thereby incorporating all Idaho State standards.

The IPNF Soil Scientist monitored post-harvest soil conditions on two timber sales on the St. Joe Ranger District (among others on the Forest) in 2006 and 2007 (S-25). This monitoring showed that acceptable productivity potential was maintained in all units monitored.

BMP monitoring is conducted annually by the IPNF to validate the implementation and effectiveness of BMPs associated with land management activities (S-44, S-45). Monitoring results are used to adapt future management actions where improvements in meeting objectives are indicated (see *Past, Present, and Reasonably Foreseeable Activities* section at beginning of Chapter 3).

The techniques and their effectiveness are documented in several publications (Seyedbagheri 1996; Lynch and Corbett 1989 and 1990; Idaho DEQ 2001). The BMPs would have a high effectiveness in minimizing soil compaction and displacement, address seeding of disturbed areas, limit operations when soil moistures are high, and address conduct of logging. BMP monitoring in past harvest units identifies that there is little to no exposed soil (S-24, S-25, S-26, S-27, S-28).

Timber Harvest: Timber harvest activities that may affect soils include approximately 552 acres of ground-based skidding, 79 acres cable yarding, 795 acres skyline yarding, and 712 acres of helicopter yarding (Table 3-51). Compaction, displacement, rutting, and severe burning can affect the soils physical, chemical, and biological properties, which indirectly can affect the growth and health of trees and other plants. Compaction reduces soil permeability and infiltration, which can cause soil erosion. Displacement reduces plant growth where topsoil and organic matter are removed. Estimates of possible detrimental disturbance from harvest operations are shown in Table 3-55. Helicopter landings are proposed on existing roads and in an existing rock-pit adjacent to an existing road.

The proposed action includes post-harvest monitoring of 14 proposed units that have existing detrimental disturbance where ground-based equipment is proposed to be used for skidding on all or part of the unit. Soils would be monitored after completion of harvest and fuel treatment activities. We estimate that proposed activities on these units would meet Forest and Regional soil quality standards, but monitoring is included to verify expected results and would be done in Units 14, 70, 100, 170, 215, 225, 226, 232, 233, 248, 251, 254, 271, and 322.

Unit 224 currently has 14% detrimental disturbance, presumably from compaction from adjacent old logging activity. Approximately eight of the 25 harvest acres are proposed for ground-based skidding in Unit 224, the other 17 acres would be cable logged. Skid trails would be decompacted after use and soils would be monitored to determine effectiveness of decompaction and to verify amount of detrimental disturbance (Chapter 2, Site-Specific Design Features). Decompaction may result in approximately one half acre of recovery. This equates to an estimated 2% recovery for the entire 25-acre unit. Skid trail decompaction is expected to be moderately effective (S-12; Heninger and others 2002; Dykstra and Curran 2000 and 2002; Plotnikoff and others 2000). Similar findings from monitoring of decompaction activities on the IPNF confirm the effectiveness with recovery levels ranging around 30-50% with an upward trend over time (S-12).

Temporary Road Construction: Approximately 0.23 miles of temporary road (NR21) would be constructed on an existing skid trail to provide access for Unit 215, which equates to approximately 2.25 acres of detrimental disturbance outside of harvest units. This road would be fully recontoured, mulched, and seeded after use.

Temporary road construction within proposed harvest Units 232 and 251 is accounted for in the soil disturbance estimates shown in Table 3-55. Temporary road construction would result in approximately 0.6 acres of detrimental disturbance in Unit 232 and approximately 0.7 acres of detrimental disturbance in Unit 251.

Roads temporarily needed for project work that would be decommissioned would have initial detrimental effects. All temporary roads would be fully recontoured to the natural slope upon completion of activities. Temporary roads that would remain on the landscape more than one dry season would be waterbarred according to specific interval direction and at specific angles to promote acceptable results (Design Feature 10.E.). They would then be mulched with a natural, weed-free material to prevent runoff and erosion during spring and/or winter runoff events.

Obliteration would begin to reduce compaction of the soil, help to restore soil productivity, and decrease hydrologic effects from road surface runoff (Switalski and others 2004). Design features (S-26) are expected to be effective at minimizing effects from temporary roads. The IPNF Soil Scientist monitored two recontoured temporary roads in the Rye on Ham Timber Sale on the St. Joe District in 2006 (S-25). The roads were nicely decompacted, showed little resistance to shovel penetration, and had plenty of organic matter and debris incorporated. Revegetation is starting to occur, mainly from surrounding vegetation and natural reseeding. Tree seedlings were also planted on

the roadbeds and appear to be doing well. Some soil mixing occurred, but enough ash is present to provide a favorable growing environment. Few to no weeds were found.

System Road Construction: Approximately 5.1 miles of system road would be constructed. That equates to approximately 23 acres of land dedicated to system roads where soil productivity would not be maintained. Roads and landings that are to remain on the landscape for future use cause irretrievable effects on productivity, as those lands become "dedicated" lands. A detailed analysis of roads and their effects is available in the *Water* section.

Road Decommissioning: Approximately 10.7 miles of system road would be decommissioned (Road Management Rx D). This would include decompaction and some recontouring (see *Road Management Prescriptions* under *Activities Common to the Action Alternatives* in Chapter 2) with the goal of restoring site productivity. Assuming 4.5 acres per mile of road, approximately 48 acres of National Forest System land would be on the path to recovery towards a productive land base.

Fuel Treatment: Activity-fuel treatments that may affect soils include approximately 316 acres of yarding tops, 307 acres of broadcast burning, 230 acres of grapple piling followed by pile burning, 20.2 miles of hand fireline construction, and 289 acres of jackpot burning (S-29). See Table 2-3 for a list of fuel treatments by unit.

Severely burned soils can become hydrophobic (water repellent) and lead to increased erosion, runoff, and/or reduced productivity. Prescribed burning would occur in the spring or when soil moisture is at least 25 percent (Design Feature 10.G.). Past monitoring has shown that burning under these conditions has minimal to no impacts on soil productivity (Niehoff 1985; Niehoff 2002; USDA Forest Service 2001, 2002 and 2003).

Design features also require piling machinery to utilize existing trails and stay on slopes less than 40 percent to prevent soil disturbance in excess of guidelines. Design features for grapple piling require operation of equipment over slash mats whenever enough material is available, preferentially re-using existing skid trails if present (Design Feature 10.C.vii.). Forest Plan monitoring and research (Eliasson and Wästerlund 2007; Han 2006; Niehoff 2002; USDA Forest Service 2001, 2002 and 2003) indicates reduced soil disturbance if equipment is operated on a slash mat.

Only areas that could be reasonably accessed would be treated and none of the trails would be excavated to facilitate access. The residual logging debris that would be lopped and scattered or that could not be grapple piled and burned would increase potential fire intensity and severity for a few years until snow could compress the debris and the fine organics would decompose.

Severe burning and ground disturbance could create bare soils and encourage noxious weed infestation. The above mentioned design features are therefore incorporated to lessen disturbance impacts in activity areas in order to prevent long-term impacts to the soil resource.

Planting in Harvest Units and Riparian Areas: Planting would not cause substantial changes to soil conditions and is not expected to affect soils because no equipment would be used off existing roads. Planting is not discussed further in terms of soils.

Pocket Gopher Control: Pocket gopher control would not affect soils because bait is placed using hand tools and no equipment is used off existing roads. Pocket gopher control is not discussed further in terms of soils.

Precommercial Thinning and White Pine Pruning: Precommercial thinning and white pine pruning would be done by hand (chainsaws and hand tools), and the cut trees and branches would be left on site with no further treatment. Since there would be no soil compaction and no removal of biomass, there would be no detrimental effect on soil productivity or quality. Nutrients held within the cut trees and branches would be released. Precommercial thinning and white pine pruning is not discussed further in terms of soils.

New Trail Construction: Approximately 0.2 miles of new motorized trail would be constructed between Road 1901 and Road 3590A. This equates to approximately 0.2 acres of disturbed soils that would be taken out of productivity and be dedicated as a trail.

Road Maintenance: No additional soil impacts would occur from proposed road maintenance activities such as blading, drainage improvements, and surfacing on existing dedicated roads. Road maintenance is not discussed further in terms of soils.

Organic Matter & Coarse Woody Debris

Timber Harvest: Harvest activities are not expected to reduce soil organic matter within the proposed units because no organic matter would be removed from the soil. Harvest activities may actually increase material that would contribute to the organic surface layer through limbs and tops left on-site. Existing organic matter would not be diminished by harvest activities, but organic matter recruitment would likely be less in those portions of units identified for yarding tops (Tables 3-52 and 3-53).

No reduction in the existing CWD level would occur from harvest activities because there is no removal of material from the forest floor. Design features recommend CWD levels based on Graham et al. (1994). CWD levels may increase from limbs, tree tops, cull logs and broken boles left on-site. Design features recommend leaving amounts of CWD as a function of habitat type (Design Feature 10.H.iii.). In addition, the proposed harvest treatments retain from 10% to 70% of the existing canopy (or basal area) (S-30) for future CWD recruitment.

Fuel Treatment: No long-term measurable negative effects on organic matter and coarse woody debris are anticipated from post-harvest underburning if soil moisture content is equal or above 25 percent when burning occurs (Niehoff 1985 and 2002). When soils have adequate moisture conditions to retain their biological, chemical, and physical integrity, effects from the loss of forest floor can be minimized (Barnett 1989; Frandsen and Ryan 1985; Hungerford and others 1991; McNabb and Cromack 1990).

In south- and southwest facing units, the prescribed burns would have limited detrimental effects when executed in the spring. Burning under controlled conditions reduces potential soil nutrient losses, decreases the possibly of higher severity impacts from wildfires, and lessens the chance of creating hydrophobic soils that can lead to increased erosion, sedimentation, and debris flows (de Dios Benavides-Soloria and McDonald 2005; Heyerdahl and others 2007; Ice 2003; Maurer 2007; Neary and others 2005; Robichaud 2000; Swanson 1981).

When burn piles are large, nutrient losses from heat and volatilization could be considerable. In some cases, burning of the slash piles may create localized patches of hydrophobic soils for a short period (as much as one to two years) but the areas are generally not large or extensive enough to alter slope hydrologic responses or long-term soil productivity.

However, on an unpredictable site-specific basis, some drier sites may underburn at a severity level that removes all of the protective duff and litter layers, even under managed fire conditions. The duff and litter layer is important in protecting the soil horizons, both as reducing erosion potential and in maintaining soil moisture. Litter prevents the breakdown of soil aggregates and lessens the velocity of any overland flow, thereby decreasing the erosion potential (Beschta and others 2004). Direct effects of prescribed underburning and pile burning could potentially remove woody debris that would otherwise provide long-term nutrients to the soil as the decay process occurs (Page-Dumroese and others 2006). Burning when soil moisture content is high helps to maintain coarse woody debris and organic matter requirements.

Nutrient Levels

Timber Harvest: Nutrient levels are not expected to decline sufficiently to irreversibly impair soil productivity because slash would be left over-winter (except where tops would be yarded) or left on site where fuels would be lopped (S-29). This would allow for leaching of nutrients from slash into the soil (Garrison and Moore, 1998). Lopping is proposed for most units although in some the material will be piled and burned after over-wintering (S-29).

A total of 316 acres in 28 units are proposed for yarding tops, which is 15% of the total acreage proposed for treatment (Table 3-52 and S-29). The purpose of yarding tops is to remove fuel where it could constitute a substantial risk to ignite surrounding timber (see *Fire and Fuels* section). Portions or all of the area of these 28 units would have tops yarded, which removes nutrients held in the foliage and branches (Garrison and Moore 1998). Yarding tops within the 28 units varies from 4% to 100% of each unit's acreage. The average percent unit area of yarding tops is 36% (S-29). The areas proposed for yarding tops are mostly located within group shelterwood (GSW) silvicultural prescriptions; GSW units comprise 189 acres or 60% of total yarding top acreage (Table 3-53 and S-29).

Table 3-52 Alternative B Information on Yarding Tops

Unit #	Acres of yarding tops	Percent of unit with yard top		Unit #	Acres of yarding tops	Percent of unit with yarding top
5	3	20.0%		232	19	35.2%
6	2	9.1%		233	5	22.7%
11	16	28.1%		251	9	36.0%
14	20	51.3%		254	17	34.0%
15	2	8.7%		264	19	33.9%
17	2	3.8%		268	9	33.3%
18	3	17.6%		271	13	100.0%
41	15	36.6%		299	18	35.3%
114	10	27.0%		301	21	33.9%
134	17	34.7%		307	10	38.5%
143	8	33.3%		311	10	62.5%
200	14	100.0%		321	16	57.1%
209	10	34.5%		322	7	17.1%
225	13	23.2%		336	8	100.0%

Yarding tops would remove nutrients but residual timber in commercial thin (CT), seed tree (ST) and GSW units contains nutrients that remain on-site. The residual timber is estimated to be 40-70% in CT units, 50-60% in GSW and 15-20% in ST units (S-30). Clearcut with reserve units have 10-15% remaining timber (S-30). Soil productivity within activity areas is not expected to be irreversibly damaged, because of residual timber, limb and top breakage during harvesting, over-wintering slash, and lop and scatter fuel treatments.

Table 3-53 Silvicultural Prescription and Number of Units with Some Yarding of Tops

Silvicultural Prescription	Clearcut with Reserves	Commercial Thin	Group Shelterwood	Seed Tree
# of Units with Some Yarding of Tops	1	13	13	1

As a direct effect, harvesting on all sites would remove within each tree bole and bark about ±43 percent of the potassium that is contained within a tree. Foliage, twigs, and branches account for the remainder (Garrison-Johnston and others 2004). This may have an indirect effect on some plants that are left in the stand. Douglas-fir and grand fir consume and store more potassium than other tree species. Over-wintering slash allows the release and makes available stored potassium, benefiting western larch, ponderosa pine, and western white pine which require less potassium for growth and maintenance (Garrison and Moore 1998; Garrison-Johnston 2007). These more potassium efficient tress would be planted as necessary in regeneration units. At this time, management recommendations from the IFTNC (Garrison and Moore 1998) are used as guidelines for maintaining sufficient potassium on a site.

Coarse woody debris recommendations call for various amounts of material by different habitat types. This would provide protection against soil erosion as well as a long-term source of nutrients and organic matter (Brown and others 2003; Graham and others 1994). Indirect effects of substantial soil-wood loss also include altered processes of forest regeneration and growth, favoring species requiring lower soil moisture and nutrient levels. Additional effects could include loss of habitat for species requiring soil wood as dens or substrate for invertebrates, bacteria and fungi, which affect food availability for small rodents and their predators.

Soil Movement (Erosion, Mass Movement)

Timber Harvest: Harvest activities are proposed in landtypes rated with low surface erosion potential on 99% of the proposed activity areas. Soil erosion is not expected because of residual canopy and ground cover, operation of mechanical equipment on a slash mat combined with other BMPs, and the overall low risk of surface erosion (S-18; S-25, S-27; S-28).

Harvest activities are not proposed on landtypes rated with high mass failure potential (HMFP) because proposed units would be buffered by ½ the height of a site potential tree (S-31) to exclude such areas and there would be no proposed harvest activities within the buffer. No change in mass failure potential is expected from the proposed harvest activities (Megahan and King 2004 p. 207) because of low and moderate mass failure potential ratings (Table 3-48; S-18), residual stocking (S-30) and relatively gentle slopes (S-32).

Road Construction: Megahan and King (2004 p. 209) attribute roads as having the greatest effect on mass failure of all practices associated with forest management. The following table displays proposed road construction, length by landtype over which construction will occur, and landtype erosion ratings (S-19).

Table 3-54 New Road Construction by Landtype

		Landtype Ratings				
Landtype	**Length (miles)**	**Surface Erosion Potential**	**Subsurface Erosion Potential**	**Mass Failure Potential**	**Sediment Delivery Potential**	**Soil Productivity Potential**
410	0.4	L	L	L	L	L-M
440	0.1	L	L	L	L	L-M
457	0.3	L	H	M	M	H
461	0.7	L	H	M	M	H
462	0.9	L	L	L	L	MH
463	0.2	L	M	M	M	MH
464	0.9	L	L	L	L	MH
465	<0.1	L	M	M	M	MH
470	0.4	L	L	L	L	M
490	0.3	L	M	L	L	MH
762	0.6	L	M	L	M	MH
763	0.2	L	M	H	M	MH
764	0.2	L	M	L	L	MH
770	0.1	L	L	L	L	M
771	0.2	L	L	L	L	L

Road construction is proposed on 0.2 miles on Landtype 763, which is rated having high mass failure potential. In the Bussel Creek drainage, there are 7.4 miles of existing roads on landtypes rated with high mass failure potential (S-33). There are 1.3 miles of already existing road on Landtype 763. Road inventories identified small mass failures on Roads 1254D, 1902, 3590, and 1900 (S-34, S-35, S-36) though none of the identified failures associated with roads were located on landtypes with high mass failure potential (S-34). The 0.2 mile of new road construction located on Landtype 763 is not expected to cause mass failure because existing roads on this landtype display no movement (S-34) and design features for the 0.2 mile of new road construction on HMFP landtype would be implemented to prevent mass failure (see Design Feature 10.K.). Please also refer to the *Water* section for additional information on roads.

Cumulative Effects of Alternative B

Past Activities

Timber Harvest and Related Activities: The most recent timber harvest overlapping with any proposed units occurred in only one area (Unit 100) that was harvested in 1983 (Map 15). Previous logging in other proposed units occurred prior to the 1960s and no record exists in the data base regarding those activities.

Existing detrimental disturbance in Unit 224 is at 14%, which is approaching the threshold for exceeding soil quality standards. The majority of this detrimental disturbance is attributed to a compacted area near the top of the unit (s-5). Old stumps indicate the area was logged quite a long time ago, but it is not exactly clear what caused the disturbance.

Proposed harvest activities can increase the potential for slope instability from increased soil water content, reduced and decomposing root mass, and decreased canopy cover, when added to already existing past harvest activities within the same vicinity (Megahan and others 1978; Gray and Megahan 1981). There is a potential for cumulative effects on approximately 55 acres associated with portions of Units 100, 224, and 283 that are located above or below old timber harvest units from 1984, 1988, and 1985, respectively (Map 15), and are adjacent to potentially unstable slopes. Slopes are generally at or less than 35 percent, and past harvest treatments are fully regenerating; therefore, they present little cause for concern because soil water uptake with 20+ year old trees in the past harvest units greatly reduce instability potentials. An additional buffer zone (S-31) is also included.

The remaining past harvest activities in the proposed project area that are not spatially associated with any of the proposed harvest units (i.e. downslope or upslope) were identified as stable or not relevant to having a cumulative effect.

Fire: No evidence of soil damage from previous fires was noted within proposed treatment units.

Road and Trail Construction: Past road and trail construction resulted in approximately 303 acres of National Forest System lands in the project area to be removed from the productive land base.

Approximately 297 acres of National Forest System lands within the Bussel 484 Project Area are dedicated to the 66 miles of system roads. The area affected by existing system roads was estimated using 4.5-acres per mile (37-foot road width that includes a 14-foot wide running surface and cut and fill slopes). Approximately five acres of land are dedicated to trails on 6.6 miles of existing trails. On gentle ground trail width is usually less (~12 ft.). To determine effects from trails, an average width of six feet was assumed (0.73 acres per mile of trail).

Transmission Line: When the Dworshak-Taft Transmission line was constructed, approximately one acre (reflecting the estimated actual physical disturbance from all towers in the ground) was removed from the productive land base and was dedicated for the transmission line towers.

Present and Reasonably Foreseeable Activities

Fire: Wildfires have been common in the past and should not be eliminated as an ecological process. Proper management through fuel reduction and prescribed burning should sustain an environment where fire plays an integral role in stand maintenance and healthy forests with minimal soil damage. It is possible that salvage opportunities would be considered if a wildfire should occur within the project area. It is impossible at this time to predict if, when, where, or how that would be proposed; so it is not possible to determine potential effects. Additional analysis and a separate decision would be required.

Successful fire suppression actions would eliminate the chance of detrimental effects to soil productivity. Most hand fireline construction would have only minor disturbance to the soil resource as identified in Table 3-53. As needed, closed roads would be reopened for access and be incorporated as part of the fireline construction. As part of post-fire work, the areas of disturbance would be rehabilitated and the roads would be returned to their previous condition.

Noxious Weed Treatment: Noxious weed monitoring and treatment would continue and would follow guidelines established in the St. Joe Noxious Weeds ROD (USDA 1999). Effects to soil resources were analyzed in the document and its adaptive strategy. No additional effects to soils beyond what was analyzed for and disclosed in the EIS are expected to occur.

Recreation: The project area is open for general motorized use which allows for hunting, fuel wood gathering, collection of miscellaneous forest products, dispersed camping, and motorized touring. Recreational activities are expected to increase over time and may contribute to localized, small-scale disturbances.

Other Activities: Activities such as berry picking, personal Christmas tree removal, and driving on open roads are not expected to affect the soil resource, because these activities do not cause substantial changes to soil conditions.

Proposed Activities

The proposed activities that would effect soils and would occur where effects from past, present, and reasonably foreseeable activities are still evident include timber harvest, fuels treatment, temporary road construction, system road construction, trail construction, system road decommissioning.

Cumulative Effects on Productive Land Base: The cumulative effects of road construction, trail construction, and system road decommissioning on the productive land base are shown in Table 3-56. Approximately 23 acres would be removed from the productive land base for the proposed new construction of 5.1 miles of system road and 0.2 acre would be removed for the proposed 0.2 miles of ATV trail construction in Lines Creek (S-37). Approximately 48 acres would be on the path of recovery towards a productive land base from road decommissioning (Rx D) (S-38). The cumulative result of Alternative B would be approximately 278 acres of National Forest System land in the Bussel 484 Project Area removed from the productive land base. This is approximately 2.3% of the 12,192 acres of National Forest System land in the project area.

Timber Harvest, Fuel Treatment, and Temporary Road Construction: The cumulative effects of timber harvest, fuel treatment, and temporary road construction in activity areas for Alternative B are shown in Table 3-55.

Table 3-55 gives a summary of disturbance from past activities and potential disturbance from proposed harvest and fuels treatment activities.

Table 3-55 Alternative B Predicted Cumulative Detrimental Disturbance

Unit ID	Unit Acres	Logging System	Existing Acres of Detrimental Disturbance	Acres of Detrimental Disturbance from Proposed Activities					Cumulative Detrimental Disturbance After Implementation of Activities # %
				Tractor Log & Pile/Burn	Aerial Log	Temporary Road Construction*	Fireline Construction	Proposed Activity Disturbance Total	
5	15	H	0.0	0.0	0.3		0.0	0.3	**2**
6	22	H	0.0	0.0	0.5		0.0	0.4	**2**
11	56	GB/S/H	0.0	1.9	0.8		0.0	2.7	**5**
14	39	GB/S	1.0	0.9	0.6		0.0	1.5	**4**
15	23	GB/S	0.0	1.0	0.3		0.0	1.3	**6**
17	53	GB/S	0.0	1.3	0.9		0.0	2.2	**4**
18	17	S	0.0	0.0	0.3		0.1	0.3	**2**
30	23	H	0.0	0.0	0.5		0.0	0.5	**2**
32	36	S	0.0	0.0	0.7		0.0	0.7	**2**
41	41	H	0.0	0.0	0.8		0.4	1.2	**3**
70	38	GB/S	1.0	2.9	0.3		0.0	3.2	**8**
84	44	GB/S	0.0	4.5	0.2		0.0	4.7	**11**
95	16	H	0.0	0.0	0.3		0.0	0.3	**2**
99	41	H	0.0	0.0	0.8		0.0	0.8	**2**
100	8	GB/S	0.1	0.4	0.1		0.0	0.5	**6**
104	27	H	0.0	0.0	0.5		0.0	0.5	**2**
107	29	GB/C	0.0	3.4	0.1		0.0	3.5	**12**
110	37	GB/S	0.0	1.5	0.5		0.0	2.0	**5**
114	37	GB	0.0	4.8	0.0		0.2	5.0	**14**
134	49	H	0.0	0.0	1.0		0.4	1.4	**3**
141	9	H	0.0	0.0	0.2		0.0	0.2	**2**
143	24	GB/S	0.0	0.8	0.4		0.2	1.4	**6**
148	44	S/H	0.0	0.0	0.9		0.0	0.9	**2**
153	10	GB/S	0.0	0.4	0.1		0.0	0.5	**5**
156	31	H	0.6	0.0	0.6		0.0	0.6	**2**
170	41	GB/S	0.8	4.4	0.1		0.0	4.5	**11**
175	22	H	0.0	0.0	0.4		0.0	0.4	**2**
176	62	S/H	1.0	0.0	1.2		0.0	1.2	**2**

Unit ID	Unit Acres	Logging System	Existing Acres of Detrimental Disturbance	Acres of Detrimental Disturbance from Proposed Activities					Cumulative Detrimental Disturbance After Implementation of Activities # %
				Tractor Log & Pile/Burn	Aerial Log	Temporary Road Construction*	Fireline Construction	Proposed Activity Disturbance Total	
181	21	GB/S	0.0	1.8	0.1		0.0	1.9	**9**
182	18	GB	0.0	0.8	0.2		0.0	1.0	**6**
183	36	H	0.0	0.0	0.7		0.0	0.7	**2**
197	18	H	0.0	0.0	0.4		0.0	0.4	**2**
198	46	GB	0.0	5.9	0.0		0.0	5.9	**13**
200	14	S	0.0	0.0	0.3		0.0	0.3	**2**
209	29	S	1.0	0.0	0.6		0.2	0.8	**3**
215	28	GB/H	0.0	3.1	0.1	1.0	0.0	4.2	**15**
224	25	GB/C	3.5	1.1	0.3		0.0	*3.8*	**15+**
225	56	GB/S/H	2.0	2.6	0.7		0.3	3.6	**6**
226	19	GB	0.4	2.5	0.0		0.0	2.5	**13**
232	54	GB/S	1.0	3.0	0.6	0.6	0.5	4.7	**9**
233	14	GB	0.9	1.8	0.0		0.1	1.9	**14**
235	10	H	0.0	0.0	0.2		0.0	0.2	**2**
248	69	GB	5.5	9.0	0.0		0.0	9.0	**13**
251	25	GB/C	1.5	0.7	0.4	0.7	0.2	2.0	**8**
254	50	GB/S	2.0	0.7	0.9		0.4	2.0	**4**
264	56	GB/S	0.0	0.8	1.0		0.5	2.3	**4**
268	27	GB/S	0.0	2.2	0.2		0.2	2.6	**10**
271	27	GB/S	1.0	1.7	0.3		0.0	2.0	**7**
273	22	H	1.0	0.0	0.4		0.0	*1.0*	**5**
275	43	H	0.0	0.0	0.9		0.0	0.9	**2**
283	61	S/C	1.0	0.0	1.2		0.0	1.2	**2**
296	53	S	0.0	2.2	0.7		0.0	2.9	**6**
299	51	GB/S	0.0	0.7	0.9		0.4	2.0	**4**
301	62	S/H	0.0	0.0	1.2		0.6	1.8	**3**
302	18	H	0.0	0.0	0.4		0.0	0.4	**2**
303	57	H	0.0	0.0	1.1		0.0	1.1	**2**
307	26	GB/S	0.0	1.3	0.3		0.0	1.6	**6**
310	27	H	0.0	0.0	0.5		0.0	0.5	**2**

Unit ID	Unit Acres	Logging System	Existing Acres of Detrimental Disturbance	Acres of Detrimental Disturbance from Proposed Activities					Cumulative Detrimental Disturbance After Implementation of Activities # %
				Tractor Log & Pile/Burn	Aerial Log	Temporary Road Construction*	Fireline Construction	Proposed Activity Disturbance Total	
311	16	GB/S	0.0	1.3	0.1		0.0	1.4	**9**
314	19	H	0.0	0.0	0.4		0.0	0.4	**2**
321	28	S/H	0.0	0.0	0.6		0.0	0.6	**2**
322	40	GB/S	2.0	0.9	0.7		0.0	*2.0*	**5**
323	52	H	0.0	0.0	1.0		0.0	1.0	**2**
325	15	H	0.0	0.0	0.3		0.0	0.3	**2**
336	8	H	0.0	0	0.2		0.1	0.3	**4**
Total Alt B	**2137**		**27**	**72**	**31**	**2**	**5**	**114**	
Total Alt C	**2137**		**27**	**47**	**35**	**0**	**5**	**96**	

GB – Ground Base
S – Skyline
H - Helicopter

#Refer to Table 3-47 for coefficients used to predict potential detrimental disturbance for proposed logging and slash treatment scenarios including burning and piling. The level of disturbance increase also depends on the amount or lack of existing skid trails. Activity units that have had little prior disturbance will show a greater incremental increase in potential detrimental disturbance than those units that already contain a network of existing skid trails. Little to no increase in disturbance is expected there because equipment would re-use existing skid trails and move on slash mats whenever possible.

*Assuming an avg. width of 37 ft. temporary road, NR 21for Unit 215 will be constructed on an already existing skid trail and will be fully recontoured and decommissioned.

+An additional precaution was added to Unit 224 because the existing disturbance patterns are localized so that equipment will not be able to utilize all existing skid trails since trails may not be in a feasible or advantageous location to use. An additional 1% of disturbance (based on professional judgment by the Forest Soil Scientist) was therefore added to account for potential disturbance in this unit beyond the expected level generally used for ground-based harvest. To further ensure compliance in this unit, skid trail decompaction is scheduled and would be monitored post-harvest to determine if impacts exceed the allowable levels set by Forest Plan and Regional standards (Chapter 2, Site-specific Design Features). This unit, among others, will be monitored post-harvest.

Units with Proposed Activity Total Acres in italics – potential management activity disturbance acres are lower than actual acres of existing disturbance. Cumulative Detrimental Disturbance displays existing disturbance incorporating proposed disturbance.

Direct and Indirect Effects of Alternative C

Effects discussed for Alternative B (except road effects) are applicable to Alternative C, which has the same level and location of proposed activities as Alternative B but does not include any system road construction (Table 3-51). Effects described in Alternative B for timber harvest, fuel treatments, organic matter, coarse woody debris, nutrients, yarding tops, and soil movement would be the same or less (43 acres less yarding tops, 55 acres less grapple piling) for Alternative C (Table 3-62, Table 2-7 in Chapter 2). Brief summaries are provided for timber harvest and fuel treatments; however, the effects discussion is identical to Alternative B and is omitted to avoid repetition. There would be no increase in risk of potential road related mass failure because no new road construction is proposed.

Detrimental Soil Disturbance

Alternative C differs from Alternative B because it has no road construction and would provide less access, so more of the proposed units would be treated with skyline or aerial methods which results in less soil disturbance than the ground-based methods (Table 2-21). Fuel treatments would also be slightly different in Alternative C and include 43 fewer acres of yarding tops, 55 fewer acres of grapple piling and burning, and six more acres of jackpot burning. Tables 3-56 and 3-57, below, show soil disturbance levels for this alternative.

Timber Harvest: Timber harvest activities that may affect soils include approximately 389 acres of ground-based skidding, 20 acres cable yarding, 297 acres skyline yarding, and 1,431 acres of helicopter yarding (Table 3-51). Estimates of possible detrimental disturbance from harvest operations are shown in Table 3-57.

The proposed action includes post-harvest monitoring of eight proposed units that have existing detrimental disturbance where ground-based equipment is proposed to be used for skidding on all or part of the unit. Soils would be monitored after completion of harvest and fuel treatment activities. We estimate that proposed activities on these units would meet Forest and Regional soil quality standards, but this monitoring is included to verify expected results and would be done in Units 70, 100, 170, 232, 233, 248, 271, and 322.

Temporary Road Construction: There would be no temporary road construction with Alternative C.

System Road Construction: There would be no system road construction with Alternative C.

Fuel Treatment: Activity-fuel treatments that may affect soils include approximately 273 acres of yarding tops, 307 acres of broadcast burning, 145 acres of slashing, 175 acres of grapple piling followed by pile burning, 20.2 miles of fireline construction, and 295 acres of jackpot burning (S-29). See Table 2-7 for a list of fuel treatments by unit.

Cumulative Effects of Alternative C

Past Activities

Timber harvest and related activities, fire, road and trail construction, and transmission line towers are identical to Alternative B.

Present and Reasonably Foreseeable Activities

Fire, noxious weed treatment, recreation, and other activities are identical to Alternative B.

Proposed Activities

The proposed activities that would effect soils and would occur where effects from past, present, and reasonably foreseeable activities are still evident include timber harvest, fuels treatment, temporary road construction, system road construction, trail construction, and system road decommissioning.

Cumulative Effects on Productive Land Base: The cumulative effects of trail construction and system road decommissioning on the productive land base for Alternative C are shown in Table 3-56.

Alternative C has no new road construction, so no land would be dedicated for new system roads. Alternative C has the same level of road decommissioning as Alternative B. As displayed in Table 3-56, approximately 0.2 acre would be removed from the productive land base for the proposed ATV trail construction in Lines Creek (S-37). Approximately 48 acres would be on the path to recovery towards a productive land base from road

decommissioning (Rx D) (S-39). Soil productivity recovery on recontoured roads may take decades but less than if left in the original state.

The cumulative result of Alternative C would be approximately 255 acres of National Forest System land in the Bussel 484 Project Area removed from the productive land base. This is approximately 2.1% of the 12,192 acres of National Forest System land in the project area.

Table 3-56 Comparison of Alternative B and C - Summary of Land Not in Productive Land Base

Designated Use	Alternative B Acres	Alternative C Acres
Existing System Roads	297	297
Existing System Trails	5	5
Existing Transmission Line Towers	1	1
Additional System Roads	23	0
Additional Trail (Lines Creek ATV Trail)	0.2	0.2
Recovery Trend towards the Productive Land Base from Road Decommissioning (Road Rx D)*	-48	-48
Total Land Dedicated to Other Uses (Soil Quality Standards Do Not Apply)	**278.2**	**255.2**

**Road decommissioning efforts (ripping, incorporation of woody material etc.) will not instantly rehabilitate all 48 acres but would initiate a long-term recovery sequence for soil productivity (S-12).*

Table 3-57 Alternative C Predicted Cumulative Detrimental Disturbance

Unit ID	Unit Acres	Logging System	Existing Acres of Detrimental Disturbance	Acres of Detrimental Disturbance from Proposed Activities				Cumulative Detrimental Disturbance After Implementation of Activities# %
				Tractor Log & Pile/Burn	Aerial Log	Fireline Construction	Proposed Activity Total	
5	15	H	0.0	0.0	0.3	0.0	0.3	**2**
6	22	H	0.0	0.0	0.4	0.0	0.4	**2**
11	57	H	0.0	0.0	1.1	0.0	1.1	**2**
14	39	S	1.0	0.0	0.8	0.0	*1.0*	**3**
15	23	GB/H	0.0	1.0	0.3	0.0	1.3	**6**
17	53	H	0.0	0.0	1.7	0.0	1.7	**3**
18	17	H	0.0	0.0	0.3	0.1	0.4	**2**
30	23	H	0.0	0.0	0.5	0.0	0.5	**2**
32	36	S	0.0	0.0	0.7	0.0	0.7	**2**
41	41	H	0.0	0.0	0.8	0.4	1.2	**3**
70	38	GB/S	1.0	2.9	0.3	0.0	3.2	**8**
84	44	GB/S	0.0	4.5	0.2	0.0	4.7	**11**
95	16	H	0.0	0.0	0.3	0.0	0.3	**2**
99	41	H	0.0	0.0	0.8	0.0	0.8	**2**
100	8	GB/S	0.1	0.4	0.1	0.0	0.5	**6**
104	27	H	0.0	0.0	0.5	0.0	0.5	**2**
107	29	GB/C	0.0	3.4	0.1	0.0	3.5	**12**
110	37	GB/S/H	0.0	1.4	0.5	0.0	1.9	**5**
114	37	GB	0.0	4.8	0.0	0.2	5.1	**14**
134	49	H	0.0	0.0	1.0	0.4	1.4	**3**
141	9	H	0.0	0.0	0.2	0.0	0.2	**2**
143	24	GB/S	0.0	0.8	0.4	0.2	1.4	**6**
148	44	S/H	0.0	0.0	0.9	0.0	0.9	**2**
153	10	GB/S	0.0	0.4	0.1	0.0	0.5	**5**
156	31	H	0.6	0.0	0.6	0.0	0.6	**2**
170	41	GB/S	0.8	4.4	0.1	0.0	4.5	**11**
175	22	H	0.0	0.0	0.4	0.0	0.4	**2**
176	62	H	1.0	0.0	1.2	0.0	1.2	**2**
181	21	GB/S	0.0	1.8	0.1	0.0	1.9	**9**

Unit ID	Unit Acres	Logging System	Existing Acres of Detrimental Disturbance	Acres of Detrimental Disturbance from Proposed Activities				Cumulative Detrimental Disturbance After Implementation of Activities# %
				Tractor Log & Pile/Burn	Aerial Log	Fireline Construction	Proposed Activity Total	
182	18	GB/S	0.0	0.8	0.2	0.0	1.0	**6**
183	36	H	0.0	0.0	0.7	0.0	0.7	**2**
197	18	H	0.0	0.0	0.4	0.0	0.4	**2**
198	46	H	0.0	0.0	0.9	0.0	0.9	**2**
200	14	S	0.0	0.0	0.3	0.0	0.3	**2**
209	29	S	1.0	0.0	0.6	0.2	0.8	**3**
215	28	GB/H	0.0	3.1	0.1	0.0	3.2	**11**
224	25	GB/C	3.5	1.1	0.3	0.0	*3.8*	**15+**
225	56	H	2.0	0.0	1.1	0.3	*2.2*	**4**
226	19	H	0.4	0.4	0.0	0.0	0.4	**2**
232	54	GB/H	1.0	3.0	0.6	0.5	4.1	**8**
233	14	GB	0.9	1.8	0.0	0.1	1.9	**14**
235	10	H	0.0	0.0	0.2	0.0	0.2	**2**
248	69	GB	5.5	9.0	0.0	0.0	9.0	**13**
251	25	H	1.5	0.0	0.4	0.2	*1.5*	**6**
254	50	H	2.0	0.0	1.0	0.4	*2.0*	**4**
264	56	H	0.0	0.0	1.1	0.5	1.6	**3**
268	27	H	0.0	0.0	0.5	0.2	0.7	**3**
271	27	GB/S	1.0	1.7	0.3	0.0	2.0	**7**
273	22	H	1.0	0.0	0.4	0.0	0.4	**5**
275	43	H	0.0	0.0	0.9	0.0	0.9	**2**
283	61	H	1.0	0.0	1.2	0.0	1.2	**2**
296	53	H	0.0	0.0	1.1	0.0	1.1	**2**
299	51	H	0.0	0.0	1.0	0.4	1.4	**3**
301	62	S/H	0.0	0.0	1.2	0.6	1.8	**3**
302	18	H	0.0	0.0	0.4	0.0	0.4	**2**
303	57	H	0.0	0.0	1.1	0.0	1.1	**2**
307	26	H	0.0	0.0	0.5	0.0	0.5	**2**
310	27	H	0.0	0.0	0.5	0.0	0.5	**2**
311	16	H	0.0	0.0	0.3	0.0	0.3	**2**
314	19	H	0.0	0.0	0.4	0.0	0.4	**2**

Unit ID	Unit Acres	Logging System	Existing Acres of Detrimental Disturbance	Acres of Detrimental Disturbance from Proposed Activities				Cumulative Detrimental Disturbance After Implementation of Activities# %
				Tractor Log & Pile/Burn	Aerial Log	Fireline Construction	Proposed Activity Total	
321	28	H	0.0	0.0	0.6	0.0	0.6	**2**
322	40	GB/S	2.0	0.9	0.7	0.0	*2.0*	**5**
323	52	H	0.0	0.0	1.0	0.0	1.0	**2**
325	15	H	0.0	0.0	0.3	0.0	0.3	**2**
336	8	H	0.0	0.0	0.2	0.1	0.3	**4**
Total Alt C	**2137**		**27**	**47**	**35**	**5**	**93**	
Total Alt B	**2137**	**2 acres (temp roads)**	**27**	**72**	**31**	**5**	**114**	

GB – Ground Base
S – Skyline
H - Helicopter

#Refer to Table 3-47 for coefficients used to predict potential detrimental disturbance for proposed logging and slash treatment scenarios including burning and piling. The level of disturbance increase also depends on the amount or lack of existing skid trails. Activity units that have had little prior disturbance will show a greater incremental increase in potential detrimental disturbance than those units that already contain a network of existing skid trails. Little to no increase in disturbance is expected there because equipment would re-use existing skid trails and move on slash mats whenever possible.

+An additional precaution was added to Unit 224 because the existing disturbance patterns are localized so that equipment will not be able to utilize all existing skid trails since trails may not be in a feasible or advantageous location to use. An additional 1% of disturbance (based on professional judgment by the Forest Soil Scientist) was therefore added to account for potential disturbance in this unit beyond the expected level generally used for ground-based harvest. To further ensure compliance in this unit, skid trail decompaction is scheduled and would be monitored post-harvest to determine if impacts exceed the allowable levels set by Forest Plan and Regional standards (Chapter 2, Site-specific Design Features). This unit, among others, will be monitored post-harvest.

Units with Proposed Activity Total Acres in italics – potential management activity disturbance acres are lower than actual acres of existing disturbance. Cumulative Detrimental Disturbance displays the existing disturbance incorporating proposed disturbance.

Consistency with Forest Plan and Regulatory Framework

Forest Plan Standards

Forest Plan Soil Standard #1:

Soil disturbing management practices will strive to maintain at least 80 percent of the activity area in a condition of acceptable productivity potential for trees and other managed vegetation. Unacceptable productivity potential exists when soil has been detrimentally compacted, displaced, puddled, or severely burned as determined in the project analysis.

All alternatives would comply by maintaining at least 80 percent of each proposed activity area in a condition with acceptable productivity potential, meeting Forest Plan Standard for soil productivity. The proposed activities have the potential to disturb approximately 156 acres for Alternative B and 122 acres for Alternative C. This total includes portions of system roads which fall within proposed activity areas (S-7, S-8).

Forest Plan Soil Standard #2

Projects should strive to maintain sufficient large woody debris to maintain site productivity. Large woody debris is essential for maintenance of sufficient micro-organism populations.

All alternatives would comply with this standard. The amount of large woody debris left on site would follow the research guidelines of Graham and others (1994) to ensure the maintenance of site productivity (Design Feature 10.H.iii.). There would be no removal of existing coarse woody debris material from the forest floor from proposed harvest activities. Post-harvest burning would occur when soil moistures are equal to or above 25 percent (Direct and Indirect Effects above).

Forest Plan Soil Standard #3

In the event of whole-tree logging, provision for maintenance of sufficient nutrient capital should be made in the project analysis.

All alternatives would comply with this standard. Provisions to maintain sufficient nutrient capital would be made in areas of yarding tops by retaining submerchantable material and breakage, such as foliage and limbs from harvest activities to contribute to the nutrient pool. Soil productivity is not expected to be irreversibly damaged. Fine organic matter layer thickness would be retained as appropriate for local conditions. Yarding tops would only occur on up to 316 acres of the 2,137 acres proposed for harvest with many of the areas being situated around the perimeter for fuel hazard reduction purpose. The majority of proposed fuel treatment would be accomplished through lopping (up to 1,766 acres) which would leave most nutrients on site.

Regional Standard

All proposed activities and estimated management-induced soil disturbance are within the Regional Soil Quality Standards. Proposed activities would result and an estimated 114 acres of total potential disturbance for Alternative B and 93 acres for Alternative C . Proposed activities would maintain productivity on at least 85 percent (Tables 3-55 and 3-57; S-6, S-9) of activity areas. Proposed activities in Units 224 and 215 are estimated to be at 15% and are approaching the threshold for exceeding soil quality standards.

Decompacting of skid trails in Unit 224 would therefore be implemented to reduce soil disturbance Design Feature, Chapter 2). As a result of this proposed rehabilitation, the cumulative detrimental effects from project implementation and restoration would not exceed the conditions prior to the planned activity and would move towards a net improvement in soil quality. Acceptable productivity potential would be maintained and the proposed unit would meet Regional Standards.

Under Alternative B only, temporary road NR 21 would be constructed just outside of Unit 215 on an already existing skid trail. The temporary would be fully recontoured and decommissioned upon completion of implementation of proposed activities. This restoration would move the area towards a net improvement in soil quality.

Organic matter layer thickness would be retained as appropriate for local conditions. Fine organic matter layer thickness would be retained as appropriate for local conditions. Yarding tops would only occur on up to 316 acres of the 2,137 acres proposed for harvest with many of the areas being situation around the perimeter for fuel hazard

reduction purpose. The majority of proposed fuel treatment would be accomplished through lopping (up to 1,766 acres) which would leave most nutrients on site.

Large woody debris would be maintained at recommended volumes (Graham and others 1994) in each proposed activity. Soil productivity is not expected to be irreversibly damaged. There would be no removal of existing course woody debris material from the forest floor from proposed harvest activities. Post- harvest burning would occur when soil moistures are equal to or above 25 percent (Direct and Indirect Effects above).

National Forest Management Act

Timber would be harvested only where soils and slopes would not be irreversibly damaged. All proposed activities would be consistent with Forest and Regional soil quality standards. Soil productivity is not expected to be irreversibly damaged (see discussion about Forest Plan and Regional Standards above). Approximately 99% of the proposed timber harvest would occur on landtypes with low surface erosion hazard, low to moderate mass failure potential, and low to moderate sediment deliver potential.

Transportation

Differences between Draft EIS and Final EIS

Information about a new private road was added to Existing Condition section. Additional information was added about road easements.

Introduction

Past and present land ownership and human uses in the Bussel 484 Project Area have affected the transportation infrastructure which evolved through changes in technology and need. The network has served a multitude of activities, creating the system that is in place today. The design, operation and maintenance of the transportation system can have consequences that affect the physical, biological and social environments. This section focuses on the social or human aspects of the transportation system along with the composition and juxtaposition of the network. The physical and biological aspects are discussed in detail in each resource section.

Regulatory Framework

National Forest Management Act (NFMA): Directs the Forest Service to design roads to standards appropriate for intended uses and requires the re-vegetation of roads within 10 years of the termination of temporary and undeveloped roads created under contract, permit or lease.

Clean Water Act (CWA): Section 404 of the Clean Water Act authorizes the Secretary of the Army to issue permits for the discharge of dredged or fill material into wetlands (33 CFR 322). Roads for timber management are exempt from the permit process (33 CFR 323.4) if they are constructed and maintained with the use of BMPs listed in 40 CFR 323.a, as well as those approved in the rules and regulations of the Idaho Forest Practices Act. Effectiveness of proposed best management practices is discussed in the *Water* section.

State of Idaho Forest Practices Act (FPA): The purpose of Rule 040, Title 38, Chapter 13 of the Idaho Code is to provide standards and guidelines for road construction and maintenance that will maintain forest productivity, water quality, and fish and wildlife habitat.

36 CFR 219: Sets the requirements for integrating forest resources, including transportation access and travel management, into the planning process, integrating biological, physical, social, and economic factors and environmental design criteria. Integration could involve the Endangered Species Act, the Clean Water Act and the National Historic Preservation Act.

36 CFR 212: Establishes the requirements for the administration of the forest transportation system and provisions for acquisition of rights-of-way. Describes a minimum road system and requires a science-based analysis to plan the road system.

36 CFR 261.12 and 261.54: Establishes prohibitions on National Forest System road that are enforceable by the Forest Service.

Road Easements, Agreements or Memorandums of Understanding: In addition to the USDA Forest Service, the following entities have ownership and / or jurisdiction of roads within the Bussel 484 Project Area:

Potlatch Corporation
Forest Capital
Bonneville Power Administration (BPA)

FSM 2700: Forest Service Manual 2700 provides direction for special uses management on National Forest System lands. Chapter 2730 – Road and Trail Rights-of-way Grants, covers policies, authorities, and direction for granting rights-of-way for roads and trails across National Forest System lands and interests in lands.

FSM 5400, Chapter 5460: Forest Service Manual 5400, Chapter 5460 provides direction concerning rights-of-way acquisition.

FSM 7700: Forest Service Manual 7700 provides direction for the planning, construction, reconstruction, operation and maintenance of the Forest Transportation System. It sets forth the authority, objectives, policy, responsibility and definitions related to the Forest Transportation System.

IPNF Forest Plan: Forest-wide management direction in the form of goals, objectives and standards are contained in Chapter II of the Forest Plan. Goals for transportation facilities is to construct, manage and maintain transportation facilities to meet management area goals in a cost effective way while meeting safety, user, and resource needs. Chapter III of the Forest Plan provides more specific management direction for individual management areas. The Forest Plan provides some specific direction related to access and road management. Forest Plan standards for lands in the analysis area are to utilize the lowest standard road meeting transportation objectives compatible with resource protection and area management goals.

For wildlife, road restrictions and closures can be used as needed to meet habitat goals. In MA-16 (riparian), new construction should be limited to cases where no reasonable alternative exists and to pursue replacement of existing stream crossing barriers with structures allowing fish passage. The Inland Native Fish Strategy amends the Forest Plan and contains additional guidelines and standards related to the design, operation and maintenance of the transportation system, these are also listed in the Roads Analysis (PD-4).

Analysis Area

For transportation purposes, the analysis area corresponds with the project area with some discussion of routes that pass through the area, serve adjacent lands or provide access to the project area. All proposed activities related to the transportation network are within the project area except for timber hauling or road maintenance.

Analysis Methods

A GIS road layer was developed using several data sources including: existing maps, aerial photography, prior transportation planning efforts, Timber Sale Road Plans, GPS surveys, road maintenance logs and condition inventories, cost share and other road use agreements, the INFRA road database and land status and rights-of-way records. Potlatch Corporation provided additional information on existing roads across their land MA-5). Road segments were assigned attributes according to their jurisdictional status and road management prescription.

Forest Service employees have driven or walked most of the roads on National Forest System lands or under Forest Service jurisdiction in the project area within the last few years. Information for roads that have not been visited recently was based on prior work experience in the area and observation of similar roads built in the same time period and area. Historic photos and maps, past timber sale files and stand data were used to produce an overlay of the development history of the road network. This historic information was used to verify road locations and to provide an indication of their condition if they had not been visited. The road jurisdiction and management prescriptions provide an indication of the use, design, operation, and maintenance of the road. All mileages were derived from the GIS road layer.

The Roads Analysis Process (RAP, FSM 7712) was utilized to identify the minimum road system needed and roads not needed for the project area (PD-4). Risk to resources, safety concerns and other evaluation items listed in Travel Management (36 CFR 212.55) were considered as part of RAPS and designation of uses of roads and trails. Needed equates to classified roads. Classified roads consist of public, private and NFS roads. The analysis uses the following road prescriptions to categorize road management:

a) Open – open to all size vehicles,

b) Road Management Prescription A - gated,
c) Road Management Prescription B - barriered,
d) Road Management Prescription C - long-term storage (LTS),
e) Road Management Prescription D - decommission (partial recontour)

Prescription A: Gated- These roads are generally needed for administrative or fire protection purposes with use restricted for resource concerns and/or facility protection. Road use is intermittent and generally only open for a specific use or time period (e.g. timber sale or firewood collection). These are long-term facilities that remain on the transportation system for current and future needs. Road maintenance is at a custodial level to protect the road investment and to minimize damage to adjacent land and resources. The roads are on a maintenance schedule to check for erosion and/ or other maintenance needs. The roadbed should have sufficient inslope, outslope or driveable water bars to facilitate good drainage. Traffic is usually controlled with a gate. The management strategy is to discourage or eliminate motorized public use of the road. Some motorized public uses may be acceptable on some routes (i.e. ATV routes, single track use).

Prescription B: This prescription is similar to Rx A, but the use and need for the facility is anticipated to occur at a lower frequency. The road may remain "closed" for a period of 5 to 15 years between uses but should remain on the transportation system for future use. Temporary bridges and culverts assessed to have a higher risk of failure should be removed and the road surface may be water barred and seeded. Traffic is usually controlled with a physical static barrier (such as a guardrail, concrete or earth barrier). The management strategy is to eliminate all over 50" width motorized use during "closure" periods. Use by vehicles under 50" width may be accepted, discouraged, eliminated or prohibited.

Prescription C: This is a long-term "storage" with no foreseeable use in the next 15 to 25 years, but may be needed at some long-term future date. Some low impact roads that do not have a reasonably foreseeable need in the future, may also be closed at this level. The road should be outsloped and have the drainage structures removed. In some instances, a culvert may be left in place, if it is sized and functioning properly, has a low risk of failure, and measures are taken to account for drainage if the culvert did become blocked. Leaving a culvert would be the exception and considered only if removal would result in a high degree of impact. The economics of an alternative treatment to the cost of removal could be a consideration to leave a culvert. The intent of this prescription is to "put the road to bed" or into "long-term storage". The road prism is basically left intact but in a condition that would not require any maintenance. All water courses and problem areas should be stabilized and rehabilitated. The roadbed may require light scarification, water bars, and/or decompaction. Seeding and/or planting should be conducted to establish a vegetative cover in the road prism. Traffic is usually controlled with a permanent barrier or by recontouring the beginning of the road. Roads with a higher probability of future use (based on such things as management area direction, interdisciplinary team concurrence, current harvest prescriptions or extension possibilities) should remain on the transportation system. If any culverts are left in place, a maintenance strategy and schedule needs to be implemented. Generally, the management strategy is to discourage, eliminate or prohibit all motorized use. On some routes, under 50" width use may be acceptable.

Prescription D: Roads "closed" at this level generally have a higher potential for failure than roads with a C prescription and there is a very low probability of needing the road in the future. The road should be decompacted and have major fills, embankments, and higher failure risk areas pulled up onto the roadbed and stabilized. Drainage structures would be removed from stream channels and the adjacent slopes restored to resemble natural condition. The goal of this prescription is to restore site productivity, eliminate the potential of a road related failure, and reestablish natural water infiltration and drainage patterns. Recontouring or partial pullback is based on site specific conditions and could range from about 20 to 100 percent of the roads length. Recontouring with a D prescription may only be a partial recontour, only pulling up the amount of fill necessary to stabilize the slope condition. Some cut and fill slopes may be evident in the areas of recontouring. A detailed on-the-ground prescription will be done on each road and reviewed by a interdisciplinary team prior to work being done to be sure management objective is reached. Following prescription implementation, roads would be removed from the National Forest Road System but tracked as historic routes in the INFRA database. The road management strategy is to eliminate all motorized use. In some exceptional cases, use of the roadway could be converted for use as a trail.

Existing Condition

Past Human Uses

Land ownership patterns have continued to shift through land exchanges and acquisitions from the early settlement days to the present. Several exchanges have occurred to consolidate various ownerships for Potlatch Corporation and the National Forest System. Potlatch Corporation also acquired Milwaukee Land Company holdings in the area, greatly increasing their ownership. The land ownership patterns influenced the development of the road system, roads locations, and road construction standards. Roads were often built to avoid crossing ownerships.

Present Human Uses

The transportation network within the analysis area provides access that facilitates a variety of uses. State Highway 3 provides primary access to and from the area, along the main stem and the West Fork of the St. Maries River.

Land ownership surrounding Clarkia is a mix of private individuals, the State of Idaho Department of Lands, Potlatch Corporation (Potlatch) and National Forest. The mixed ownership pattern has resulted in a road network with mixed jurisdictions, rights-of-way and agreements.

The Forest Service has cost-share agreements with Potlatch in the analysis area. Cost-Share principles apply to construction, reconstruction, maintenance and use of shared facilities. Cost-Share roads are National Forest System Roads that are needed for the long-term management of the National Forest and also serve the needs of the cooperators.

Public access on FS jurisdiction open roads is currently approximately 30.8 miles.

Table 3-58 Existing Condition (Alternative A) of the Road System in the Project Area

Road Jurisdiction	Open	Gated Rx A	Barriered Rx B	LTS Rx C	Decommissioned Rx D	Total	% of Total Miles in Project Area
FS on NFS Land	24.3	17.7	23.2	1.4	0.0	**66.6**	65
FS on non-NFS Land	6.5	0.0	0.0	0.0	0.0	**6.5**	6
Subtotal: FS Jurisdiction	**30.8**	**17.7**	**23.2**	**1.4**	**0.0**	**73.1**	**71**
Other* on non-NFS Land	25.3	4.9	0.0	0.0	0.0	**30.2**	29
Subtotal: Other Jurisdiction	**25.3**	**4.9**	**0.0**	**0.0**	**0.0**	**30.2**	**29**
Total Miles of Road in Project Area by Rx	**60.0**	**22.6**	**23.2**	**1.4**	**0**	**103.3**	**100**

** "Other" roads include private.*
NOTE: Differences in total miles for this and each of the following tables is due to rounding and addition of a new private road. See Transportation Appendix in project file for a break down of private miles.

Road development within the project area has been extensive. The base transportation network of arterials, collectors and major local roads is well established. Even though the project area is well roaded, timber harvest using conventional ground-based and cable logging systems would require additional local road development. Consideration was given to long-term use and need of these roads. There would be 5.1 miles of new construction and approximately 29.1 miles of existing roads but into road management prescription C or D in Alternative B.

Major Routes within and Adjacent to the Project Area

Jurisdictional changes from BPA, private and Forest Service existing roads to joint use agreements, as well as sharing in requests for access across National Forest System lands are identified as *cost-share* opportunities. Cooperative use agreements (cost share) develop and use a single road system when such a system serves or can be made to serve the needs of both the Forest Service and other landowners (FSM 5467.02 and 36 CFR 212). Cost-share roads are National Forest System Roads. Cost-share principles apply to construction, reconstruction, maintenance and use of shared facilities. The Forest Service has existing cost-share agreements within the project area with Potlatch.

State Highway 3 is a double-lane, paved highway. The alignment on some segments reduces travel speed to 35-45 miles per hour. Fog and icy conditions are prevalent from fall through spring. Commercial truck traffic is primarily associated with log and wood chip transport. The highway provides regional access to the Clarkia area from Moscow-Pullman, Lewiston-Clarkston, Grangeville, St. Maries and Interstate 90 (Wallace, Coeur d'Alene and Spokane). The route serves as an alternative to US 95 between Interstate 90 and US 12. A gradual increase in use can be expected.

The St. Maries River Railroad is used primarily to transport logs from the Potlatch log yard in Clarkia to their plywood mill and sawmill in St. Maries with cedar logs transported to Bovill. The rail line also provides rail links from the Potlatch facilities, Regulus Stud Mill in St. Maries, the Medley Cedar Mill and Scott Paper chip plant in Santa and Emerald Creek Garnet Company south of Fernwood to major rail carriers and the Port of Lewiston. A recent decline in use is likely to continue for the near future. Market conditions, Potlatch operations, truck haul competition and timber availability in the Clarkia/Floodwood area will all play a role in the future status of the railroad.

The primary forest arterial is the Clarkia Marble Creek Road 321 that intersects with Road 301 near Clarkia, continues over Hobo Pass and down Marble Creek to FH 50. Portions on both ends of the route are cost-shared. The tributary area of Road 321 to Clarkia includes Merry Creek, Bussel Creek, Hobo Creek and Cornwall Creek and includes Potlatch and State lands. Road 321 provides the primary access to Marble Creek and the associated historical recreation and interpretive sites. The combination of FH 50, SH 3 and Road 321 provide an easily accessible scenic loop normally suitable for passenger cars. Generally, Road 321 receives heavy truck traffic on an intermittent basis and use is expected to continue to be heavy at times. Recreational use is expected to increase.

The combination of Blackwell Hump Divide Creek Road 226 and Grand Mother Mountain Road 758 is a cost-share collector route providing access to National Forest, Potlatch and State lands. The tributary area includes the area near Bussel Peak (Roads 1498), Toles Creek and Little Bear Creek (Roads 1254, 1900 & 3591). The Dworshak Taft transmission line also crosses the tributary area, giving the Bonneville Power Administration an interest in some of the tributary roads. The current trend for the next decade is increased use for commercial timber haul that may discourage other public uses.

Road 758 from Road 226 to Road 321 is cost-shared with Potlatch Corporation. Road 226 from 758 to 1491 is partially cost-shared with Potlatch Corporation. The current use is administration of permits for mineral extraction. Other uses are primarily related to hunting with some dispersed camping and general forest day-use activities.

East Elk Road 1451 is a cost-shared route connecting SH 3, near the Cedar Creek Campground to Road 1491 in the West Fork of Merry Creek. This road, locally referred to as the Staples Creek Road, has a tributary area that extends into the Norton, Toles, and Lines Creek Drainages. The route also has a buried power line that continues to a BPA microwave site on Incline Ridge. The road serves intermingled owned lands in the project area.

Other collector roads available for unrestricted use are the Norton Creek Road 1900 from Road 226 to Road 3591A. This road provides access to Norton Creek and Tyler's Ridge and is a main tie-through system. The Norton Mica Connection Road 1904 from Road 345 to 3591A, accesses the east side of Toles Creek, Mica Meadows and the Lines Creek Historical area. Road 3570A from 1441A to 3570 is on the south east side of the project and provides assess to the Marble Creek Drainage. See Existing Access Map 7 in Appendix A.

Environmental Consequences

Present and Reasonably Foreseeable Activities

Within the next ten to twenty years, current uses can be expected to continue. Indications are that timber harvest on Potlatch Corporation lands will continue at or near their current levels. Roads will continue to be developed on private lands to facilitate primarily tractor and cable logging systems. Potlatch Corporation has also been in the process of decommissioning unneeded roads on their lands, meeting the requirements for an abandoned road (Idaho Forest Practices Act, Rule 040, section 04(e)).

Road maintenance activities will continue on public, private and National Forest roads. BPA needs continued access across NFS lands to maintain power line facilities.

Some illegal motorized use occurs in the project area. In some instances, roads with legal restriction orders and restriction devices have been breached. For example, a road with a gate and a legal restriction that would allow ATVs but not full-sized vehicles has had the restrictive device breached and full-sized vehicles are driving the road.

Some of the illegal use is caused by confusion about where it is legal to drive due to inadequate signs, maps, or restrictive devices. The District will be working on access and travel management plan and map over the next year for publication, and that will help with clear up some of the confusion for forest visitors.

Alternative A

Direct, Indirect and Cumulative Effects

Alternative A would not change existing conditions; it maintains current public access to National Forest System lands. Maintenance of National Forest System roads would occur primarily on cost-share and major forest routes that provide open public access. Secondary gated and closed roads (Road Management Prescriptions A and B) would be maintained as funding allows at a minimal level to prevent environmental damage. The Forest Service and BPA would continue to cooperatively maintain BPA roads that occur on National Forest System lands. Public access on FS Jurisdiction open roads would remain at approximately 30.8 miles. Table 3-59 provides a *summary* of Alternative A road miles by road management and jurisdiction for the project area.

Table 3-59 Alternative A Summary of Roads by Road Management & Jurisdiction

Road Jurisdiction	Open	Gated Rx A	Barriered Rx B	LTS Rx C	Decommissioned Rx D	Total	% of Total Miles in Project Area
FS on NFS Land	24.3	17.6	23.2	1.4	0.0	**66.6**	65
FS on non-NFS Land	6.5	0.0	0.0	0.0	0.0	**6.5**	6
Subtotal: FS Jurisdiction	**30.8**	**17.6**	**23.2**	**1.4**	**0.0**	**73.10**	**72**
Other* on NFS Land	0	0.0	0.0	0.0	0.0	**0**	0
Other* on non-NFS Land	25.3	4.9	0.0	0.0	0.0	**30.2**	29
Subtotal: Other Jurisdiction	**25.3**	**4.9**	**0.0**	**0.0**	**0.0**	**30.2**	**29**
Total Miles of Road in Project Area by Rx	**60.0**	**22.5**	**23.2**	**1.4**	**0**	**103.3**	**100**

** "Other" roads include private.*

Alternative B

Direct, Indirect and Cumulative Effects

With Alternative B the Forest Service would request a Non-Cost-Share easement from Potlatch Corporation within the existing Merry Creek Cost-Share Area. Approximately 1.7 miles of proposed road construction would require additional easements. Of the 1.7 miles, about 1.5 miles would cross National Forest System lands, and 0.2 miles would cross Potlatch Corporation and serve National Forest System lands. This section would not be cost-shared as the development would only benefit the Forest Service. Potlatch would be granting 0.2 miles (construction) of non-cost-share easements.

The Forest Service would also be acquiring approximately 4.9 miles of cost-share easements on existing Roads 226C, 226J, 226M and a new Potlatch road not yet numbered from Potlatch Corporation.

Alternative B would also construct approximately 5.1 miles of new National Forest System road (NFSR) in order to access those lands for management activities. These roads would then be put into Rx C following that management activity. Another approximately 0.5 miles of temporary road would be constructed then be decommissioned and fully recontoured. Reconstruction and restoration to original road standards would occur on approximately 6.7 miles. Overall, public access on FS jurisdiction open roads would be reduced from approximately 30.8 miles within the project area to approximately 28.5 miles available for unrestricted use.

Table 3-60 Alternative B Summary of Existing Roads by Road Management Rx & Jurisdiction

Existing Roads Management Prescription After Implementation								
Road Jurisdiction	**Open**	**Gated Rx A**	**Barriered Rx B**	**LTS Rx C**	**Decommissioned Rx D**	**Trail**	**Total**	**% of Total Miles in Project Area**
FS on NFS Land	20.3	5.2	7.9	21.6	10.7	0.9	**66.6**	64
FS on Non-NFS land	*8.2	0.0	0.0	0.0	0.0		**8.2**	8
Subtotal: FS Jurisdiction	**28.5**	**5.2**	**7.9**	**21.6**	**10.7**		**74.8**	**72**
Other on NFS Land	0.0	0.0	0.0	0.0	0.0		0.0	0
Other on Non-NFS Land	25.3	4.9	0.0	0.0	0.0		**30.2**	28
Subtotal: Other Jurisdiction	**25.3**	**4.9**	**0.0**	**0.0**	**0.0**		**30.2**	**28**
Total Miles of Existing Road in Project Area	**53.8**	**10.1**	**7.9**	**21.6**	**10.7**		**104.0**	**100**

Proposed New Construction and Management Prescription After Implementation on National Forest System Lands						
	New Construction	**Gated Rx A**	**Barriered Rx B**	**LTS Rx C**	**Decommissioned Rx D**	**Total**
NFS System Roads (for proposed timber sale)	5.1	0.0	0.0	5.1	0.0	**5.1**
Total New Construction	**5.1**	**0.0**	**0**	**5.1**	**0.0**	**5.1**

Alternative B, both permanent and temporary roads were analyzed in the transportation system. It was determined that there was a need for long-term specified road construction to meet future and recurrent management needs. Temporary roads would be built in lieu of specified roads in areas were they are not necessary for long-term resource management. The criteria in 7703.2, 36CFR 212.1 and FSM 7705 were used to decide between permanent and temporary roads. See Regulatory Framework above.

Timber traffic from Alternative B would have the greatest impact to open, single-lane roads available for public use. The possibility of mixed user conflicts would be highest on Road 321, where public use tends to be higher due to campgrounds located on this road. Timber traffic on Roads 226, 758, 1900, 1451 and 1904 is not as likely to cause user conflicts because the roads historically were used primarily for timber purposes.

Alternative C

Direct, Indirect and Cumulative Effects

Alternative C does not propose any new road construction. Upon site-specific investigation, reconstruction and reconditioning of existing roads to original road standards is anticipated to occur on approximately 5.4 miles of road. Public access on FS jurisdiction open roads would decrease from 30.8 miles to 26.2 miles. Table 3-61 displays a summary of the road system by road management and jurisdiction according to ownership. Timber traffic from Alternative C would be very similar to Alternative B.

Table 3-61 Alternative C Summary of the Roads by Road Management Rx & Jurisdiction

Road Jurisdiction	Open	Gated Rx A	Barriered Rx B	LTS Rx C	Decommissioned Rx D	Trail	Total	% of Total Miles in Project Area
FS on NFS Land	20.3	5.2	7.9	21.6	10.7	0.9	66.6	65
FS on Non-NFS land	6.2	0.0	0	0.0	0		6.2	6
Subtotal: FS Jurisdiction	**26.2**	**5.2**	**7.9**	**21.6**	**10.7**		**71.6**	**71**
Other* on NFS Land	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
Other on Non-NFS Land	25.3	4.9	0.0	0.0	0.0		**30.2**	29
Subtotal: Other Jurisdiction	**25.3**	**4.9**	**0.0**	**0.0**	**0.0**		**30.2**	**29**
Total Miles of Existing Road in Project Area	**51.5**	**10.1**	**7.9**	**21.6**	**10.7**	**0.9**	**101.8**	**100**

Consistency with Forest Plan and Regulatory Framework

Alternative A

Alternative A does not meet Forest Plan Objectives for Transportation Facilities because it does not provide for an efficient balanced resource management program between federal and private ownership. Alternative A does not begin to identify the minimum road system needed as required by Forest Service Manual 7712.

Action Alternatives

All action alternatives meet Forest Plan objectives by utilizing the lowest stand road meeting transportation objectives compatible with resource protection and area management goals. This would be accomplished by placing 20.2 to 25.9 miles of Forest Service roads into Prescription C and 10.7 to 11.0 miles of Forest Service roads into Prescription D. The conditions for construction and reconstruction of roads are described in Section 33 CFR 323.4. All construction and reconstruction would be designed and constructed in accordance with the Forest Plan objectives and other laws and directives such as the Clean Water Act, Idaho State BMPs, Forest Service Manual and Forest Service Handbook direction.

All road construction and reconstruction plans would include standards and specifications to provide for minimum needed road width, drainage and safe operation while incorporating measures for mitigating for resource disturbances. Provisions for and execution of maintenance on existing roads and newly constructed roads within Forest Service jurisdiction and on NFS lands are designed to minimize resource disturbance, as required by the Forest Plan.

Visual Quality

Differences between Draft EIS and Final EIS

Acres of visual quality objectives for proposed harvest units were updated based on changes in alternatives described in the Introduction for the FEIS.

Regulatory Framework

Scenery management direction for the analysis area is contained in the Idaho Panhandle National Forests Land and Resource Management Plan of 1987 (Forest Plan) and is described in the terms of visual quality objectives (VQOs). VQOs were established during the Forest planning process and were mapped by computer. The mapping was based on the area seen from sensitive travel corridors and other features having a high visual sensitivity level. VQOs were assessed upon guidance contained in the Visual Management Handbook, Chapter I of the National Forest Landscape Management Series (USDA Forest Service 1974). The system was revised and is now known as the Forest Service Scenery Management System. The revised guidelines are contained in Landscape Aesthetics, a Handbook for Scenery Management (USDA Forest Service publication 701 1995).

Visual Quality Objectives (VQOs) were adopted during the forest planning process using the scenery data obtained from the previously described landscape attractiveness and visibility analyses. Adopted VQOs for the IPNF are contained in maps generated during the Forest planning process and are available at the St. Joe Ranger District office in St. Maries.

Visual Quality Objectives consist of five levels that describe scenery management objectives ranging from low scenic integrity to very high scenic integrity. The five levels are: Preservation, Retention, Partial Retention, Modification and Maximum Modification. The levels are directly correlated to VQOs contained in the IPNF Forest Plan.

Analysis Area

The geographic scope of the scenery analysis (existing condition, direct, indirect and cumulative effects) for the Bussel 484 Project is confined to boundaries of the project area.

Analysis Methods

To define the existing condition of the visual resource, the visual character of the landscape is assessed in terms of how it has been altered by human activities. Proposed management activities were reviewed to see how they may change the character. Visual significance was evaluated based upon viewing opportunities form important travel routes in the vicinity. Results were then evaluated as to whether or not they meet Forest Plan standards (VQOs). The temporal scope of the analysis is confined to the decade following a decision.

Affected Environment

Landscape Character

The combination of landforms, water characteristics, vegetation, and cultural elements has resulted in a consistent landscape character over the geographic area (Landscape Aesthetics, Chapter 1). The landscape of the project area falls into one landscape character class of “Highly modified mature/immature mixed conifer forested landscapes on mountain slope or stream break landforms.”

Variety Classes

The variety classifications are: Class A - Distinctive, Class B- Common, and Class C-Indistinctive.

The entire project area falls into Class B - Common, which is defined as areas where landform, vegetation patterns, water characteristics, and cultural features combine to provide ordinary or common scenic quality. These landscapes have generally positive, yet common attributes of variety, unity, vividness, mystery, intactness, order, harmony, uniqueness, pattern and balance.

Landscape Visibility

Landscape visibility is defined by two elements:

1. Human values as they relate to the relative importance to the public of various themes
2. Relative sensitivity of scenes based on the position of the observer

The "human value component" is usually described by "concern" levels. The observer position component utilizes varying distance zones.

Concern Levels

The main travel routes which traverse the area and from which the area is viewed are:

Sensitivity Level 1 Travel Routes: None

Sensitivity Level 2 Travel Routes: None

Sensitivity Level 3 Travel Routes: All travel routes in the project area.

Site-Specific Forest Plan Visual Quality Objectives

Forest Plan VQO mapping was digitized and placed in a VQO GIS data layer for the project area. A map showing site-specific VQOs for the area can be found in the project file (VQ-1). The VQO mapping also incorporates site-specific information on visibility from differing concern level (sensitivity levels) features, scenic attractiveness classes, and viewing zones. Table 3-62 summarizes the gross acreages within the project area of each of the five scenery integrity levels previously described.

Table 3-62 Forest Plan Visual Quality Objectives of the Bussel 484 Project Area

VQO	Activity Area (acres) in Proposed Harvest Area	Percent of Total Proposed Harvest Acres
Preservation	0	0
Retention	0	0
Partial Retention	216	11
Modification	1,921	89
Maximum Modification	0	0

Environmental Consequences

Land management activities can affect the scenic resource because of contrasts created between natural or natural-appearing forested landscapes and those unacceptably modified by management activities. These contrasts consist of changes in line, form, color, and texture of the vegetation and soil. The effects these alterations have are somewhat dependent upon individual values. The same activities can also alter the landscape character of an area.

Timber Harvest and Fuelbreak Treatments

The ability to control how timber harvest activities appear on the landscape depends on existing topography, logging systems, silvicultural systems, and slash disposal methods.

Clearcut with Reserves: (CC w/RES): This type of treatment generally (depending on the view shed and existing topography) does not meet Retention or Partial Retention VQOs when placed in foreground viewing zones. It can meet Partial Retention VQOs in the middleground or background viewing areas if unit boundaries are blended well with surrounding vegetation patterns and topographic features such as natural openings (use similar shapes and avoid straight line boundaries).

Seedtree Cut (ST): This type of cut can meet Partial Retention VQOs in the middleground or background viewing areas if unit boundaries are blended well with surrounding vegetation patterns and topographic features such as natural openings (use similar shapes and avoid straight line boundaries). Saving seed trees and scattered young trees in the opening greatly helps to soften the visual impact.

Commercial Thin (CT): This treatment can meet Retention in all viewing zones if unit boundaries are blended with surrounding vegetation patterns and topographic features such as natural openings (use similar shapes and avoid straight line boundaries).

Group Shelterwood (GSW): This treatment can meet partial retention or retention VQOs in the middle ground if openings are shaped to mimic surrounding natural openings and opening boundaries are not geometrically (or having straight lines) shaped.

Road Construction/Decommissioning

The appearance of road construction and road decommissioning depends upon existing topography, presence or absence of screening vegetation, the contrast between soil and rock colors of undisturbed areas vs. road fills/cuts created by soil disturbance, and the ability to restore or re-vegetate road cuts and/or fill areas. Roads constructed through or along the tops of clearcuts typically stand out when viewed in the foreground or middle ground viewing zones. Given time, revegetation of visible road cut and fills slopes as well as trees growing in the clearcuts or openings can ameliorate the soil/vegetation contrast situation. Usually within ten years the disturbed soil of decommissioned roads will revegetate with shrubs and trees filling in the old road prism opening.

Prescribed Burning

The effects of burning activity slash are normally short-term (lasting normally one growing season) if the shapes of burned units are blended with existing topography, natural openings, and surrounding vegetation texture. Straight, geometrically- shaped fireline construction can produce longer lasting effects because of potential soil/vegetation color contrasts (disturbed subsurface vs. surrounding vegetated area). This can be ameliorated over the long term by revegetating disturbed soil. As harvest units are regenerated and shrubs grow back, most burned areas should be fully revegetated within a decade from treatment.

Timber Stand Improvement

The proposed timber stand improvement (TSI) work (pre-commercial thinning and pruning) work would meet VQOs because line, form and texture would not change.

Alternative A

Direct, Indirect, and Cumulative Effects

The existing condition section describes the existing scenic condition of the project area. All activities that would continue under this alternative were designed to meet Forest Plan VQOs and would be implemented to meet Forest Plan VQOs. If Alternative A were implemented there would be no change to the landscape character of the area or the view sheds of Sensitivity Level 1 or 2 features within the project area.

Alternatives B and C

Direct, Indirect, and Cumulative Effects

All proposed activities under these alternatives were designed to and would be implemented to meet Forest Plan VQOs. All alternatives meet VQOs. If Alternative B or C were implemented there would be no change to the landscape character of the area or the view sheds of Sensitivity Level 1 or 2 features within the project area

Timber Harvest Activities: No units are proposed within High Scenic Levels (Retention). Other proposed timber harvest units that are within Moderate Scenic Levels (Partial Retention) are commercial thinning (CT) and seed tree (ST) silvicultural prescriptions or are screened by the existing topography and would meet VQOs. Most units fall within Low Scenic Levels (Modification).

Consistency with Forest Plan and Regulatory Framework

All alternatives meet Forest Plan VQOs and would be consistent with the Forest Plan. All activities that would continue under Alternative A were designed to meet Forest Plan VQOs and would be implemented to meet Forest Plan VQOs. All proposed activities in Alternatives B and C were designed to and would be implemented to meet Forest Plan VQOs.

Water

Differences between Draft EIS and Final EIS

Summary of Changes to Alternatives B & C

Acreage removed from proposed harvest (aerial):	92 acres
Acreage removed from proposed harvest (ground based)	11 acres
Net change in acreage removed from proposed harvest (aerial & ground)	103 acres

Summary of Change to Alternatives B

Changed from aerial to ground based log system	27 acres
Net change in ground based log system	+16 acres
Proposed road construction changes (system road)	-0.38 mile
Proposed road construction changes (temporary road)	+0.23 mile
Net change in proposed road construction (system & temporary)	-0.15 mile

In summary: In the FEIS 103 fewer acres are proposed for treatment in Alternatives B & C than in the DEIS. For Alternative B 0.15 fewer miles of road construction are proposed and new construction would not cross any streams, and there is a net change of 16 increased acres of ground based logging system. Twelve culverts that currently do not meet the criteria to accommodate a 100-year flood event would be upgraded.

Environmental effects from sediment from the changes between draft and final are addressed based on estimates derived from the surface erosion curves of the WATSED model (SW-50, 56). Effects would be less than stated in the DEIS because reducing the road construction and eliminating the originally proposed stream crossing would reduce sediment generation and reducing acres of timber harvest would result in less sediment. The estimated net change in sediment from the changes between draft and final would be a reduction of sediment (SW-56) compared to the value identified above for Bussel Creek.

Environmental effects for water yield changes from the changes between draft and final are addressed qualitatively. With the 103 acres of dropped harvest acreage there would be a reduction in the amount of timber removed within the Bussel Creek watershed. The reduction in proposed road construction would slightly lessen water yield values. The reduced amount of timber removal and decreased road construction would slightly decrease the water yield estimate. The environmental effects related to water yield, discussed in the DEIS and presented below are not expected to change appreciably from the changes between draft and final EIS.

Introduction

Bussel Creek is a 23-square mile watershed that is a tributary of Marble Creek, a 142-square mile watershed. Marble Creek is a tributary of the St. Joe River, a major stream in northern Idaho. The St Joe River flows into Lake Coeur d'Alene then the Spokane River. All of these drainages are part of the Columbia River system.

Regulatory Framework

Forest Plan

The Idaho Panhandle National Forests' Forest Plan (USDA FS 1987) defines the following management goals for the water resources on NFS lands:

1. Maintain water quality protective of fisheries habitat, water-based recreation, public water supplies, and to meet or exceed State Water Quality Standards: To help accomplish this objective, BMPs must be applied to management activities. Monitoring efforts must focus on the implementation of BMPs and their effectiveness in protecting water quality. Water quality that is below Forest standards must be improved through restoration projects and through scheduling of timber harvest and road building activities.
2. Protect stream channel integrity: Manage riparian areas to meet objectives for dependent resources (fish and wildlife habitat, water quality, stream channel integrity, and vegetation) while producing other resource outputs.

Forest-wide standards direct the following on NFS lands with respect to the water resource:

1. Management activities on Forest lands would not significantly impair the long-term productivity of the water resource and would ensure that state water quality standards are met or exceeded.
2. Maintain concentrations of total sediment or chemical constituents within State standards.
3. Implement project-level standards and guidelines for water quality contained in the Best Management Practices (Forest Service Handbook 2509.22, available upon request), including those defined by State regulation or agreement between the State and Forest Service such as:
    a. Rules Pertaining to the Idaho Forest Practices Act (IDAPA 20.02.01)
    b. Stream Channel Alterations Rules (IDAPA 37.03.07)
    c. Best Management Practices (Appendix B)
4. Cooperate with the states to determine necessary instream flows for various uses. Instream flows should be maintained by acquiring water rights or reservations.
5. Manage public water system plans for multiple-use by balancing present and future resources with public water supply needs. Project plans for activities in public water systems would be reviewed by the water users and the State. Streams not defined as public water systems, but used by individuals for such purposes would be managed to the standards stated below or to the fisheries standards whichever is applicable.
6. Activities within non-fishery drainages, including first and second order streams, will be planned and executed to maintain existing biota. Maintenance of existing biota will be defined as maintaining the physical integrity of these streams. Best Management Practices (Appendix B), Forest Plan Appendix O, and riparian guidelines will be used to accomplish this objective.
7. It is the intent of the Forest Plan that models be used as a tool to approximate the effects of National Forest activities on water quality values. The models will be used in conjunction with field data, monitoring results, continuing research, and professional judgment, to further refine estimated effects and to make recommendations.

Inland Native Fish Strategy (INFS) Forest Plan Amendment

Standards for managing riparian areas were established as Forest Plan amendments based on the Inland Native Fish Strategy (1995), commonly referred to as INFS. Riparian Habitat Conservation Areas are determined for watersheds and essentially promote water quality benefits through stream shading, vegetative buffers for sediment control, and channel stabilizing features of woody debris and stream bank vegetation.

Clean Water Act

A declared objective of the Clean Water Act (CWA) of 1977 (33 U.S.C. 1323) is to "...restore and maintain the chemical, physical, and biological integrity..." of streams (US Congress, 1988). The CWA directs the Forest Service to meet state substantive and procedural requirements respecting control and abatement of pollution. Through a Memorandum of Understanding Implementing the Non-point Source Quality Program in the State of Idaho of 1994, the Forest Service is responsible for implementing nonpoint source pollution control and the Idaho Water Quality Standards (IDAPA 58.01.02) on National Forest System lands. Forest Service water quality policy within the MOU is to: promote the improvement, protection, restoration and maintenance of water quality to support beneficial uses, promote and apply approved Best Management Practices (BMPs) to control non-point source pollution, comply with state and national water quality goals, and design monitoring programs for specific activities and practices that might affect in-stream beneficial uses.

40 CFR Part 232 identifies Exempt Activities Not Requiring 404 Permits and 232.3(c)(1) identifies that normal silvicultural activities are exempt. 33 CFR Part 323.4 identifies discharges of dredged or fill material that do no require permits under section 404 of the Clean Water Act. For silvicultural activities the discharge of sediment “is not prohibited or otherwise subject to regulation under section 404”. 33 CFR Part 323.4(a)(6) identifies that forest roads do not require discharge permits if constructed and maintained in accordance with best management practices where “adverse effect on the aquatic environment will be otherwise minimized”.

State Water Quality Laws & Regulations

The State of Idaho established the Idaho Water Quality Law (§39-3601 et. seq.) and Water Quality Standards (IDAPA, 58.01.02) designed to protect beneficial uses. The State's Antidegradation Policy (IDAPA 58.01.02.051) directs that existing uses and the level of water quality necessary to protect those uses must be maintained and protected. In order to meet the intent of the CWA, the Forest Service is responsible for implementing non-point source pollution control and the Idaho Water Quality Standards on National Forest System lands.

Bussel Creek is an Undesignated Surface Waters (IDAPA 58.01.02.110.11); beneficial uses applied to undesignated waters are cold water aquatic life, and primary or secondary contact recreation (IDAPA 58.01.02.101.01.a).

Idaho State Water Quality Standards has a section for Rules Governing Nonpoint Source Activities (IDAPA 58.01.02.350). This section of the water quality standards identifies that nonpoint source pollution management will occur through the use of best management practices (IDAPA 58.01.02.350.a).

Water Quality Limited Segments

Bussel Creek is listed on Idaho's 2002 303(d) list of Water Quality Limited Water Bodies (SW-17). The pollutants of concern are temperature and sediment. Bussel Creek is a tributary to Marble Creek, which is also listed for temperature. Previous to the 2002 303(d) list, Bussel Creek was not listed as impaired. Only Bear and Little Bear Creeks, tributaries of Bussel Creek were listed as not supporting beneficial uses. This listing of Bussel Creek occurred as a change in "assessment unit" delineation (Idaho DEQ 2005 p 6).

Total Maximum Daily Loads (TMDLs)

TMDLs were developed by Idaho DEQ for Bear and Little Bear Creeks within the Bussel Creek watershed. The Bear and Little Bear sediment TMDL calls for reducing sediment by 14 tons/year from National Forest System (NFS) lands and 7 tons/year from non-NFS lands (SW-16). The temperature TMDL calls for increasing shade canopy over the stream channels by 20-80% in Bear and Little Bear Creeks (SW-16).

Executive Order 11988

Executive Order 11988, Floodplain Management (SSW-5) directs that each agency shall provide leadership and shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by floodplains in carrying out its responsibilities for:

(1) acquiring, managing, and disposing of Federal lands and facilities;

(2) providing Federally undertaken, financed, or assisted construction and improvements;

(3) conducting Federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulating, and licensing activities.

Executive Order 11990

The Protection of Wetlands Order 11990 (SSW-6) directs agencies to provide leadership and take action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands in carrying out the agency's responsibilities for (1) acquiring, managing, and disposing of federal lands and facilities; and (2) providing federally undertaken, financed, or assisted construction and improvements; and (3) conducting federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulating, and licensing activities.

Analysis Area

The analysis area for direct, indirect and cumulative effects for water resources is the Bussel Creek watershed. See Map 18 in Appendix A. The water analysis determined there would be no appreciable effect in maintenance of beneficial uses in the Bussel Creek watershed (see Water Section: Project Activities and Regulatory Framework). Since there would be no appreciable effect to beneficial uses in Bussel Creek it is expected that there would be no effects to beneficial uses in Marble Creek (SW-57). Therefore, effects from the proposed activities are only analyzed for the Bussel Creek watershed. The terminus of the cumulative effects analysis is the confluence of Bussel Creek at Marble Creek.

Analysis Methods

The water resource is assessed through

1. water yield,
2. water quality/beneficial uses,
3. stream channel form and channel process.

Models are used for estimating direct effects from proposed management activities for comparison of alternatives and to guide and support professional judgment. The models used in this analysis do not estimate indirect effects from management activities. Water yield and peak flow are interchangeable in the analysis that follows.

Water yield is estimated through the WATSED model. Additionally, peak flow analysis was based on St. Joe River discharge values from the USGS gauging station near Calder, Idaho (SW-A5). Changes in peak flow were plotted on a flood frequency curve for Bussel Creek to estimate changes in flood frequency (SW-18).

Stream channel form and process are analyzed in terms of their response to changes in water yield and sediment yield. Stream channel response is also discussed in relation to stream classification developed by Rosgen (1996), Montgomery and Buffington (1998) and Beechie and others (2006). Stream channel pattern is analyzed through comparison of historical and recent aerial photographs.

Water quality/beneficial uses are assessed through a sediment budget, vegetative buffers, channel form and process, and stream temperature. Sediment from the proposed activities was estimated based on coefficients and equations developed by the Idaho Department of Environmental Quality (DEQ) for the St. Joe River Subbasin Assessment and TMDL (2003) (SW-16). This is referred to as the TMDL model in this analysis. The TMDL model is used to compare estimated sedimentary effects to the TMDL values. In addition, the WATSED model estimated changes in sediment. The WATSED model is commonly used throughout Forest Service Region 1.

Stream crossing culvert sizes were field inspected and measured. For each stream crossing culvert the discharge of a 100-year peak flow event was calculated. The existing measured culvert size was determined adequate or inadequate to pass the 100-year peakflow event. The amount of potential sediment in stream crossing fills was estimated (SW-A4), but the risk of crossing failure was not evaluated, because there is always the potential of inlet blockage and subsequent crossing failure.

Effects to wetland resources are qualitatively analyzed. Hydrological connectivity in three dimensions (lateral, longitudinal and vertical) is also discussed.

Assumptions and Limitations of Analysis Methods

Channel Form and Process Assumptions

There are eight interrelated variables involved in the downstream changes in river slope and channel form: width, depth, velocity, slope, sediment load or yield, size of sediment debris, hydraulic roughness, and discharge (Leopold and others 1964 p. 268).

Channel Form

Channel form is addressed through the following parameters:

Channel cross-section (width, depth, sediment yield)

Channel pattern (sinuosity – slope, discharge, sediment yield)

Sediment yield (sediment load, size of sediment debris)

Pebble count (size of sediment debris, hydraulic roughness)

Channel Process (physical)

A channel's physical process is to convey the water, sediment and wood delivered to it from adjacent areas; also, wood may be stored and sediment deposited or stored in the channel network (Schumm 1977 p. 104-105; Montgomery and others 2003 p. 21; Grunell 2003 p. 75; Gordon and others 1992 p. 319; Gregory 2003 p. 2).

Variables associated with channel form and process are estimated (sediment yield, discharge) and quantified (width and depth through cross-sections, hydraulic roughness and size of sediment debris through pebble counts).

Slope is correlated to sinuosity (though measured at some cross-sections (SW-19)). Stream velocity is not quantified or estimated.

Sediment Estimate Assumptions and Limitations

The Bussel 484 DEIS identifies a sediment budget for the Bussel Creek watershed that shows sediment reductions and additions for activities on Forest Service managed lands and cumulatively for roads on non-Forest Service land. The TMDL and WATSED models are used to estimate a sediment budget. The TMDL modeling includes reductions from road recontouring and stream crossing removals (long-term storage), but not road graveling. The TMDL model incorporates sediment additions from road construction, stream crossing restorations and non-stocked stands. The WATSED model incorporates roads (existing and new), harvesting and fuels treatments. WATSED does not explicitly model road recontouring or stream crossing removals, so the WATSED sediment estimate may be elevated compared to the TMDL model estimate. Montgomery and Coe (2007 p. 156) identify that "[s]ediment transport models developed for larger alluvial channels typically overpredict sediment transport rates in headwater channels by at least an order of magnitude (Hassan et al. 2005a)". The estimated sediment levels in this analysis are not definitive and should be used for comparison between alternatives. The TMDL and WATSED estimate different levels of sediment and the average may provide a better representative value.

TMDL Model

Idaho Department of Environmental Quality (DEQ) completed a sub-basin assessment for the St. Joe River that includes Bussel Creek and its tributaries (SW-16). The sub-basin assessment included a model to estimate 'natural' or background sediment levels and to estimate sediment levels from human activity. The model estimated that human-caused sediment was over 50% above 'natural' sediment levels in Bear and Little Bear Creek, which they believe indicates non-support of beneficial uses. The Idaho DEQ Sub-basin Assessment and Total Maximum Daily Load (TMDL) (SW-16) identified a sediment reduction for Bear and Little Bear Creeks, intended to meet full support of beneficial uses, based on their spreadsheet model (TMDL model).

The water resource analysis uses the coefficients and equations of this TMDL model to estimate new sediment sources and sediment reductions from proposed activities. The use of the TMDL model to estimated sediment levels is consistent with the DEQ TMDL, in that it estimates activity sediment in the same way the TMDL model estimated sediment levels. IDEQ has commented that their TMDL model was not intended to analyze project-level sediment production; however since this was the process used to determine TMDL allocations; it was used in this analysis to estimate sediment reductions and compare with the TMDL values.

Sediment reduction and addition levels from proposed activities were estimated based on coefficients and equations used by DEQ in their TMDL spreadsheet model. DEQ references the USFS WATSED model (in Appendix C Sediment Model Assumptions and Documentation; SW-16 p. 223) when discussing sediment export coefficients measured in-stream on geologies of northern and north central Idaho. The TMDL model counts sediment generated by roads up to 200-feet on either side of a stream crossing. The DEQ TMDL model also attributes sediment to 'encroaching' roads – those roads within 50 feet of a stream channel – that are modeled as causing within-channel erosion. Timber stands that are non-stocked (SW-20) were also considered as a sediment source (SW-16).

The number of stream crossings and lengths of encroaching roads are derived from Arcview GIS (intersected road layer and 50-foot buffered stream layer), with the number of crossings verified through hard-copy maps (SW-21) and electronic GIS maps, Arcview queries and field collected data (SW-11, SW-12).

The Idaho DEQ TMDL (2003, SW-16, p.143-152) identified that sediment modeling provides "…relative, rather than exact, sediment yields." And that "[s]everal conservative assumptions were made in the model construction, which cause it to develop conservatively high estimations of sedimentation of the streams modeled." Using the TMDL model for estimating sediment reductions from restoration activities has these same limitations as identified by DEQ. The DEQ model overestimates sediment production by at least 20% (SW-16).

No fill failure values were included in the DEQ TMDL model for the portion of the St. Joe River within the project area. Every stream crossing has the potential for failure given the right circumstances – the culvert may become plugged or the design flow exceeded. The amount of potential sediment in road fills was estimated (SW-A4), but it was not used to estimate changes in sediment production. The risk of crossing failure was not evaluated. For crossings proposed for removal and those that would remain, fill sizes were estimated (1500-7500 cubic feet of fill) and potential sedimentation from various fill failure amounts (25%-100%) was averaged, and these values are in the project file (SW-A4). The DEQ spreadsheet model (SW-16) includes a mass failure component, but Bussel

Creek and its sub-watersheds were not identified as contributing sediment from mass failures (SW-16, p. 37). These sub-basins were not assessed for mass failure during TMDL development (SW-22).

Idaho DEQ, in the St. Joe Subbasin Assessment and TMDL (SW-16), lists 65 stream crossings in Bear/Little Bear Creeks and 71 for Bussel Creek (SW-16, p. 36). However, field investigations (SW-11, SW-21) determined that there are about 20 stream crossings in Bear/Little Bear Creeks, six road segments that are "encroaching" within a 50-foot stream buffer, and an additional 95 crossings throughout the Bussel Creek watershed for a total of 115 road crossings (SW-22, SW-A36).

Short and Long-term Sediment

The TMDL model provides a long-term sediment budget for Bussel Creek that applies sediment estimates only to roads within 200 feet of either side of a stream crossing and encroaching road lengths within 50 feet of a stream, whether it is new construction, a recontoured road or a stored road (SW-A36, SW-A23). Stream crossing restorations and non-stocked stands are short-term sediment additions and are included in the sediment estimate. Regeneration harvested areas are estimated to be non-stocked and contributing sediment for two years.

Sediment generated during stream crossing removal and restoration is identified as a short-term sediment addition (SW-A36). It is recognized that sediment would be generated when a stream crossing is removed and restored, but this would be a short-term sediment addition compared to the continual sediment additions from road encroachment and road surface delivery if the road and crossing were left in place. Crossing removals also eliminate the risk of failure of an estimated 1500-7500 cubic feet of fill per crossing. It is estimated that there would be some sediment generated for one year (or possibly two years) from these restorations; but the chronic sources of sediment would essentially be eliminated, and sediment would not be generated into perpetuity from these sites.

All new road construction on National Forest System land is proposed for recontouring (temporary road) or long-term storage (RX C, system roads) (SW-A20). Upon completion of these proposed treatments, new roads would no longer generate sediment (per the TMDL model). In this analysis the sediment from new road construction is modeled over five years because that is the estimated length of the timber sale contract.

What is most important to understand in the Bussel Creek sediment budget is that some sediment will be generated in the short-term, but long-term sediment reduction is consequentially large (Table 3-68, SW-A30, SW-A31, SW-A36), which should lead to increased support of beneficial uses (Switalski and others 2004).

Road Maintenance

Because the TMDL model always counts a road the same way (it estimates road sediment from 200 feet on either side of a stream crossing and from encroaching roads – those within 50 feet of a stream) it does not increase or decrease sediment to the stream system from road maintenance. The TMDL model sediment estimates do not change because of maintenance. Periodic road maintenance may reduce sediment from surface ruts or plugged ditches.

Timing of Sediment Additions and Reductions

The timing for sediment additions and reductions was calculated based on the estimated dates of proposed timber sales and the typical 5-year length of a timber sale contract. Within the 5-year contract period it is impossible to predict what year any given activity would occur – all activities could occur in the first year or they might not occur until the last year of the contract period. Two scenarios are used for the TMDL model (SW-48). One shows most activities occurring in the first and second years, and the other shows most activities occurring in the fifth and sixth years.

WATSED Sediment Estimate

The WATSED model estimates sediment changes from management activities, but the model has not been recently calibrated for the Bussel Creek watersheds and thus the accuracy of the estimate for Bussel Creek from this model is not known. The sediment estimate should be used to compare alternatives. Further, in attempting to calibrate the WATSED model through measuring sediment, one cannot separate natural sediment from management-generated sediment (NCASI 1999, pp. 1-21). For example, say sediment is measured some distance downstream from management activities, but a tree blows over in a windstorm and lands in the stream channel in the reach below activities and above the measurement point. The tree blocks the channel and causes an avulsion (a new channel position in the valley bottom) with down-cutting and sediment generation, which would then be

measured at the sediment-sampling site. Or a channel-spanning log has stored sediment behind it, but the log rots out and releases this stored sediment. It is infeasible to separate sediment attributable to natural processes from sediment generated by management activities.

The WATSED data set was adjusted to model road recontouring and stream crossing removals and restorations (SW-23). Roads proposed for Rx D or recontouring were removed from the WATSED model's data set. Roads proposed for storage, Rx C (decompacted, stream crossing removal and restoration), were given a mitigation factor (ROB – 'road obliteration') within the data set. Comparison of a WATSED estimate for all activities with no road treatments, to the estimate of all activities with road treatments (Rx C & Rx D) will provide an estimate of the change in sediment levels from road recontouring and road storage (SW-23).

The WATSED model estimates sediment generated from harvest units, but monitoring on the Bitterroot National Forest (USDA 2006a p 81-82) shows there was no movement of sediment from harvest units into Riparian Habitat Conservation Areas. The estimated value for sediment from harvest units in the WATSDED model may be exaggerated (also see discussion under *Scientific Uncertainty and Controversy, Sediment Estimate and Buffer Efficacy* section below).

MacDonald and Coe (2007 p. 158) state, " [a]lthough increases in suspended sediment were attributed to the watershed area occupied by roads, there was little field evidence of sediment delivery from newly constructed roads (Lewis et al. 2001)." Based on those findings, the WATSED model may overestimate sediment.

Timing of Sediment Additions and Reductions

The WATSED sediment estimate is based on timber sale related activities occurring over three years and road recontouring and storage in the third year (SW-48). The Forest Service sometimes grants contract extensions beyond five years, but to try to incorporate a possible extension would be speculation and it is not included in the sediment timing presented here.

Water Yield Estimate Assumptions and Limitations

The WATSED model was used to estimate increases in water yield (SW-23) from FS proposed activities. A water yield estimated based on equivalent clearcut area (ECA) was used to estimate water yield from disclosed private land activities for cumulative effects (SW-25). WATSED does not model rain-on-snow or snowmelt related to harvest activities. For this analysis water yield is synonymous with peak flow.

USGS gauged data from the St. Joe River annual-series of peak flows was used for the period of record (1911-1912, 1921-2006) to extrapolate peak discharge for Bussel Creek based on discharge per unit area (SW-58). This extrapolation was done because there is no gauged data for the Bussel Creek watershed. The extrapolated data was used to construct a flood frequency graph for Bussel Creek (SW-18). Estimated changes in peak flow were plotted on this graph to show the possible change in flood frequency from proposed activities. The St. Joe River gauged data should reflect any peak flow increases from management activities conducted in the basin above the stream gauge location.

Effects to seasonal low flows are based on results of water yield research in the central Rocky Mountains (Stednik and Troendle 2004 p. 175).

WATSED Water Yield Estimate

WATSED is designed to objectively compare relative differences among forest management alternatives in terms of changes in trend, risks, and regimen of water and sediment yield. Estimates are calibrated using measured data that include a combination of primary watershed processes. The model is driven by local climatic conditions and it uses Equivalent Clearcut Area (ECA) notation to represent the apparent degree of landscape disturbance through time. Recovery curves for various road designs and configurations (clearing width, cutslope area, width, and length), logging systems and harvest methods (tractor, cable, aerial), wildfire, and site preparation (mechanical, prescribed fire, or hand) are used to characterize the watershed disturbances that result in cumulative effects. WATSED is not intended to simulate watershed response for individual or episodic storms such as rain-on-snow, mass erosion events or extreme drought or flood years. It is not intended to accurately predict sediment and water yields that might occur as a result of stochastic events or non-forest related actions. The WATSED estimate is not a definitive water yield value, and should only be used to compare management alternatives. It does not address or analyze the effects of grazing or mining (other than vegetation removal and road construction) or other non-silvicultural related practices (SW -24).

The WATSED estimate for water yield with all roads included (new construction) showed a 3% increase. When roads proposed for recontouring or long-term storage were removed or mitigated, the water yield increase was 2% (SW-23). The estimated 3% increase is what is used throughout this chapter.

Equivalent Clearcut Area (ECA) Water Yield Estimate

Water yield was estimated for cumulative effects from proposed private land activities (SW-39) within the Bussel Creek watershed. The ECA procedure uses precipitation, proportion of stand removed in relationship to a clearcut and water yield increase curves based on evapotranspiration changes from vegetation removal (SW-25). This procedure does not estimate rain-on-snow or peakflow increases, but identifies increased water yield per acre from changes in vegetation. ECA was used as a separate analysis for estimating cumulative effects from private land.

Historic and Current Aerial Photographic Analysis

A comparison of past conditions and current conditions in Bussel Creek used 1933, 1965, 1979, 2002 aerial photographs (SW-26). Because of the relatively small stream size, except for the main Bussel Creek channel, channel location and size are difficult to discern and compare over time in these aerial photographs. Quantification of stream channel width is difficult because of different photographic scales for the various years. Also a lack of clarity in the 1965 and 1979 photos make it difficult to discern the actual Bussel Creek channel width. Channel depth cannot be determined from aerial photographs. The main emphasis of this analysis was on changes to the Bussel Creek channel below the Lines Creek confluence. Tributary channels are not discernable at a level to draw conclusions. It is assumed that substantial changes over time in the Bussel Creek channel would indicate that upstream channels were also substantially changing over time.

Cumulative Effects

There is uncertainty in future activities on non-federal land and effects from those activities. Information was disclosed by non-federal land owners/managers regarding future activities. The disclosed future activities were included in the cumulative effects analysis (SW-27, SW-A21). Equivalent clearcut area was used to estimate water yield increases on privately owned land, and the TMDL model was used to estimate sediment levels for activities on privately owned land.

Scientific Uncertainty and Controversy

Stream Channel Form and Process

There is some uncertainty and controversy in estimating effects to stream channels and separating the degree of anthropogenic effects from non-human effects. Human activities can influence the morphology of streams, but the effects may not be different from natural conditions or disturbances – magnitudes of certain variables in the geomorphic system may increase [from human activities] resulting in accelerated or decelerated responses in fundamental geomorphic processes. The appropriate [geomorphic] principles are not abrogated (Leopold and others 1964 p. 434).

Beechie and others (2006) identify that lateral channel migration rates based, in part, on ages of floodplain surfaces increase in this order of channel patterns: straight, meandering, island braided to braided. Residence time of floodplain sediments is short for most braided channels (5 years) and longer for straight channels (average of 89 years), although straight channels may range from 100 to 200 years (Beechie and others 2006 p. 135). Natural changes and their consequences are similar to changes induced by man's activities (Schumm and others 1984 p. 161; Schumm 1977 pp. 133-137). Stream channels evolve: an alluvial river is continually changing its shape, dimension and pattern and "it is the rule rather than the exception that banks will erode, sediment will be deposited and floodplains, islands, chutes and side channels will undergo modification with time" (Schumm 1977 p. 131).

Ward and others (2001 p. 312) suggest that there may be false perceptions of natural conditions in relation to river systems, that "non-equilibrium conditions prevail" and that there is a "remarkable degree of spatio-temporal heterogeneity that characterizes river corridors in the natural state." They also suggest (2001 p. 316) that "[t]he limited empirical knowledge of dynamic processes operating in natural river corridors means that we lack sound 'benchmarks', not only for assessing human impacts, but also for addressing restoration and conservation strategies." Montgomery (2008, p. 291) suggests that reexamination is necessary for what constitutes a "natural channel".

Recognition of the role of large woody debris (LWD) in streams has grown over the past several decades. Wood debris significantly and sometimes systematically affects channel processes (Montgomery and Piegay 2002). LWD was likely removed to facilitate use of the Bussel Creek channel for log drives in the late 1920s and early 1930s. Large wood was surveyed for the Bussel Creek watersheds, but there is no indication of the relative stability of individual LWD or aggregates of LWD in the collected field data (see *Fisheries* section).

Interpretation of existing condition in relationship to effects from proposed activities is used to estimate channel form and process response. This estimate is based on professional experience and judgment. "Channels are complex systems that need to be interpreted within their local and historical context" (Montgomery and Buffington 1998 p. 38). Uncertainty increases as one attempts to predict the effects of multiple activities over time and space; and it can be very difficult to predict accurately the effects of policies and management activities at the watershed scale (MacDonald and Coe 2007 p. 161).

Stream Classification Response Potential

Rosgen (1996 p. 8-8 & 8-9) and Montgomery and Buffington (1998 p. 31) present classified stream type and stream reach morphology (respectively) -based response potential to sediment and water yield increases. Analysis of existing channel form, sediment yield and size, channel process, riparian vegetation and inventoried large woody debris amounts, in relation to changes in sediment and water yield does not coincide with the response results presented by Rosgen or Montgomery and Buffington. Because of the diverse and complex nature of the headwater-downstream interaction for water, sediment, large wood, particulate organic matter, nutrients and water temperature (MacDonald and Coe 2007 p. 161) there is a large degree of uncertainty in applying the classification based response potential to effects from management activities.

Cumulative Effects

"One characteristic that is common to both streams and research is that what initially appears complex is even more so upon further investigation (National Council of the Paper Industry for Air and Stream Improvement (NCASI 1999 p. iv)." "Cumulative watershed effects are particularly difficult to predict and identify because the individual water and sediment inputs are delivered to the stream system at different points in time and space, and these interact with the water and sediment already in the stream" (NCASI 1999 p. 1). "The often nebulous relation between management activities and stream response has even resulted in CWEs [cumulative watershed effects] being called the UFOs of hydrology (Rice and Thomas 1986)" (NCASI 1999 p. 5).

There can be a "tremendous amount of uncertainty in how a given policy or management activity in an upslope or upstream area will affect aquatic resources. This uncertainty stems from the wide variability of site conditions, the variability in how a given activity is carried out, the uncertainty with respect to future storm events and the inability to adequately characterize all of the controlling processes and site factors" (MacDonald and Coe 2007 p. 161).

"Uncertainty is a hallmark of all CE [cumulative effects] assessments, and this must be recognized by managers, regulators, and the public. The problem of scope, scale, and predictability are based in science, but their resolution is a question of values and will therefore be a continuing source of controversy" (MacDonald 2000 p. 312).

Aerial Photograph Comparison

Comparisons of historical 1933, 1965, 1979 and recent aerial photographs were used to compare the Bussel Creek channel and riparian conditions over time. Channel depth cannot be determined from aerial photographs. There is a small degree of uncertainty in determining the condition of the Bussel Creek channel over time without comparing channel depth over time, but that data is not available.

Sediment and Wildfire Compared to Human Activity

MacDonald and Coe (2007 p. 154-155) state that severe wildfire can increase the production and delivery of sediment by several orders of magnitude and that moderate-and low-severity wildfires are an order or more magnitude lower. Nitschke (2005 p. 315) identifies that wildfire increases sedimentation more than harvesting. The delivery of sediment to stream channels can be from discrete events (mass failure) or chronic (storm-by-storm sediment from roads) (MacDonald and Coe 2007 p. 152) or short-term episodic from wildfire until vegetative regrowth. The amount of sediment generated by human activities is, as modeled here, nowhere near an order of magnitude increase and is believed to be substantially less than what could occur under natural conditions caused by wildfire. There is no data on sediment delivery to stream channels following wildfire in the Bussel Creek watershed.

Total Maximum Daily Load Reduction

The sediment reduction assigned in the DEQ TMDL is based on amount of land ownership (SW-16 p. 61-63). The majority of estimated sediment is from roads (SW-16 p. 47), and a more accurate reflection of needed sediment reductions should be based on road mileage or road density by ownership, which would likely lessen the amount of sediment reduction assigned for National Forest System lands. Road density on NFS land in the project area is 2.9 mi./sq. mi., and on non-federal land it is 9.9 mi./sq. mi. This issue needs to be addressed in the future TMDL Implementation Plan.

There is no long-term sediment monitoring data for Bussel Creek or the St. Joe River to indicate current vs. natural loading and transport rates. The assigned sediment reduction values for Bear Creek are to reduce the sediment level to 50% over estimated natural or background levels, but it is uncertain that this reduction would lead to full beneficial support. Monitoring aquatic conditions is necessary to determine beneficial use support status (SW-16, p. 54).

WATSED Sediment Estimate

The sediment estimate from the WATSED model includes a mitigation value assigned to roads proposed for long-term storage (Rx C – decompaction, stream crossing removal and restoration) and the removal of roads proposed for recontouring (temporary roads). There is some degree of uncertainty in applying these methods to the WATSED model. The sediment estimate is for comparison between alternatives.

Sediment Estimate and Buffer Efficacy

There is scientific controversy and uncertainty in the TMDL estimate of sediment from non-stocked stands, WATSED sediment routing, and delivery of sediment to the stream channel. The TMDL assigns a coefficient for sediment yield from stands that are not fully stocked by Forest Practices Act standards (SW-16, p 221; SW-47). One hundred percent of the TMDL sediment yield value is considered delivered to stream channels (SW-16, p 222). The TMDL model does not take into account vegetative buffers. It is not known if the WATSED model incorporates vegetative buffers' ability to prevent sediment from entering the stream system from proposed harvest units. RHCA monitoring conducted on the Bitterroot National Forest found no movement of sediment into or through RHCA buffers (USDA 2006a p 81-82).

The *Soils* section identifies that all proposed harvest units have low surface erosions hazard ratings and that soil erosion is not expected within harvest units. BMP monitoring in harvest units identifies that there is little to no exposed soil (SSW-14, 50, 59, 61; SW-13). Erosion is unlikely to occur if there is no exposed soil to erode.

The ability of vegetative buffers to filter sediment from non-channelized flow (such as from stand harvesting) is documented in INFS (1995 p. A-5) and in monitoring conducted on the Bitterroot National Forest (USDA 2006a p 81-82). Vegetative buffers around streams, wetlands, and high mass failure potential areas are included in the proposed action. It is believed that these buffers are adequate for protecting the stream from potential harvest-generated sediment.

Jackson and others (2007) document response and recovery of channels, macroinvertebrates and amphibians following harvest in headwater streams in the Coast Ranges of Washington State. They found that "[d]istribution of mesoscale habitat types [pool, riffle, run, step, subsurface flow and bedrock], as well as sediment particle size distributions and amphibian assemblages, were largely unchanged in the buffered streams following harvest." Buffers in the streams studied ranged from 8-10 meters (26-32 feet), which are less than the RHCA buffers in the proposed action.

Modeled sediment delivery from non-stocked stands and the ability of vegetative buffers to prevent sediment delivery are conflicting concepts, which cannot be reconciled in this analysis.

Stream Crossing Restoration Sediment Addition

Short-term sediment additions were estimated for stream crossing restoration using an average width, length, and depth where winnowing of fine sediment might occur (SW-A36, SW-A30) after water is returned to the reconstructed channel. There is uncertainty in the estimated sediment from the restoration activities because monitoring data of stream crossing restoration is rare. Monitoring culvert removal stream crossing restorations on the Clearwater NF indicates that small amounts of sediment were generated and that State Water Quality

Standards for turbidity were met, except for a few samples (SW-27). It may be that the estimated sediment increase from stream crossing restoration activities is substantially overestimated (SW-28).

Water Yield

There is some degree of uncertainty and controversy in attempting to quantify changes in water yield peak discharge related to forest harvest activities. Kattelmann and Ice (2004 p.194) cite various authors and disparate conclusions from analysis of the same data related to timber harvest and peakflows within the transient snow zone. They further state (p. 192), "The role of logging in the rain-on-snow or transient snow zone is controversial" and invite readers (p. 194) "…who wish to delve deeper into the debate about forest management and changes in peak flow" to "review the articles and the numerous 'comments' that were published in the exchanges between the authors".

MacDonald and Coe (2007 p.151) identify numerous difficulties in trying to determine management-induced changes in streamflow, including spatial scale, contradictory results from various analyses, modeling and field studies.

Stednick and Troendle (2004 pp. 169-186) document water yield and peakflow increases from timber harvesting practices in the central Rocky Mountains. They state (p. 176) in a discussion of peak flows on Fool Creek: "Timber harvesting can increase the size of the peak flow, but that change is less evident for recurrence intervals greater than two years." (A two-year recurrence interval peak flow has a 98% chance of occurring in any year.) They also identify that no change from harvest was detectable for seasonal low flows (p. 175).

In northwestern Montana and northeastern Idaho, rain-on-spring-snowmelt was the most common cause of annual maximum daily flows, although relatively infrequent mid-winter rain-on-snow events caused the largest flows on record (MacDonald and Hoffman 1995 p. 90). In their study of causes of peak flows in NW Montana and NE Idaho, MacDonald and Hoffman (1995 p. 94) state: "For the six study basins there was no apparent correlation between the magnitude of peak flows and the amount of forest harvest", and they also state (p. 94) that "Forest harvest would be expected to cause differential increases in the magnitude of observed peak flows, but climatic differences are the dominant control on the size of peak flows within the study area."

The WATSED model was used to estimate changes in water yield related to the proposed activities. WATSED compares management activities' effect on the peak flow month discharge. The estimated values are displayed in Table 3-68. Further WATSED documentation is found in project file documents (SW-23, SW-24) for the model and results. Applying WATSED percent increase in peak month discharge to estimated, instantaneous peak flows has some degree of uncertainty.

Additionally, analysis was conducted on peak flow data from a USGS gauging station on the St. Joe River (SW-A7, SW-58). Peak flow data was extrapolated for Bussel Creek from St. Joe River gauge station data based on the area/discharge relationship, because Bussel Creek does not have a gauging station. The trend lines for the St. Joe River and for Bussel Creek (with extrapolated data) do not display increasing peak flows (SW-A7). Based on a TSMRS query that included data from 1962 to the present, harvest levels on NFS land have increased over time in the Bussel 484 Project Area (SW-A6, SW-B13), but the TSMRS data does not have historical data from activities evident in the 1933 aerial photographs (SW-26, SW-A6, SW-B13). The level of timber harvest and roading above Calder, Idaho have not led to a trend in peakflow increases at the St. Joe River gauging station (SW-A7). There is some degree of uncertainty in extrapolating discharge from the St. Joe gauged data to the Bussel Creek watershed based on the area/discharge relationship, because there is likely spatial and temporal variability in precipitation and runoff over a large watershed (1,030 sq. miles) like the St. Joe River above the gauging station at Calder, Idaho.

Pebble Counts (Sediment Size)

Twelve cross-section sampling sites have pebble count data from 2004 through 2007 (except Bussel #4 which is missing 2006), and seven of those sites have data for 2002, 2003 or both (SW-19, SW-29). Sampling stream substrate in pebble counts may have inherent error because of individual bias, such as not identifying sand, silt or clay sized particles as the first particle encountered by the samplers' fingers or hand underwater. Also pure randomness could lead to disparate results over time or there could be a shift in particle size distribution from a natural event or from human activity. Particle size distribution through pebble count samplings is believed to be representative of sediment entering, moving and in storage in the stream channels. There is some degree of uncertainty in ascribing the pebble count size distribution as representative of particle sizes found throughout the channel network.

Beneficial Use

The cold water aquatic life beneficial use designation states: "water quality appropriate for the protection and maintenance of a viable aquatic life community for cold water species" (IDAPA 58.01.02.100.01). For DEQ determination of beneficial use support status (IDAPA 58.01.02.053), the "Department shall employ a weight of evidence approach in evaluating a combination of water quality data types (including but not limited to aquatic habitat and biological parameters), when such a combination of data are available, in making its final support determination." The St Joe River Subbasin Assessment and TMDL (SW-16, p. 26-32) does not indicate when, how often or how rigorous the data collection is for determination of beneficial use support. For Bear Creek the subbasin assessment documents non-support of beneficial use through an average of stream macroinvertebrate index (SMI), stream fish index (SFI) and stream habitat index (SHI). The Bear Creek average is 1.7 with SMI and SHI at 1 and SFI at 3 (SW-16, p. 27). An average value of 2 or greater for these indices indicates support of the cold water use (SW-16, p. 26).

Bussel Creek may be currently supporting beneficial uses even though it is listed on the 2002 303(d) list. DEQ in their St. Joe Subbasin Assessment and TMDL (DEQ 2003; SW-16 p 42) conducted a sediment analysis for Bussel Creek. The determination for Bussel Creek is that its sediment level was currently at 33.8% over 'natural' or 'background' levels (DEQ 2003; SW-16 p 42). The Subbasin Assessment and TMDL (DEQ 2003; SW-16 p 53-54) identifies that sediment levels below a 50% threshold above 'background' will support beneficial uses. It appears that Bussel Creek should be supporting beneficial uses because its sediment level is below the 50% value.

The DEQ changed their method for applying non-support status to streams within a watershed by changing their accounting unit delineation (DEQ 2002-2004 Integrated Report http://www.deq.state.id.us/water/data reports/surface_water/monitoring/integrated_report_2002_final_intro.pdf p. 1) and it does not always match previous boundaries. In the case of Bussel Creek, only the tributary Bear Creek was listed as non-supporting in 1998, but in 2002 all of Bussel Creek is listed because of the change in delineation of accounting units. It may not be appropriate to apply beneficial use support status from the tributary Bear Creek to all of Bussel Creek.

Existing Condition

Water Quality and Beneficial Uses

The existing sediment and temperature TMDL for Bear Creek indicate water quality does not support beneficial uses (SW-16). The 2002 Integrated Report (SW-17, Sec. 5, p. 33) identifies Bussel Creek as not supporting beneficial uses because of sediment and temperature. Marble Creek is listed in the 2002 Integrated Report (SW-17, Sec. 5, p. 34) as not supporting beneficial uses because of temperature from Hobo Creek to mouth. The draft 2008 DEQ Integrated Report identifies that both Bussel Creek and Marble Creek fully support beneficial uses (SW-54).

Stream Crossing Culverts

Existing stream crossing culverts were analyzed to determine if their size would allow passage of a 100-year peak flow event (SW-12, SW-31). This analysis was used in the RAPS to determine which roads need culvert upgrades and which roads would benefit from culvert removal and stream crossing restoration (SW-32).

Wetlands

Wetland maps from the National Wetland Inventory (NWI) of the US Fish and Wildlife Service were used in an initial attempt to identify wetlands in the Bussel Creek watershed. The NWI maps identify two wetlands within the Bussel Creek watershed. One is located at the site of the splash dam on Bussel Creek just below the confluence with Bear Creek. The second mapped wetland is located in an upland position.

Field verification of the upland wetland did not identify wetland conditions – no hydrophytic vegetation or a source of water for periods of inundation (SW-34). It is likely that this upland mapped wetland is an error.

Wetlands are typically associated with springs, seeps, stream channels and floodplains. Proposed harvest units were surveyed (during soil monitoring), and no wetlands were noted in the field reports or in unit photographs (SW-3). Because proposed harvest units have RHCA buffers it is not likely that wetlands would be found within

Municipal Water Supply

There is no public or municipal water supply source from streams in the Bussel Creek watershed. There are no known wells contributing water supply for a municipality or the public.

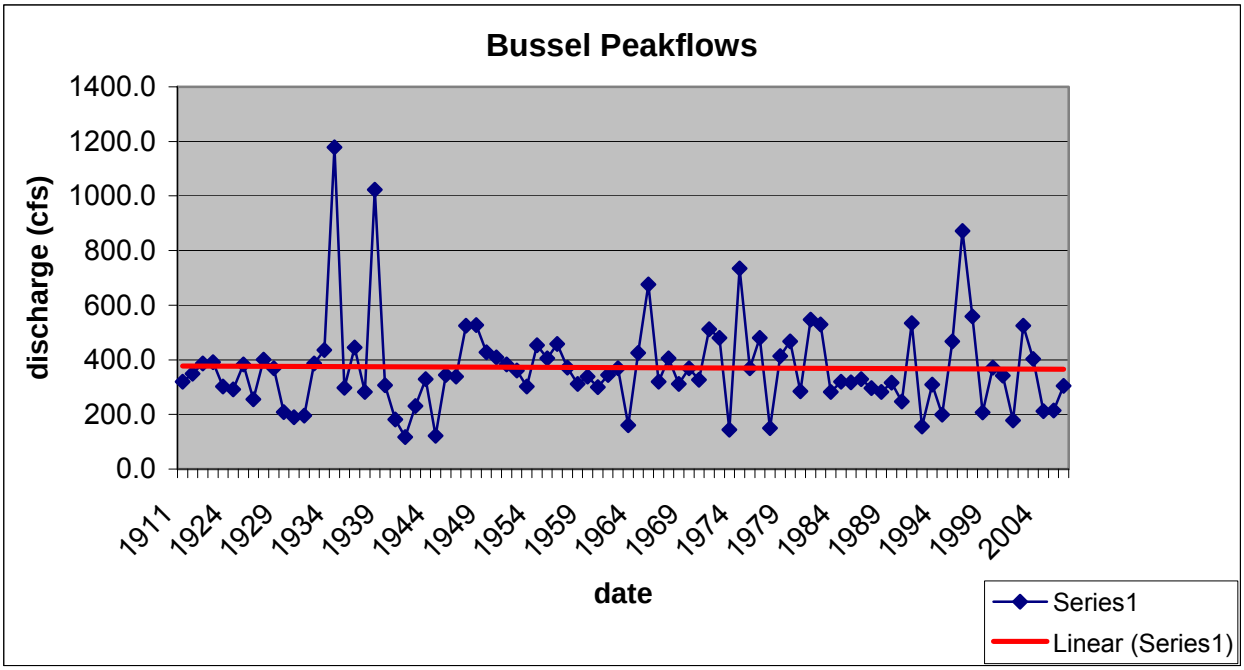
Floodplains

Floodplains are found on Bussel Creek, Toles Creek, Norton Creek, Lines Creek and Bear Creek. These floodplains are generally narrow, well vegetated, and have good lateral connectivity to the stream. In Toles Creek the floodplain is rife with distributary channels from high flow events (SW-34). The moderately confined nature of the valleys limits extensive floodplain development. The largest floodplains are located upstream of old splash dams where large amounts of sediment are stored behind the dams. These larger floodplains are approximately 100-150 feet wide. Minimal floodplain widths are in the higher headwater elevations or where bedrock constriction creates a narrow valley bottom like at Bussel Creek cross-sections 6 and 7 (SW-D, SW-E).

Water Yield

Discharge records from the Calder, Idaho gauging station on the St. Joe River (1911-1912, 1921-2006) were used to extrapolate data for Bussel Creek. The extrapolated data indicates that peak flows are not appreciably changing (Figure 3-7, SW-A7). The following chart displays peakflow data and its trend line.

Figure 3-7 Bussel Creek Estimated Peak Discharge 1911-2006



The WATSED model estimates that there is currently a 5% water yield increase over natural watershed conditions (SW-23).

Stream Channel Form

Channel form is addressed through the following parameters:

(see Appendix E Glossary)

- Channel cross-section (width, depth, discharge, sediment yield)
- Channel pattern (sinuosity – slope, discharge, sediment yield)
- Sediment yield (sediment load, size of sediment debris)

Pebble count (size of sediment debris, hydraulic roughness)

Channel Cross-Sections

Graphs of data from cross-sections in the Bussel Creek area do not show substantial changes to those cross-sections over the time period monitored (2002-2007) (SW-D, SW-E, SW-35). The stream cross-sectional areas appear relatively stable for the monitored sites.

Channel Pattern

Bussel Creek exhibits low sinuosity (SW-26) and would be classified as straight to meandering (Beechie and others 2006 p. 130, Fig. 4 p. 137), pool-riffle or plane bed (Montgomery and Buffington 1998), moderate gradient B to lower gradient C and E stream channels (Rosgen 1996). Field crews report that there appears to be gradual lateral migration or shifting of the Bussel Creek channel in the vicinity of cross-section #3 (SW-19).

Natural or Background Sediment Yield

The DEQs TMDL identifies a natural background sediment level in Bussel Creek of 289 tons/year (SW-16, p. 42), which is considered routed to stream channels (SW-22). The WATSED model identifies a natural background sediment level in Bussel Creek of 277 tons/year routed to stream channels (SW-23). The DEQs TMDL identifies a natural background sediment level in Bear/Little Bear Creeks of 47.5 tons/year (SW-16, p. 42), which is considered routed to stream channels (SW-22). The WATSED model identifies a natural background sediment level in Bear/Little Bear Creeks of 69 tons/year routed to stream channels (SW-23).

Current Sediment Yield

Current sediment production estimates are shown in the table below (SW-16 p. 42; SW-23; SW-16 p. 42; SW-23).

Table 3-63 Current Sediment Production Estimates

Bussel Creek		Bear Creek / Little Bear Creek	
TMDL Current Sediment	WATSED Current Sediment	TMDL Current Sediment	WATSED Current Sediment
387 tons/year	548 tons/year	93 tons/year	171 tons/year

Existing Sediment Size, Pebble Counts

Seven cross-sections are established on Bussel Creek, one each on Lines and Norton Creeks, and three on Toles Creek (SW-19). Random pebble counts were conducted near established cross-sections in stream channels of the Bussel Creek drainage from 2002-2007 (SW-19). Some cross-sections do not have data for every year (SW-29), but all have pebble counts for three to six years.

The pebble count median sample size is typically coarse gravel with some cross-sections having small to large cobbles (SW-29). A comparison of median particle size distribution from 2004-2007 from pebble counts at cross-sections in the main creeks indicates that, for the most part, the sediment size is not substantially changing (SW-19, SW-29). The median value at Toles #3 has shifted from gravel to fine sand over the sampling period, which appears to indicate a fining of the particle size distribution (SW-29). This shift in median particle size was reported in 2007 by the field team (SW-19) as potentially the result of sediment storage by woody debris forced step-pools and subsurface channel moss.

Pebble count sampling typically found 84% of particles to be gravels, cobbles and boulders. The pebble count d16 is a particle size for which 16% of sampled particles are smaller than, and represents one standard deviation from the mean in a normal distribution (Gordon and others 1992, p. 205). The d16 is mostly gravel-sized particles except for Toles Creek #3 and Bussel #1, which have silt and sand sizes (SW-29). Norton #1 and Bussel #1 also show d16 values in the sand-silt class for the last two years whereas previously it was gravel. Gravel, cobbles and boulders are the typical particle sizes greater than the d16 value (SW-29).

Channel Process

A channel's physical process is to convey the water, sediment and wood delivered to it from adjacent areas or to store that sediment and wood (Glossary Appendix E). Cross-section survey data from 2002-2007 indicates that the existing water and sediment yield is being conveyed because there is no evidence of aggradation or degradation (SW-35). Large woody debris surveys note many pieces of wood, with a large number of aggregates (Table 3-64; SW-A8), which indicates that wood is being conveyed and stored.

Large Woody Debris

Fisheries field crews collected data on woody material associated with stream channels. The woody material, generally referred to as large woody debris (LWD), is found throughout the tributary channel network (see *Fisheries* section) although no monitoring was done on Bussel Creek itself. It is expected that the amount of LWD found in other stream channels would also be representative of what might be found in Bussel Creek. The table below summarizes LWD data and includes average bankful width (SW-A8; SW-19, SW-36).

Table 3-64 Summary of Large Woody Debris

Stream	Stream bankfull width (feet)	Stream reach length (feet)	Total pieces of LWD	Average diameter of LWD (feet)	Average length of LWD (feet)
Norton	11.8	18,487	900.0	1.0	15.0
Toles	12.6	13,622	512	0.8	16.6
Bear	7	12,083	116	0.7	15.3
Lines	8.4	7,559	354	1.2	14.0

Beaver Activity

Beaver dams were noted on field maps believed to be from 1998 (SW-37). Current beaver activity was noted near the mouth of Bussel Creek in 2003 (SW-38). A fisheries field crewmember reported beaver dams on Norton Creek in 2003 and believe they are still active (SW-38). 2006 field notes for cross-sections 6 & 7 identify recent beaver activity near the mouth of Bussel Creek (SW-19). Old beaver activity was noted in Toles Creek near cross-section #3 (SW-34). Beaver dams trap sediment and cause aggradation in the upstream vicinity of the dam. If beaver are no longer in this area their dams may have failed and caused downstream fine sediment loading, such as noted at Toles Creek #3.

Historic Splash Dams

Splash dams were built on Bussel Creek at two locations to facilitate moving logs downstream (log drives) and are visible in 1933 aerial photographs (SW-26). Remnants of at least the upper Bussel splash dams are still visible in 2007 (SW-D, Bussel #2, #3). Splash dams interrupted sediment transport processes and stored sediment upstream of their location. These aggraded areas are currently riparian meadows (SW-26) where some channel adjustment may still be occurring (SW-D, Bussel #2, #3; SW-19).

Past Wildfire

Approximately 7,015 acres or 48% of the watershed area were previously burned, primarily in 1922 (6,235 acres) and in 1931 (780 acres). Burning 48% of the Bussel Creek watershed may have caused high sediment delivery to stream channels (Macdonald and Coe 2007 pp. 154-155). This may have caused some of the aggradation evident in the 1933 aerial photographs (SW-26), although logging and log-drives may also have contributed to that situation.

The Elm Street Fire burned during the summer of 2007 in the project area. It was a mixed-severity fire having a highly varied mosaic of effects due to variable pre-fire fuel loads. The largest opening created by the fire is approximately 15 acres where the fire burned with high enough intensity to consume the crowns of the overstory trees. The perimeter is approximately 1.9 miles long and is surrounded by approximately 1.5 miles of dozer line with the remainder comprised of existing roads. All dozer lines were rehabilitated using an excavator to pull the berm back into the line and to place coarse woody debris over the line. The dozer lines were also seeded. No

change in sediment levels is expected as an effect from this fire because: 1) the small areal extent of openings; 2) the distance of the fire from stream channels (SW-44); and 3) the relative short duration between fire and rehabilitation work (SW-45).

Range of Natural Variability

Within a watershed, the "range of natural variability" of sediment and water yields is a product of historical disturbances such as fire and floods. Human activities such as logging, road construction and development affect natural processes such as sediment and water yield. For the purposes of this analysis, the focus is upon how logging and road construction affect sediment and water yields in light of the natural range of variability.

In an unmanaged landscape in northern Idaho, wildfires were the significant disturbance factor influencing erosional processes, hydrology, and stream channel morphology. In this part of northern Idaho, fires of variable intensities occurred at 50 to 150-year intervals. More severe stand-replacing or "lethal" fires occurred about every 200 years or so, depending upon variables described further in the fire section of this report.

During and after severe fires, water yield can increase due to canopy removal and decreases in evapotranspiration (McCaughey, Farnes and Hansen 1997; Beschta 1990; Tiedemann and others 1979). The shifts in water yield may cause adjustments within the stream channel through changes in water quantity, timing, and duration. Adjustments can include increases in bank erosion, increases in the sorting and transport of bedload sediment, and potential stream bank erosion. Surface erosion can increase due to the reduction of hillslope vegetation. As a result, movement of bedload and fine sediment through stream channels is accelerated. When severe fires remove large woody debris and vegetation in the riparian zones, stream velocities increase, bank stability decreases, pool habitat is removed and stream temperatures increase (Minshall and Brock 1991).

Fire affected streams by killing trees within and on the fringes of the riparian zones. Over time this fire-killed timber gradually fell over and supplied large woody debris to the streams. The fires also affected the streams by reducing the forest canopy, which allowed greater snow accumulation on the ground and increased water yields during spring flows. In-stream erosion might increase slightly in the channels in response to the increased water yields. Sediment transported during these peak flows would settle out at breaks in the stream gradient and/or behind channel obstructions.

Researchers have attempted to compare the effects of both logging and road construction to the effects of wildfire. Nitschke (2005 p. 315) states that wildfires may significantly increase sediment yield and thus be more detrimental than typical harvesting systems. Forest road construction and maintenance appears to emulate sediment from wildfire in the short-term, but forest roads as a long-term sediment source differs from wildfire (Nitschke 2005 p. 316). Another study by MacDonald and Coe (2006 pp. 154-155), states that high severity wildfires may increase the production and delivery of sediment by several orders of magnitude. Larsen and others (in review, SW-55 p. 3) identify that "[w]ildfires increase hillslope- and watershed-scale runoff and sediment yields by several orders of magnitude…)".

Classification of Stream Channels

Stream channels were classified using systems developed by Rosgen (1996), Montgomery and Buffington (1998), and Beechie and others (2006). Classification of streams in the Bussel drainage are:

- Rosgen: Moderate gradient B single thread channel, E-C low gradient slightly meandering channel in some stream reaches
- Montgomery and Buffington: pool-riffle and plane-bed single thread channel
- Beechie and others: straight to meandering channel

For headwater channels there may be higher gradient Rosgen A stream types and Montgomery and Buffington colluvial and step-pool reaches (SW-19, SW-37).

Stream Channel Length

There is approximately 320,000 feet of stream channel within the Bussel Creek watershed. Table 3-65 displays channel lengths identified in GIS ARCVIEW (SW-A9, SW-A35).

Table 3-65 Stream Channel Lengths in Bussel Creek (feet)

Drainage	Toles	Norton	Lines	Bear	Little Bear	Bussel
Channel Length (feet)	62,591	60,639	46,328	31,207	22,683	98,476

Aerial Photograph Analysis

Aerial photography was used to analyze and document changes over time of stream channels and riparian areas in the Bussel Creek watershed. This assessment used 1933, 1965, 1979 and 2002 aerial photographs (SW-26). The photo analysis consists primarily of a qualitative assessment of channel location, channel width, riparian vegetation, sediment depositional areas and stream-adjacent valley wall erosion. Aerial photographs show that Bussel Creek is moderately confined by valley walls with little opportunity for extensive floodplain development. Human activity occurred throughout the watershed prior to the 1933 aerial photographs.

The 1933 aerial photographs show a managed and burned landscape. The Bussel Creek valley bottom was heavy with depositional areas and a relatively wide stream channel that was braided or had multiple channels. Overall, vegetation was sparse in 1933, either from fire or harvest or both. There was almost no riparian vegetation present below the Lines Creek confluence. There were railroads, trails and roads across the landscape and some that end at the valley bottom. Other roads paralleled valley bottoms and had stream crossings (Toles and Bear Creeks). There were two splash dams, one just below the Bussel-Lines Creek confluence and one on Bussel Creek below the Bear Creek confluence. The 1933 photos show eroded valley walls at the lower end of Bussel Creek, likely caused by slope undercutting from splash dam releases and/or log abrasion during log drives.

The 2002 aerial photographs show that the riparian area is well vegetated and the stream channel is generally a single thread with adjacent vegetated floodplain in the valley bottom. Field crew photographs also document the well-vegetated riparian area (SW-19, SW-D). The landscape and the stream channel are recovering from the sparse vegetative conditions present in 1933. The stream channel appears stable in the 2002 photos with no evidence of substantial deposition. Near the mouth it is in the same location as in 1933. Where splash dams were located in 1933 vegetated meadows currently exists. Bussel Creek below the Lines confluence has a relatively low sinuosity. The resilience of the stream and landscape is evident in the 2002 photos and 2006 orthophotos compared to 1933 conditions (http://maps.insideidaho.org/WebMapping/Search/Download2006SURDEX/index.asp). In 2002 the valley walls no longer exhibit signs of erosion and appear vegetated (SW-26) or are stable scree slopes (SW-38).

Stream channels and riparian areas have improved since 1933 and the historic log drives. The 2002 photos do not show large areas of current deposition as would be expected if substantial entrenchment were occurring.

Environmental Consequences

Present and Ongoing Activities Common to All Alternatives

Road Maintenance

No additional impacts are expected from road maintenance activities such as blading, drainage improvements, culvert maintenance and surfacing on existing dedicated roads. These activities are designed to prevent erosion and also prevent hydrologic connectivity of roads to the stream network. Utilizing BMPs to minimize adverse effects on the aquatic environment is consistent with the Clean Water Act and Idaho water quality standards.

Recreation

Some roads in the project area are open for general motorized use which allows for hunting, fuel wood gathering, collection of miscellaneous forest products, dispersed camping, and motorized touring. Recreational activities are expected to increase over time and may contribute to localized, small-scale disturbances. Future small-scale disturbances or their effects are not estimated because these are impossible to predict.

Grandmother Mountain Land Exchange

A decision to acquire a 40-acre parcel in Section 33, T44N, R2E was signed on October 16, 2007. There are no proposed activities in this parcel, so no effects are expected from this land exchange.

Fire

Wildfires have been common in the past. Effects of wildfire are typically greater than effects from human activities, although effects from roads may emulate fire disturbance conditions (Nitschke 2005: MacDonald and Coe 2007 p. 154-155).

Management through fuel reduction and prescribed burning should sustain an environment where fire plays an integral role in stand maintenance and healthy forests with minimal soil damage, detrimental erosion or water yield increases. It is possible that salvage opportunities would be considered if a wildfire should occur within the project area. It is impossible at this time to predict if, when, where, or how that would be proposed; so it is not possible to determine potential effects. Additional analysis and a separate decision would be required. Fire suppression activities would occur. As needed, closed roads would be reopened for access and be incorporated as part of any fireline construction. As part of post-fire work, the areas of disturbance would be rehabilitated and the roads would be returned to their previous condition.

Noxious Weed Treatment

Noxious weed monitoring and treatment would continue and would follow guidelines established in the St. Joe Noxious Weeds ROD (USDA 1999). Effects to soil resources were analyzed in the document and its adaptive strategy. No additional effects to water resources beyond what was analyzed for and disclosed in the EIS are expected to occur.

Power Transmission Line Maintenance

Power line maintenance periodically removes trees or large shrubs from the existing opening below the power line. It is anticipated that this activity involves hand sawing and lop and scatter of slash. Because there is no new opening or soil disturbance this activity is not expected to change water or sediment yields appreciably.

Past Railroad Grade Construction

Railroad grade construction is estimated to have occurred in the 1920s for facilitating timber harvest. Railroad grades are visible in 1933 aerial photographs (SW-26). Effects from this construction have been assimilated by the landscape. The Lines Creek and Norton Creek RR grades are proposed for use by ATVs. Some clearing and maintenance would be necessary for proposed use as ATV trails. This maintenance is designed to prevent erosion and delivery of sediment to the stream systems. A new crossing on Norton Creek would need to be in place for use of this grade for ATVs. BMPs need to be applied to maintenance activities and the new Norton Creek crossing. Application of BMPs is expected to protect and maintain existing beneficial uses.

Other Activities

Activities such as firewood gathering, camping, berry picking, personal Christmas tree removal, and driving are not expected to affect the water resource, because these activities do not cause appreciable changes to erosion or water yield.

Direct and Indirect Effects: Alternative A

No change in the existing condition would occur from implementing this alternative, although there may be a decrease in water yield as vegetation becomes denser and utilizes more soil moisture and intercepts more precipitation. Wildfire may increase sediment and water yields, fire suppression would likely continue.

Cumulative Effects: Alternative A

The conditions discussed in the Existing Condition section are the effects from past activities. Current sediment levels are identified in the Existing Condition section. WATSED estimates a peak flow month water yield increase of 5% over natural conditions. Proposed activity, as disclosed by private landowners within the Bussel 484 Project Area includes 497 acres of regeneration timber harvest. The TMDL model estimated a sediment increase of 19.9 tons/year of sediment from non-stocked stands. It is estimated that this will continue until the stand becomes stocked according to Idaho Forest Practices Act, which is believed to occur after two years for a total of about 40 tons. The harvest activities were identified as occurring from 2007-2014 and so there is approximately a 5 ton/year increase in sediment over this time period (SW-A21). The private land, sediment-generating harvest units are not

in the Bear/Little Bear watershed. The estimated water yield increase from private activity is 2.1% (SW-A21). The existing water yield estimated by the WATSED model is 5% over natural conditions (SW-23).

The cumulative effects to stream channels of Alternative A, in relation to sediment and water yield, would be less than those discussed in Alternative B. Activities on non-Forest Service land are regulated by the State of Idaho by administrative rules such as the Forest Practices Act and water quality standards that are designed to protect the environment, decrease sediment generation and maintain and protect beneficial uses.

Activities Common to Action Alternatives

Riparian Planting

Up to 1.8 miles of streamside land may be planted with conifers, hardwoods and shrubs. This planting would occur over numerous years. It is anticipated that over time the riparian planting may moderate stream temperatures after these plants begin shading the stream channel.

Precommercial Thinning

Pre-commercial thinning would be done by hand (chainsaws), and the felled trees would be left on site with no further treatment. No substantial change in precipitation interception or infiltration is expected because all thinned vegetation remains on-site. No consequential increase in water yield is expected from this activity because residual trees and other existing vegetation have the ability to utilize any increased soil moisture. No appreciable change to wetlands is expected. No appreciable increase in sediment is expected from this activity because there would be no soil disturbance.

Road Reconstruction

Proposed road reconstruction would include reinstallation of eight culverts that were previously removed (SW-42). Sediment was estimated by the TMDL model to be reduced by up to 65 (-65) tons from this previous road treatment. Reinstallation of these culverts is estimated to generate about 41 (+41) tons of sediment. Sediment from road reconstruction is off-set by the reduction of sediment realized from past stream crossing removals. It is estimated that there is a reduction of about 24 (-24) tons in this sediment accounting. This value is not reflected in the estimated sediment budget presented in Tables 3-67 and 3-68. The 65 tons would be part of the existing condition and the 41 tons would result from proposed activities. The 65 ton reduction has not been used in any previous sediment accounting method or for 'off-setting' any sediment increase. Utilizing BMPs to minimize adverse effects on the aquatic environment is consistent with the Clean Water Act (40 CFR 232.3(c)) and Idaho water quality standards (IDAPA 58.01.02.350). Also, twelve culverts that currently do not meet the criteria for accommodating a 100-year flood event would be upgraded.

Gopher Control with Rodenticide

No effect to the water resource is expected from the placement of rodenticide if design features are followed. EPA documents effects from rodenticide application (SSW-71). Design features for gopher poisoning include: Follow manufacturer's recommendations for use; and no gopher baiting treatment within INFS RHCA buffers, in areas with saturated soil, or during periods of or forecasted periods of heavy precipitation. See *Design Features* in Chapter 2.

Hydrologic Connectivity and Proposed Activities

Hydrologic connectivity is: 1) longitudinal – up and downstream; 2) Lateral – riverine and floodplain interactions; 3) vertical – riverine and subsurface or groundwater interactions (Kondolf and others 2006 p. 1; Beechie and others 2006 p. 125; Ward and others 2001 pp. 312-314).

No changes are expected in longitudinal hydrologic connectivity because there are no proposed dams or diversions or change in base flow conditions (Stednick and Troendle 2004 p. 175).

The vegetative recovery of Bussel Creek riparian areas and floodplains since 1933 (SW-26) indicates that river-floodplain dynamics are evolving since historic fires and log drives occurred in the 1920s-1930s. Little change is expected in the current lateral hydrologic connectivity of the stream to the floodplain because frequency of inundation would not diminish from proposed activities (see *Water Yield* discussions), no levees are proposed, and no appreciable channel incision is expected (see *Channel Form and Process* discussions) (Kondolf and others 2006 p. 2).

Sediment and Wildfire Compared to Human Activity

The proposed activities' effects are not outside the realm of natural variability that would result from wildfire (Nitchske 2005), though estimated effects are likely considerably less than from wildfire (MacDonald and Coe 2007).

Design Feature Effectiveness

Standard and site-specific Best Management Practices (BMPs) and soil and conservation practices as described in the Soil and Water Conservation Practices (SWCP) Handbook FSH 2509.22 are included as design features (FEIS Appendix B) and would be applied during timber harvest and road decommissioning, construction, maintenance and reconstruction to minimize soil erosion. The Soil and Water Conservation Practices Handbook outlines BMPs that protect the soil and water resources at a higher level than do existing Idaho Forest Practices rules and regulations, thereby incorporating all Idaho State standards. These techniques and their effectiveness are documented in several publications (Seyedbagheri 1996; Lynch and Corbett 1989 and 1990; Idaho DEQ 2001; USDA 2002).

Design features and BMPs are expected to be effective. Past monitoring indicates that BMP effectiveness is generally high. BMP monitoring is conducted annually by the IPNF to validate the implementation and effectiveness of BMPs associated with land management activities. Monitoring results are used to adapt future management actions where improvements in meeting water quality objectives are indicated (see *Past, Present, and Reasonably Foreseeable Activities* section at beginning of Chapter 3). Monitoring of BMPs on the St. Joe Ranger District indicates that they do get implemented and are, in most cases, continuing to function as expected and are meeting their intent (SSW-14, 50, 59, 61; SW-13, SW-30).

Summary of Direct and Indirect Effects

The following tables summarize effects for the alternatives.

Table 3-66 Forest Service Watershed Effects Summary

Parameter	Existing: Alternative A	Alternative B	Alternative C
New Road Construction (miles)	0.0	5.1	0.0
Road Recontour (Rx D) (miles)	0.0	10.7	10.7
Road Storage (Rx C) (miles)[1]	1.0	19.6	19.6
# of Stream Crossing Removed	0	57	57
# of Culverts Upgraded	0	12	12
Encroaching Roads Removed[2] (miles)	0	1.1	1.1
RHCA Roads Rx D (miles)	0	1.8	1.8
RHCA Roads Rx C (miles)	0.0	3.0	3.0
Roads in RHCA (miles)[3]	15.8	5.5	5.5
TMDL model Long-term Sediment Reduction for Bussel Creek (change from existing in tons/yr)	n/a	26	26
TMDL model Short-term sediment addition for Bussel Creek [4] (change from existing in tons)	n/a	0 to 5.5	0 to 4.1
TMDL model Sediment Reduction After 7 Years for Bussel Creek [5] (change from existing in tons)	n/a	39 to 126	84 to 177
WATSED Model Long-term Sediment Reduction for Bussel Creek (change from existing in tons/yr)	n/a	66	66
WATSED Model Short-term Sediment Addition for Bussel Creek [4] (change from existing in tons)	n/a	60 to 88	30 to 58
WATSED Model Sediment Reduction After 7 Years for Bussel Creek [5] (change from existing in tons)	n/a	138	260
TMDL Model Long-term Sediment Reduction for Bear/Little Bear Cr. (change from existing in tons/yr)	n/a	7	7

Parameter	Existing: Alternative A	Alternative B	Alternative C
TMDL Model Short-term Sediment Addition for Bear/Little Bear Cr. [4] (change from existing in tons)	n/a	0 to 8.5	0 to 8.5
TMDL Model Sediment Reduction After 7 Years for Bear/Little Bear Cr. [5] (change from existing in tons)	n/a	4 to 33	4 to 33
WATSED Model Long-term Sediment Reduction for Bear/Little Bear Cr. (change from existing in tons/yr)	n/a	46	46
WATSED Model Short-term Sediment Addition for Bear/Little Bear Cr. [4] (change from existing in tons)	n/a	2.8	2.8
WATSED Model Sediment Reduction After 7 Years for Bear/Little Bear Cr. [5] (change from existing in tons)	n/a	217	217
Stream Temperature Increase[6]	n/a	0.0	0.0
Net Soil Acres Returned to Productivity From Road Recontouring	0.0	20	20
Modeled water yield increase over natural in Bussel Creek[7]	5%	8%	<8%
Acres of Riparian Planting[8]	0	18 to 27	18 to 27

[1]The mileage identified in Existing: Alt A is included in total for Alts B & C. The totals for Alternative B do not include proposed new construction going to Rx C (storage).

[2]Encroaching road mileage removed is included in the road recontour and storage mileage.

[3]Existing and remaining RHCA road mileage is from GIS ARCVIEW Query.

[4]Short-term = 2-5 years. The range of sediment addition depends on timing of activities.

[5] Range of sediment reduction depends on timing of activities. Estimate based on TMDL model.

[6]Minimal activity within RHCA buffers so no appreciable increase in stream temperature expected.

[7]WATSED estimated water yield peak increase. Alt C would be less than Alt B because of no road construction.

[8]Acres of Riparian Planting based on up to 1.8 miles along streams, range based on 10-15 acres/mile.

Direct and Indirect Effects: Alternative B

Sediment

TMDL Sediment Budget and Timing

Two different scenarios were used to estimate sediment timing (SW-A30) in the TMDL model. In general the first has timber sales occurring in years one and two, and the second scenario has the timber sales occurring in years five and six. Both scenarios have two years of non-stocked stands sediment additions. Some road recontour and road storage occur in the first year, but most occurs in the same year as the timber harvest activities. See Table 3-67 for TMDL sediment estimates (SW-A1, SW-48).

Sediment additions are generally a short-term response to an activity. Non-stocked stands are regeneration harvest areas and typically are planted to adequate stocking levels within two years of harvest/fuels activities. Stream crossing restoration involves culvert removal and channel restoration with sediment generated from winnowing of fine material once water is returned to the restored channel and during the next year's runoff period (approx. 10-12 month time-frame), but then it is expected that the channel stabilizes and produces no more sediment (SW-43, SW-A36). Sediment addition from new road construction is calculated as tons/year over the 5-year contract period.

Sediment reductions are estimated in both tons and tons/year and are calculated based on the removal of encroaching roads and stream crossings (SW-16). The TMDL model sediment budget for individual drainages (SW-A36) within the Bussel Creek Project Area is shown below. Sediment reductions over two years are compared with sediment additions over two years (Table 3-67). This assumes all proposed activities are complete.

Table 3-67 Sediment Reductions and Additions by Drainage (TMDL Model)

Watershed	2-Year Sediment Reduction (tons)	2-Year Sediment Additions (tons)
Bear	12.2	5.5
Bussel	3.8	15.5
Lines	2.2	6.8
Little Bear	2.0	3.0
Norton	16.4	9.0
Toles	15.6	9.3
total	52.2	49.1

WATSED Sediment Budget and Timing

WATSED modeled road construction in the first year and harvest/fuel activities in the second and third years (SW-23). Road recontouring and storage are accounted for by removing the road from the data set or applying mitigation, respectively (SW-23). Table 3-68 displays the change in sediment over existing conditions estimated by WATSED once activities are complete (SW-23, SW-48).

Table 3-68 Sediment Change from the Existing Condition (TMDL and WATSED models)

Bussel Creek Watershed (Project Area)	Alternative B
TMDL Model Long-term Sediment Reduction (tons/yr)	26
TMDL Model Short-term Sediment Addition[1] (tons)	0 to 5.5
TMDL Model Sediment Reduction After 7 Years[2] (tons)	39 to 126
WATSED Model Long-term Sediment Reduction (tons/yr)	66
WATSED Model Short-term Sediment Addition[1] (tons)	60 to 88
WATSED Model Sediment Reduction After 7 Years[2] (tons)	138
Bear/Little Bear Creek Watershed	**Alternative B**
TMDL Model Long-term Sediment Reduction (tons/yr)	~7.1
TMDL Model Short-term Sediment Addition[1] (tons)	0 to 8.5
TMDL Model Sediment Reduction After 7 Years[2] (tons)	4 to 33
WATSED Model Long-term Sediment Reduction (tons/yr)	46
WATSED Model Short-term Sediment Addition[1] (tons)	2.8
WATSED Model Sediment Reduction After 7 Years (tons)	217

[1]Short-term = 2-5 years. The range of sediment addition depends on timing of activities.
[2] Range of sediment reduction depends on timing of activities. Estimate based on TMDL model.

Harvest Activity and Change in Sediment Yield and Sediment Size

Sediment Yield

In the TMDL model, for two years of non-stocked stands it is estimated that there would be about a 30-ton increase (SW-A30) or about a 15% increase in sediment. It is estimated that stands would be non-stocked for two years. According to the TMDL model once stands become stocked they are no longer contributing sediment. The WATSED model estimated an overall sediment increase of about 24% as the highest one-year increase following activities (SW-23).

Although modeling estimates increased sediment from harvest activities, the *Soils* section shows all harvest units have low surface erosion hazard ratings and explains that soil erosion is not expected within harvest units. Also the adequacy of buffers in preventing sediment delivery to stream channels needs to be considered because even if sediment is generated there may be no sediment delivered to stream channels. Inland Native Fish Strategy (INFS)

documents that RHCA buffers are believed to prevent sediment in non-channelized flow from reaching stream channels (INFS 1995, p. A-5).

Sediment Size

It is expected that any sediment generated from harvest activity would be in the smallest particle sizes – sand, silt and clay, unless a mass failure were to occur.

New Road Construction and Change in Sediment Yield and Sediment Size

Sediment Yield

The WATSED model estimates an increase in sediment of about 9% from road construction (including temporary) in the first year (SW-23). The WATSED estimated 6% annual increase in sediment after six years is likely new roads continuing contribution, eventually dropping to about a 3% increase, which continues at least through 2040 (SW-23).

Temporary Roads

All temporary roads including forwarder trails would be fully recontoured to the natural slope or decompacted upon completion of activities. Temporary roads that would remain on the landscape more than one dry season would have waterbars installed according to specific interval direction and at specific angles to promote acceptable results (Timber Sale Contract, Erosion Control and Temporary Road provisions). They would then be mulched with a natural, weed-free material to prevent runoff and erosion during spring and/or winter runoff events. Obliteration would begin to reduce compaction of the soil, improve precipitation infiltration and remove road surface runoff and sediment generation (Switalski and others 2004).

Sediment Size

Typically roads generate sediment in the sand, silt and clay particle sizes (MacDonald and Coe 2007 p. 154; Burroughs and others 1983 p. 216) unless mass failures were to occur. See the *Soils* section for mass failure analysis.

Road Recontour, Stream Crossing Removals/Restorations: Change in Sediment Yield and Sediment Size

Sediment Yield

According to the TMDL model, road recontouring and removal of stream crossings is expected to reduce sediment yield for Bussel Creek totaling approximately 26 tons/year into perpetuity (SW-A30, SW-A36). The WATSED model estimates an annual reduction of around 66 tons/year from this road work (SW-48). Restoration of stream crossings is estimated to increase sediment for one runoff season, because stream flow returned to the reconstructed channel is expected to winnow fine material away. It is estimated that stream crossing restorations may increase sediment by a total of about 17 tons over one to possibly two years (SW-A30, SW-A36) and this value is incorporated into the TMDL model short-term sediment addition value. It is not known if the WATSED model incorporates a short-term sediment increase from these restoration activities, but it is recognized that there would be a short-term increase.

Sediment Size

It is expected that any sediment generated from recontouring and stream crossing removal/restoration activity would be fine-grained particle sizes (sand, silt and clay) with perhaps some larger particles from existing alluvial deposits under or adjacent to the stream crossing. Based on estimates from the TMDL and WATSED models there would be a substantial reduction in sediment from road recontouring and stream crossing removals. Table 3-68 displays sediment reductions by year seven (SW-30, SW-48).

The TMDL and WATSED models estimate a short-term increase in sediment for one or two years depending on activity timing (SW-48). After 7 years there is a total sediment reduction of around 39-217 tons (SW-A30, SW-48). The sediment reduction is from roads so it would be a reduction in fine-grained or sand, silt and clay sized particles (MacDonald and Coe 2007 p. 154; Burroughs and others 1983 p. 216).

Channel Form, Pattern and Sediment

Channel form is not expected to substantially change, because:

1) The estimated overall change in sediment yield is a reduction in the finer particle size classes that are typically carried as suspended solids in the water column;

2) Activity-generated sediment is typically small particle size with high travel distance (MacDonald and Coe 2007 p. 156);

3) Existing cross-sections appear stable and have not changed appreciably over the monitoring time-period (SW-19, SW-35; SW-D);

4) Vegetated stream buffers are typically large enough to prevent sediment from harvest units (INFISH 1995 p. A-5) from entering the stream system;

5) Channel cross-sections are not expected to become wider or deeper from the change in sediment yield or sediment size;

6) There is an estimated one- or two-year increase in sediment of about 5 tons estimated by the TMDL model and 30-88 tons by the WATSED model, and if delivered to stream channels this sediment may be stored within channels in the lee of large boulders, on the channel margins, pools, behind large woody debris and on floodplains or terraces (MacDonald and Coe 2007 p.156) but no substantial aggradation is expected because:

a) aggradation is not expected to occur unless there would be a 100% increase in sediment (Megehan and King 2004 p. 217);

b) the sediment would be distributed over 320,000 feet of channel length and an estimated 2,250,000 square feet of channel area (SW-A9) and

c) some portion of this sediment would be deposited on the floodplain;

7) Channel pattern is not expected to appreciably change from changed sediment yield and size because of stable cross-sections, the existing riparian vegetation and relatively confined nature of the stream channel (SW-26, SW-D) and

8) Sediment is not expected from harvest units because they are located on landtypes with low surface erosion potential ratings and have vegetated buffers.

Megehan and King (2004 p. 217) suggest that increases of sediment yields of about 100% were needed to cause channel aggradation. They also say (p. 217) it is difficult to predict temporal and spatial responses in downstream habitats resulting from sediment yield increases from upstream land management activities.

WATSED estimated an increase in sediment from proposed activities (without accounting for road recontouring or storage) (SW-23) of 24% for the first year, 13% in the second year, 8% in the fourth year, 6% after six years and down to 4% after 11 years. WATSED estimated a decrease in sediment when modeling road recontouring or stream crossing removals combined with the proposed harvest and road activities (SW-23). The estimated sediment reduction after all activities are completed (harvest, fuels, road construction, road recontouring and storage) is 24% less than the existing condition. The estimate from the WATSED model shows a sediment reduction of approximately 66 tons/year compared to the existing condition (SW-23) and the TMDL model estimate is approximately 26 tons/year (SW-A30, SW-A31, SW-A36).

Channel Process and Sediment

Channel process is defined as the ability to transport (or store) material delivered to the stream channel (see definitions Appendix A). Channel process is not expected to appreciably change from the estimated short-term sediment addition because:

1) sediment caliber (size) is typically fine-grained and carried in suspension;

2) storage of fine-grained material in channels may take place in the lee of boulders, in channel margins, behind large woody debris, under the surface armor layer or on floodplains and terraces (MacDonald Coe 2007 p. 156);

3) relatively stable channel width and depth (SW-D; SW-35);

4) the relative abundance of existing large wood (SW-A8; SW-A19); and

5) the average existing piece of large wood is long enough to span the channel (Table 3-64, SW-A8).

Water Yield

See Figure 3-7 for estimated annual peak flow data for Bussel Creek from 1911-2006 (SW-A7).

Harvest Activity, New Road Construction and Water Yield

Proposed harvest, fuels treatments, and new road construction are modeled by WATSED. The WATSED model estimates a 3% water yield increase for Bussel Creek for the first year, 2% for the second and third years, one percent for the next three years and a return to the estimated existing 5% over natural water yield in the seventh year (SW-23). The model estimate drops to a 2% increase over natural water yield after about 26 years, which is likely from existing and proposed roads.

The WATSED model's estimated three percent increase in water yield may change peak flows. Based on the area/discharge relationship for the St. Joe River extrapolated to Bussel Creek, Table 3-69 below identifies the existing recurrence interval and peakflow. It also displays a three percent increase in peak flow and the resultant recurrence interval based on flood frequency analysis (SW-A7; SW-18).

Table 3-69 Existing and Estimated Change in Water Yield and Recurrence Interval

Existing Recurrence Interval (years)	Existing Peak Flow (CFS)	3% Increase in Peak Flow (CFS)	Increased Recurrence Interval (years)
1.5	306	316	1.75
10	529	545	15
30	872	898	32
45	1023	1053	50

In the higher recurrence intervals, the change in peakflow may go from a 10-year event to a 15-year event, or a 45 year-event to a 50-year event. Or the change in peakflow may be like the 30-year event and only change by two years to a 32-yr event.

Stednick and Troendle (2004 pp. 169-186) document water yield and peakflow increases from timber harvesting practices in the central Rocky Mountains. They state (p. 176) in a discussion of peak flows on Fool Creek: "Timber harvesting can increase the size of the peak flow, but that change is less evident for recurrence intervals greater than two years" (A two-year recurrence interval peak flow has a 98% chance of occurring in any year). They also identify that no change from harvest was detectable for seasonal low flows (Stednick and Troendle 2004 p. 175).

Channel Form, Channel Pattern and Water Yield

No substantial change in channel form or channel pattern is expected from the estimated 3% water yield increase, because:

1) the estimated increase is small and of short duration (SW-23);
2) channel cross-sections are relatively stable (SW-35; SW-D);
3) the existing stream channels experienced the 1996 peak flow event that is estimated as the third highest flow since 1911 (SW-A7) and stream channels had little or no morphological adjustment (SW-26)
4) the quality and abundance of riparian vegetation including vegetated stream banks (SW-D);
5) relatively large amount of woody debris currently exist within the stream channels (SW-A8; SW-19); and
6) the change in water yield is an estimated two to five year shift in recurrence intervals (i.e. a 10-year event up to a 15-year event) (SW-A7; SW-18).

Channel Process and Water Yield

No substantial change in channel process – transport (or storage) of water, sediment and wood – is expected from the estimated 3% increase in water yield, because of the same reasons identified in *Channel Form, Channel Pattern and Water Yield* section above. An additional consideration is the ability of increased water yield to

transport higher levels of sediment, but the increase would be of short duration and is not likely to substantially change sediment transport within the channel network.

Stream Classification Response Potential

Effects from proposed activities considered the classification response potential identified by Rosgen (1996) and Montgomery and Buffington (1998). The response potential by classified reaches or stream types indicates that there could be some channel adjustment from changes in sediment and water yield (SW-40), however; analysis of channel form and process in relationship to water yield, sediment, LWD and riparian vegetation was used to determine estimated effects from proposed activities.

Montgomery and Buffington (1998 p. 13) identify that "Consideration of channel bed morphology, confinement (the ratio of the width of the valley floor to the width of the bankfull channel), position in the channel network, and external influences (such as riparian vegetation and in-channel woody debris) can guide evaluation of channel condition and response potential in forested mountain drainage basins."

"Channel classification cannot substitute for focused observation and clear thinking about channel processes. Channels are complex systems that need to be interpreted within their local and historical context" (Montgomery and Buffington 1998 p. 38).

Wetlands

Wetlands and Sediment

No wetlands were identified in proposed harvest units. No activities are located within identified wetlands. The identified wetland at the old splash dam location is included in riparian buffers and is not located near any proposed activity, so no detrimental effect is expected. Riparian buffers are typically large enough to prevent sediment from entering the streams (INFS 1995 p. A-5) and adjacent wetlands. Design features require wetland buffers around any wetland discovered during implementation of proposed activities. This would protect wetlands from impacts.

Wetlands and Water Yield

The change in water yield from proposed activities as modeled by WATSED have an estimated maximum yearly increase of 3% (SW-23) for Alternative B. Alternative B would have the maximum level of management activities. One function of wetlands is floodwater storage (SW-41), so storing this increase in water yield-peak flow is within a wetland's natural role. This increase is not expected to appreciably change the identified wetland. Typically, impacts to wetlands are caused by a reduction in water yield, draining or filling.

Wetlands and Sediment Yield, Sediment Size

The estimated short-term increase of 2-16 tons (TMDL model) in sediment would be expected to occur over one to two years (SW-A30). After this short-term increase there would be an annual estimated reduction of 26 tons/year of sediment, once all proposed activities are completed. One function of wetlands is to filter suspended sediment from water that flows through them (SW-41). Even if some proportion of the short-term estimated sediment reaches the wetland it is not outside the function of the wetland to store it. Another consideration of the short-term sediment estimated increase is that it is not likely a single, one-time burst of material; but that it would likely be spread out over many days, weeks, months, or multiple years.

Cumulative Effects Alternative B

The conditions discussed in the Existing Condition section are the effects from past activities. Current sediment levels are identified in the Existing Condition section. WATSED estimates a peak flow month water yield increase of 5% over natural conditions.

Sediment

Proposed activities on private land, as estimated by the TMDL model, would result in a 19.9 ton increase in sediment for one year of non-stocked stands or 39.8 tons for two years of non-stocked stands (SW-A21). The estimated time frame for this increase is from 2007-2014 (SW-A21; SW-25), so the average annual sediment increase would be about five tons.

Private activities combined with proposed Forest Service activities for Bussel Creek would result in an estimated increase to the sediment budget over the short-term, but would not substantially change the estimated long-term sediment reduction.

Based on information from non-federal landowners in Bussel Creek there would be a cumulative sediment increase over the short-term before there would be an annual sediment reduction from proposed road recontouring and storage activities. There may be some temporary sediment storage within the Bussel Creek channel or accretion on floodplains until there would be a balance of estimated sediment addition and reduction, after that there would only be sediment reduction.

As stated above, the additional sediment is typically in the fine-grained clay, silt or sand size particles that are in suspension. The dispersal or travel distance of fine-grained sediment is high (MacDonald and Coe 2007 p. 156). There are about 320,000 feet of stream channel length and 2,250,000 sq. ft. of channel area (SW-A9) within the Bussel Creek drainage where storage might take place, which does not take into account floodplain storage.

Water Yield

There would be an estimated increase in water yield of 2% from proposed private-land activities (SW-25). The estimated 2% water yield increase would result from activities proposed from 2007-2014. Combined with WATSED's estimated three percent for National Forest activities, there would be a cumulative total 5% water yield increase. The cumulative 5% increase is not expected to substantially alter channel form, pattern or process for the same reasons identified in the direct and indirect effects for Alternative B.

Wetlands, Cumulative Sediment and Water Yield

The cumulative sediment level is estimated to increase over the short-term and decrease over the long-term. There could be some suspended sediment that settles out in the identified wetland, but this would be the same process that has occurred since the construction of the splash dam as evident by the conversion of the pond in 1933 to the meadow in 2002. No affect to the wetland is expected once sediment reduction is achieved because there would no longer be a chance of aggradation.

The relatively short-term cumulative 5% water yield increase could contribute to increased water flowing into and through the wetland. But because the wetland has been inundated during various recurrence-interval flooding, the wetland is not expected to substantially respond to a change from an estimated water yield increase that changes the recurrence interval by two to five years.

Direct and Indirect Effects: Alternative C

The effects identified for Alternative B are applicable to Alternative C, though effects would be reduced, because Alternative C proposes no road construction so compared to Alternative B lower levels of effects are expected.

Sediment

TMDL Sediment

In Alternative C, there would be no Forest Service road construction, so there would be no increase in estimated sediment from proposed road construction (SW-A30, SW-A36). Table 3-70 below, identifies the TMDL model sediment estimate.

WATSED Sediment

The WATSED Model estimated sediment for Alternative C for timber harvest and fuels activities in years 1 and 2 (SW-23) and road recontour and storage treatments in year three (SW-48). Table 3-70 below, displays the estimated sediment change from the existing condition. The WATSED model estimated a 9% increase in sediment from road construction in the two years following construction (SW-23); so Alternative C would have not have this sediment increase because no road construction is proposed.

Table 3-70 Sediment Change from the Existing Condition (TMDL and WATSED models)

Bussel Creek Watershed (Project Area)	Alternative C
TMDL Model Long-term Sediment Reduction (tons/yr)	26
TMDL Model Short-term Sediment Addition[1] (tons)	0 to 4.1
TMDL Model Sediment Reduction After 7 Years[2] (tons)	84 to 177
WATSED Model Long-term Sediment Reduction (tons/yr)	66
WATSED Model Short-term Sediment Addition[1] (tons)	30 to 58
WATSED Model Sediment Reduction After 7 Years[2] (tons)	260
Bear/Little Bear Creek Watershed	**Alternative C**
TMDL Model Long-term Sediment Reduction (tons/yr)	7.1
TMDL Model Short-term Sediment Addition[1] (tons)	0 to 8.5
TMDL Model Sediment Reduction After 7 Years[2] (tons)	4 to 33
WATSED Model Long-term Sediment Reduction (tons/yr)	46
WATSED Model Short-term Sediment Addition[1] (tons)	2.8
WATSED Model Sediment Reduction After 7 Years (tons)	217

[1]Short-term = 2-5 years. The range of sediment addition depends on timing of activities.
[2] Range of sediment reduction depends on timing of activities. Estimate based on TMDL model.

Channel Form, Pattern and Sediment

The discussion and effects identified in Alternative B for channel form, pattern and sediment changes are applicable to Alternative C, except impacts are expected to be less than those of Alternative B.

Channel Process

The discussion and effects identified in Alternative B for channel process and sediment changes apply to Alternative C, except impacts are expected to be less than those of Alternative B.

Water Yield

WATSED: Estimated Water Yield

In using the WATSED model for Alternative C, roads proposed for recontouring (Rx D) were removed from the data set, and roads proposed for storage (Rx C) were mitigated with road obliteration (95%) to reflect the proposed activities. WATSED estimates a 2% water yield increase for Alternative C (SW-23). The existing condition as identified above in Table 3-69 would be the same for Alternative C. The water yield and recurrence interval change identified under Alternative B would be slightly less for Alternative C because the estimated increase for Alternative B is 1% lower (SW-23). Alternative C water yield returns to the existing condition four years after activities are complete (SW-23).

Channel Form, Pattern and Water Yield

The discussion and effects identified for Alternative B for channel form, pattern and water yield changes are applicable to Alternative C.

Channel Process

The discussion and effects identified for Alternative B for channel process and water yield changes are applicable to Alternative C.

Wetlands

The effects to wetlands are expected to be similar to Alternative B but slightly less because of a lower short-term sediment increase.

Cumulative Effects: Alternative C

Cumulative effects discussed in Alternative B are also applicable to Alternative C though somewhat lessened because there would be no road construction.

Sediment

Proposed activities on private land, as estimated by the TMDL model, would result in a 19.9 ton increase in sediment for one year of non-stocked stands or 39.8 tons for two years of non-stocked stands (SW-A21). The estimated time frame for this increase is from 2007-2014 (SW-A21; SW-25), so the average annual sediment increase would be about five tons.

Private activities combined with proposed Forest Service activities for Bussel Creek would result in an estimated increase to the sediment budget over the short-term, but would not substantially change the estimated long-term sediment reduction.

Wetlands

The cumulative effects of changes in water yield as discussed in Alternative B would apply for Alternative C though somewhat lessened because of a lower estimated water yield.

Range of Natural Variability

Nitschke (2005 p. 315) identifies that wildfire can cause significant increases in sediment yield and thus be more detrimental than harvesting activities. Forest road construction and maintenance appears to emulate sediment from wildfire in the short-term, but forest roads as a long-term sediment source differs from wildfire (Nitschke 2005 p 316).

MacDonald and Coe (2006 pp.154-155) identify that high severity wildfires can increase the production and delivery of sediment by several orders of magnitude, and for sites with lower severity it is one or more orders of magnitude lower. Larsen and others (in review, SW-55 p 3) identify that “[w]ildfires increase hillslope- and watershed-scale runoff and sediment yields by several orders of magnitude…)”.

Based on this research and the modeling completed for the Bussel watershed analysis, it appears that the levels of sediment and water yield identified resulting from the proposed activities or cumulatively are well within the range of natural variability.

Consistency with Forest Plan and Regulatory Framework

Forest Plan Standards

The long-term productivity of the water resource would improve through reductions in sediment. The short-term 3% to 5% water yield increase would not substantially change water resource productivity. Design features include BMPs for project activities that are intended to maintain and protect beneficial uses.

State Water Quality Standards

Idaho DEQ (SW-46 2003 letter p. 2) identifies, for waterbodies with a TMDL, that sediment loading from a timber project should have sediment reductions prior to or occurring in the same time frame as the timber project. The sediment budget as presented shows sediment reductions over the same time frame as the proposed timber project (SW-A30 A-31, A36; see Tables 3-68 and 3-69 and *Sediment* discussions).

Overall, water quality standards would be met because:

1. application of BMPs is consistent with IDAPA 58.01.02.350 Rules Governing Nonpoint Source Activities;
2. the estimated short-term sediment increase is not expected to impair aquatic population viability (see Fisheries section: Effects on Species Diversity and Distribution on the IPNF) because of temporal and

spatial scales; i.e. duration estimated up to five years, length and surface area of the channel and floodplain network;

3. the estimated short-term sediment increase includes sediment generated by restoration activities;
4. the estimated sediment reduction is expected to occur over the same time-frame as the timber project (SW-58);
5. the estimated amount of the short-term sediment increase is not expected to cause aggradation (Megahan and King 2004 p. 217) and is not outside the range of natural variability so existing beneficial uses would be maintained and protected;
6. the overall long-term sediment reduction would improve beneficial use support; and
7. riparian plantings would eventually increase stream shading and reduce stream temperature.

Since there is uncertainty in actual sediment delivery to the stream channel from harvest activities and the uncertainty of the estimated amount of sediment generated from stream crossing restoration sites, there may or may not be short-term sediment additions (see *Scientific Controversy and Uncertainty*). The estimated stream crossing restoration sediment is an unavoidable outcome from winnowing fine material from the streambed once stream flow is returned to the restored channel; but this amount of sediment is not expected to prevent maintenance and protection of beneficial uses. The estimated amount of sediment addition is small compared to the long-term reduction amount and the benefit of removing perpetual, chronic sediment sources.

Clean Water Act

The physical, chemical and biological properties of waterbodies in the Bussel Creek watershed would be protected or improved from the proposed activities. The action alternatives would meet the Clean Water Act because:

Buffer strips would protect the physical integrity of the water within the Bussel Creek watershed from temperature modification and sediment routing. The overall sediment level would decrease under the action alternatives. No substantial changes to stream channels are expected, as described in the channel form and process sections.

The chemical integrity of the water would not be affected by activities under the alternatives because no extraneous pollutants are expected to enter the stream system, except through possible accidental occurrences. No fueling of equipment would occur within RHCA buffers.

The biological integrity of water in the Bussel Creek watershed would be protected and enhanced from activities proposed in the action alternatives. Riparian plantings are proposed for all action alternatives, which may eventually decrease stream temperature and provide aquatic habitat improvements. Additionally, riparian plantings may have the capability to attenuate flood peaks and enhance floodplain development.

Application of best management practices would minimize adverse effect on the aquatic environment.

Floodplain Management and Wetland Protection

The activities are expected to meet Executive Order 11988 and Executive Order 11990 related to floodplains and wetlands because no activity is proposed in wetlands or on floodplains and no substantial effect is expected.

Wildlife

Differences between Draft EIS and Final EIS

- Further explanation was added on how past, present and reasonably foreseeable actions were addressed in the analysis.
- The gray wolf is no longer listed under the ESA. It is now considered as a sensitive species and is addressed in that section.
- Modifications to the goshawk analysis were made to be more consistent with recent literature and direction.
- Information on the 2007 Elm Street wildfire in the project area is incorporated into the analysis.
- The Changes to Alternatives between DEIS and FEIS – documented in Chapter 2 -were reviewed and changes were made to the analysis as appropriate.
- Changes, additions, and edits were made (e.g. in response to comments) to clarify, correct, or otherwise improve the display and documentation of the analysis.

Regulatory Framework

The regulatory framework providing direction for the management of wildlife habitat comes primarily from the following sources:

- The Endangered Species Act of 1973 as amended (ESA)
- The National Forest Management Act of 1976 (NFMA)
- The Forest Plan for the Idaho Panhandle National Forests (FP)

Section 7 of the ESA directs federal agencies to ensure that actions authorized, funded, or carried out by them are not likely to jeopardize the continued existence of any threatened or endangered species or result in the destruction or adverse modification of their critical habitat.

NFMA provides for balanced consideration of all resources. It requires the Forest Service to plan for diversity of plant and animal communities based on the suitability and capability of the specific land area and within multiple use objectives of a Land Management Plan.

The Forest Plan, in compliance with NFMA, establishes Forest-wide and Management Area direction, goals, objectives, standards, and guidelines for the management and protection of wildlife habitat and species. Forest standards that to one degree or another apply to this project level wildlife analysis include but are not limited to:

- Elk - Utilize the “Guidelines for Evaluating and Managing Summer Elk Habitat in Northern Idaho” to evaluate effects on elk habitat.
- Threatened and Endangered Species – Management of habitat and security needs for T&E species will be given priority in identified habitat.
- Management Indicator Species - Maintain viable populations distributed throughout the Forest.
- Cavity Habitat - Maintain habitat by implementing the IPNF Snag and Woody Debris Management Guidelines.
- Sensitive Species - Manage habitat to prevent further declines in populations that could lead to federal listing.
- Old Growth Habitat – (to provide for viable populations of old-growth dependent and management indicator species) maintain at least 10 percent of the forested portion of the IPNF as old growth and maintain at least 5% of the forested portion of Old Growth Management Units that have 5% or more existing old growth.

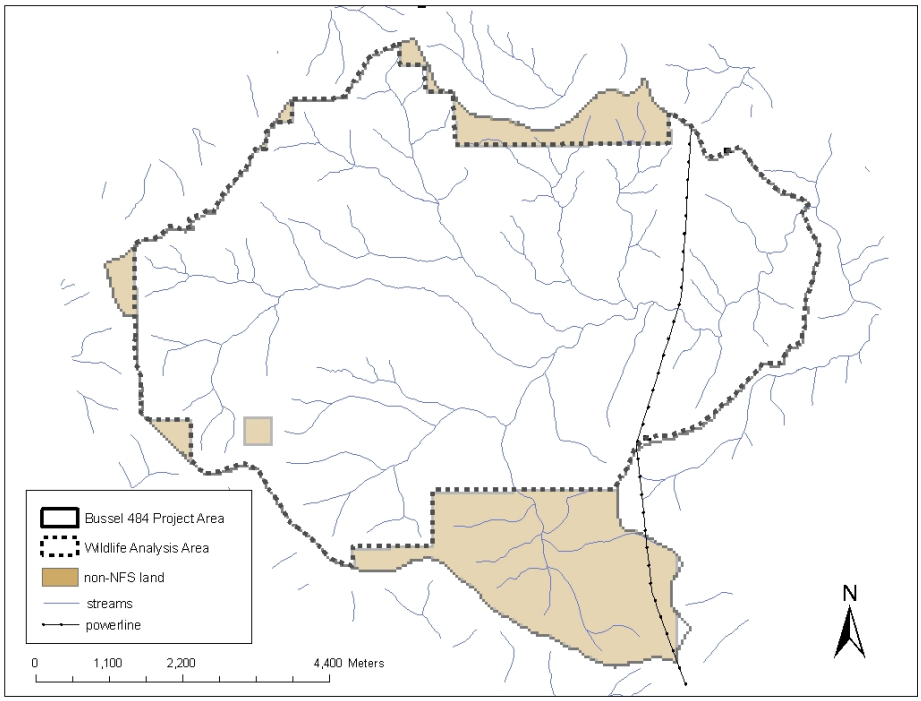
Management Area direction from the Forest Plan is described in Chapter 1. Direction concerning implementation of the ESA and NFMA are found in Forest Service Manuals (FSM) and direction from the Forest Service's Washington Office, Regional Office, and the IPNF Supervisor’s Office.

Analysis Area

The Bussel 484 Project Area was defined and delineated based on the scope of the proposed action and watershed boundaries. The geographic scope of potential effects on wildlife for this project level analysis was determined based on the spatial distribution of all proposed federal actions associated with the proposed action(s), the home ranges of species that may be impacted, topographical features, land ownership boundaries, the amount of area needed to determine potential effects (direct, indirect, and cumulative), and characteristics of the landscape surrounding the project area that may influence cumulative effects or species use of habitat.

The Bussel 484 Wildlife Analysis Area for direct and indirect effects on most species is delineated by the contiguous block of NFS lands within the project area. This includes the NFS lands within the project area - excluding the two small isolated stands in the southwest corner of the project area - and an ≈ 40 acre parcel of non-NFS land entirely surrounded by NFS land (Figure 3-8). This is approximately 12,270 acres of primarily NFS land. Ownership boundaries were used to delineate portions of the wildlife analysis area because they represent very real biological differences in existing and future habitat conditions on the ground as well as human-defined lines on a map (WL-39). The wildlife analysis area allows for the analysis and disclosure of potential effects from the federal actions(s) in the context of suitable habitat on NFS lands. It also acknowledges the likelihood that private timber company lands do not and will not provide suitable habitat for some wildlife species (e.g. species associated with mature forest structure) and therefore such habitat (and most home ranges) will occur primarily on NFS lands. Past, present, and future actions on adjacent non-NFS lands have and continue to impact habitat for some species; these effects are include in the cumulative effects sections for the affected species.

Figure 3-8 Wildlife Analysis Area



For some species habitat adjacent to the wildlife analysis area was considered in the analysis of direct and indirect effects. For example, the influences of adjacent roads on elk security have been assessed. Also, for some species, due to the nature of species occurrence, distribution of capable/suitable habitat, the scope of the alternatives and lack of impacts throughout the wildlife analysis area, the geographic scope of the analysis is restricted to the area of potential impact. A more specific description of the geographic scope of the analysis – if it varies from the wildlife analysis area - is found under each habitat or species/guild section of this document.

The wildlife analysis area is large enough to assess cumulative effects for most species – i.e. it encompasses one or multiple home ranges. However, when pertinent, information outside of the analysis area was considered in the analysis of cumulative effects for some species.

Analysis Methods

The appropriate methodology and level of analysis needed to determine potential effects is influenced by a number of variables, including the potential for impacts (e.g. the scope of the activities and the associated risk to resources and species), available information, and the information necessary for an informed decision. This analysis starts at a course/medium level of analysis and proceeds to a finer level of analysis as needed to determine potential effects.

With acknowledgement and due consideration of differing/contrary views (e.g. regarding goshawk – Greenwald and others 2005) and/or seemingly contrary information (e.g. regarding black-backed woodpecker – Hillis and others 2002) the analysis is based on scientific literature most appropriate for Region 1 of the Forest Service, the IPNF, and the project area. This includes available Conservation Assessments and Strategies for wildlife species, other pertinent assessments (e.g. St. Joe Geographic Assessment), Forest Service direction, and additional scientific literature.

This analysis is organized by habitat and/or species. The main sections are:

- Terrestrial Habitat – including forest structure (i.e. successional stages), old growth, riparian habitat, access/disturbance, and connectivity.
- Management Indicator Species (MIS)
- Threatened and Endangered Species (T&E), and
- Sensitive Species

All past, present, and reasonably foreseeable actions listed at the beginning of Chapter 3 were reviewed for their relevancy to the wildlife analysis and their potential effects on wildlife (WL-18). Those actions vary in their potential for impacts on wildlife, the consequences of potential impacts, the measurability of effects, and how they are measured. Some actions may influence impacts but have no measurable effects on wildlife that need to be directly attributed to the action. For example, road maintenance, transmission line maintenance, and other present and reasonably foreseeable actions may contribute to disturbance levels but are a part of the impacts measured by open road densities; and transmission line maintenance may impact vegetation but in terms of effects is essentially maintaining existing open/seedling conditions. Also, some actions occur at a level that does not have a measurable effect (e.g. Christmas trees for personal use) or can't be quantified for measurement because of their stochastic nature and the inability to predict their extent (e.g. fire suppression and wildfires).

Habitat associations provide the foundation for assessing habitat capability/suitability and assessing potential effects. The IPNF developed queries of TSMRS/FSVeg databases for select species to represent those factors, including biotic (variable attributes such as stand structure and composition) and abiotic (fixed attributes such as slope and aspect) components. Interpretation of key habitat components for determining habitat suitability is in the project file (WL-1) and based on referenced scientific literature. Habitat query results were reviewed and updated based on recent literature and direction. The analysis methodologies for various species display suitable habitat based on habitat associations using the best science and disclose differences in potential effects between alternatives.

Past actions (e.g. fire history and harvest activities) in the Bussel 484 Wildlife Analysis Area and surrounding landscape have influenced the availability and distribution of wildlife habitat present today, particularly the level of late-successional habitat (See Table 3-73). Aerial photos (1933 to 2004, located in the photo files at the St. Maries District Office, 2006 photo rectified imagery [WL-39]) and stand exam data (stand files and timber stand data bases located at the St. Joe District office) were used as the basis for habitat analysis. Additional field reviews, walk-through exams, and data reviews were conducted to validate and update this information (WL-2, V-1, V-13, OG-4). This information was compiled into spreadsheets and evaluated to determine habitat suitability (WL-3).

The analysis evaluates habitat in terms of the capability and suitability of vegetation (e.g. structure and composition) and human disturbance. For the purposes of this analysis, capable habitat is wildlife habitat that has the fixed attributes that enable it to produce the habitat requirements for a given species currently or in the future. These fixed attributes include soils (parent material or landtype), slope, aspect, elevation, and potential vegetation (e.g. habitat type). Suitable habitat is wildlife habitat that currently has both the fixed and variable stand attributes

that enable it to provide the habitat requirements for a given species. Variable attributes change over time and may include seral stage, forest type, stand density, tree size, stand age, or stand condition.

There is some level of uncertainty associated with almost any analysis methodology: habitat associations are complex, some variables may be unknown or undescribed, or available data was not collected specifically for wildlife habitat purposes. However, this analysis is based on the most applicable scientific literature and uses the best available data. Data was validated for use in the wildlife analysis by the wildlife biologist through filed reviews, office verification (e.g. aerial photo review), and coordination with the silviculturist. The analysis measures habitat and describes potential effects in a manner that is reliable and accurate. The methodology is commensurate with the existing knowledge, existing data, and the risks associated with the project. The analysis allows for a comparison of potential effects by alternative and a decision based on environmental consequences.

Detailed stand data is available only for National Forest System (NFS) administered lands within the wildlife analysis area. However, the ownership pattern within the wildlife analysis area (i.e. relatively large contiguous block of NFS land surrounded by other land) allows for adequate analysis of direct, indirect and cumulative effects for most species with the data from NFS lands only. Where information on non-NFS land is needed to analyze effects (e.g. for cumulative effects), data was developed via a combination of field review, photo interpretation, and extrapolation from data on NFS land.

Acre figures displayed in the wildlife section come from the TSMRS and FSVeg database and road/trail miles come from the infra database. The calculations of acres and miles are documented in the project file (WL-3 & 4). All values are approximate due to such factors as rounding of acres and combining/grouping of stands. There are differences between resources (e.g. Vegetation and Watershed) in how effects on the same action/feature are counted. The differences are due to the scale at which the analysis is conducted (e.g. stand vs. within a stand), the level at which effects become noteworthy, and the consequences of the effects on different resources. For example, the shelterwood prescription does not change forest structure at the stand level (*Forest Vegetation* section); however in this section the small openings created by this type prescription are taken into account.

When needed, cumulative effects from possible impacts on non-NFS lands are evaluated based on past/present practices, management objectives, available information, and assumptions of probable activities. Due to the lack of detailed data, the effects from activities on non-NFS lands are more difficult to quantify and qualify. They are therefore measured in more general terms than effects from activities on NFS lands. The assumptions regarding activities on non-NFS land and the possible impacts represent a conservative approach (from a species perspective) for analyzing effects on wildlife species and habitat. For example, the analysis is based in part on the premise that non-NFS lands will not provide any appreciable amount of old growth habitat. Therefore it is also assumed, for analysis purposes, that these lands do not contribute to wildlife habitat such as mature/old forest structures or they provide it at inherently low levels.

The interaction of disturbance (both human-caused and naturally occurring) and forest succession, in large part, determines the quality and quantity of habitat on a spatial and temporal scale. The existing condition and availability of habitat in the landscape will change regardless of management actions. This change could be sudden and readily apparent (e.g. a stand-replacing wildfire) or slow and subtle (e.g. stand aging). As they pertain to this analysis, natural changes are random and unpredictable. Forest succession normally takes place at a rate that is essentially too slow to measure within the temporal scale of this project level analysis. However, because of its long-term effect and the existing condition of stands in the project area (e.g. ages close to but not yet mature) its effects are discussed.

More specific discussions of analysis methods can be found under the section for each species or group of species.

Species Relevancy Screen

The National Environmental Policy Act directs the agency to focus on a full and fair discussion of significant issues, and identify and eliminate from detailed study the issues that are not significant. Some elements of wildlife habitat require a detailed analysis and discussion to determine potential effects. Other elements may not be impacted; may be impacted at a level that does not influence use, occurrence, or the decision to be made; or can be adequately addressed through design of the project. These elements then do not necessarily require detailed analysis.

TE&S species, MIS, and other wildlife species of interest or potential concern known to occur on the IPNF were reviewed for their relevancy to the proposed actions and the wildlife analysis area. Relevancy was determined if there is evidence of species occurrence, capable and/or suitable habitat present (sufficient to support the species),

or potential for the proposed actions to affect a species or its habitat. Some species or habitats do not occur in the wildlife analysis area and no further analysis is necessary.

The assessments of the potential for effects made in this screen consider the scope and nature of the activities associated with the proposed action and alternatives, the potential risks for adverse impacts, and the ability to determine potential effects based on available information at the time of this phase of the analysis. If the potential for effects could not be determined with a reasonable degree of confidence in this process then additional analysis was conducted.

Table 3-71 displays the results of the species relevancy screening process. Further information on species not requiring further analysis and the rationale is discussed following the table.

Table 3-71 Species Relevance Screen

Species/Habitat	Species or Habitat Present in St. Joe Drainage?*	Potential for Measurable Effects in Analysis Area?	Need for Further Analysis?	Rationale for No Further Analysis**
Endangered				
Woodland caribou	N	N	N	1
Threatened				
Grizzly bear	N	N	N	1
Canada lynx	Y	Y	Y	
Sensitive				
Bald eagle	Y	N	N	2
Black-backed woodpecker	Y	Y	Y	
Western toad	Y	Y	Y	
Coeur d'Alene salamander	Y	U	Y	
Common loon	N/I	N	N	1
Fisher	Y	Y	Y	
Flammulated owl	Y	N	N	1&2
Gray wolf	Y	Y	Y	
Harlequin duck	Y	N	N	1
Northern bog lemming	N	N	N	1
Peregrine falcon	N/I	N	N	1&2
Townsend's big-eared bat	Y	N	N	1&2
Wolverine	Y	U	Y	
Black swift	U	N	N	1
Pygmy nuthatch	Y	N	N	1&2
Fringed myotis	U	N	N	1&2
Management Indicator				
Elk	Y	Y	Y	
Northern goshawk	Y	Y	Y	
Moose	Y	Y	N	3
Marten	Y	Y	Y	
Pileated woodpecker	Y	Y	Y	
Other				
Forest land birds	Y	Y	N	3
Cavity / snag habitat	Y	Y	N	2

* **Y**es, **N**o, **U**nknown or **I**ncidental (if at all).

** 1 Rationale and documentation is provided in the project file for the determination that the species or habitat is not present within the St. Joe/St. Maries River drainages and/or wildlife analysis area.

2 Species or habitat may be present, but due to the scope of the proposed actions - including design criteria - there would not be any effect on habitat or the species (e.g. harvest of trees would not impact habitat for species associated with lakes). Rationale is provided in the project file and in this document.

3 Species does not apply, is not appropriate for the project, or indicators for other habitats/species measure the potential impacts. Rationale is provided in the project file and in this document.

Rationale for No Further Analysis

Bald eagles occupy riparian or lacustrine habitat almost exclusively during the breeding season (USDI 1994). They select isolated shoreline areas with larger trees for nesting, feeding, and loafing. Components of nesting habitat include proximity to sufficient food supply, the presence of dominant trees, and line-of-sight to a large body of water (often within 0.25 mile of water). Nest sites are commonly distributed around bodies of water >80 acres or major rivers. Bald eagles often forage year round near riffles, runs, and pools of rivers. Bald eagle winter habitat is mostly associated with areas of ice-free water where fish or waterfowl are available as prey but they can also occur scattered through upland areas where they feed on carrion.

Species/Habitat Presence: There are no large bodies of water or major rivers in the Bussel 484 Project Area. The closest known nest is >8 miles from the project area near the St. Joe River. The St. Joe River receives incidental and opportunistic migrating or wintering bald eagle use and eagles have been sighted along Marble Creek approximately two miles from the project area. The project area does not provide nesting habitat or characteristic foraging conditions for bald eagles. The possibility of a bald eagle occurring in the project area is inconsiderably small and the potential for any impact from the proposed action(s) even more so.

Rationale for No Further Analysis: There are no large bodies of water in the project area and no bald eagle nesting habitat. Project activity would have no effect on the bald eagle under any alternative because of the lack of habitat and species occurrence. No further analysis or discussion is warranted.

Flammulated owls, pygmy nuthatches and fringed myotis are associated with dry habitats throughout their ranges.

Flammulated owls are seasonal migrants that occupy home ranges in the northern latitudes during the spring, summer and fall. They are cavity nesters that depend upon naturally occurring or excavated cavities for nesting. Consequently, snags and other defective trees are an important component of their breeding habitat. Flammulated owls are attracted to relatively open, older forests featuring ponderosa pine and Douglas-fir (Hayward and Verner 1994; Wright 1996). These conditions are correlated with drier habitats. Reynolds and Linkhart (1992) reported that all published North American records of nesting, except one, came from forests in which ponderosa pine was at least present, if not dominant. The flammulated owl's preference for ponderosa pine and/or Douglas-fir can also be linked to prey availability. Reynolds and Linkhart noted a stronger correlation between prey availability and ponderosa pine and Douglas-fir, than with other common western conifers.

Pygmy nuthatches show a strong and almost exclusive preference for ponderosa pine habitat (Ghalambor 2003), especially mature to late-seral stands that are fairly open and park like. Secondary habitats that the species may use include open Douglas-fir, juniper, and aspen. Species abundance is directly correlated with snag density (i.e. cavity availability). They feed on pine seeds and insects extracted from the bark of trees.

Fringed myotis are mostly found in dry habitats where open areas are interspersed with mature forests and snags are abundant (Keinath 2004). This bat forages for insects in riparian and wetland areas. They have been captured in ponderosa pine and Douglas-fir forest while foraging over willow/cottonwood areas. They use caves, buildings, bridges, crevices and large cavities for roosting. Primary threats to the species include: 1) roost loss and modification - loss of existing and potential roost sites from mine closures, snag removal, and destruction/modification of buildings and bridges, 2) habitat alteration – reductions in old growth forests (dry) and snags, and 3) toxic chemicals.

Species/Habitat Presence and Rationale for No Further Analysis: Suitable dry habitat for these species is not present in the wildlife analysis area. There are four stands totaling 132 acres (1% of the wildlife analysis area) with the fixed attributes capable of providing the habitat requirements for these species currently or in the future. Currently there are no dry habitat sites with open ponderosa pine or Douglas-fir that are suitable habitat for these species. The proposed action(s) would treat one dry habitat site with an existing spruce cover type. The species are not known or suspected in the project area. Based on the lack of suitable habitat and occurrence there would be no impact on habitat or the species.

Peregrine falcons are seasonal migrants to northern Idaho, nesting in the northern temperate regions while wintering in the U.S. and southward. They nest on cliffs that are typically higher than 100 feet, with overhanging ledges or potholes and a vertical surface that provide protection from predation. Foraging areas associated with nest sites can include wooded areas, marshes, grasslands and open water (USDA 1989).

Species/Habitat Presence and Rationale for No Further Analysis: There are no known historic aeries or capable/suitable nesting habitat in the wildlife analysis area. The species is not known or suspected to occur in the area. Existing habitat capability and suitability and the nature and scope of the project preclude the potential for effects on habitat or the species. No further analysis and discussion is warranted.

Townsend's big-eared bat: This species is strongly correlated with cave or cave-like roosting habitat (Pierson and others 1999). Caves and cave-like structures are a critical habitat for this species, both as hibernacula in the winter and as roosts for summer nursery colonies (ibid). They occasionally use bridges and old buildings for roosting and in some places have been known to use building attics as nursery sites (Perkins 1992 p. 9). In northern Idaho, Townsend's big-eared bats primarily roost in abandoned mines. Loss and disturbance of hibernacula and roosting habitat are the limiting factors for Townsend's big-eared bats.

Species/Habitat Presence and Rationale for No Further Analysis: There are no abandoned mines or caves in the wildlife analysis area that may serve as potential habitat. The species is not known or suspected in the project area. Based on the lack of suitable habitat and occurrence there would be no impact on habitat or the species.

Black swifts require moist cliff environments for nesting. They nest behind or next to waterfalls and wet cliffs or in shallow caves (Wiggins 2004). Generally, there are five factors present at nest sites: water, high relief, inaccessibility, no direct sunlight, and unobstructed flyways. Black swifts feed on insects and forage over forests and in open areas. Risks to the species include decreases in water flow and recreational use of nest sites (e.g. rock climbers and hikers).

Species/Habitat Presence and Rationale for No Further Analysis: There are no waterfalls, wet cliffs or caves in the wildlife analysis area that may serve as potential habitat. The species is not known or suspected in the project area. Based on the lack of suitable habitat and occurrence there would be no impact on habitat or the species.

Moose were identified in the Forest Plan as a MIS associated with mature timber stands. Moose eat a variety of plants with shrubs and trees being the most important winter forage. Components of moose habitat include mature timber stands, second growth forests, wetland areas and old harvest units or brush fields.

Species/Habitat Presence: Moose are known to occur and are relatively common in the wildlife analysis area.

Rationale for No Further Analysis: The parameters used to evaluate effects on elk and other MIS (e.g. road density, security, and changes in forest vegetation) are applicable and sufficient for addressing potential effects on moose. Therefore, no analysis specifically for moose is warranted.

Forest land birds include all the avian species sometimes collectively termed as ‘Neo-tropical migratory birds’, ‘migratory songbirds’ and 'resident songbirds'. This group of birds is an extremely diverse group of species, with divergent habitat associations and potential effects (Idaho PIF 2000).

Species/Habitat Presence & Rationale for No Further Analysis: Various land birds are known to be present in the wildlife analysis area. Any treatment, including no action, can have adverse effects on some species and beneficial effects on others. Species likely to be affected by activities are represented by other habitat elements and species addressed in this screen and/or analyzed further, including: general forest species (elk), dry-site species (flammulated owl), wetlands/riparian habitat (Coeur d'Alene salamander, see also the *Water* and *Fisheries* sections), old growth (flammulated owl, fisher, pileated woodpecker and northern goshawk), and snag-dependent species (pileated and black-backed woodpeckers). The potential impacts on this group of species are reflected in the impacts on the various components of terrestrial wildlife habitat (e.g. forest structure/size class, old growth, dry site habitat, and riparian habitat), by potential impacts on representative species (e.g. pileated woodpecker, flammulated owl, black-backed woodpecker, harlequin duck), and by potential impacts on other wildlife species (e.g. elk and western toad).

This group of species is best addressed at the programmatic level or a larger scale. Monitoring, research, management, and education efforts are ongoing at the state level (Idaho Partners in Flight). Because potential effects on habitat(s) for forest land birds and representative species are included in project-level analyses, there is no benefit or need to specifically include this group of birds. Analysis for this group of species is beyond the scope of a project-level analysis and would not provide additional information critical to the decisions being made.

Cavity Habitat: The amount of snags and down woody material present has been identified as a measure of forestland integrity (Quigley and others 1996). Snags of varying size, condition, and tree species provide habitat for a variety of wildlife species (Bull and others 1997).

The species totally or largely dependent on cavity habitat include some sensitive species (e.g. black-backed woodpecker, flammulated owl) and MIS (e.g. pileated woodpecker).

Species/Habitat Presence & Rationale for No Further Analysis: Existing cavity habitat is a function of past and present disturbances (e.g. fire, insects, disease, and timber harvest), stand initiation, and succession. There is a relatively low amount of forest structure (i.e. 23% of wildlife analysis area) with reduced cavity habitat potential due to past activity and/or natural conditions (WL-3). This includes brush/seedling/sapling/pole stands and larger size classes with past harvest activity that may have reduced the cavity habitat potential. Conversely, there is a relatively large amount of sawtimber/mature sawtimber and immature sawtimber forest structure (77% of wildlife analysis area) well distributed in the analysis area (WL-3).

A recent analysis of the density and distribution of snags on the IPNF estimates the average number of snags per acre on all forested lands on the IPNF with a d. b. h. greater than or equal to 10 inches and less than 20 inches is 10.4 snags. The average number of snags per acre with a d. b. h. of greater than or equal to 20 inches is 1.4 snag per acre. Estimates for the landscape area within which the Bussel 484 Analysis Area lies are 6.3 snags per acre that are greater than 10 inches and less than 20 inches and two snags per acre that are greater than or equal to 20 inches (WL-5).

Providing numbers of snags that have been shown to support viable populations is a prudent approach to managing for viable/sustainable populations of woodpeckers and other species that use snags. Recent studies indicate that viable woodpecker populations occurred in areas with about four snags per acre (Bull and others 1997). Bull and others (1997) recommend providing snags in every 5- to 25-acre stand to satisfy distribution needs.

In both action alternatives, some snags (i.e. cavity habitat) would be lost due to timber harvest and associated activities. However, the potential impacts on snags and down wood are alleviated by a number of factors. Areas outside of proposed treatment units would continue to provide snags at existing levels in the short term and the number of snags and down woody material in these areas would increase as stands succeed. Areas would be reserved from treatment within riparian habitat conservation area (RHCA) buffers. Design features of the project were devised – based on the Northern Region Snag protocol (USDA 2000)- to ensure the retention and selection of snags at a level and distribution which has been shown to support viable populations of species that use snags and down logs (Design Features, Chapter 2 p. 36). Snags and snag replacements would be retained in all treatment units at levels recommended by scientific literature based on recent studies (12 per acre in most units) which would exceed Forest Plan standards of three to four per acre. While acknowledging notable differences, the commercial thin treatments and design features for snag retention are similar to treatments that have been shown to maintain cavity habitat and wildlife use (Quesnel and Steeger 2002).

The analysis for terrestrial habitat (i.e. old growth, dry site, and riparian), black-backed woodpecker, pileated woodpecker, and also forest carnivores provides a level of analysis specific to those cavity/mature forest structure associated species.

The existing condition of cavity habitat is reduced from 100% of potential but occurs at a level (77%) that exceeds Forest Plan standards (40-60% of potential). Forest Plan standards for cavity nesting species would be met or exceeded in all alternatives. Snag densities on the IPNF and the landscape within which the Bussel 484 analysis area falls are at levels that are not of concern at this time Design features are incorporated that would retain snags and snag replacements at levels recommend in scientific literature (e.g. Bull and others 1997) and consistent with the Northern Region Snag protocol (USDA 2000). Based on the information documented above, no further analysis is warranted.

Issue Indicators

Changes in forest vegetation and human disturbance/access resulting from the proposed federal action(s) could impact existing habitat for wildlife species, and project activities could cause or increase risk of mortality. Based on habitat relationships, indicators of potential impacts on relevant species are measured. Indicators and units of measurement for habitat and species are displayed in the following table. Queries of the timber stand data base (TSMRS/FSVeg) and information from field reviews/surveys were used to identify types of habitat and capable and suitable habitat for wildlife species (WL-1 & 3). The changes in habitat conditions and habitat for species are

disclosed and the effects are discussed. The analysis of effects on species is tiered to the analysis of effects on the types/components of habitat displayed in the table. To facilitate analysis and to most accurately reflect habitat for some species it was necessary to combine size classes differently depending on the species addressed.

Table 3-72 Issue Indicators for Wildlife

Habitat/Species	Indicator of Effects	Measurement
Terrestrial Habitat		
Forest Structure	Amount and percent of successional stages present in the area (including allocated old growth.	Acres and percent of size classes and historic range of variability.
Riparian Habitat	Changes in riparian vegetation and crossings removed	Length improved and crossings removed
Disturbance/Access	Changes in human access	Road density & changes in road status
Connectivity	Changes in vegetation in travel routes	Maintenance of vegetation along ridges, in saddles, and riparian areas
Management Indicator Species		
Elk	Changes in potential elk use* and vulnerability*	Potential elk use and acres of security
Northern Goshawk	Changes in suitable habitat* by home range	Acres of suitable habitat by home range
Pileated Woodpecker	Changes in suitable habitat*by home range	Acres of suitable habitat by home range
Threatened and Endangered Species		
Canada Lynx	Changes in winter snowshoe hare habitat, Northern Rockies Lynx Management Direction	Acres of unsuitable habitat & compliance with NRLMD
Sensitive Species		
Gray Wolf	Changes in disturbance & prey availability	Road density and potential elk use
Fisher (and Marten)	Changes in suitable habitat* and security	Acres of suitable habitat and road density
Wolverine	Disturbance of denning habitat* and security	Activity (winter) near denning and road density
Black-Backed Woodpecker	Changes in suitable/source habitat*	Acres of suitable/source habitat
Coeur d'Alene Salamander	Disturbance of microhabitat*	Risk of habitat disturbance
Western Toad	Impacts on breeding habitat* and direct mortality	Impacts to riparian habitat &risk of mortality

**suitable habitat, denning habitat, etc. are defined in the section for each species.*

Terrestrial Wildlife Habitat

This section of the analysis uses a medium-course-filter level of analysis to display existing conditions and effects at the scale of the wildlife analysis area. Data displayed in this section is used in the analysis for wildlife species.

Vegetation /Successional Stages/Habitat

Plant communities at various successional stages provide habitat for wildlife species. For example, some wildlife species are associated with late successional stages/large trees and others may require or are associated with combinations of young and late successional stages.

The St. Joe Geographic Assessment and the Interior Columbia Basin (ICB) Assessment (at their respective scales) revealed that late-seral habitat has decreased from historic levels. Many MIS and sensitive wildlife species are associated with this type of habitat. Therefore, one of the potential issues/concerns regarding the proposed action and alternatives is the impact on the quality and quantity of mature and old growth stands in the analysis area.

The Forest Plan (page II-5) states that "Approximately 10 percent of the Forest will be maintained in old growth as needed to provide for viable populations of old growth dependent and management indicator species. To obtain the desired distribution, the IPNF will be managed to maintain approximately 5 percent of each old-growth unit as old growth where it exists."

Affected Environment

Table 3-73 Existing Vegetation by Size Class Group in Wildlife Analysis Area

Size/Structure	Acres	Percent of Area
Sawtimber/Mature sawtimber	2,779	23
Immature Sawtimber	7,024	57
Pole	1,182	10
Sapling	990	8
Seedling	0	0
Brush	272	2
Open/meadow	21	<1

A wildfire in 2007 impacted approximately 43 acres of immature sawtimber, 11 acres of sawtimber/mature sawtimber and 3 acres of pole size forest structure on NFS land; another 8 acres of non-NFS land was impacted (FF-5, WL-35). Acres of existing size class were not adjusted because of the highly varied mosaic intensity of the fire and the relatively small affect on habitat at the project level scale (i.e. only approximately 15 acres in immature sawtimber may change size class – this represents 0.2% of the existing immature sawtimber).

While the following information on historic and current vegetation structure for the St. Joe Area is not directly comparable with information in the analysis area it nonetheless provides context for both the existing condition and the evaluation of potential effects.

Table 3-74 Historic and Current Vegetation Structure

	Old Growth	Large/ Mature	Medium/ Immature	Pole	Shrub/ Seed/Sapling
Historic	20.2%	23.7%	20.3%	15.3%	20.5%
Current (c. 2002)	11.2%	20.0%	44.7%	4.7%	19.4%
Bussel 484 Wildlife Analysis Area	*	23%	57%	10%	10%

* *old growth is not separated out from the size classes*

In the wildlife analysis area, there are approximately 2,523 acres of allocated old growth, 2,004 acres that fully meet old growth criteria and 519 acres of "potential" old growth (presently don't fully meet criteria) allocated to create blocks or logical old growth units. Across the Forest and the St. Joe Ranger District Forest Plan standards for old growth are met (see Old Growth, Chapter 3).

Environmental Consequences

All Alternatives

Direct, Indirect and Cumulative Effects

To determine the change in the amount of habitat, for the purposes of this analysis, it is necessary to determine the acres of openings that would be created in the various proposed vegetation treatments. Based on prescription

objectives and stand conditions following treatment the silviculturist and biologist assigned the following percent change (of treated acres) in size class by silvicultural prescription.

Clear cut with reserves	100%	Seedtree	100%
Commercial thin	0%	Group Shelterwood	50%
Precommercial thin	0%		

Table 3-75 below displays the changes in acres and percentage of size classes by alternative (WL-6).

Table 3-75 Size Class by Alternative

Size/Structure	Alt. A	Alt. B & C
	acres (%)	acres (%)
Sawtimber/Mature Sawtimber	2,779 (23%)	2,613 (21%)
Immature Sawtimber	7,024 (57%)	6,791 (55%)
Pole	1,182 (10%)	1,182 (10%)
Sapling	990 (8%)	990 (8%)
Seedling	0	429 (3%)
Brush	272 (2%)	272 (2%)
Open (field/riparian)	21 (<1%)	21 (<1%)

The proposed timber harvest would reduce the amount of forest in the Mature/Sawtimber (SAWT, MHRS & MLRS) and Immature Sawtimber (IMSA) size classes with a corresponding increase in the amount of forest in the seedling size class.

The table below displays the total acres in each size class group that would be treated by proposed harvest in this project and the acre changes in size class due to treatment (WL-6).

The proposed commercial thinning treatments would not change the size class of the stands; however, it would impact some (not necessarily all) aspects of the habitat provided by the stand. For example, the thinning treatments would retain >50% of the basal area and fisher/marten would still travel through the stands but forage and denning values would be reduced.

Table 3-76 Acres Proposed for Harvest Treatment by Size Class

Forest Structure	Alternative A		Alternative B		Alternative C	
	treated	changed	treated	changed	treated	changed
SAWT/Mature Sawtimber	0	0	255	166	255	166
IMSA (immature sawtimber)	0	0	1,889	233	1,889	233

In the two action alternatives 55% of the analysis area would succeed from immature sawtimber to sawtimber/mature sawtimber (15% with partial treatment and 40% with no treatment). This change would be slow and subject to a multitude of variables (e.g. natural fires, insect & disease).

In addition to the effects from timber harvest displayed in Table 3-76 there would be reductions (there is no category to show corresponding increases) from proposed new road construction that would impact existing forest structure. The effects on forest structure from new road construction outside of proposed harvest units in Alternative B is the elimination of approximately 2 acres of immature forest structure and 0.4 acres of mature/sawtimber forest structure (WL-36).

There would be no change in existing old growth from timber harvest; however, 0.4 acres of old growth would be impacted by road construction (See the Old Growth Section). All alternatives were designed to maintain old growth habitat and would allow the majority of both existing mature and immature forest habitat in contiguous blocks to naturally succeed (see the previous discussion regarding impacts on successional stages). Options for an increase

in the amount of sawtimber/mature sawtimber habitat in the future would be maintained in all alternatives (as succession of existing small/medium/immature stands occurs).

In addition, precommercial thinning would occur on 821 acres – with 555 of those acres also receiving white pine pruning treatment - and gopher control would occur on approximately 367 acres. These activities would not change the size class of the treated stands.

Succession would continue to proceed and slowly affect the amount of acres in each size class. The effects on successional stages/habitat would not significantly change the amount of habitat available for wildlife species (e.g. moose, goshawks). The effects would not cause a shift away from historic vegetation conditions for the St. Joe area.

The Forest Service is proposing to control pocket gopher populations in regeneration harvest units and the regeneration portion of other harvest units. The treatment is intended to protect both natural and artificial regeneration from pocket gopher damage during establishment. It consists of placing poisoned baits – either (0.05%) strychnine treated oats or (2.0%) zinc phosphide treated oats - in the burrows or runs of pocket gophers. There is an initial treatment and up to two follow up treatments, if needed, to minimize losses in the regeneration.

There would be no direct impact on forest vegetation. Indirect effects on vegetation would include higher stocking densities of conifer trees in the treated units. A potential concern is the possibility of non-target mortality from strychnine/zinc phosphide baiting. The main species that could be affected are mice and other small rodents that may consume treated bait in gopher burrows (Anthony and others 1984 in Black 1994). Strychnine and/or zinc phosphide killed gophers appear to present little hazard to mammalian (e.g. wolves) or avian predators (WL-8 & 40). Carcasses of poisoned gophers contain low levels of strychnine (less than 0.3 mg. per carcass) and are usually found below ground (Evans 1987 in Black 1994). Zinc phosphide presents very little potential for secondary poisoning of predator or scavenger species that may consume dead rodents (Marsh, 1985 in Bonar, 1995). Research (Barnes et. al. 1985) concluded that carcasses of gophers in baited areas did not pose a hazard and that secondary hazards to predators appear to be greatly lessened by the tendency of gophers to die underground.

A more detailed analysis of potential effects from pre-commercial thinning and gopher control can be found in the project file (WL-7, 8, & 40).

Cumulative Effects

Data displayed in Table 3-75 and Table 3-76 and the discussion pertaining to impacts from proposed road construction depict conditions that would result from all past, present and reasonably foreseeable activities on NFS land.

It is expected that the majority of non-NFS land surrounding the project area would be actively managed and, therefore, few if any stands on non-NFS land would remain in the sawtimber/mature sawtimber forest size class for any appreciable length of time before being treated. NFS lands would provide the vast majority of mature/sawtimber size forest on the landscape with non-NFS lands being in younger successional stages.

There are an additional 207 acres of reasonably foreseeable gopher baiting in past harvest units. The potential effects from this treatment are the same as those discussed under direct and indirect effects (see also WL-8 & 40).

Succession would continue to occur, untreated stands on NFS lands would become older and contain larger trees, and natural disturbances (e.g. insects, disease, wind throw) would continue to set back succession – at some indeterminable level.

Riparian Habitat

The St. Joe Geographic Assessment identified that, compared to historic conditions, changes in riparian zones have occurred (e.g. loss of mature cottonwood).

Affected Environment

The Ecosystem Analysis at the Watershed Scale (PD-2) identified that much of the riparian vegetation in the Bussel 484 Wildlife Analysis Area has been impacted by human activities such as timber harvesting (and associated road/railroad activity).

Environmental Consequences

This analysis focuses on the roads and stream crossings in the riparian area and improvement in riparian conditions. See the *Watershed* and *Fisheries* sections of this document for a more detailed display and discussion of effects related to road removal in RHCAs.

Alternative A

Direct and Indirect Effects

There would be no further impact on riparian habitat associated with this alternative.

Alternatives B & C

Direct and Indirect Effects

RHCA buffers would protect existing riparian habitat (see Fisheries Section). Native conifers and shrubs would be planted in the riparian areas along approximately 1.8 miles of Bear and Little Bear Creeks and in some portions of riparian areas in other parts of the Bussel Creek Drainage. This would occur over a 10 – 15 year time frame.

These alternatives would remove approximately 49 existing stream crossings in the project area. This (along with the riparian planting) would begin the process of restoring/moving the riparian habitat closer to historic conditions.

Disturbance/Access

Many wildlife species are sensitive to human disturbance and/or adversely impacted by human access (Joslin and Youmans 1999). The St. Joe Geographic Assessment also identified security as a concern. Potential temporary disturbance of wildlife is inherent in most human activity (e.g. project implementation) and may include alteration of normal use patterns and potential relocation to avoid disturbance (e.g. using alternate forage areas). This type of disturbance is not based on loss or long-term alteration of habitat.

Potential adverse impacts from human disturbance are associated with access levels, roads, and off-road recreation (Wisdom and others 2004). Effects on wildlife are caused by roads themselves and by the increased contact with humans that they afford. High levels of open roads (or roads and trails used by motorized vehicles) can affect wildlife species by increasing their vulnerability to mortality and by displacing them from preferred habitats for one or more seasons.

The degree of effects on wildlife from roads and trails is related to the amount and type of use on them. For the purpose of assessing impacts on wildlife from roads on NFS land, only roads that impact or potentially impact wildlife are included in the wildlife analysis. For example, an old road that is re-vegetated to the same composition and size class as the surrounding forest would have no measurable impact on wildlife (but may constitute an impact on other resources).

The ICB Assessment categorized road density levels (expressed as mi/mi2) of 0.7 to 1.7 as moderate, 1.7 to 4.7 as high and more than 4.7 as extremely high. Road density goals for wildlife vary depending on the species, area under consideration and the objectives and designation assigned to the drainage.

Data displayed in this section represents conditions in the wildlife analysis area and therefore may not match the figures displayed elsewhere for other resources. Some roads cross back and forth between NFS lands and non-NFS lands and in and out of the project/analysis area. It is not reasonable to exclude their effects on wildlife. In these cases the length of road on non-NFS lands are included in the road density values. This also results in approximately 90 acres of non-NFS lands being added to the analysis area for disturbance and access (for road density purposes). Also, this analysis is based on the actual known use (e.g. motorized vs. non-motorized) of roads and trails and not necessarily the management status.

Affected Environment

Many of the current and foreseeable actions in the analysis area do and would influence disturbance and access (WL-18). Regardless of the cause for any disturbance or impact on access, the effect is best measured by road/trail miles and densities. There are approximately 68.4 miles of road in the wildlife analysis area and an additional 10.8 miles of trail. The road miles and densities by type/status of road/trail are displayed in the following

table. There are 65.3 miles of road and trail (3.4 mi/mi^2) that currently have some level of motorized use. These routes have the greatest impact on wildlife (Wisdom and others 2004; Gaines and others 2003).

Table 3-77 Existing Roads and Trails within the Wildlife Analysis Area

Road Status/Use	Miles	Miles/Mile^2
Open/no restrictions	33.6	1.7
Motorized use - < 50”	28.4	1.5
Total road miles with the greatest wildlife impacts	62.0	3.2
No motorized use/Impassable	6.4	
Trail Status/Use		
Motorized use - < 50”	3.4	.2
No motorized use	7.5	
Total trail miles	10.9	

Environmental Consequences

Table 3-78 displays the total road miles, total road densities, open road miles, and open road densities in the wildlife analysis area for each alternative (WL-4). Road densities are displayed as mi/mi^2.

Table 3-78 Access Conditions/Road Densities and Miles

	Alternative A		Alternative B		Alternative C	
Road Status/Use	Miles	Miles/Mile^2	Miles	Miles/Mile^2	Miles	Miles/Mile^2
Open/no restrictions	33.6	1.7	22.1	1.1	22.1	1.1
Gated open to < 50”	28.4	1.5	5.2	13.1	5.2 13.1	.3 .7
Barriered open to < 50”			7.9		7.9	.4
Impassable/No motorized use	6.4	0.3	32.3	1.7	32.3	1.7
Total road miles	68.4	3.5	67.5	3.5	67.5	3.5
Road miles impacting wildlife	62	3.2	35.2	1.8	35.2	1.8
Trail Status/Use						
Motorized use - < 50”	3.4	.2	6.8	.4	5.4	.3
No motorized use	7.5	.4	4.3	.2	5.7	.3
Total trail miles	10.9	.6	11.1	.6	11.1	.6
Trail miles impacting wildlife	3.4	.2	6.8	.4	5.4	.3
Total roads and trails impacting wildlife	65.4	3.4	42	2.2	40.6	2.1

The following discussions by alternative describe the activities that would lead to the conditions displayed in Table 3-78.

Alternative A

Direct, Indirect, and Cumulative Effects

There are no reasonably foreseeable activities that would affect road miles or road management on NFS or non-NFS lands in this alternative.

Alternative B

Direct, Indirect and Cumulative Effects

Approximately 5.6 miles of road to access proposed harvest units would be constructed on NFS land. When activities are complete all of the 5.6 miles would be put in a state that would not provide access or appreciably disturb wildlife.

Road rehabilitation, and changes in road management (which reduce the miles of road that may impact wildlife) would combine to decrease the total road density and open road density on all ownerships in the wildlife analysis area.

Alternative B & C

Direct, Indirect and Cumulative Effects

Table 3-78 displays the access conditions and changes due to a variety of changes to the existing road and trail system in the wildlife analysis area. Roads and trails open to some form of motorized access would decrease by 23.4 miles in Alternative B and 24.8 miles in Alternative C. The density of these roads with the most impact on wildlife would decrease by 1.2 mi/mi^2 and 1.3 mi/mi^2 respectively. This would decrease the adverse impacts on wildlife associated with open roads and off-road recreation. Potential effects on species will be discussed in their respective sections later in this section.

Connectivity

The spatial arrangement of existing forest structure, roads, and topography can affect movement of wildlife to varying degrees. Maintenance of connectivity was one consideration in the development and design of the proposed action and alternative, and treatments were modified as the analysis proceeded to provide or maintain the potential for movement of wildlife in and through the analysis area.

Affected Environment

Areas typically used by wildlife for travel include ridges, riparian areas, and saddles. Past and present actions have affected and continue to affect wildlife movement in and through the analysis area, primarily by reducing the amount of cover in areas typically used for travel. Vegetation in portions of the transmission line right-of-way in the analysis area is maintained in a condition with no tall trees and reduced vegetative cover. However, the width of the right-of-way (<200 feet), topographic relief, and the vegetation that is present in some places (e.g. tall brush) reduce the adverse effects on wildlife movement. Roads can also alter movement of some species by both their lack of vegetation and the human use on them. In addition, the amount of travel cover in the landscape surrounding the Bussel 484 Wildlife Analysis Area has been reduced by past harvest (primarily on non-NFS land). Prominent ridges and other areas that provide potential connectivity were identified and mapped (WL-9).

Environmental Consequences

Common to All Alternatives

Direct and Indirect Effects

Proposed harvest activity would not create permanent barriers to movement. The proposed action and alternatives were designed with an objective of minimizing impacts on traditional areas of wildlife movement (Design Feature 14. E.). Proposed harvest units were designed to minimize impacts on areas typically used by wildlife for travel.

In addition, design features of the project - i.e. avoiding or limiting openings on ridges designated as potential travel areas - would further minimize impacts on wildlife travel/movement and would provide for continued use of typical travel ways. All alternatives would maintain areas for travel/movement for potential use by wildlife.

Cumulative Effects

Past, present and future harvest on non-NFS land would continue to impact the potential for movement adjacent to the wildlife analysis area. The magnitude and extent of this impact would vary depending on the harvest method and prescription.

Past and present actions adjacent to the project area would continue to affect wildlife movement into and out of the analysis area. Based on existing and foreseeable conditions on NFS lands the area would maintain opportunities for movement of wildlife (WL-9).

Given the design features of all alternatives (Design Features, Chapter 2 pp. 36-37) and the conscious desire to minimize impacts through alternative design, no alternative would have unacceptable, irreversible and irrevocable adverse impacts on connectivity. Areas for movement by wildlife exist and opportunities for movement/travel would be maintained (WL-9).

Management Indicator Species

Management indicator species (MIS) are species selected to estimate the effects of management activities on wildlife populations. The Forest Plan identified the MIS for the Forests. They include several categories of species including: threatened, endangered and sensitive; commonly hunted or trapped; and species whose population changes are believed to indicate effects of management on other species or biological communities. Those species in the Forest Plan applicable to the St. Joe District and project area are displayed in Table 3-79. MIS that are also threatened or endangered species are addressed in the Threatened and Endangered Wildlife Species section of this document.

MIS were screened for their relevancy to the wildlife analysis area and proposed action. See the Species Relevancy Screen (Table 3-71) and *Rationale for No Further Analysis* section above for more discussion regarding MIS analysis needs. More information can be found in the project file (WL-10) and in referenced scientific literature.

Table 3-79 Wildlife MIS for the St. Joe District

Species	Remarks	Existing Habitat / Need for Further Analysis
Pileated Woodpecker	Primary cavity excavator, old growth indicator because of dependence on large snags, associated with mature forest structure.	Habitat and species present, further analysis conducted.
Marten	Trapped, associated with mature and late successional mesic conifer forest habitat.	Habitat present, analysis is documented in section with fisher.
Goshawk	Old growth indicator because prefer mature old forest structure for nesting, use variety of forest structural conditions.	Habitat present, no known nest sites, further analysis conducted.
Elk	Hunted, important big game species, affected by human disturbance and human use of roads.	Habitat and species present, further analysis conducted.
Moose	Hunted, relatively unique big game species, occurs in low numbers throughout the IPNF.	Habitat and species present, elk and Vegetation/Habitat/Successional Stages analysis meets analysis needs, no analysis specifically for moose will be completed.

Marten and potential effects on their habitat are addressed under *Sensitive Species* along with fisher and are not addressed further in this section. The Species Relevancy Screen determined that there was no benefit to analyzing potential impacts on moose and that further analysis specifically for moose is not necessary.

Old Growth Associated MIS -Pileated Woodpecker

The pileated woodpecker is an old growth indicator in the Forest Plan because of its strong tie to the availability of large snags. Pileated woodpeckers are often associated with late successional forests but they also use young and fragmented forests with abundant remnant old structure (Bull and Jackson 1995). Pileated woodpeckers require tall, large-diameter dead or live defective trees within forested stands for nesting (USDA 1990). Nest tree size has been identified as a minimum diameter of 15” (Samson 2006) to 20” (USDA 1990) with no upper limit. With a median dispersal distance of 148 miles, habitat/territory distribution at this project level or at the Forest level is not an issue (Samson 2006). Carpenter ants make up the bulk of their diet. Feeding habitat includes large snags with advanced decay, the moist decaying butts of live trees, logs greater than 10 inches diameter, and natural or cut stumps. Large trees, canopy cover, and the number and size of feeding sites (e.g. dead trees greater than 10 inches diameter) are all important features of quality pileated habitat (USDA 1990). Activities that reduce these habitat features may affect pileated habitat suitability.

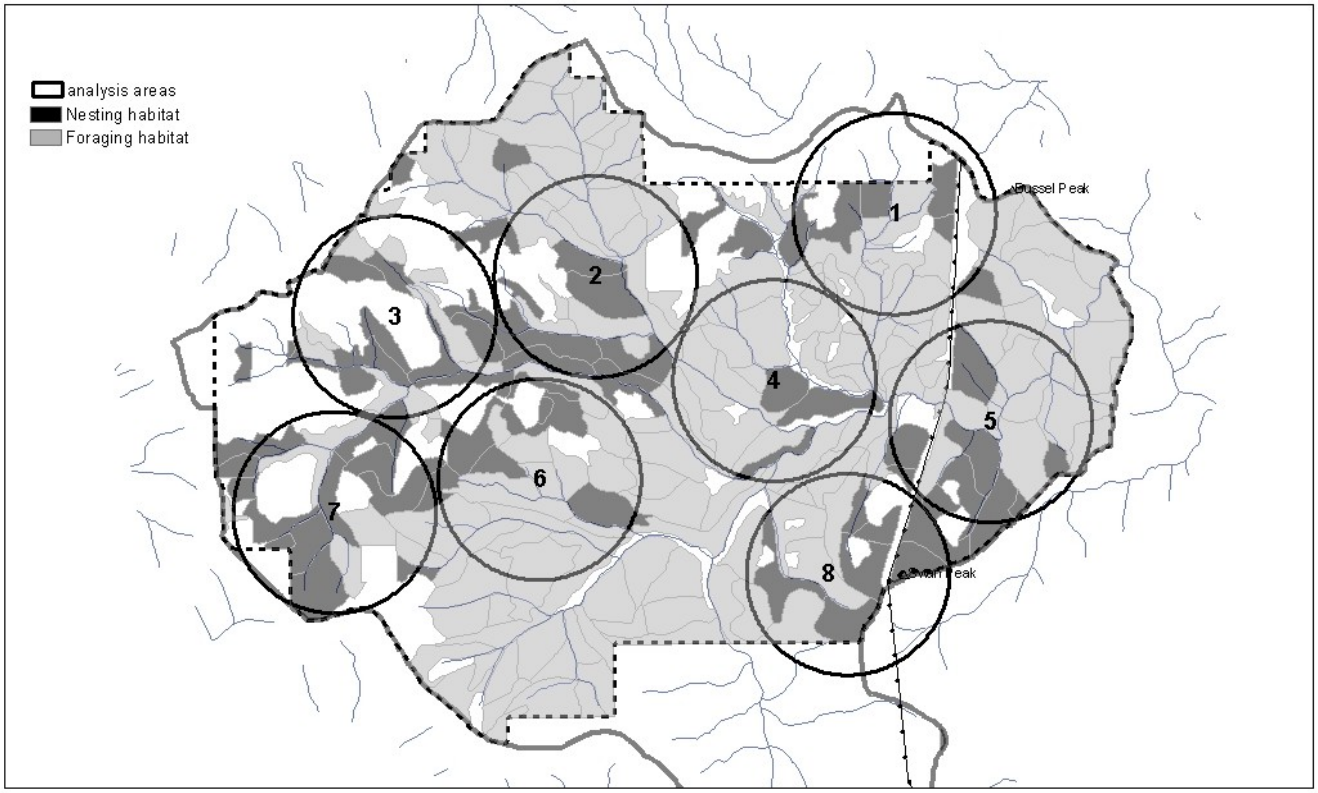
Methodology and Geographic Scope

The analysis of effects on pileated woodpeckers is based on habitat associations and direction in *Old-Growth Habitat and Associated Wildlife Species in the Northern Rocky Mountains* (USDA 1990) and *A Conservation Assessment of the Northern Goshawk, Black-backed Woodpecker, Flammulated Owl, and Pileated Woodpecker in the Northern Region, USDA Forest Service* (Samson 2006) and other scientific literature (Bull and Jackson 1995). This analysis is tiered to the analysis done for size class and old growth. The geographic scope for direct, indirect, and cumulative effects is the wildlife analysis area; however, some habitat outside of the analysis area has been included in the analysis for some home ranges.

TSMRS/FSVeg data and habitat values based on the HSI models (USDA 1990) were used to identify potentially suitable habitat and assess the potential for effects (WL-3 & 11). The analysis displays a comparison of potential effects on hypothetical home ranges using habitat associations based on literature descriptions of habitat and index values from the HSI model (WL-21). Field review was conducted to verify the habitat associations used for the analysis (WL-2 & 3).

The analysis methodology for determining potential effects on pileated woodpeckers involved mapping old growth and mature forest stands (i.e. suitable nesting habitat) in the wildlife analysis area and delineating hypothetical 1,000-acre home ranges based on the distribution of suitable nesting stands/groups of stands (Figure 3-9).

Figure 3-9 Pileated Woodpecker Home Ranges



Based on relative habitat values and the acres of suitable nesting habitat a home range should have (USDA 1990, WL-21), areas with at least 100 acres of contiguous mature and/or old growth forest habitat and an additional contiguous 100 acres of immature/sawtimber size tree habitat were identified as having sufficient suitable habitat.

Once home ranges with suitable nest stands were identified, the suitability of surrounding stands in the home range to provide adequate feeding habitat was evaluated. Within each home range at least 500 acres of sawtimber/mature sawtimber forest and/or immature sawtimber habitat is needed to provide adequate feeding habitat (USDA 1990). Potential impacts on suitable habitat were then determined for each home range.

Affected Environment

Forest Plan standards are being met for old growth across the St. Joe Ranger District and the Forest (see the Old Growth Section). The Forest Plan standards for old growth meets the Forest Plan objective for providing for viable populations of old growth dependent and MIS species – including the pileated woodpecker. There are 2,523 acres of allocated old growth in the wildlife analysis area. Approximately 23 percent (2,779 acres) of the Bussel 484 Wildlife Analysis Area is sawtimber/mature sawtimber – this includes allocated old growth. These stands (along with stands in the immature sawtimber size class) provide structure and attributes used by pileated woodpeckers (USDA 1990; Samson 2006).

For analysis purposes a total of eight home ranges (see Figure 3-9) were delineated. All eight of these home ranges contain sufficient nesting and feeding habitat to support a breeding pair of pileated woodpeckers. Portions of some home ranges extend beyond the wildlife analysis area due to the spatial distribution of existing nesting habitat and to more accurately represent existing conditions and potential effects. When needed to determine viability of these home ranges, conditions outside of the analysis area were considered.

Environmental Consequences

Table 3-80 displays the existing condition and potential effects on pileated woodpecker home ranges. For analysis purposes regeneration harvest would result in unsuitable nesting and foraging habitat and partial harvest would maintain the suitability of habitat at a reduced value (Samson 2006).

Table 3-80 Pileated Woodpecker Habitat by Home Range

	Existing		Alternatives B & C			
			Suitable		Un-impacted	
Home Range	Mature/Old Nesting	Foraging	Mature/Old Nesting	Foraging	Mature/Old Nesting	Foraging
1	172*	615	156*	599	139	511
2	307	792	298	762	298	762
3	308	507	308	507	308	463
4	109*	921	73	799	73	665
5	313	899	275	862	238	680
6	260	906	247	893	235	681
7	437	653	414	620	382	586
8	322	663	308	574	295	402

** Sufficient additional immature sawtimber acres available to provide sufficient suitable nesting habitat*

Common to All Alternatives

Direct and Indirect Effects

No alternative would harvest exiting old growth and less than one acre of potential old growth would be impacted by road construction (see Old Growth, Chapter 3).

Cumulative Effects

There would be no cumulative effects associated with this project or analysis area that would jeopardize populations of pileated woodpeckers. This is based on the potential effects from this project, the maintenance of existing suitable habitat and home ranges in the analysis area, the retention of existing immature sawtimber stands that would succeed to suitable habitat, compliance with the Forest Plan standards for old growth (to provide for viable populations of old-growth dependant and MIS), and the abundance and distribution of nest site habitat and winter forage habitat across Region 1 and the IPNF (Samson 2006).

Samson (2006) concluded that short-term viability of the pileated woodpecker in the Northern Region is not an issue for the following reasons:

- No scientific evidence exists that the pileated woodpecker is decreasing in numbers.
- Increases in the extent and connectivity of forested habitat have occurred since European settlement.
- Well-distributed and abundant pileated woodpecker habitat exists on today's landscape.
- The level of timber harvest ([in 2004] 0.09% of the forested landscape in the Northern Region) is insignificant. The level of timber harvest in 2006 was 0.08% in the Northern Region and 0.14% on the IPNF.

Consequently, none of the alternatives would likely result in appreciable adverse habitat modification or a perceptible change in populations of pileated woodpeckers.

In the analysis area at least 40% of NFS lands would succeed naturally from immature sawtimber forest to sawtimber/mature sawtimber size classes over time. This represents 70% of the existing immature sawtimber size class (Table 3-75). These areas would increase (over 10+ years) the potential suitable habitat and the number of home ranges.

It is expected that the majority of non-NFS land surrounding the project and analysis area would be actively managed; and therefore, no stands would remain in the sawtimber/mature sawtimber size class for any appreciable length of time before being treated. NFS lands would provide the vast majority of mature/old forest with non-NFS lands being in younger successional stages.

Alternative A

Direct and Indirect Effects

There would be no effect on suitable pileated woodpecker nesting habitat or feeding habitat on NFS lands within delineated home ranges.

Alternatives B and C

Direct and Indirect Effects

These alternatives would maintain suitable habitat to support pileated woodpeckers in 7 of the 8 home ranges (WL-11).

Proposed seed tree harvest treatment would render unsuitable ≈36 of the existing 109 acres of mature suitable nesting habitat in Home Range 4. This would result in insufficient suitable mature/old nesting habitat in Home Range 4.

In Home Range 3 ≈44 acres of the existing 507 acres of foraging habitat would be impacted by partial harvest. Approximately 463 acres of foraging habitat would be maintained as untreated. Due to the design features (i.e. snag retention levels), prescriptions (i.e. thinning), pileated woodpecker use of areas with 10% forest cover (Samson 2006), and information that indicates that cavity habitat and pileated woodpecker use can be maintained in partially treated stands (Quesnel and Steeger 2002), the 44 acres of partial harvest would retain their suitability as foraging habitat (albeit at a reduced level) and the suitability of the home range would be maintained.

In Home Range 8 ≈261 acres of the existing 663 acres of foraging habitat would be impacted by partial harvest. Approximately 402 acres of foraging habitat would be maintained as untreated. Due to the design features (i.e. snag retention levels), prescriptions (i.e. thinning), pileated woodpecker use of areas with 10% forest cover (Samson 2006), and information that indicates that cavity habitat and pileated woodpecker use can be maintained in partially treated stands (Quesnel and Steeger 2002), the 261 acres of partial harvest would retain their suitability as foraging habitat (albeit at a reduced level) and the suitability of the home range would be maintained.

Old Growth Associated MIS –Northern Goshawk

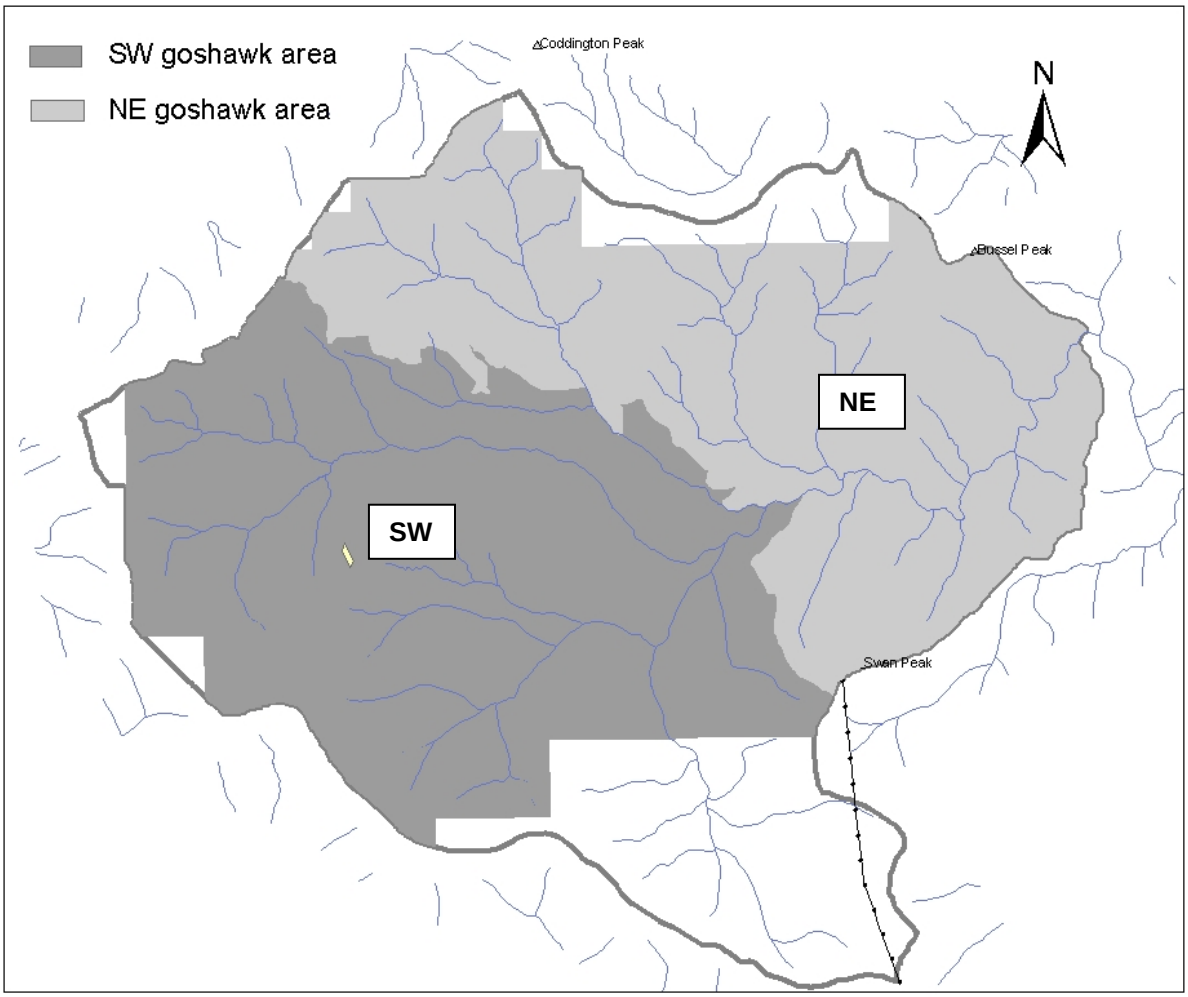
Goshawks use a variety of forest types, structures, and successional stages, and have been primarily associated with late-successional habitat. For nesting, goshawks utilize mature to old growth stands on gentle to moderately steep slopes (Kennedy 2003). Forest habitat that provides prey species and which is open enough to allow unimpeded flight through the understory is considered suitable for foraging.

The analysis of effects on goshawks uses direction in *Old-Growth Habitats and Associated Wildlife Species in the Northern Rocky Mountains* (USDA 1990), *Management Recommendations for the Northern Goshawk in the Southwestern United States* (Reynolds and others 1992), *Northern Goshawk, Northern Region Overview, Key Findings and Project Considerations* (Brewer et al. 2007), and *A Conservation Assessment of the Northern Goshawk, Black-backed Woodpecker, Flammulated Owl, and Pileated Woodpecker in the Northern Region, USDA Forest Service* (Samson 2006) to assess potential effects. The analysis is tiered to the analysis done for size class (see *Terrestrial Wildlife Habitat*).

Geographic Scope

Goshawk territory sizes range from approximately 1,235 to 9,880 acres (Samson 2006). Assessment areas of 5,000 acres at a minimum (USDA 1990) and 5,400 acres not including nest areas, post fledging area, and natural or created openings (Reynolds and others 1992) are recommended for evaluation of potential goshawk suitability. For this analysis two assessment areas within the wildlife analysis area were delineated based on topographic features and existing stand boundaries. These assessment areas represent hypothetical goshawk home ranges. For analysis purposes the assessment areas are entirely within the Bussel 484 Wildlife Analysis Area, actual goshawk home ranges may include areas outside of the analysis area.

Figure 3-10 Goshawk Analysis Areas



Management recommendations for each home range include approximately three suitable nest areas and three replacement areas (in a developmental phase) per home range and a mosaic of vegetation structural

stages in both an approximately 420-acre Post-fledging Family Area (PFA) and an approximately 5400-acre foraging area (Reynolds and others 1992).

Affected Environment

Based on literature descriptions (USDS 1990; Reynolds and others 1992; Kennedy 2003; Samson 2006, and Brewer and others 2007) and field verification of habitat, there is capable and suitable habitat available within the Bussel 484 Project Area; and goshawks are occasionally sighted within the wildlife analysis area. Surveys in the analysis area have not detected nesting goshawks (WL-22). There is a report of possible goshawk nesting activity in the analysis area (WL-44). Surveys will be scheduled for the area and if nesting is confirmed Design Feature 14. G. would be implemented.

Potential nest areas include: mature/sawtimber forest structure, old growth, and stands classed as immature with at least 20 trees per acre greater than 14 inches d.b.h.; these criteria are consistent with literature descriptions of nest habitat (USDS 1990; Reynolds and others 1992; Kennedy 2003; Samson 2006, and Brewer and others 2007) and direction (Brewer and others 2007). An additional criterion for percent slope < 40% was also applied in this analysis (USDA 1990). Although more restrictive than nesting criteria in some literature this criterion does not limit the suitability of the assessment areas based on availability of nesting habitat.

Table 3-81 Existing and Recommended Conditions for Goshawk

			Forage Area Vegetation Structure							
			Existing acres and % of the area				Management Recommendations			
Area	Area Acres	Potential Nest Areas*	Grass Shrub	Seed/ Sapling	Pole	Mid Old	Grass Shrub	Seed/ Sapling	Pole	Mid Old
Bussel 484 SW	6,487a	18+	119a 2%	462a 7%	816a 13%	5,089a 78%	10%	10%	20%	60%
Bussel 484 NE	5,704a	19+	173a 3%	488a 9%	367a 6%	4,676a 82%				

**The exact number of potential nest areas depends on how patches of at least 40 acres in size are counted. These values represent a minimum number based on a conservative approach when assessing nest areas.*

An assessment of conditions in an approximately 450-acre area surrounding each potential nest stand revealed that the SW area has 8 nest stands with hypothetical PFAs that meet recommendations for vegetative conditions and the NE area has 11 nest stands that meet the recommendations (WL-23).

Environmental Consequences

Common to All Alternatives

Direct and Indirect Effects

All alternatives would maintain middle-aged to old forest habitat (i.e. those with the higher forage value) in excess of the recommended 60% in each goshawk analysis area. All alternatives would maintain sufficient nesting habitat well distributed throughout each goshawk analysis area with potential PFAs (Table-3-81).

Cumulative Effects

Based on the availability of suitable habitat there would be no effect on goshawk populations in either of the goshawk analysis area. There would be no cumulative effects associated with this project or analysis area that would jeopardize populations of northern goshawks. This is based on the limited effects from this

project, the maintenance of suitable habitat and home ranges in the analysis area, and habitat estimates across Region 1 and the IPNF (Samson 2006).

Samson (2006) concluded that short-term viability of the goshawk in the Northern Region is not an issue for the following reasons:

- No scientific evidence exists that the northern goshawk is decreasing in numbers.
- Increases in the extent and connectivity of forested habitat have occurred since European settlement.
- Well-distributed and abundant northern goshawk habitat exists on today's landscape.
- The level of timber harvest (in 2004, 0.09% of the forested landscape in the Northern Region) is insignificant. The level of timber harvest in 2006 was 0.08% in the Northern Region and 0.14% on the IPNF.

A 2005 survey of nesting goshawks concluded that the frequency of goshawk presence in the accessible portion of R1 suggests that the goshawk is relatively common and well distributed in R1 (USDA 2006).

Consequently, none of the alternatives would likely result in appreciable adverse habitat modification or a perceptible change in populations of northern goshawks.

The following table summarizes the recommended habitat conditions for each goshawk analysis area and shows how each alternative compares to those conditions (WL-6).

Table 3-82 Goshawk Desired Condition, Existing, and Predicted

Habitat	Recommended	Alternative A		Alternatives B & C	
SW Area					
# Nest Areas	6*	8**		7**	
	% of area	Acres	%	Acres	%
Grass/Shrub	10	119	2%	119	2%
Seed/Sap	10	462	7%	704	11%
Pole	20	816	13%	816	13%
Mid/Old**	60	5,089	78%	4,847	75%
NE Area					
# Nest Areas	6*	11**		9**	
	% of area	Acres	%	Acres	%
Grass/Shrub	10	173	3%	173	3%
Seed/Sap	10	488	9%	650	11%
Pole	20	367	6%	367	6%
Mid/Old**	60	4,676	82%	4,514	79%

**Recommendation is for 3 suitable and 3 replacement (Reynolds and others 1992) and 6 (Brewer and others 2007)*

***nest areas with suitable PFAs*

Alternative A

Direct and Indirect Effects

This alternative would not impact forest habitat in either of the goshawk home ranges.

Alternatives B and C

Direct and Indirect Effects

In each alternative the amount of seedling/sapling size would move above recommended levels in both goshawk analysis areas. This is not expected to affect the suitability of the analysis area to support a breeding pair of goshawks - as evidenced by known active nests in areas with high percentage of seedling/sapling elsewhere on the District and the amount of immature sawtimber and sawtimber size classes retained. Goshawk foraging habitat will have sustainable and abundant prey when the majority of forage are in the older age classes (Reynolds and others 1992). Older age classes of forest structure provide the most prey species at higher population levels (ibid) and provide higher forage habitat values for goshawks (USDA 1990). There are approximately 133 acres in the SW Goshawk Analysis Area and approximately 342 acres in the NE Goshawk Analysis Area typed as sapling size class that will succeed to the pole size class within a few years (five years + or -). The proposed pre-commercial thinning would increase the rate at which this succession to pole size class stands occurs. Based on the higher forage value of immature sawtimber vs. sapling size classes and the impending succession of existing sapling stands the increase (short term) in seedling/sapling size class would not adversely affect the suitability of either analysis area to support goshawks - now or in the future.

Elk

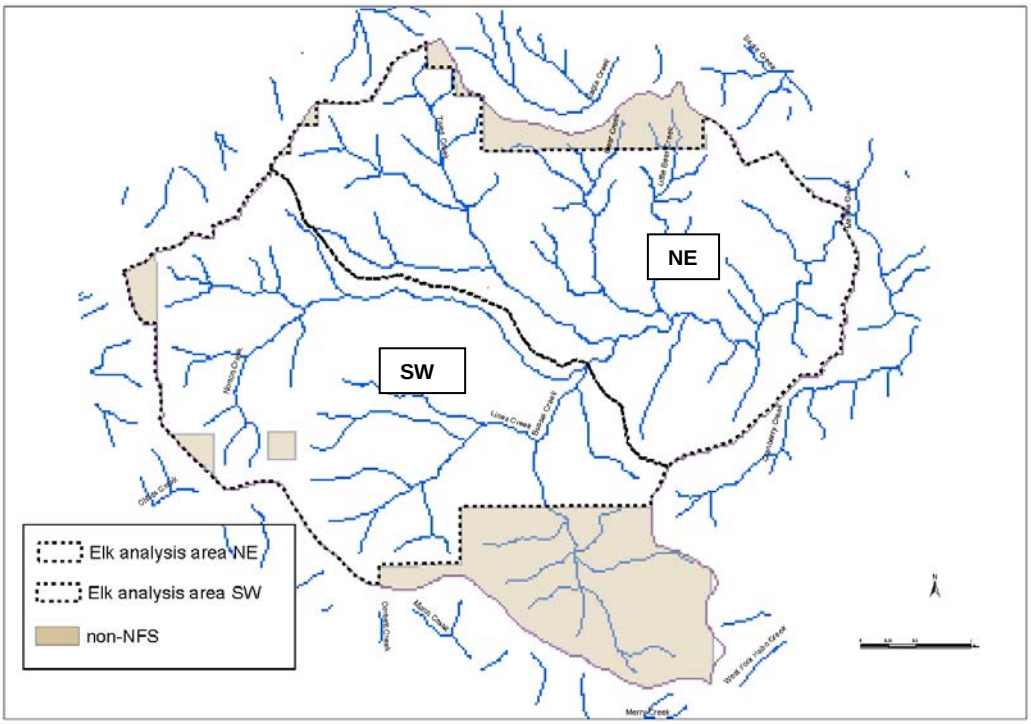
Elk are an important big game species within the analysis area. Elk were identified in the Forest Plan as general forest seral species easily affected by management activities. Land management activities, particularly timber harvest and associated roads affect elk habitat quality, potential elk use of habitat, and elk mortality from hunting.

Geographic Scope

The analysis area for elk was determined by considering the proposed actions, logical topographic boundaries (i.e. ridges and streams), ownership, and existing road systems. To display effects from Forest Service actions the analysis area was broken into two separate evaluation areas based on elk home range size. Due to the nature of the road system and their effects on elk, the elk analysis area includes more roads on private land than the wildlife analysis area. The effects on security from roads on adjacent non-NFS land not included in the analysis area are included in the analysis of effects.

The Bussel 484 Wildlife Analysis Area is in Elk Habitat Unit (EHU) 8, which includes the wildlife analysis area and the West Fork of Merry Creek. The two evaluation areas in Bussel 484 are used as the cumulative effects area and are discussed in context with EHU 8.

Figure 3-11 Elk Evaluation Areas



Methodology

To disclose how the proposed action and alternatives would affect elk and potential elk use of habitat, *Guidelines for Evaluating and Managing Summer Elk Habitat in Northern Idaho* (Leege 1984) was used. The procedure evaluates various factors affecting elk habitat quality such as road miles (and motorized trials [Wisdome and others 2004]), security acres, cover, forage, and other factors and assigns a numerical rating. This rating is used to determine elk habitat quality (expressed as a percent of potential elk use or Elk Habitat Potential - EHP).

If all habitat factors were in optimum abundance and distribution, habitat would be rated at 100% of potential. If the procedure calculates the habitat to be at 50% of potential, this indicates that the area can support 50% as many elk as it could if all factors were optimal.

Optimum conditions are rarely met - especially if roads are present. The most important factor usually regulating use of habitat by elk is disturbance by people. Most disturbance (and hunting mortality) is related to roads used by people on motorized vehicles (Leege 1984). Based on existing vegetation conditions (e.g. the amount and distribution of size classes) cover and forage do and would not reduce habitat conditions. Cover adjacent to roads does affect habitat use and is evaluated. To meet Forest Plan goals and objectives for elk habitat, EHP goals were established by District. The goal for the St. Maries District was set at .53. To distribute elk habitat potential a target of .49 was identified for EHU 8.

Affected Environment

Past disturbances, forest succession, the existing road systems, and present management of roads combine to affect existing elk habitat quality.

A portion of the wildlife analysis area is identified in the Forest Plan as big game winter range (i.e. MA-4). However, the analysis area is used by elk throughout the year. The analysis area is not used much as winter range and does not provide winter range of any importance (Spicer, per. comm., WL-46). Based on existing conditions, cover and forage and their availability do not limit big game summer habitat in the project area.

Areas that typically are used by elk (and other wildlife) for travel include ridges, riparian areas, and saddles. Areas in the wildlife analysis area that provide suitable conditions for travel have been mapped and considered in the development and design of the proposed action and alternatives (WL-9 & Design Feature 14. E.), see also the prior section on Connectivity.

The analysis area is not in any grazing allotment. However, cattle do occasionally wander into the analysis area but not to an extent that they conflict with elk (or any other wildlife). There is no appreciable cattle grazing in the project/analysis area and livestock effects on wildlife are not specifically addressed further.

A total of approximately 65.3 miles of road and trail affect potential elk use and security within the elk analysis areas. The following table displays the existing conditions for elk in the elk analysis areas (WL-14).

Table 3-83 Existing EHP and Security Acres by Elk Analysis Area

Elk Analysis Area	Elk Habitat Potential (EHP)	Security
SW Area	.34	0
NE Area	.41	0
Analysis Area	.38	0

The EHP on the St. Maries part of the District is above the goal of .53. The latest calculations put the number at .62. The EHP on NFS land in EHU 8 was calculated at .54 – above the target of .49. There has been no activity (e.g. road construction or changes in road status) that would reduce these values.

Environmental Consequences

Long-term impacts are displayed for the period following completion of proposed federal actions and cumulative actions - e.g. approximately 5-7 years following the decision (WL-14). Because of existing conditions (e.g. no security and use on most existing roads) there would be no appreciable difference between existing conditions and those that would occur during implementation of proposed activities, therefore, elk habitat conditions are not displayed for the time period during implementation.

Table 3-84 EHP and Security by Alternative

Area	Alternative A	Alternatives B & C
SW Area		
EHP	.34	.41
% Change	0	+19%
Security Acres	0	0
NE Area		
EHP	.41	.58
% Change	0	+48%
Security Acres	0	1,027
Analysis Area		
EHP	.38	.50
% Change	0	+32%
Security Acres	0	1,027

Alternative A

Direct and Indirect Effects

There are no present or reasonably foreseeable federal actions that would measurably affect big game habitat.

Cumulative Effects

There are no reasonably foreseeable actions in the analysis area or the rest of EHU 8 that would measurably affect big game habitat.

Alternative B & C

Direct and Indirect Effects

Following completion of all activity and implementation of proposed restoration actions, 1,027 acres of security would be created in the NE analysis area. The changes in access management would increase the EHP by 19% in the SW elk analysis area and (along with the created security) by 48% in the NE elk analysis area.

Cumulative Effects

There would be an increase of 1,027 acres in security and an increase in the EHP from .38 to .50 a 32% improvement for the combined Elk Analysis Area. This would increase the EHP in EHU 8 and maintain or improve slightly the EHP at the district level. Forest Plan goals and objectives for elk habitat would continue to be met on the district.

Threatened and Endangered Wildlife Species

The U. S. Fish and Wildlife Service (USFWS) identified three listed wildlife species that may occur on the Idaho Panhandle National Forests - Species list # 1-9-08-SP-0067, August 9, 2008 (WL-37):

- Canada lynx *(Lynx canadensis*)
- Grizzly bear *(Ursus arctos)*
- Woodland caribou *(Rangifer tarandus caribou)*

Species requiring analysis were identified based on the Species List, review of the area, a search of district records, scientific literature, and professional knowledge of the area. See Table 3-71 and *Rationale for No Further Analysis* section for additional discussion regarding analysis needs of listed species in the wildlife analysis area. The following table displays a synopsis of habitat and existing conditions.

The grizzly bear and woodland caribou do not occur in the project area (WL- 38, MacCracken and others 1994; USDI 1993; USDI 1996; and USFWS 1993). Based on species absence, the location of the project (outside of recovery areas), and the existing condition of habitat (i.e. low elevation, lack of remoteness), there would be no effect on grizzly bear or woodland caribou and no further discussion for those species is needed.

Table 3-85 Listed Wildlife Species

Common Name	Habitat	Existing Condition in the Assessment Area
Canada Lynx	Mesic conifer forests that provide a prey base of snowshoe hare (generally above 4,000' & in association with subalpine fir/spruce habitat types). Late and early successional stages.	Based on lynx habitat as currently mapped a portion of the WL analysis area is currently within a LAU.
Grizzly Bear	Large areas of undisturbed habitat. Low elevation riparian areas, meadows, snow chutes, shrubfields, grasslands, and open timbered stands.	Project area is not in a Grizzly Bear Management Unit or area of known grizzly bear use. No known or suspected suitable habitat in analysis area.
Woodland Caribou	Mature to old growth forests with dense canopies over a large elevation gradient. High elevation timbered ridges with abundant lichens.	The project area is outside of the woodland caribou recovery area. The species is not known or suspected on the St. Joe Ranger District.

Canada Lynx

Canada lynx occur in mesic coniferous forests that have cold, snowy winters and provide a prey base of snowshoe hare (Ruediger and others 2000). In the St. Joe River drainage lynx habitat generally occurs above 4,000 feet in subalpine fir forests or cedar/hemlock habitat types when in association with subalpine fir and spruce habitat types (ibid) - within approximately 200 meters (WL-25). Habitats that support their primary prey include early successional stages resulting from natural disturbance and timber harvest. Characteristics of foraging habitat include a dense, multi-layered understory that provides cover and browse at ground level and at varying snow depths throughout the winter. Multi-story mature or late successional forests with a substantial understory of conifers or small patches of shrubs and young trees also provide lynx foraging habitat.

The common component of natal den sites appears to be large woody debris. Den sites may be located within older regenerating stands or in mature conifer. For denning habitat to be functional it must be in or adjacent to foraging habitat (Ruediger and others 2000).

The *Canada Lynx Conservation Assessment and Strategy* (LCAS) (Ruediger and others 2000) provides an approach for management of lynx on federal lands and *Northern Rockies Lynx Management Direction* (NRLMD) *FEIS/ROD* incorporates goals, objectives, standards, and guidelines for management of lynx into the IPNF Forest Plan. As part of the programmatic planning standards, Lynx Analysis Units (LAUs) were delineated (ca. 2000) in collaboration with the USFWS to facilitate project planning. Based on potential vegetation in portions of the area

and our understanding of lynx habitat at that time, the Bussel 484 area was included in the Bussel Creek LAU (WL-15).

Unrelated to and independent of this proposed project the IPNF is close to finalizing the remapping of its lynx habitat. This effort was initiated (in 2006) by the increase in our understanding of lynx habitat and better information concerning existing primary vegetation/habitat since the initial mapping effort. The re-mapping process, a better understanding of lynx habitat, and the assessment of lynx habitat revealed - early in the re-mapping process - that some LAUs are not consistent with direction in the LCAS and that adjustments should be made. For example, the Bussel Creek LAU contains approximately 1,680 acres of primary vegetation – i.e. subalpine fir (WL-16). This is not consistent with the LCAS guideline which states that 10 mi^2 (6,400 acres) of primary habitat should be present within each LAU to support lynx survival and reproduction.

Prior to and independent of finalizing the lynx habitat re-mapping across the Forest, the quantity and distribution of lynx habitat within the Bussel 484 Project Area was reassessed in coordination with the USFWS (WL-27). The reassessment was based on the original mapping protocols in 2000 and - as stated previously - the Bussel Creek LAU did not provide sufficient subalpine fir habitat. To facilitate the Bussel 484 analysis based on the best available information, the reassessment resulted in dropping the old Bussel Creek LAU and re-delineating the existing Grandmother Mountain LAU to incorporate the lynx habitat in the Bussel 484 area (See Figure 3-12). This resulted in improved consistency and compliance with the mapping directions contained in the LCAS (e.g. at least 6,400 acres of primary vegetation should be present in each LAU).

The ongoing remapping of lynx habitat, the pending issuance of the NRLMD, and the state of flux relative to lynx management (e.g. quantity and distribution of lynx habitat and changes in standards) resulted in development of the proposed action and alternatives with the knowledge that some aspects of the proposal(s) may need to be modified. Now that the remapping is nearing finalization and the NRLMD is in effect the associated issues with lynx management relative to the project have become clearer. This entailed modifications of the proposed action during developement. This analysis and the modifications of the proposed actions are based on consistency with the NRLMD (and protecting lynx) regardless of the final lynx habitat remapping.

Standards and guidelines established by the NRLMD for vegetation management activities apply to the lynx habitat (i.e. primary vegetation and secondary vegetation within ≈200 meters of primary) in that portion of the analysis area in an LAU, those that are most pertinent to effects from the proposed action(s) include:

- Limit unsuitable habitat (i.e. structural stage that does not yet provide winter snowshoe hare habitat) in each LAU to ≤30%,
- Do not regenerate more than 15% of lynx habitat on NFS lands within an LAU in a ten-year period,
- Pre-commercial thinning in lynx habitat when stands provide winter snowshoe hare habitat is limited to daylight thinning planted rust-resistant white pine where 80% of the winter snowshoe hare habitat is retained,
- Do not manage vegetation in multi-story mature or late successional stands so that winter snowshoe hare habitat is reduced.

Affected Environment

Approximately 6,300 acres of the southern portion of the analysis area are included in the Grandmother Mt. LAU. This area contains ≈3,520 acres of lynx habitat (WL-18) – i.e. primary vegetation and secondary vegetation within ≈200 meters of primary vegetation (Figure 3-13).

Table 3-86 displays the existing condition in the Grandmother Mt. LAU (WL-19).

Table 3-86 Lynx Habitat Existing Condition in the Grandmother Mt. Lynx Analysis Unit

LAU	LAU acres (% federal)	% Unsuitable	Unsuitable last 10 years
Grandmother Mt.	31,386 (≈96+%)	<1%	<1%

Figure 3-12 Lynx Analysis Units Mapping Changes

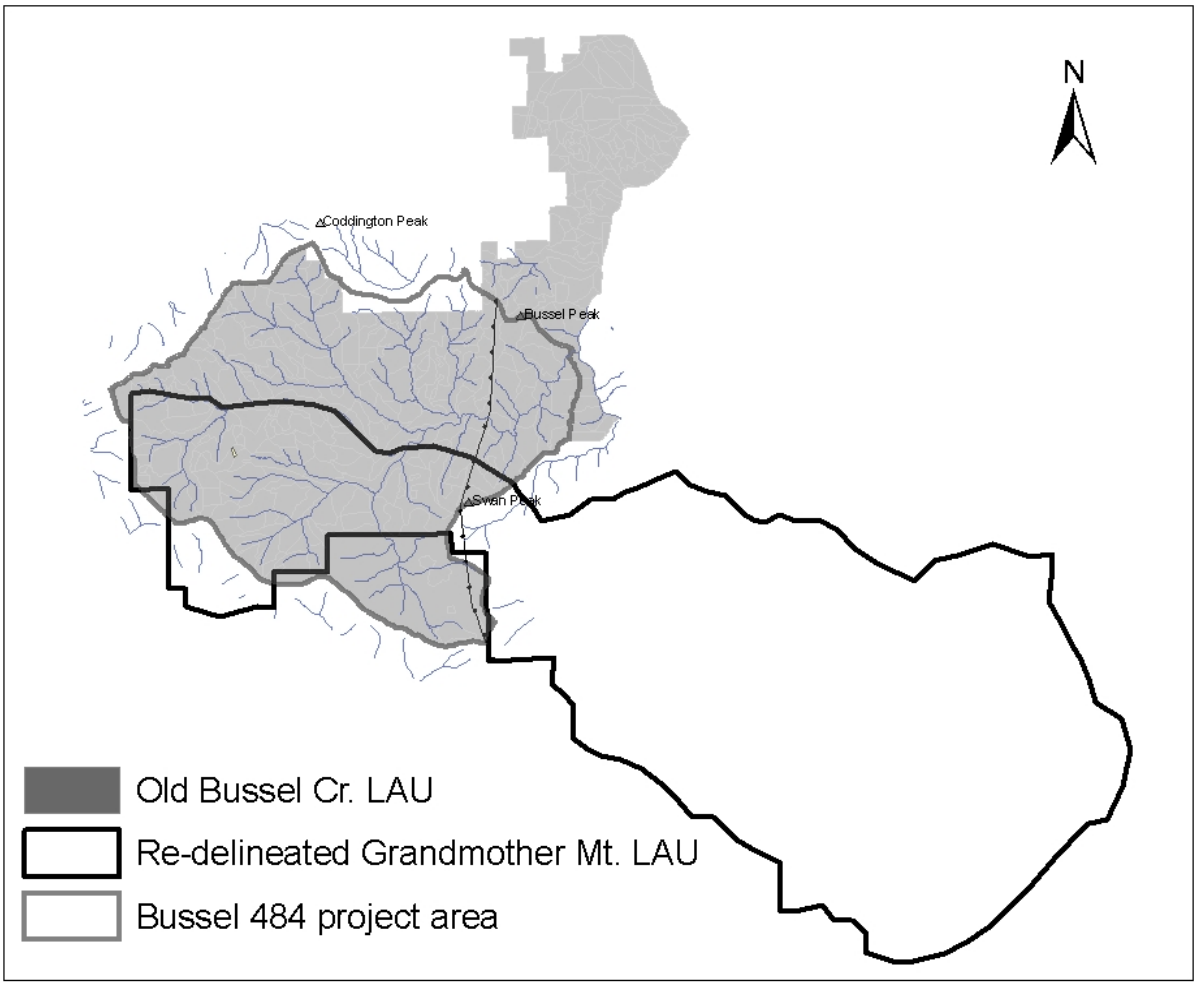


Table 3-87 Proposed TSI in Lynx Habitat

Stand	Acres		Stand	Acres
48401035	48		48402052	46
48402002	7		48402057	35
48402012	33		48402115	19
4802040	17		48403045	41
Total acres			246	

Environmental Consequences

Table 3-87 displays the proposed pre-commercial thinning/pruning stands in lynx habitat. The thinning/pruning prescription for these stands would be limited to daylight thinning around individual planted rust-resistant white pine where 80 percent of the winter snowshoe hare habitat is retained. This treatment would be consistent with the standard for pre-commercial thinning in the NRLMD ROD (WL-26).

Figure 3-13 Lynx Habitat within the Bussel 484 Project Area

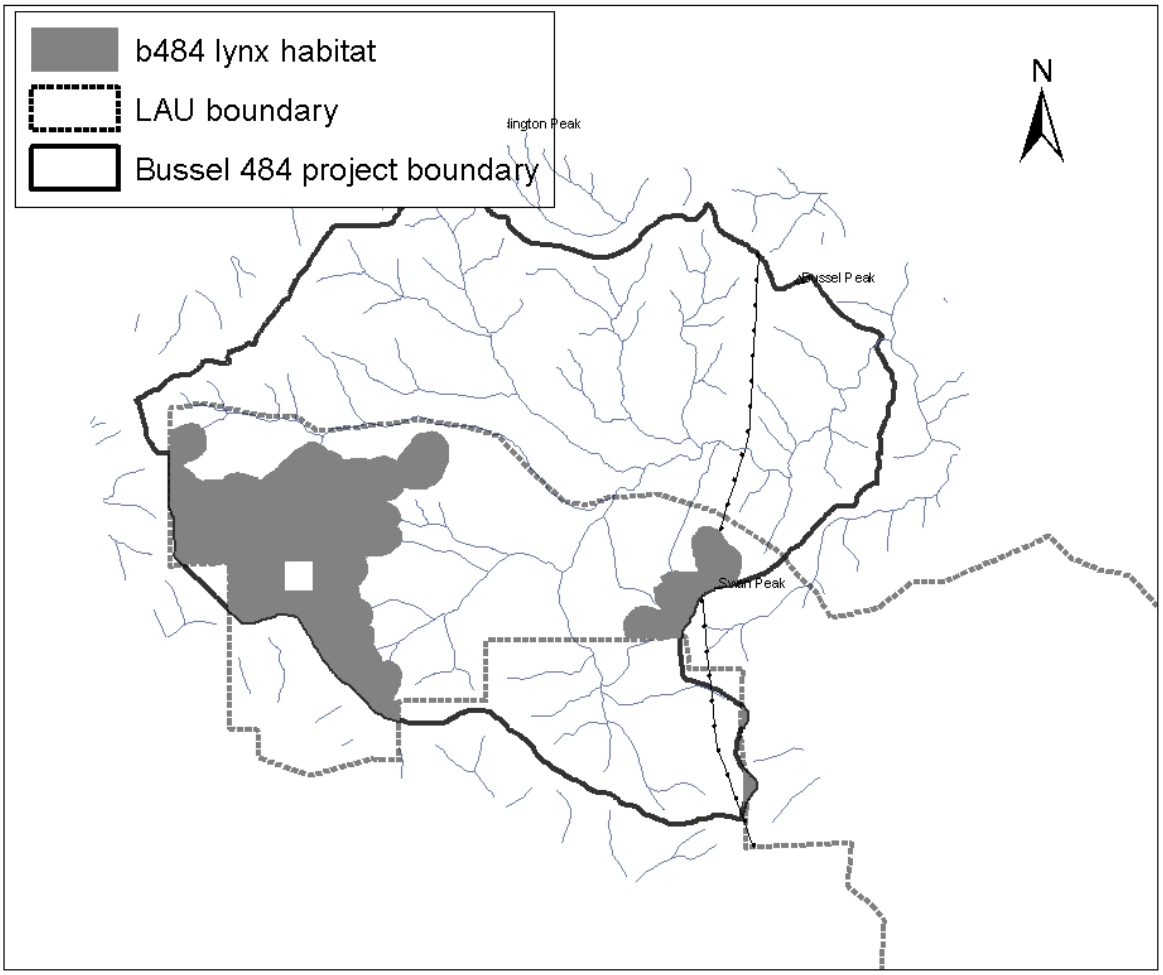


Table 3-88 displays the proposed harvest units totally or partially in lynx habitat. These units have been field reviewed and it has been determined that the existing stand conditions do not provide snowshoe hare habitat in multistory forest stands (WL-43). Treatment of these units would be consistent with the standard in the NRLMD ROD that limits vegetation management that reduces winter snowshoe hare habitat in multistory forests to certain exceptions.

Table 3-88 Proposed harvest Units Totally / Partially in Lynx Habitat

Unit	RX	Acres	Acres in Lynx Habitat	Regeneration Harvest Acres
153	CCWR	10	2	2
182	CT	18	8	
197	CT	18	15	
200	CT	14	4	
215	CT	28	25	
232	GSW	54	54	27
271	CT	27	14	
283	CT	61	20	
295	CCWR	13	13	13
301	GSW	62	33	17
310	CT	27	9	
322	CCWR	40	40	40
	Totals	372	237	99

Alternative A

Direct and Indirect Effects

There are no current or reasonably foreseeable federal actions in the analysis area that would measurably affect lynx or their habitat.

Cumulative Effects

There are no reasonably foreseeable actions in the analysis area or the Grandmother Mt. LAU that would adversely affect lynx or their habitat. The Grandmother Mountain land exchange would – when finalized – add approximately 1,080 acres of land to the federal land base in the LAU. This may result in a minor reduction in the potential for impacts on lynx from activities on non-federal land (WL-49).

Alternative B & C

Direct and Indirect Effects

Twelve proposed harvest units are partially or completely within potential lynx habitat (Table 3-88, WL-20). A total of approximately 238 acres of lynx habitat would be impacted. One hundred acres would receive some form of regeneration harvest and would become unsuitable lynx habitat until regenerating trees become big enough to provide habitat. The remaining 138 acres proposed for harvest would be thinned and would not become unsuitable lynx habitat. Given the existing condition of the Grandmother Mt. LAU, unsuitable habitat would remain well below 30% of the LAU and the alternatives would not regenerate more than 15% of the LAU in a 10 year period (see Table 3-86).

There would be no pre-commercial thinning in potential lynx habitat other than daylight thinning of planted rust resistant white pine where 80% of the winter snowshoe hare habitat is retained. The daylight thinning on 246 acres (Table 3-87) may reduce some habitat effectiveness but would not appreciably affect lynx occurrence or use of habitat; and the treatment is consistent with the standard in the NRLMD ROD that limits vegetation management that reduces snowshoe hare habitat in multistory forests to certain exceptions – including this activity.

No vegetation management would occur in multi-story mature or late successional stands that provide snowshoe hare habitat (WL-21). The 12 proposed harvest units in lynx habitat have been field reviewed and determined to not be multi-storied mature or late successional winter snowshoe hare habitat (WL-21). This determination is based on the lack of horizontal cover in the stands. Treatment of these units would be consistent with the standard in the NRLMD ROD that limits vegetation management that reduces snowshoe hare habitat in multistory forests.

All alternatives are consistent with the *Northern Rockies Lynx Management Direction* and the *Canada Lynx Conservation Assessment and Strategy* (WL-26).

Sensitive Wildlife Species

Sensitive species are determined by the Regional Forester (FSM 2670.5) and are those species for which population viability is a concern. The IPNF Forest Plan goal for sensitive species is to manage habitat to maintain populations of identified sensitive species.

The ICB Assessment found that species that are likely in decline (includes many Sensitive species) are associated with landscape and habitat components that are declining. Forest Plan direction for the Idaho Panhandle National Forests (IPNF) states that habitat of sensitive species will be managed to prevent further declines in populations which could lead to federal listing.

This analysis identified capable and suitable habitat based on the latest scientific literature for each species and data in the TSMRS/FSVeg databases. Impacts on acres of suitable habitat are measured by alternative and discussed for each species.

Sensitive species on the Regional Foresters list (WL-47) were screened for their relevancy to the wildlife analysis area and the proposed action. See the Species Relevance Screen (Table 3-71) and the *Rational for No Further Analysis* section earlier in this document.

Based on species occurrence, habitat capability and suitability, and the likelihood or risk of potential impacts on habitat and the species, there would be no impact on species identified in the Species Relevancy process as needing no further analysis.

Table 3-89 displays the sensitive species that require further analysis, a brief description of their habitat, and comments regarding capable/suitable habitat in the analysis area.

Table 3-89 Sensitive Wildlife Species and Habitats

Common Name	Habitat	Comments
Gray Wolf	Large areas with high prey densities, isolation from human activities, and availability of den and rendezvous sites.	Wolves are known to occur in the analysis area.
Fisher	Mature and old growth forests (riparian linkages)	Suitable habitat available within wildlife analysis area. Marten occupy similar habitat.
Wolverine	Areas of adequate food supply in large remote areas	Limited capable or suitable habitat in wildlife analysis area.
Black-backed woodpecker	Conifer forests, dead/dying trees from fire or insect/disease	Suitable/source habitat available in the wildlife analysis area
Coeur d'Alene salamander	Fractured rock, seeps, waterfall spray zones, & stream sides	Limited capable or suitable habitat in wildlife analysis area, no known micro-sites or occurrences.
Western toad	Breed in lakes, ponds, streams and persistent water sources	Potential habitat present in wildlife analysis area

Gray Wolf

Wolves were recently de-listed as a T&E species under the ESA. They are now considered a sensitive species by the Forest Service in Region 1.

Historically wolves were distributed throughout most of Idaho in unknown populations. Wolf packs of four to ten animals appear to have ranged widely in the mountains of northern and central Idaho. A decline of native ungulates, control programs designed to eradicate wolves, and conflicts with livestock and humans caused the decline of wolf populations in Idaho and led to the absence of a breeding population in Idaho (Hansen 1986).

Wolves exhibit no particular habitat preference. High prey densities, particularly big game, and minimal conflict with human interests and uses characterize wolf habitat. Other important habitat features for wolves include den and rendezvous sites (Hansen 1986). Dens are commonly located on southerly aspects of moderately steep slopes usually within 400 yards of surface water and tend to be located away from sources of human disturbance such as roads and campsites (USFWS 1987). Rendezvous sites are usually complexes of meadows and adjacent hillside timber (ibid.).

Human disturbance (measured by the density of roads/trails with the greatest impact on wildlife) and prey availability (measured by EHP) are used to disclose potential effects in this analysis.

Affected Environment

The analysis area falls within an area with documented wolf activity (W-29; Nadeau and others 2007). There are no known den sites in the analysis area; however, there are two sites suspected of being used as rendezvous sites (Spicer, per. comm.). The area was not identified as a “dispersal corridor” or as a “key area for wolf conservation” (Hansen 1986) nor as a linkage zone (Servheen and others 2003).

The existing road/trail density in the analysis is 3.4 mi/mi^2. The potential elk use value in the analysis area is .38.

Environmental Consequences

Table 3-90 Road Density and Prey Availability by Alternative

	Alternative A		Alternative B		Alternative C	
	Miles	Mi/Mi^2	Miles	Mi/Mi^2	Miles	Mi/Mi^2
Motorized Roads	62	3.2	35.2	1.8	35.2	1.8
Motorized Trails	3.4	.2	6.8	.4	5.4	.3
Total road/trail miles	65.4	3.4	42	2.2	40.6	2.1
EHP	.38		.50		.50	

Common to All Alternatives

Cumulative Effects

Reintroduction of wolves in Idaho has resulted in a population estimate of 633 wolves in Idaho (Nadeau and others 2007) and they have been removed as a listed species under the ESA. The federal actions evaluated in this proposal would not add to any adverse cumulative effects nor contribute to the loss of populations or adversely affect critical or important habitat for gray wolves. This conclusion is based on the analysis of direct and indirect effects presented in the evaluation, design features which would avoid adverse impacts (e.g. maintenance of corridors/linkages), the envisioned impacts on land management from wolf reintroduction, the likelihood and nature of occurrence of wolves, and the relative lack of preference for special habitat exhibited by wolves.

Alternative A

Direct and Indirect Effects

There are no present or reasonably foreseeable federal actions that would measurably affect road densities, prey availability, or wolves.

Cumulative Effects

There are no reasonably foreseeable actions in the analysis area or the surrounding landscape that would measurably affect road densities, prey availability, or wolves.

Alternative B & C

Direct and Indirect Effects

The proposed action(s) would not significantly affect the forest structure component of habitat or interrupt any linkages or connections between habitats. Following completion of all activity and implementation of proposed restoration actions, road densities would decrease and prey availability (as measured by EHP) would increase in the analysis area.

The activities associated with these alternatives (e.g. timber harvest) may disturb wolves in the analysis area. There is a possibility of disturbance near a homesite (den or rendezvous sites); however, no den sites are known. The disturbance could result in abandonment of the homesite and adversely affect the vulnerability (e.g. abandonment, predation, accident) of any pups present. Disturbance at or near a rendezvous site is not of great concern as by the time they are using rendezvous sites any pups would be big enough and mobile enough to move away from the disturbance with little affect on their vulnerability. Recent research (Frame and others 2007) suggests that disturbed homesites are re-used and disturbance of homesites did not influence reproductive success. Disturbance of any rendezvous site in the wildlife analysis area is not of major concern (Spicer, per. comm.) and would have no significant affect on wolf populations.

The wolf population in Idaho has continued to expand since initial reintroduction in 1995. By the end of 2006 the Idaho population was estimated at 673 (Nadeau and others 2007) and recovery objectives have been met. This proposed project would have no substantive effect on the Idaho wolf population. Proposed activities are not expected to influence reproductive success or affect populations of wolves.

Cumulative Effects

There are no reasonably foreseeable actions in the pack use area that would add to the direct and indirect effects from the proposed action(s).

Fisher and Marten

Fisher and marten occupy similar habitat (Ruggiero and others 1994) and are included in the same group based on habitat as defined by vegetation cover types and structural stages (Wisdom and others 2000). Given the mesic nature (e.g. as evidenced by habitat types – see Table 3-37 in the Vegetation Section) of the analysis area the overlap of fisher and marten habitat in the wildlife analysis area is especially marked. Potential impacts are analyzed for both species using the same methodology (the marten is a MIS and not a sensitive species but is addressed in this section of the document).

Fisher is a Species of Greatest Conservation Need under the Idaho Comprehensive Wildlife Conservation Strategy (Idaho Department of Fish and Game 2005). They prefer late-seral stage coniferous and mixed forest habitat. Fisher use riparian habitats as resting sites and extensively for travel. Fisher appear to avoid high elevations (> 4,000 ft.) and non-forested areas (Ruggiero and others 1994). Extensive alteration of forest structure through logging (i.e. reduction in canopy closure, snags, and down woody material) may reduce its habitat value for fisher (Heinemeyer and Jones 1994).

Marten associate closely with late-successional stands of mesic conifers (Ruggiero and others 1994) where suitable conditions are found; however, suitable conditions for marten may also be found in mid-seral stages (Coffin and others 2002). In the western United States martens are most abundant in mesic mature to over-mature spruce-fir forests where small mammal prey species are most abundant (USDA 1990). In general, marten prefer forest stands with greater than 40 percent tree canopy closure and with large, down logs; stumps; and snags which provide access to prey under the snow and denning sites. Use or selection of riparian zones by marten has been reported in the literature (Ruggiero and others 1994).

Methodology

The analysis uses management guidelines from *Fisher Biology and Management in the Western United States* (Heinemeyer and Jones 1994). The percent of the area in mature/old forest structure (i.e. suitable habitat) is displayed and compared to the guidelines. Changes from the existing condition relative to guidelines for forest structure are discussed. The goal at the scale of this analysis (i.e. the Bussel 484 Wildlife Analysis Area or "subdrainage") is to maintain functional home ranges (Heinemeyer and Jones 1994).

Fishers (and marten) are vulnerable to trapping (Heinemeyer and Jones 1994). The Forest Service has no jurisdiction concerning trapping; and it is beyond the scope of this project analysis. High quality habitats for fisher are not necessarily strongly associated with low levels of human populations and roads (Carroll and others 2001). However, road densities are associated with vulnerability (to trapping) and changes in road density are displayed.

Affected Environment

Vegetation/Habitat

Late-successional habitat is an essential component of forest carnivore habitat. The physical structure of the forest appears to be more important for fisher and marten than the species composition (Ruggiero and others 1994).

Habitat management considerations for fisher and marten emphasize maintaining late-successional forest habitat. Mature riparian forest is especially important for denning sites and travel ways for fisher. Based on habitat requirements, the quality, amount and distribution of late successional forest habitat within the drainage is considered the most important factor for fisher and marten.

There are approximately 12,184 acres of capable fisher/marten habitat in the Bussel 484 Wildlife Analysis Area (WL-3). There are 2,779 acres of mature/sawtimber size habitat and approximately 2,588 acres that provide currently suitable fisher/marten denning habitat.

The existing condition of forested habitat on NFS lands in the Bussel 484 Wildlife Analysis Area and the guidelines for forest structure by subdrainage are displayed in the following table.

Table 3-91 Guidelines for Forest Structure

Forest Structure	Existing Condition*		Subdrainage Guidelines		
			High Quality	Moderate Quality	Low Quality
Mature/Sawtimber	2,779a	23%	65-75%	>40%	30-40%
IMSA	7,024a	57%	10-25%	na**	na
Pole/sapling	2,172a	18%	10-25%	na	na
Open/seed	293a	2%	na	na	na

** % of capable habitat in the wildlife analysis area*
*** not applicable – no guidelines identified*

Based on the amount of mature/sawtimber forest structure, the existing condition of the Bussel 484 Wildlife Analysis Area is below the criteria needed for a low-quality subdrainage. This is due primarily to the fire and harvest history that results in the majority of the stands being classified as immature sawtimber. See the discussion in the *Forest Vegetation* section of this chapter.

In addition to the 2,779 acres of mature/sawtimber habitat, approximately 4,246 acres of immature sawtimber size forest stands have a number of large trees (>20/acre at least 14-15 inches d. b. h.) that may also provide suitable fisher/marten habitat (WL-3). Based on field review some of these stands appear to provide suitable habitat for fisher/marten. Based on these figures, there are as many as 7,025 acres (58% of NFS capable habitat) of suitable fisher/marten habitat in the wildlife analysis area. When these additional stands are considered, the existing condition of the analysis area would meet the criteria for a moderate-quality subdrainage. Preliminary survey data for fisher and marten have detected fisher presence ≈2 miles from the analysis area and marten presence ≈6 miles from the analysis area. The analysis is based on the impacts on mature/sawtimber and immature sawtimber sized stands.

The landscape surrounding the analysis area to the southwest and west around to the northeast is primarily non-NFS land that does not or likely will not provide much mature or late successional forest within the foreseeable future.

Impacted riparian zones are also affecting existing fisher/marten habitat. See the previous section on riparian habitat for further discussion on effects on riparian habitat.

Access/Vulnerability Risk

Trapping-vulnerability risk has been cited as one of the factors affecting forest carnivores in Idaho (Heinemeyer and Jones 1994). However, human impacts (e.g. roads) have not been significant variables in regional-scale models (Carroll and others 2001). Roads are correlated with trapping vulnerability and human disturbance. In areas having fisher or marten trapping seasons road densities greater than or equal to 1 mi/mi2 road densities have a high risk to trapping vulnerability for fisher. It should be noted that marten are legally trapped in Idaho.

Roads and trails used by motorized vehicles have the greatest impact on wildlife (Wisdom and others 2004; Gaines and others 2003) and provide the most access for trapping. The existing motorized road/trail density in the Bussel 484 Wildlife Analysis Area is 3.4 mi/mi2.

Environmental Consequences

Vegetation/Habitat

Table 3-92 Acres and Percent of Forest Structure by Alternative

Forest Structure	Alternative A		Alternatives B & C	
Mature/Sawtimber	2,779a	23%	2,613a	21%
Immature Sawtimber	7,024a	57%	6,791a	55%
Pole/Sapling	2,172a	18%	2,172a	18%
Open/Seed	293a	2%	722a	6%

Access/Vulnerability Risk

Table 3-93 Effects on Road Density (miles/mile2)

	Alternative A	Alternative B	Alternative C
Road/Trail Density	3.4	2.2	2.1

Common to All Alternatives

Cumulative Effects

Succession of immature sawtimber stands would at some undetermined future date result in a minimum of 77% of the analysis area in mature/sawtimber. This would meet the criteria for a high-quality subdrainage. Road density remains at a level considered a high risk to trapping vulnerability. However, in all action alternatives there is a reduction in road/trail densities and human-impacts (e.g. roads) have not been significant variables in regional-scale models (Carroll and others 2001).

Alternative A

Direct and Indirect Effects

This alternative would not affect suitable mature forest habitat.

Alternative B

Direct and Indirect Effects

A total of approximately 256 acres (255 acres harvest and 0.4 acres road construction) of mature forest and 1,891 acres (1,889 harvest and 2 road construction) of young forest (immature sawtimber and pole-size stands) would be impacted. This would reduce mature forest habitat by 167 acres (166 acres from harvest and 0.4 acre from road construction) and reduce immature sawtimber (i.e. young forest) by 235 acres (233 from harvest and 2 from road construction). The 89 acres of partial harvest in mature forest would result in a total or partial loss of suitable fisher/marten denning habitat until the habitat attributes (e.g. down wood) are restored (e.g. succession). The 1,656 acres of partial harvest in immature sawtimber forest would retain the future suitability of the treated stands.

Wolverine

Wolverines are low-density, wide-ranging species that inhabit remote forested areas, ranging over a variety of habitats (Ruggiero and others 1994). They have been found to be associated with alpine vegetation, alpine climatic conditions, or relatively high probabilities of spring snow cover (Aubry et al. 2007). In central Idaho they prefer subalpine habitats (Copeland et al. 2007). Resident female wolverine home ranges in Montana and Idaho range from 11.6 mi^2 to over 300 mi^2. Wolverines tend to use lower elevations in winter and higher elevations in summer when they provide the greatest potential food supply (Hornocker and Hash 1981). The proximity of rocky areas such as talus slopes/boulder fields for den sites is important for wolverines in Idaho (Ruggiero and others 1994).

The availability of large mammal (i.e. ungulate) carrion as food is important for the distribution, survival, and reproductive success of wolverines (Ruggiero and others 1994). Wolverine presence appears to be associated with low human occurrence/access.

Factors with the potential to threaten local population viability of the species include reduction of "wilderness refugia" (large areas of habitat with limited human access) or natural reserves and food availability (Ruggiero and others 1994).

Management objectives for wolverine at the drainage level primarily involve maintaining quality habitat by managing road systems to limit disturbance and reduce risk of displacement during critical wolverine denning periods.

Affected Environment

The territory size requirements, lack of rocky areas, relatively low amount of subalpine vegetation, and existing access in the wildlife analysis area and adjacent drainages preclude other than incidental occurrence within the wildlife analysis area. The existing road/trail density in the wildlife analysis area is 3.4 mi/mi^2.

Environmental Consequences

Common to All Alternatives

Direct and Indirect Effects

Due to the lack of habitat, there would be no disturbance of potential denning habitat. Based on existing human access, changes in road density would have little to no beneficial effect on wolverine habitat.

Cumulative Effects

No proposed Forest Service action would add to existing effects on wolverine habitat. High road densities from past and present activities in the wildlife analysis area and the surrounding landscape would continue to limit the suitability of the area as wolverine habitat.

Black-Backed Woodpecker

Black-backed woodpeckers nest in snags or in live trees with heart rot. They feed primarily on wood-boring beetles and respond to insect outbreaks in conifer forests from either wildfire or other disturbances (Hutto 1995; Samson 2006). Breeding densities of black-backed woodpeckers vary considerably in response to prey availability. They are specialists in exploiting recent forest fires, especially for the first three to five years after burning, and rapidly utilize new burns (Hutto 1995). It has been suggested that black-backed woodpeckers may be well distributed but relatively uncommon in the more natural landscape (Bonn and others 2007) where older forests and small disturbances provide habitat. Lodgepole pine has also been identified as source habitat (Wisdom and others 2000).

Affected Environment

Black-backed woodpecker surveys have been conducted in the St. Joe Ranger District, and their presence has been confirmed. Based on literature descriptions and field verification of habitat, there is capable and suitable habitat available within the Bussel 484 Project Area. Distribution of black-backed woodpeckers is presumed to coincide with existing stands of mature and old forest structure and lodgepole pine (pole size and larger) that provide the highest potential habitat (Wisdom and others 2000, Bonn and others 2007). In the analysis area they are suspected of occurring at levels comparable with other areas on the Forest and District.

The wildlife analysis area contains 2,779 acres of mature/sawtimber size stands and an additional 179 acres of lodgepole pine pole size or larger (WL-3) that is considered source habitat (total of 2,958 acres). There have been 3 fires in the last five years totaling approximately 3.5 acres (3 acres, 0.3 acres, and < 0.25 acres) that are providing some level of post fire habitat (WL-28). During the fire season of 2007 a wildfire burned in the analysis area and created a mosaic of fire-killed trees on approximately 65 acres (FF-5 and WL-35).

Current fire suppression policy is not conducive to the creation of large areas of fire-killed trees in the project area. Insect and disease infestations in the project area are at or near naturally occurring endemic levels (see *Forest Vegetation* section).

Environmental Consequences

Treatment in mature/sawtimber size stands and lodgepole pine forest types would impact habitat for black-backed woodpeckers (WL-6). For the purposes of this analysis all vegetative treatments are displayed as an adverse effect on existing suitable habitat. However, prescribed burning for fuels treatment of activity-created fuels would have a likelihood of improving habitat for black-backed woodpeckers by providing fire-killed trees. It is reasonable to expect mortality of some trees retained after harvest, and these changes will also be displayed.

Alternative A

Direct and Indirect Effects

This alternative would have no impact on habitat for black-backed woodpeckers.

Alternatives B and C

Direct and Indirect Effects

Table 3-94 Effects on Black-Backed Woodpecker Habitat

Adverse Impacts		Beneficial Impacts			
		Rx Burning Acres			
	Acres of Source Habitat Treated		Broadcast	Jackpot	Broadcast Openings
Mature/Old	255	CCWR/ST	130		
Lodgepole Pine	0	GSW			544
Total	255	CT		283	

Common to All Alternatives

Direct and Indirect Effects

Succession would continue on untreated pole size and larger stands and improve their suitability as black-backed woodpecker habitat.

A minimum of 2,703 acres (91%) of existing source habitat would be maintained. In addition, all proposed treatment units would retain snags at levels intended to maintain viability of cavity dependent species.

Based on the limited effects from this project, the level of suitable habitat maintained and/or improved, and estimates of existing habitat across Region 1 and the IPNF (Samson 2006) no alternative would adversely impact black-backed woodpecker populations.

Cumulative Effects

Historically wildfire in the drainage would have created stands of fire-killed trees at periodic intervals. It is reasonable to assume that the suppression of fires in the St. Joe River Drainage and wildlife analysis area has reduced both habitat quantity and quality that would have been present. It is also reasonable to assume that suppression of nonprescription fires would continue. This would continue to affect the availability of high quality habitat for black-backed woodpeckers.

Less than one acre of allocated potential old growth would be impacted. Retention of snags at levels in the design features would maintain some habitat value for black-backed woodpeckers in partially treated stands (albeit at a lower level). The proposed federal action would not contribute to adverse impacts on black-backed woodpecker populations within the project area or at a landscape level (see also direct and indirect effects section).

Samson (2006) concluded that short-term viability of the black-backed woodpecker in the Northern Region is not an issue for the following reasons:

- No scientific evidence exists that the black-backed woodpecker is decreasing in numbers.
- Increases in the extent and connectivity of forested habitat have occurred since European settlement.
- Increases in amounts of small and mid-size trees have increased since European settlement.
- Well-distributed and abundant blacked-back woodpecker habitat exists on today's landscape.
- The level of salvage timber harvest (in 2004, 1210 ha of 2,276,588 ha or 0.05%) or overall timber harvest (0.09% of the forested landscape in the Northern Region) is insignificant.

Bonn and others (2007) concluded that habitat for the black-backed woodpecker is increasing in the region due to insect outbreaks, fire, and a decrease in the salvage of dead trees; and that more than 30,000 acres of black-backed woodpecker habitat needed to maintain viability is maintained on the National Forests in the Northern Region, with 309,616 acres on the IPNF alone.

Consequently, none of the alternatives would likely result in appreciable adverse habitat modification or a perceptible change in populations of black-backed woodpeckers.

Coeur d'Alene Salamander

Coeur d'Alene salamanders are restricted to cool damp aquatic habitats that have thermal and hydric stability. The species has been found in three major types of habitats in northern Idaho: spring seeps, waterfall spray zones and along stream edges between 1,800 to 3,500 feet elevation. Known populations occur in association with sharply fractured rock formations in conjunction with both persistent and intermittent surface water (Cassirer and others 1994). These conditions are critical for Coeur d'Alene salamanders since they respire through the skin and lose water to the environment through evaporation.

Affected Environment

There are no known salamander sites in the Bussel 484 Wildlife Analysis Area. In general, the geology of the wildlife analysis area is not conducive to habitat for Coeur d'Alene salamanders (e.g. very little fractured rock associated with springs/seeps and stream sides). Given that there are no known sites in the drainage and the small amount of capable/suitable habitat, Coeur d'Alene salamanders are considered relatively uncommon compared to other areas on the St. Joe District.

Environmental Consequences

Direct and Indirect Effects Common to All Alternatives

Based on the lack of known sites, the small amount of capable habitat, and the design features (RHCA buffers) there would be no direct or indirect effects on known salamander sites. It is unlikely that any habitat would be impacted by activities. The alternatives differ in their potential adverse impacts from road construction, timber harvest, etc. However, the risk to the species and habitat is negligible because of the inherent limited presence of capable habitat.

Cumulative Effects Common to All Alternatives

There would be no additional effects on Coeur d'Alene salamanders or suitable habitat from any current or reasonably foreseeable federal action. The same inherent lack of capable habitat that limits the potential for adverse impacts on salamander habitat on NFS land also applies to all lands in the analysis area. Cumulative adverse impacts that would affect populations are unlikely.

Western Toad

Western toad breeding habitat includes shallow, quiet water in lakes, marshes, bogs, ponds, wet meadows, and other persistent water sources (Maxell 2000). Young toads are restricted in distribution and movement by available moist habitat, while adults can move several miles and reside in marshes, wet meadows, or forested areas. Toads hibernate in the winter in habitats that maintain a high humidity and above-freezing temperatures. Areas that provide shelter for hibernating toads include rodent burrows, beaver dams and slash piles (Loeffler 1998).

Reasons for the decline of the western toad have not been defined with any degree of certainty. However, habitat alterations from timber harvest, grazing, recreation, and water development would likely not be beneficial to long-term enhancement of western toad habitats (Loeffler 1998). One hypothesis explaining the western toad decline concerns mortality caused by disease or some other widespread agent (ibid). However, none of these factors have been shown as causative agents for population declines. Since this species depends on wetlands to breed, the reduction of or adverse impacts on wetlands potentially have detrimental effects on western toads.

It is important that toads be able to move among their seasonal habitats. The biggest potential barriers to their movement are roads. Steep road cuts can be a barrier to toads moving between seasonal habitats. Juvenile toads are vulnerable to being killed by motorized vehicles when they are dispersing from their natal ponds.

Affected Environment

Ocular evaluation of habitat conditions indicates that potentially suitable breeding habitat is present in the analysis area. This habitat is found primarily in riparian areas adjacent to many streams in the wildlife analysis area.

Based on habitat needs as described in the literature, the mesic nature of much of the forests of the IPNF indicate that toads have many opportunities to find persistent small water sources for breeding, and could successfully disperse through moist forests.

Vehicle traffic on existing open roads and restricted roads arguably constitute some level of risk to toads. This risk is considered to be small, based primarily on a combination of low toad densities, the relative unsuitability of roads as dispersal "habitat", and the relative low availability of road surface versus forest habitat.

Environmental Consequences

Habitat alterations from timber harvest and recreation have not been shown as causative agents for population declines (Loeffler 1998). The primary area of concern for potential impacts to toads would be impacts on breeding habitat. Of secondary concern is the potential for direct mortality of dispersing toads.

Direct and Indirect Effects Common to All Alternatives

The riparian buffer zones established on creeks in the project area would limit the potential for any substantive adverse impacts to potential breeding habitat. These buffers would also protect the majority of timbered stands near water that would be most likely to be used by toads. There would be no changes in water yield that would result in any measurable adverse impact on potential breeding habitat (see *Watershed*, Chapter 3).

This species can breed along roadside ditches and can be found in upland habitat that would not have any special protection. Some mortality may occur to adults and metamorphs in these situations. Increases in vehicle traffic and project-related activity (e.g. harvest and road storage) may increase the risk of mortality. The existing risk is low, and any changes including new road construction would remain low and inconsequential based on the same rationale as described in the *Affected Environment* section (e.g. low densities of toads and roads relative to forested habitat). The road decommissioning in the action alternatives may tend to decrease the risk of mortality over a long term; however, this effect is difficult to measure in any meaningful way and is not expected to be consequential.

Cumulative Effects Common to All Alternatives

Restoration actions provide an opportunity to create/improve habitat. The impacts from proposed federal actions under all alternatives would not contribute appreciably to existing impacts and would not affect population viability. Activities on non-NFS lands are expected to have similar consequences for the same reasons described for federal actions (e.g. low toad and relatively low road densities in riparian areas). Any cumulative mortality from any alternative is unlikely; and potential adverse effects would not significantly exceed exiting levels of risks to the species.

Summary of Effects for Sensitive Wildlife Species

The preceding Sensitive Wildlife Species section documents the analysis of potential impacts and provides the rationale for the effects determinations.

Table 3-95 Summary of Conclusion of Effects for Sensitive Species*

Species	Alternative A	Alternative B	Alternative C
Black-backed Woodpecker	NI	MIIH	MIIH
Black Swift	NI	NI	NI
Coeur d'Alene Salamander	NI	MIIH	MIIH
Common Loon	NI	NI	NI
Fisher	NI	MIIH	MIIH
Flammulated Owl	NI	NI	NI
Fringed Myotis	NI	NI	NI
Gray Wolf	NI	MIIH	MIIH
Harlequin Duck	NI	NI	NI
Northern bog lemming	NI	NI	NI
Northern Goshawk	NI	MIIH	MIIH
Perigrine Falcon	NI	NI	NI
Pygmy Nuthatch	NI	NI	NI
Townsend's Big-Eared Bat	NI	NI	NI
Western Toad	NI	MIIH	MIIH
Wolverine	NI	NI	NI

Conditions: None

Recommendations: The district biologist should be notified if any sensitive species are observed during pre-sale and sale activity.

NI = No Impact
MIIH = 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
WIFV =** Will Impact Individuals or Habitat With a Consequence That The Action May Contribute to a Trend Towards Federal Listing or Cause a Loss of Viability to the Population or Species

BI = Beneficial Impact

***** The rationale for the conclusion of effects is contained in the Wildlife section of Chapter 3. Other pertinent information for the evaluation of effects on sensitive species (e.g. description of activity) is also contained there.

****** Considered a trigger for a significant action in NEPA

Consistency with Forest Plan and Regulatory Framework

All alternatives are consistent with applicable goals, direction, standards, and guidelines from the Forest Plan for the management of wildlife habitat and species populations. All alternatives, to varying degrees, comply with other direction and recommendations regarding management of the various components of wildlife habitat including the percent old growth allocated and size of old growth units/patches. All alternatives comply with applicable conservation strategies for wildlife species. All alternatives are consistent with the Endangered Species Act (ESA), the National Forest Management Act (NFMA), and other direction and requirements for the management of wildlife species and habitat.

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