United States Department of Agriculture
Forest Service
Pacific Northwest Region
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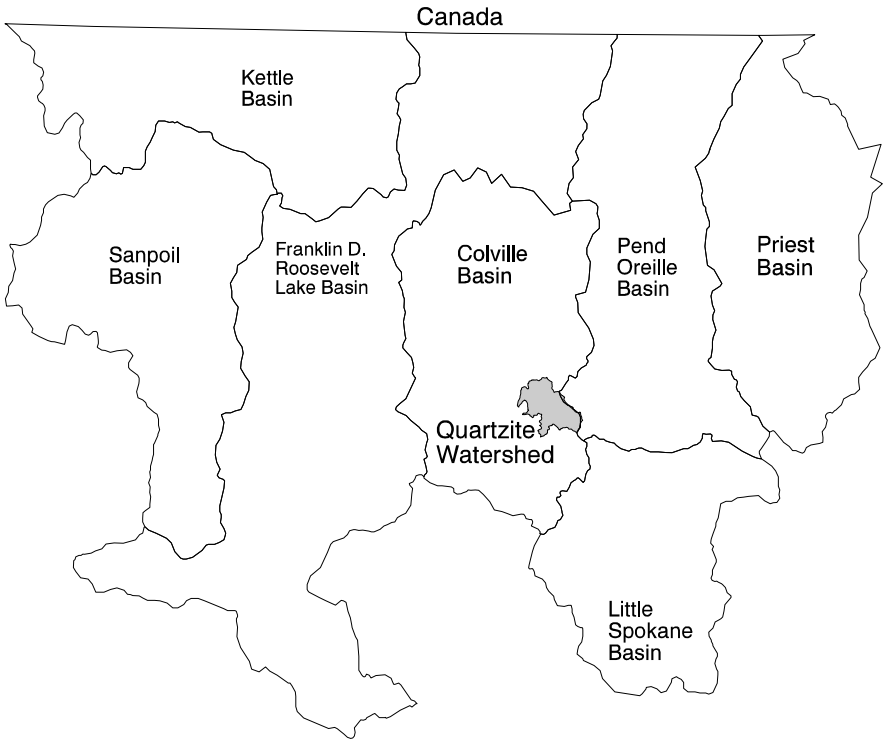
Colville National Forest
Three Rivers Ranger District

Quartzite Watershed Management Project

Final Environmental Impact Statement



Cover Sheet

Quartzite Watershed Management Project

Type of Statement: Final Environmental Impact Statement

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Abstract:

The Colville National Forest proposes watershed management activities in the Thomason-Sherwood-Cottonwood Creek area of the Three Rivers Ranger District, just east of Chewelah, Washington. The project includes vegetation management, riparian/wetland management, and road management activities.

Vegetation management activities are grouped into two categories: Timber Sale activities; and Prescribed Fire and Non-Commercial Thinning activities. The objective of vegetation management proposals is to improve ecosystem integrity by moving the vegetation toward the natural range of variation; by developing forest matrix, patches and corridors that are consistent with fire landscapes; and by improving the landscape patterns of habitats for native and desired non-native species. **Riparian/wetland Management activities** include improving the stream channel, and planting native riparian plant species. The objective of riparian and wetland management is to improve ecosystem integrity by increasing the diversity of vegetation, and by improving in-stream fish habitat in low elevation riparian areas. **Road management activities** include road development, road/stream crossing improvement, and road closures. Objectives for road management proposals are to upgrade, maintain and develop those roads, which are necessary for long-term land management and important to public access, and to eliminate unneeded roads.

Seven alternatives were developed for the project, including a no action alternative. The **No Action Alternative (A**) would not implement the proposed watershed management activities. The **Proposed Action Alternative (B)** was designed to improve ecosystem integrity. It includes 4,254 acres of timber sale activities; 6,342 acres of non-commercial thinning and prescribed fire activities; 10.83 miles of new road construction; and 35.52 miles of road re-construction. It would close 1.8 miles of open road; improve road drainage at six stream crossings; and improve the stream channel and plant riparian species on 100 acres at Woodward Meadows. The **Upper Cottonwood Alternative (C)** was designed to limit the effects associated with timber harvest and road construction proposed in Betts Basin. This alternative would implement the Proposed Action Alternative in all areas except the Betts Basin. It would implement 2,877 acres of commercial harvest, and 4,784 acres of non-commercial thinning and fire. It would build 6.89 miles of new road, and re-construct 32.68 miles of existing road. The **Wildland Alternative (E)** broadens the range of effects the alternatives have on the unroaded area by excluding all proposed activities located within the unroaded area (as defined by the Quartzite Watershed Scale Ecosystem Analysis). It would implement all other activities associated with the Proposed Action Alternative, including 1,748 acres of commercial harvest, and 3,020 acres of non-commercial thinning and fire. It would build 2.33 miles of new road, and re-construct 35.05 miles of existing road. The **Vegetation Alternative (F)** This alternative is designed to address forest health concerns. It would implement the Proposed Action Alternative plus additional commercial harvest areas where insects, disease, storm damage and overstocking occur. Unlike the Proposed Action, it would not close the two segments of existing open road. It would implement 5,446 acres of commercial harvest, and 7,034 acres of non-commercial thinning and fire. It would build 18.37 miles of new road, and re-construct 35.54 miles of existing road. The **Wildland Fire Alternative (J)** uses fire to maintain desired vegetation conditions in the unroaded area. It would implement the Wildland alternative plus any maintenance fire areas within the unroaded area. It would implement 1,748 acres of commercial harvest, and 3,479 acres of non-commercial thinning and fire. It would build 2.33 miles of new road, and re-construct 35.05 miles of existing road. The **Existing Roads Alternative (K)** is designed to reduce the effects of road construction. It would implement the Proposed Action Alternative except for any commercial harvest areas (and associated restoration fire areas) not feasible from existing roads. It would implement 3,753 acres of commercial harvest, and 5,635 acres of non-commercial thinning and fire. It would not build any new roads. It would reconstruct 35.52 miles of existing road.

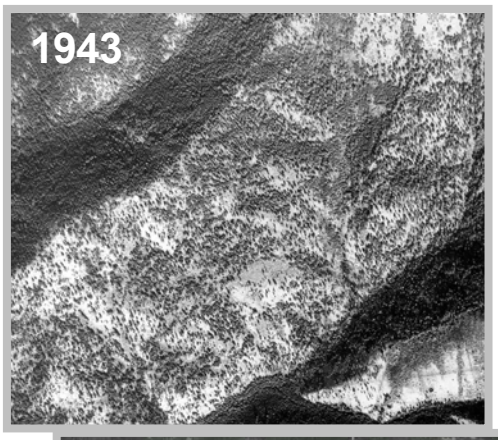
After reviewing public comments generated during scoping, and considering the concerns and unresolved conflicts identified with the key issues, the Forest Supervisor recommended the **Existing Roads Alternative (K)** as the Agency's preferred alternative, when the draft environmental impact statement was released for public review on June 5th, 2002.

Quartzite FEIS Table of Contents

Chapter 1 Purpose of and Need For Action

In the winter of 1998/99, the Colville National Forest completed a detailed ecosystem analysis for the Quartzite Watershed. The analysis looked at the differences between present conditions and past conditions for a variety of ecosystem components (erosion processes, hydrology, vegetation, stream channels, water quality, species and habitats, and human uses). Significant changes from past conditions were identified, and their causes and effects on ecosystem processes were determined.

The analysis showed that the overriding cause for most ecosystem change is fire suppression[1]. The effect of which is manifested in many forms, from dense forests, to shifts in tree species, to changes in wildlife habitat. The effect on ecosystem processes is less evident, but it is easy to see that today the ecosystem is storing much more energy than it did in the past.



Aerial photos from 1943 show a landscape characterized by open forests of large diameter trees; the result of frequent low intensity fire. These old images help illustrate the point that landscapes are dynamic and fire disturbance is an integral ecosystem process that helps balance other processes like photosynthesis.

It is also evident that if one type of disturbance is suppressed, another type will replace it. Over the past 20 years, many large diameter trees have succumbed to root disease. Others are falling prey to more recent infestations of Douglas-fir bark beetle.

Another critical finding shows that native wildlife adapted to fire and the resulting range of habitat patterns over the past thousands of years. A long history of ecological studies already indicates the strong association between disturbance processes and species survival. Ecological processes, such as hydrologic and nutrient cycles, also are adapted to disturbance.

The Quartzite Watershed is a dynamic landscape. The Quartzite Watershed Management Project recognizes this and proposes to apply the knowledge we have acquired by approximating historical disturbance events through management practices.

Document Structure

This is the first of five chapters included in this project level environmental impact statement. As the chapter title indicates, the purpose of and the need for the Quartzite Watershed Management Project will be identified here. Chapter Two describes the alternatives to the proposed action. Chapter Three entitled Affected Environment and Environmental Effects, presents the existing environment against which change is measured and the effects the alternatives have on the environment. Chapter Four lists the preparers of the Statement. And finally, Chapter Five lists people, agencies and organizations to whom copies of this Statement are sent.

Chapter Structure

The first of five sections in this chapter, Section 1.1 offers a brief overview of the Quartzite Project, including maps and a description of the project location. The resource management direction provided by laws, The Colville National Forest Plan, and other documents are discussed in Section 1.2. Section 1.3 discusses the purpose of and the need for the Quartzite Project and Section 1.4 provides a description of the proposed action.

Section 1.1 – Project Overview

The Colville National Forest is proposing watershed management activities that are designed to improve ecosystem integrity. They include vegetation management, riparian/wetland management, and road management activities.

One of the key findings of the Quartzite Ecosystem Analysis[2] is that fire exclusion has changed forest vegetation. These changes in upland forest density, understory composition, and tree species have increased forest susceptibility to insects, disease, drought and atypical fire. These changes are outside the natural range of variability and have increased the uniformity of upland forests while decreasing patchiness and forest diversity.

Upland forest vegetation dominates the watershed and consequently provides the majority of wildlife habitat. A precept of ecosystem analysis is that native species have evolved with fire and with the landscape patterns of habitats that resulted from fire. Hence, the potential for survival of many species may be diminished if habitat patterns shift outside the natural range of variation. A particular concern is that the increase in upland forest uniformity and the decrease in patchiness in the watershed has shifted landscape habitat patterns and reduced native species diversity.

The objective of vegetation management is to improve ecosystem integrity by moving the vegetation toward the natural range of variation; by developing forest matrix, patches and corridors that are consistent with fire landscapes; and by improving the landscape patterns of native species habitats.

A second key ecosystem analysis finding is that vegetation diversity and in-stream fish habitat in low elevation riparian areas has deteriorated. The increased foraging opportunities, denning and nesting opportunities, and travel opportunities provided by riparian corridors benefit a wide range of species, and quality in-stream fish habitat favors native fish. The objective of riparian and wetland management is to improve ecosystem integrity by increasing the diversity of vegetation, and by improving in-stream fish habitat in low elevation riparian areas.

A third ecosystem analysis finding that drives the purpose and need for this project concerns roads. Forest roads provide access to conduct needed management. The

[1]State and Federal agencies have suppressed fire in the area since the 1920's.
[2] In the winter of 1998/99 the Three Rivers Ranger District used the Regional Interagency Executive Committee's Federal Guide for Watershed Analysis to complete the Quartzite Watershed Scale Ecosystem Analysis. A copy of the report for this analysis is located in the analysis file.

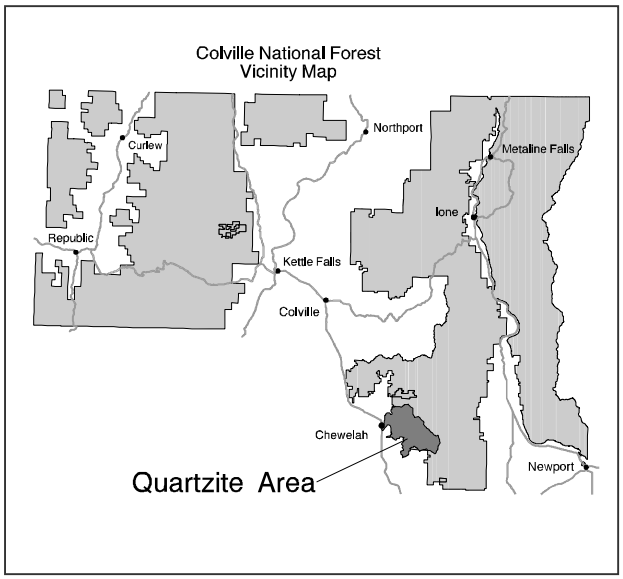
benefits of forest roads are many. So too, are the ecological effects in the watershed. The ecosystem analysis notes that road corridors create habitat for noxious weeds that displace native plants. They also have introduced change to a variety of wildlife habitats. The connectivity of wildlife travel corridors has been disrupted in many places where roads cross riparian areas. In addition, road access has fragmented seclusion habitat. The objective for road management is to upgrade, maintain and develop those roads which are necessary for long-term land management and public access, while eliminating unneeded roads.

1.1.1 Setting and Scale

The 1.1 million-acre Colville National Forest is located in the northeast corner of Washington State. It is bound on the north by British Columbia, Canada, and on the east by the State of Idaho. One of four districts on the Forest, the Three Rivers Ranger District (formerly the Colville and Kettle Falls Ranger Districts) administers 483,000 acres, and is situated in the center of the Colville National Forest. The area is mostly rural. Forestry, livestock grazing, mining, and localized agriculture are the principal uses. Communities are mostly small. Summer residences are common at lakes and large river systems, and outdoor recreation in all seasons is increasing.

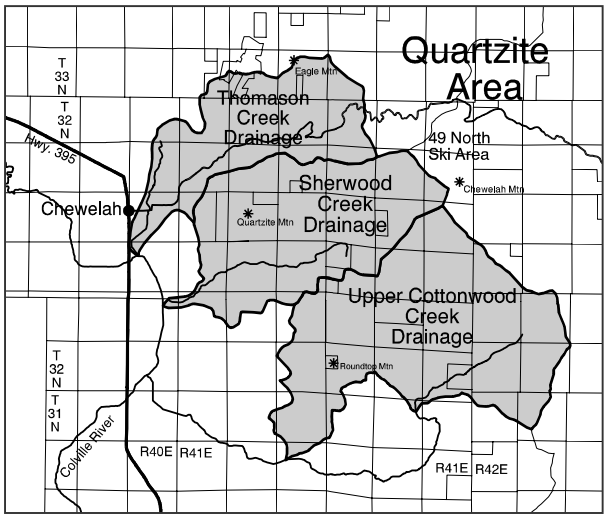
The Quartzite analysis area is located on the southeast side of the Colville River Basin, directly east of the town of Chewelah, Washington. It occupies a relatively small percentage (3.6%) of this larger basin and is limited to three small west-flowing streams (Thomason, Sherwood & Cottonwood) that drain into the Colville River. Thirty six miles downstream from the analysis area, the Colville River empties into the Franklin D. Roosevelt Reservoir, the pool formed by the Columbia River Grand Coulee Dam.

The analysis area is 36.4 square miles (23,311 acres) in size, 55% of which is private or other ownership (12,723 acres). Elevations range from the 5,700 foot Chewelah Mountain, to the Colville River, which is 1,640 feet above sea level. Vegetation in the watershed is dominated by coniferous forest, however occasional pastures and fields are found at the lower elevations. Fire suppression has occurred for the past 80 years. The Flowery Trail Road passes through the Thomason Creek Drainage, in the northern third of the analysis area. It provides access to the adjacent



downhill ski area (49° North), for an estimated 50,000 visitors per year.

The legal description for the project planning area is: Township 33 North, Range 41 East, Sections 31-34; Township 32 North, Range 41 East, Sections 3, 9-14, 17, 22-24, 26, 27, 34 & 36; and Township 32 North Range 42 East, Sections 18-20 & 29-32; Willamette Meridian, on the Three Rivers Ranger District, of the Colville National Forest in Stevens County, Washington.



Ecosystem Setting

The Map of Ecoregions and Subregions of the United States, places the Forest within the Okanogan Highlands Section of the Northern Rocky Mountain Forest-Steppe - Coniferous Forest - Alpine Meadow Province[3].

Interior Columbia Basin Ecosystem Management Project

This analysis was guided by integrated ecological assessments and strategies that began in 1993 by direction from President Clinton to "develop a scientifically sound and ecosystem based strategy for management of eastside forests." This direction resulted in the combined Bureau of Land Management and Forest Service project known as the Interior Columbia Basin Ecosystem Management Project (ICBEMP)[4].

This assessment covers the "interior" portion of the Columbia River basin and those portions of the Klamath and Great Basins within Oregon. This includes the states of Oregon and Washington east of the crest of the Cascade Mountains, most of Idaho state and small portions of northern Nevada, western Montana and western Wyoming for a total of 145 million acres. Of that, federal lands encompass 76 million acres (lands administered by the USDI, Bureau of Land Management and USDA, Forest Service).

The *Integrated Science Assessment for Ecosystem Management in the Interior Columbia Basin* (1996), hereafter called "Integrated Science Assessment," is a summarization of the work of the Science Integration Team of the Interior Columbia Basin Ecosystem Management Project (ICBEMP). This document provided a Columbia River basin-wide assessment of ecosystem status, and provided a large-scale context for this project.

Research data from the scientists involved in the Interior Columbia Basin Ecosystem Management Project has been released. Disturbances related to fire and insect mortality

[3] Ecological types are classified and ecological units are mapped based on associations of those biotic and environmental factors that directly affect or indirectly express energy, moisture, and nutrient gradients which regulate the structure and function of ecosystems. A description of this province can be found at <www.fs.fed.us/land/pubs/ecoregions/ch45.html#M333C>.

[4] Detailed information about the Interior Columbia Basin Ecosystem Management Project can be found at <www.icbemp.gov/>.

have played an important role in determining forest composition throughout the interior Columbia Basin. Forested ecosystems have become more susceptible to severe fires and outbreaks of insects and diseases.

The Colville subbasin (and consequently the Quartzite analysis area) is within the boundary of the area analyzed by the Integrated Science Assessment. This assessment divided the Columbia Basin into six subbasin clusters of forestland that have common ecological conditions. The Quartzite Analysis Area is located in Forest Cluster 6.

Using coarse analytical procedures, the Integrated Science Assessment assigned ecological integrity ratings to each cluster, where a high rating indicates ecological functions and processes are being maintained. Forest Cluster 6 was rated “low” for aquatic, hydrologic, forest and composite ecological integrity, due to: declines in late and early forest structure; fragmented aquatic systems; roads; and the cropland conversion of lower elevation valleys. The Scientific Assessment also identified the social and economic conditions of the communities in the Columbia Basin. Chewelah was identified as an isolated trade center, with employment specialized in agriculture and wood product manufacturing.

The *Interior Columbia Basin Ecosystem Management Project Eastside Draft Environmental Impact Statement* (1997) (commonly referred to as "Draft Eastside EIS" or "ICBEMP" or "Ice-bump") was **not** utilized in the design of this project. The Draft Eastside EIS analyzed seven alternative strategies for restoring and maintaining ecosystem health while sustaining a flow of goods and services. It is a draft document and no decision has been made as to which alternative will be implemented.

Ecosystem Analysis at the Watershed Scale

As noted above, the Three Rivers Ranger District used the ‘Regional Interagency Executive Committee’s Federal Guide for Watershed Analysis, 1995’ to complete the Quartzite Watershed Scale Ecosystem Analysis. This process was used to characterize the human, aquatic, riparian, and terrestrial features, conditions, processes, and interactions within the Quartzite Watershed. By design, the analysis process provides a systematic way to understand and organize ecosystem information. Consequently, it enhances the ability to estimate direct, indirect, and cumulative effects of management activities and guide the general type, location, and sequence of appropriate management activities within the Quartzite watershed.

The analysis was conducted by a team of journey-level specialists who followed the standard, interagency six-step process:

1) **Characterization of the watershed** – Identify the dominant physical, biological, and human processes and features of the watershed that affect ecosystem functions or conditions.

2) **Identification of issues and key questions** – Focus the analysis on the key elements of the ecosystem that are most relevant to the management questions and objectives, human values, or resource conditions within the watershed.

3) **Description of current conditions** – Develop information relevant to the issues and key questions.

4) **Description of reference conditions** – Explain how ecological conditions have changed over time as a result of human influence and natural disturbances.

5) **Synthesis and interpretation of information** – Compare existing and reference conditions of specific ecosystem elements and explain significant differences, similarities, or trends and their causes.

6) **Recommendations** – Bring the results of the previous steps to conclusion, focusing on management recommendations that are responsive to watershed processes identified in the analysis.

Four categories of recommendations resulted: Vegetation Management Recommendations; Road Management Recommendations; Wildlife Habitat Management Recommendations; and Stream and Wetland Management Recommendations. Some of these helped guide the purpose and need for the Quartzite Watershed Management Project.

Section 1.2 – Current Law and Management Direction

This analysis is guided by federal and state law, including *the Forest and Rangeland Renewable Resources Planning Act* (RPA), *National Forest Management Act* (NFMA), *National Environmental Policy Act* (NEPA), and the *Clean Water Act.*

The guiding management direction for the project planning area is provided by the 1988 *Land and Resource Management Plan, Colville National Forest* (hereafter referred to as the Forest Plan). This Environmental Impact Statement is tiered to the Forest Plan and its accompanying documents (Final Environmental Impact Statement and Appendices, and the Record of Decision). It is also tiered to the *Colville National Forest Integrated Noxious Weed Treatment Environmental Assessment* (Decision Notice signed September 4, 1998).

Forest Service National Agenda

The USDA Forest Service National Agenda[5] is an agency policy that outlines management philosophy and priorities for administration of National Forest System lands. The National Agenda helps set priorities and guide management decisions within the framework of existing laws, regulations, and the Forest Plan. The agenda focuses on four key areas:

- Healthy Watersheds
- Sustainable forest ecosystem management
- Forest roads
- America's wildland playground

[5]For more information, see http://www.fs.fed.us/news/agenda/.

Forest Service Road Management[6]

The USDA Forest Service has identified three primary actions to develop an appropriate balance between the safe and efficient access for all forest road users, and the protection of healthy ecosystems:

1) Develop new analytical tools to decide when-and-if both new and existing roads are needed to meet resource management objectives.

2) Aggressively decommission non-beneficial or unauthorized roads that are determined (through forest planning and NEPA[7] and other analyses) to be damaging to the environment or to be no longer necessary for achieving resource management objectives.

3) Maintain and improve those important roads needed for recreation, rural access, and the sustainable flow of goods and services, which do not compromise healthy lands and waters.

12Jan2001 Forest Service Road Management Strategy

To implement these actions, the Forest Service adopted a "final policy" governing the National Forest Transportation System[8].

The final policy notes that road construction/reconstruction in roaded areas (like the Quartzite planning area) should be supported by a roads analysis[10] that determines when-and if-both new and existing roads are needed to meet resource management objectives. The Quartzite Interdisciplinary Team used the road management recommendations found in the Quartzite Watershed Ecosystem Analysis Report[11] to develop the roads analysis for the project. The Quartzite Roads Analysis and its recommendations can be found in the analysis file. In summary, road management proposals included with the proposed action follow roads analysis recommendations. These proposals are detailed in section 1.5.3 of this chapter.

In addition, the final policy imposed a significant restriction on road construction or reconstruction in inventoried roadless areas and *contiguous unroaded areas*, until a forest-scale roads analysis was completed and incorporated into the Forest plan.

14Dec2001 Interim Administrative Directives

Pursuant to a late January 2001 memorandum from the President's Chief of Staff to cabinet members, the Chief of the Forest Service undertook a review of the newly adopted Forest Service Road Management Strategy. These reviews led the agency to issue an interim directive, effective 14Dec2001, which removes "contiguous unroaded areas" from the road construction or reconstruction restrictions that were included with the 12Jan2001 Forest Service Road Management Strategy.

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[6] See Forest Service Manual Title 7700-Engineering.
[7] The National Environmental Policy Act.
[8] Notices for these actions were published in the Federal Register, Volume 66, Number 9, on 12Jan01.
[9] Notices for these actions were published in the Federal Register, Volume 66, Number 9, on 12Jan01.
[10] A science-based road analysis process developed by the Forest Service is entitled "*Roads Analysis: Informing Decisions About Managing the National Forest Transportation System."*
[11] See Section 1.1 of this chapter for more information.

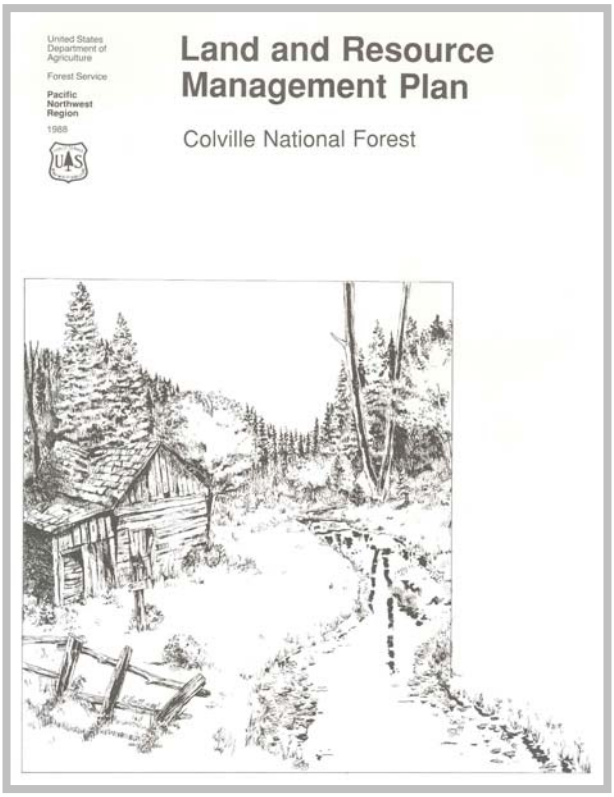
Quartzite Unroaded Analysis

Current Forest Service policy imposes significant restriction on road construction or reconstruction in inventoried roadless areas. No inventoried roadless areas occur within or adjacent to the Quartzite analysis area. No road construction restrictions apply to the area.

While the agency does not define the term "unroaded", the Quartzite Interdisciplinary team chose to use it in response to public concern for proposed road construction. **For this analysis** the team defines an unroaded area as any area greater than 1,000 acres in size and greater than 100 meters from any existing road or past harvest activity. The team uses this definition to help the public understand the effects associated with road construction. The definition is specific to this project.

No road construction or reconstruction restrictions apply to areas that meet this definition.

The Forest Plan

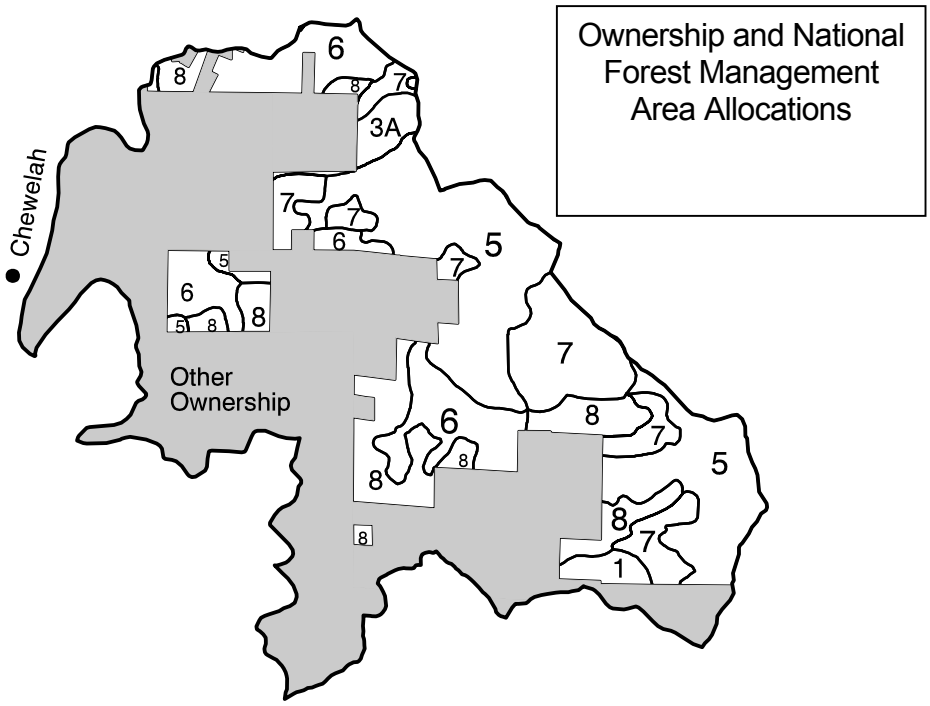


The Forest Plan provides management direction in terms of Standards and Guidelines. Standards and Guidelines may be Forest-wide or directed to a specific Management Area where more detailed direction is provided.

The Forest Plan established thirteen unique management areas across the Forest. Management Areas are defined by the Forest Plan as units of land to which a prescription or set of prescriptions is applied in order to achieve a particular management objective.

The management area prescriptions define the type and intensity of resource activities that are or are not permitted within that management area.

The Forest Plan identifies six different management areas within the Quartzite Watershed Management Project planning area (see the map and following table).



Mgt. Area Emphasis	Management Area Goal	Acres	% of NFS Lands
MA-1: Old Growth Dependent Species Habitat	Provide essential habitat for wildlife species that require old growth forest components, and contribute to the maintenance of diversity of wildlife habitats and plant communities.	217	2%
MA-3A: Recreation	Provide roaded and unroaded recreation opportunities in a natural appearing setting.	311	3%
MA-5: Scenic/Timber	Provide a natural appearing foreground, middle, and background along major scenic travel routes while providing wood products.	3,975	37%
MA-6: Scenic/Winter Range	Provide a natural appearing foreground, middle and background along major scenic travel routes while providing for winter range management.	2,082	20%
MA-7: Wood/Forage	Manage to achieve optimum production of timber products while protecting basic resources.	2,130	20%
MA-8: Winter Range	Meet the habitat needs of deer and elk to sustain carrying capacity at 120% of the 1980 level, while managing timber and other resources consistent with fish and wildlife management objectives.	1,872	18%
	Total =	10,587	100

Forest Plan Amendments

The Forest Plan includes two amendments that influence the management direction for this project. The Regional Forester's Forest Plans Amendment #2 and the INFISH Direction are collectively referred to as "Screening Direction." The screening direction was

implemented to preserve future planning options concerning wildlife habitat associated with Late and Old structural stages, fish habitat, and old forest abundance.

- Regional Forester's Forest Plan Amendment #2, entitled *Revised Continuation of Interim Management Direction Establishing Riparian, Ecosystem and Wildlife Standards for Timber Sales* (June 5, 1995). This amendment replaced the interim ecosystem standard and the interim wildlife standard from Regional Forester's Forest Plans Amendment #1 (May 20, 1994).

- *Inland Native Fish Strategy* (July 28, 1995). This amendment replaced the interim riparian standard from Regional Forester's Forest Plans Amendment #1. The Inland Native Fish Strategy is hereafter referred to as "INFISH Direction."

Section 1.3 – The Purpose of and Need for the Proposed Action

As a result of the Quartzite Ecosystem Analysis, the Colville National Forest is proposing watershed management activities in the Quartzite Watershed. The Quartzite Ecosystem Analysis considered all lands within the Thomason, Sherwood, and Upper Cottonwood creek drainages. One of the key findings of the analysis is that fire exclusion has changed forest vegetation. These changes in upland forest density, understory composition, and tree species have increased forest susceptibility to insects, disease, drought and atypical fire. The objective of vegetation management proposals is to improve ecosystem integrity by moving the vegetation toward the natural range of variation; by developing forest matrix, patches and corridors that are consistent with fire landscapes; and by improving the landscape patterns of habitats for native and desired non-native species.

A second ecosystem analysis finding revealed that vegetation diversity and in-stream fish habitat in low elevation riparian areas has deteriorated. The objective of riparian and wetland management is to improve ecosystem integrity by increasing the diversity of vegetation, and by improving in-stream fish habitat in low elevation riparian areas.

A third ecosystem analysis finding concerns roads. Forest roads provide access to conduct needed management. The benefits of forest roads are many. However, the ecosystem analysis notes that road corridors create habitat for noxious weeds that displace native plants. They also have introduced change to a variety of wildlife habitats. The connectivity of wildlife travel corridors has been disrupted in many places where roads cross riparian areas. In addition, road access has fragmented seclusion habitat for large home range vertebrates. Objectives for road management proposals are to upgrade, maintain and develop those roads, which are necessary for long-term land management and important to public access, and to eliminate unneeded roads.

Section 1.4 – Proposed Action

The objectives of the Quartzite Ecosystem Analysis were to identify significant departures from past ecosystem conditions, and to make recommendations that improve ecosystem integrity. This watershed management proposal is the result of these recommendations. It includes **vegetation management, riparian/wetland management and road management** activities. These proposals are intended to reduce the disparity between past and present ecosystem conditions.

1.4.1 Vegetation Management

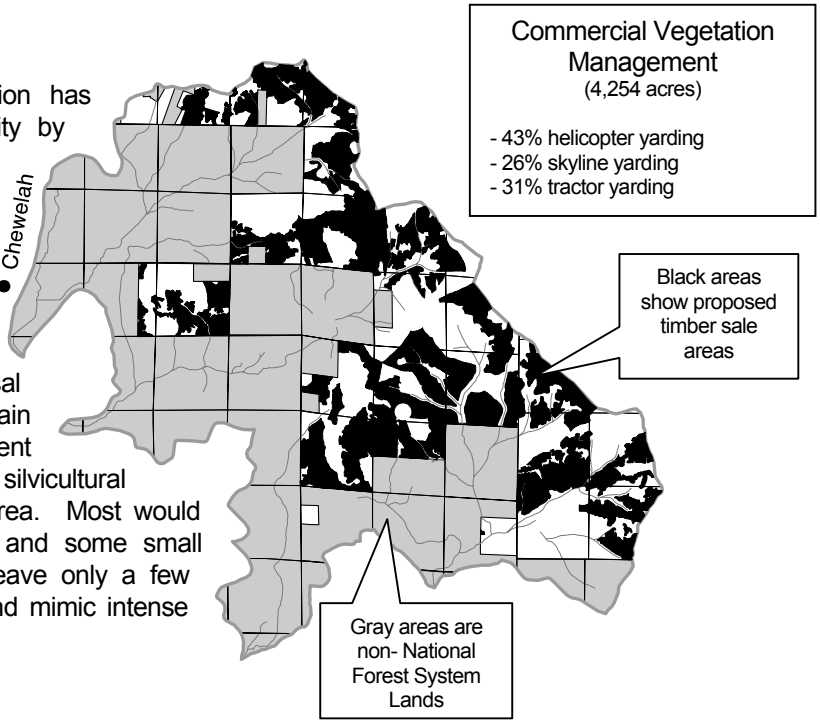
Upland forest vegetation dominates the watershed and consequently provides the majority of wildlife habitat. A precept of ecosystem analysis is that native species have evolved with fire and with the landscape patterns of habitats that resulted from fire. Hence, the potential for survival of many species may be diminished if habitat patterns shift outside the natural range of variation.

A particular concern is the increase in upland forest uniformity and density, and the decrease in patchiness in the watershed, all of which have shifted landscape habitat patterns and reduced native species diversity.

Vegetation management activities are grouped into two categories: Timber Sale activities; and Prescribed Fire and Non-Commercial Thinning activities.

Timber Sale

Eighty years of fire suppression has increased uniformity and density by establishing a class of younger trees across the Quartzite Watershed. Many of these 70-80 year old trees are now merchantable and are included in the timber sale proposal. This *commercial* vegetation management proposal is designed to restore or maintain vegetation conditions consistent with fire ecology. Consequently, silvicultural prescriptions vary across the area. Most would thin trees to reduce stocking, and some small areas (up to 5 acres) would leave only a few trees, to increase patchiness and mimic intense fires.

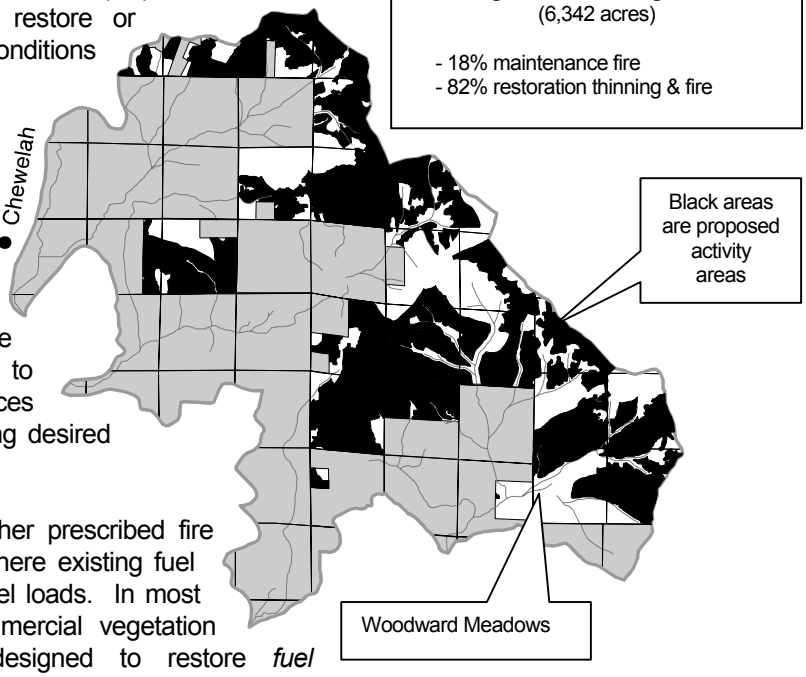


Prescribed Fire and Non-Commercial Thinning

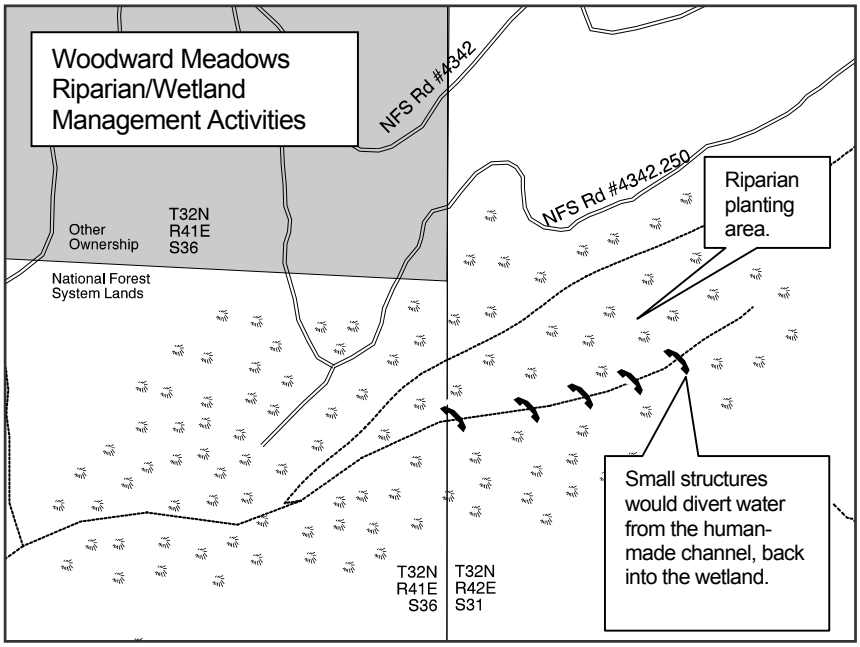
Most non-commercial thinning and prescribed fire vegetation management proposals would come after commercial activities. Like the commercial proposals, these activities are designed to restore or maintain vegetation conditions consistent with fire ecology.

Prescribed fire that is designed to maintain current desired conditions would occur outside commercial vegetation management areas. Existing fuel loads in these areas are low enough to conduct a burn that reduces these fuels, while maintaining desired vegetation conditions.

Restoration thinning and other prescribed fire proposals occur in areas where existing fuel loads are outside historic fuel loads. In most instances, they follow commercial vegetation management, and are designed to restore *fuel conditions* consistent with fire ecology.



1.4.2 Riparian/Wetland Management



Riparian/wetland management proposals are located on National Forest System Lands, in the Woodward Meadows riparian area. They are designed to improve riparian vegetation diversity and wetland habitat in this lower elevation wetland that was previously modified for livestock grazing. Management activities include improving the stream channel, and planting native riparian plant species.

1.4.3 Road Management

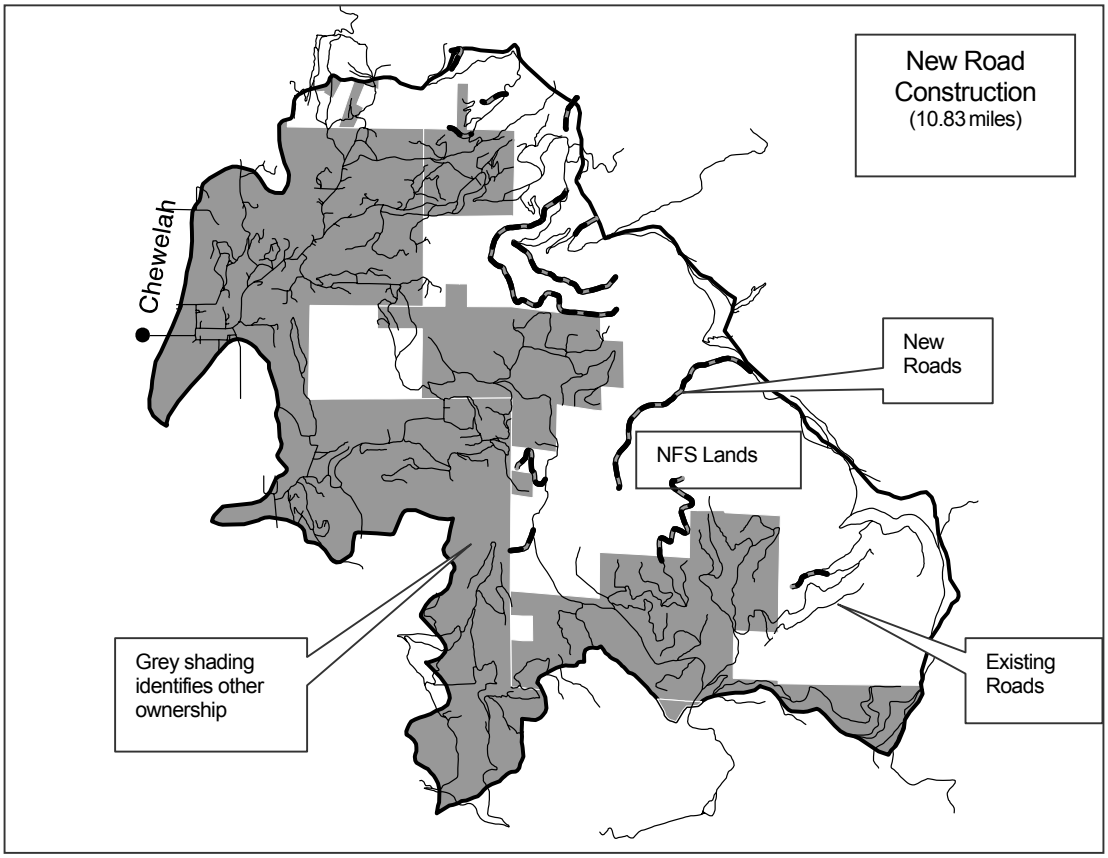
Objectives for road management proposals are to upgrade, maintain and develop those roads, which are necessary for long-term land management and important to public access, and to close or eliminate unneeded roads.

The Quartzite Watershed Management Project's Interdisciplinary Team used the road management recommendations found in the Quartzite Roads Analysis to develop a road system that is safe and responsive to public needs and desires. It is designed to be affordable and efficiently managed. It is also designed to have minimal negative ecological effects on the land. And it is designed to be in balance with available funding for the proposed management actions.

Road management proposals include road development, road/stream crossing improvement, and road closures.

Road Development

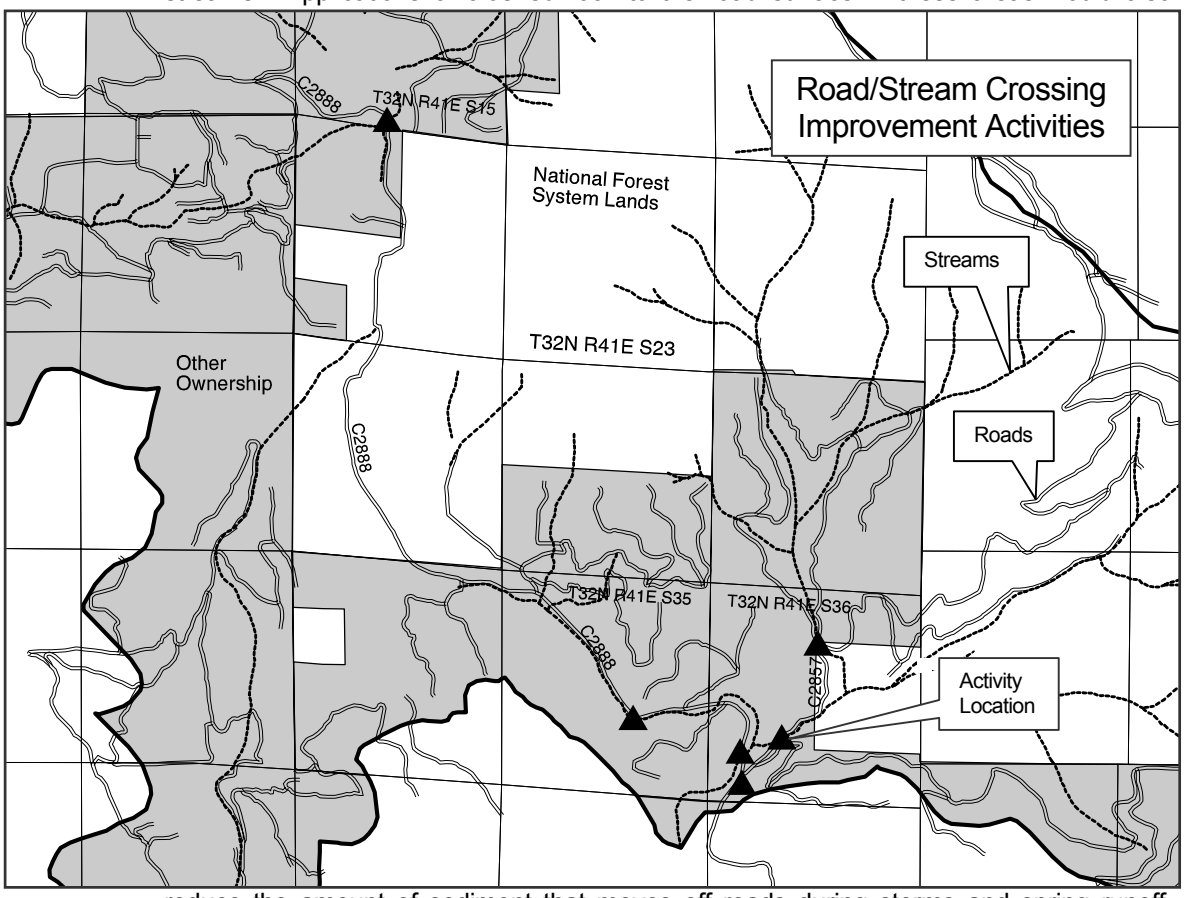
Road re-construction and new road construction are proposed in conjunction with timber sale activities. This includes 10.83 miles of new road and 35.52 miles of re-construction of existing roads.



These roads are designed to improve the feasibility of vegetation management proposals while minimizing effects on wildlife, hydrology and native plants. Following the timber sale, all new roads would be closed, as would all presently closed existing roads.

Road/Stream Crossing Improvement

Six locations are proposed for improvement, where roads cross streams. Proposals are designed to reduce the amount of road-generated sediment that reaches streams, by modifying road and ditch drainage structures such that water is directed away from streams. Applications of crushed rock to the road surface in these areas would also



reduce the amount of sediment that moves off roads during storms and spring runoff. While these six locations are all outside National Forest System road maintenance jurisdiction[14], legislation passed by Congress[15] allows the Forest Service to enter into and contribute financial resources toward cooperative watershed enhancement agreements on private or public land that benefits resources on National Forest System lands. The county may also elect to use funds from *The Secure Rural Schools and Community Self-determination Act of 1999* (Public Law 106-393)[16].

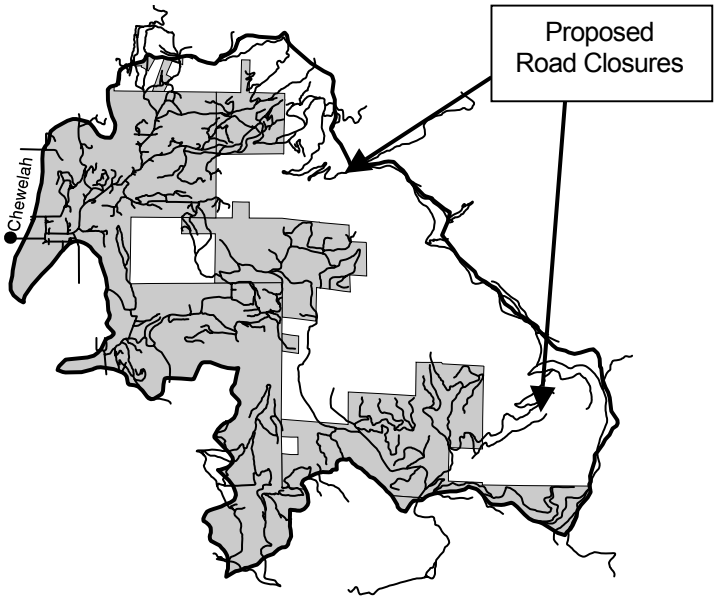
[14] Roads C2888 and C2857 are maintained by Stevens County.

[15] This legislation is most commonly referred to as The Wyden Amendment.

[16] Public Law 106-393 is designed to restore stability and predictability to the annual payments made to States and counties containing National Forest System lands and public domain lands managed by the Bureau of Land Management for use by the counties for the benefit of public schools, roads, and other purposes.

Road Closures

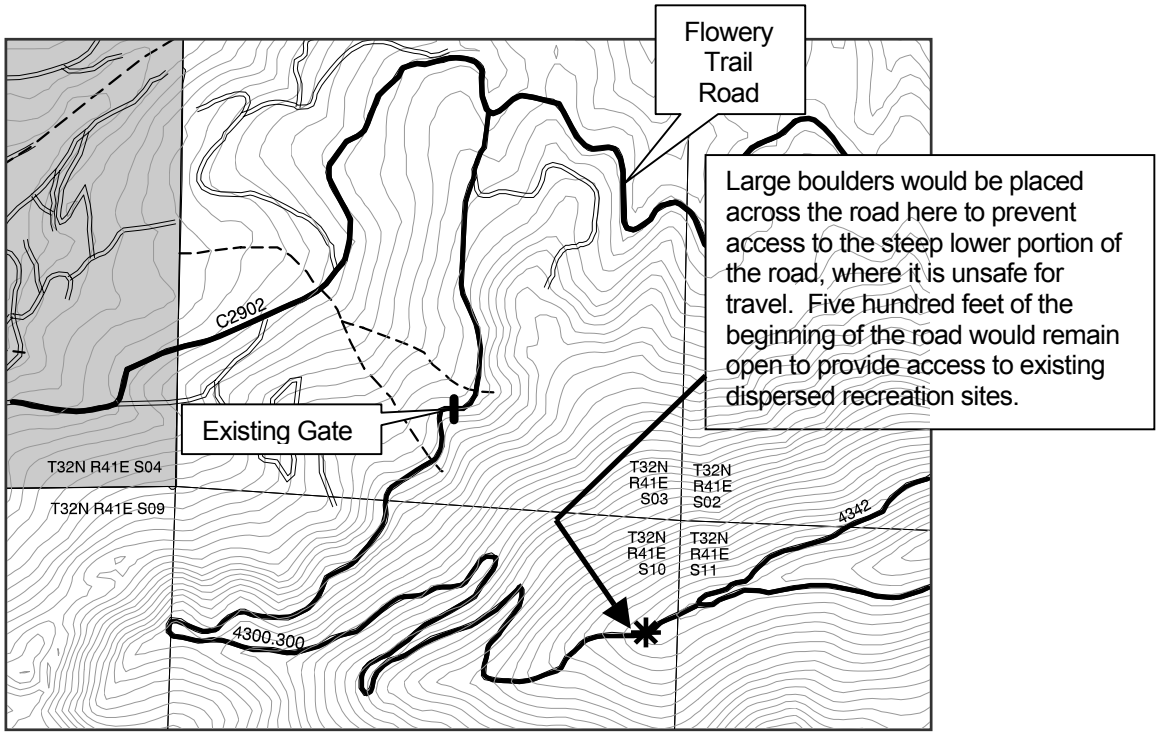
As noted in Section 1.2 of this chapter, the Forest Service road management strategy identified three primary actions to help find an appropriate balance between the safe and efficient access for all forest road users, and the protection of healthy ecosystems. The second of these three actions allows for the decommissioning of non-beneficial or unauthorized roads that are determined to be damaging to the environment or to be no longer necessary for achieving resource management objectives.



Using this strategy, the Quartzite Watershed Management Project Interdisciplinary Team used the road management recommendations found in the Quartzite Roads Analysis to help identify the two roads that are proposed for closure. One is located in the Jay Gould Ridge Area, and the other is adjacent to Woodward Meadows.

Jay Gould Ridge Road Closure

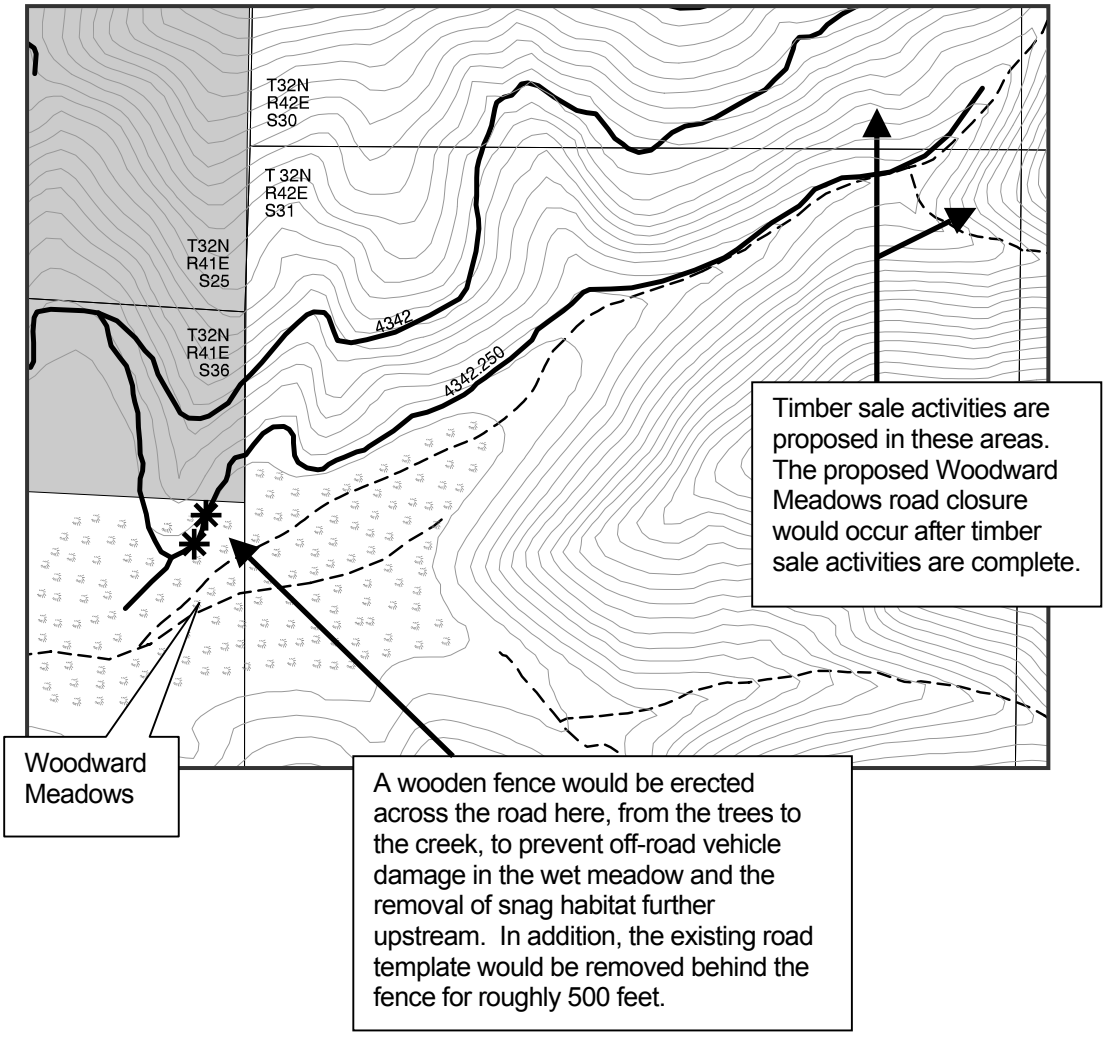
Colville National Forest Road #4300.300 connects the Flowery Trail Road (Stevens County Road #2902) with the Cottonwood Divide Road (Forest Road #4342). This road



has been closed by a gate for many years on the Flowery Trail end, but has remained open on the Cottonwood Divide end, where steep grades on Jay Gould Ridge threaten safety and damage soil. This proposal adds a closure device near the Cottonwood Divide end.

Woodward Meadows Road Closure

The second proposed road closure is adjacent to Woodward Meadows. Forest Road #4342.250 passes through Woodward Meadows and parallels a branch of Upper Cottonwood Creek for more than a mile. Illegal firewood gathering has degraded habitat for species dependent on late and old forest along this branch of Upper Cottonwood Creek; and vehicles that leave the road have damaged wetlands in Woodward Meadows. The proposed location of the closure device would leave the first 2000 feet open, and close roughly $1^{1/2}$ miles of road that is currently open to travel.



Section 1.5 Responsible Agency and the Decision to be made

The scope of the decision to be made from this environmental impact statement is limited to the activities presently proposed within the project area.

Broader, programmatic resource allocations for the Colville National Forest were previously approved by the Record of Decision for the Forest Plan FEIS, signed on December 29th, 1988. Resource allocations associated with the June 12th, 1995 Forest Plan Amendment were approved by the Decision Notice for the Revised Continuation of Interim Management Direction Establishing Riparian, Ecosystem and Wildlife Standards for Timber Sales. Resource allocations associated with the July 31st, 1995 Forest Plan Amendment were approved by the Decision Notice for the Inland Native Fish Strategy.

The Colville National Forest Supervisor is the deciding official for this environmental impact statement. The decision options are:

- Whether or not to implement vegetation management activities, and if so, identify the site-specific location of appropriate timber sale, prescribed fire, and non-commercial thinning practices.
- Whether or not to implement riparian/wetland management activities in the Woodward Meadows area.
- Whether or not to implement road management activities, and if so: identify the appropriate level of road development necessary to accomplish activities.
- Whether or not to implement road/stream-crossing improvements.
- Whether or not to implement road closures.

Document Check Point

This completes Chapter One. It was designed to familiarize you with the project setting, the guiding management direction, the objectives of the project, and the proposal itself.

The next chapter will display reaction to the proposal, issues, and the alternatives to the proposal that the issues created.

Chapter 2

Alternatives Including the Proposed Action

The National Environmental Policy Act of 1969, (NEPA) directs all agencies of the Federal Government to study, develop, and describe appropriate alternatives to those proposed actions involving unresolved conflict. Public comment on the proposed action defines unresolved conflict.

This chapter describes the alternatives, including the proposed action[17]. Alternatives to the proposed action were developed to respond to the issues that came out of the many comments solicited from the public, governments, and others. The primary objective of the alternatives is to present the public and the decision maker with a reasonable range of effects on these issues.

Also, the range of alternatives should not prematurely foreclose options that might protect, restore, and enhance the environment. Alternatives must also meet the purpose and need of the proposed action. Along with these responsibilities, the interdisciplinary team used context and intensity to classify issues. From this, three major issues evolved: Road Management, Betts Basin, and Forest Health. These were used to focus the range of alternatives.

To vary the effects between alternatives, the proposed action was modified by deleting activity areas, by changing transportation plans, and by using different yarding methods. The six resulting action-alternatives and the No-Action Alternative are described in detail in this chapter.

Chapter Structure

A synopsis of project public involvement in Section 2.1 describes scoping activities and lists issues that the Interdisciplinary Team identified during the scoping process. Section 2.2 describes the alternatives, including features common to all action-alternatives and mitigation measures. Section 2.3 describes monitoring activities. Section 2.4 displays a comparative synopsis of the environmental consequences of the alternatives. And the last section in this chapter, Section 2.5 identifies the Forest Service preferred alternative.

Section 2.1 – Public Involvement

In the winter of 1998/99, the Colville Ranger District used the Regional Interagency Executive Committee's Federal Guide for Watershed Analysis to complete the Quartzite Watershed Scale Ecosystem Analysis[18]. It was during this process that public information was first solicited for the Quartzite Watershed.

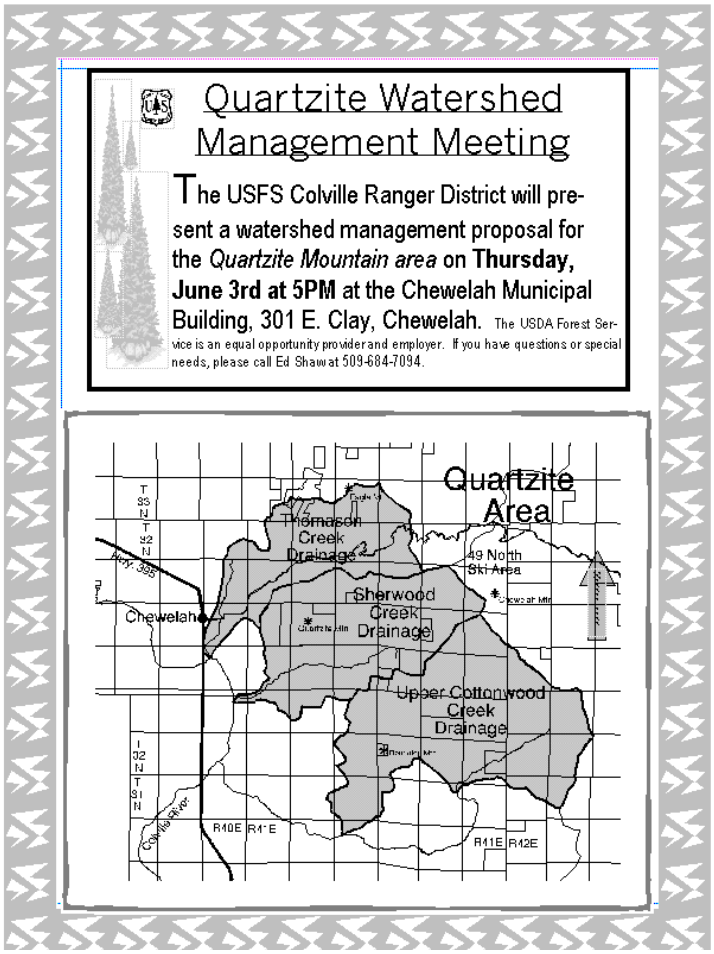
[17] The proposed action was presented in Section 1.4 of Chapter One of this EIS.
[18] See Section 1.1 of this EIS.

In March of 1998 a letter to adjacent landowners and others, and newspaper notices in Colville and Chewelah, asked for information about "current or historic uses of the watershed, past disturbances (fire, logging, flooding, etc.), or the location of unique and sensitive resources." Many people who responded to this request provided valuable information to the analysis.

While this solicitation initiated the exchange of information between the public and the Forest Service, it was limited to the watershed scale ecosystem analysis.

2.1.1 Scoping

The National Environmental Policy Act uses scoping to identify issues associated with Federal actions that may significantly affect the quality of the human environment. To identify issues for the Quartzite Watershed Management Project, comments were solicited from Federal, State and local agencies, adjacent landowners, and other interested people.



The public was first asked to comment on the proposed action[19] on May 27, 1999, when the Three Rivers District Ranger initiated scoping with a letter and newspaper notices. Also, in an effort to fully disclose what was being proposed, two public meetings were held in the summer of 1999. Both took place in Chewelah, Washington, the first occurred on June 3rd and the second on July 27th.

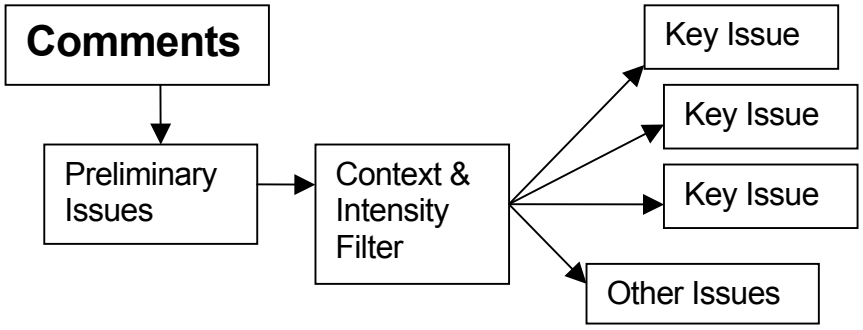
A notice of intent to prepare an environmental impact statement for the project was published in volume 64, number 150 of the Federal Register, on Thursday, August 5, 1999.

Comments were received from over 120 individuals, agencies, businesses and organizations before the Draft EIS was published. Public comments were received in the form of letters, electronic mail messages, phone calls, and personal visits.

[19] The proposed action is presented in Section 1.4 of Chapter One of this EIS.

2.1.2 Issues

The interdisciplinary team used the comments received during scoping, to identify conflicts and to develop issues. A list of preliminary issues was developed, and after a determination of significance was made[20], some issues were withdrawn from detailed analysis because broader effects analysis addressed them adequately; because they were outside the scope of the project; or because mitigation common to all action-alternatives resolved potential conflicts.



These other issues are listed in Appendix A, and letters and scoping correspondence are located in the Project Analysis File. The three remaining Key Issues were used to develop alternatives to the proposed action.

Key Issues

- Road Management
- Betts Basin
- Forest Health

Key Issue: Road Management

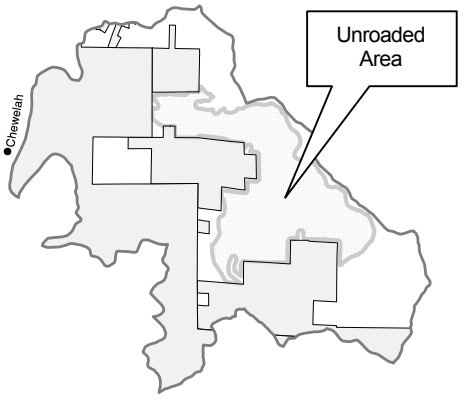
Forest roads are an essential part of the transportation system in this part of Stevens County. They help to meet recreation demands and they provide economic opportunities.

The proposal to build new roads and close existing roads caused concern for some. New road construction is viewed by some of the public to be inconsistent with ecosystem management. Would new roads reduce the quality of wildlife habitat? Would they reduce water quality? Also, two roads currently open would be closed by the proposed action. One is steep and unsafe for most vehicles and would be closed to protect unknowing travelers. The other would be closed to improve wildlife habitat and wetland conditions in the Woodward Meadows area. Some people would prefer these be left open for recreation, firewood

[20] Not all issues become Key Issues. NEPA determines significance by considering the *context and intensity* of the issue. *Context* means that the significance of an action must be analyzed in several contexts such as society as a whole (human, national), the affected region, the affected interests, and the locality. Significance varies with the setting of the proposed action. For instance, in the case of a site-specific action, significance would usually depend upon the effects in the locale rather than in the world as a whole. Both short- and long-term effects are relevant. *Intensity* refers to the severity of impact.

gathering and wildfire access.

In addition, an unroaded area 4,801 acre in size is located on national forest system lands between the Upper Cottonwood Road, and the Cottonwood Divide Road. To improve disturbance ecology, the proposed action builds roads and cuts trees in this area. There is concern that these activities would reduce natural integrity, reduce the opportunity for solitude, and reduce primitive recreation opportunities. Some consider unroaded areas essential for both humans and wildlife. Should the improvements to disturbance ecology be forfeited to preserve this unroaded area? If so, are the risks of catastrophic fire acceptable? Can disturbance ecology be improved without building roads and cutting trees?



Measurable Indicators: The following measurements of change will be used to evaluate and compare the effects of the alternatives on the Road Management issue.

Concern	Measurement of Change
Wildlife habitat & Water quality	Miles of road constructed.
Road access	Miles of existing open road closed by the alternatives.
Unroaded area preservation	Acres meeting unroaded criteria[21].

Key Issue: Betts Basin

The Betts Meadows Wetland Preserve is a 140-acre family trust, located on the 3,420 acre Upper Cottonwood Creek drainage. The purpose of the trust is to maintain the property as a wildlife refuge and native fishery. Many are concerned that building roads and cutting trees above this area would reduce water quality and degrade fish habitat in the preserve. Should the area above the Betts Meadows Wetland Preserve be exempted from treatment to establish baseline water quality information? Or conversely, would the proposed treatments reduce the possibility of an atypical fire event and its associated sedimentation?

Measurable Indicators: The following measurements of change will be used to evaluate and compare the effects of the alternatives on the Betts Basin issue.

Concern	Measurement of Change
Water quality & Fish Habitat	Percent increase in unforested open areas.

[21] For this analysis, an unroaded area is any area greater than 1,000 acres in size that is greater than 100 meters from any existing road or past harvest activity.

Key Issue: Forest Health

There are areas where storm damaged trees; trees infested by Douglas-fir beetle; trees dying from root rot; and overstocked trees are not proposed for treatment. There are concerns that if left un-treated, forest health and productivity will decline. Should all areas with forest health problems be treated? Are certain amounts of these areas typical for the ecosystem? What role do they play in ecosystem functions and processes? If left un-treated, will these areas cause significant losses? If the trees are going to die anyway why shouldn't they be salvaged for human use? What is the difference between ecosystem health and forest health? Should tree vigor and forest health be given priority over ecosystem health?

Measurable Indicators: The following measurements of change will be used to evaluate and compare the effects of the alternatives on this issue.

Concern	Measurement of Change
Forest health	The acres of Douglas-fir beetle infestation included in timber sale units.

Other Measurements of Change

In addition to the resources associated with the Key Issues, the effects the alternatives have on a variety of other resources are discussed. These resources are managed under Forest Plan Standards and Guidelines and the effects the alternatives have on these resources are described in detail in Chapter III of this EIS. They include:

- Soil productivity
- Air Quality
- Vegetation (Forests, Sensitive plants, Competing and Unwanted Vegetation)
- Species and Habitats (including Threatened, Endangered and Sensitive Species; and Management Indicator Species)
- Fisheries
- Roads and Road Management
- Scenery
- Recreation
- Economics
- Heritage sites

Section 2.2 – Alternative Description

The National Environmental Policy Act gives the interdisciplinary team the responsibility of providing the decision maker with alternatives to the proposed action, when unresolved conflict exists. The Act notes that all reasonable alternatives[22] should be considered. As noted above, public comment generated three Key Issues involving unresolved conflict: *Road Management*; *Betts Basin*; and *Forest health*.

To provide a reasonable range of effects in the context of these three issues, the team considered the features of the proposed action that sparked public comment. These include the timber harvest and road construction proposed in Betts Basin; road closures; unattended insect and disease problems; and timber harvest and road construction proposed in an unroaded area. Varying these activities between alternatives extends the range of effects the alternatives have on the issues. As you consider the six action-alternatives, you will notice that some severely limit these activities, some impose moderate limitations and others do not limit them at all.

2.2.1 The Alternatives

Chapter 1/Section 1.4 of this EIS describes three general categories of activities included with the Proposed Action: *vegetation management; riparian/wetland management; and road managemen*t. Similar to the Proposed Action, all action-alternatives include some amount of these management activities. As a result, the following descriptions of the action-alternatives use the Proposed Action as a reference. Detailed maps and tables of the action-alternatives are located in Appendix B.

All six action-alternatives employ measures to mitigate unwanted effects. These are described in Section 2.2.4, which follows the alternative descriptions.

No Action (A): Alternative A is the No Action alternative. This alternative is required by law and serves both as a viable alternative in itself as well as a baseline for comparison of the effects of all the alternatives. No Action means that the proposed vegetation management riparian/wetland management and road management activities described in the Proposed Action would not be initiated at this time. Under No Action there would be no change in current management direction or change from the level of ongoing management intensity within the project area.

While this alternative doesn't propose any new management activities, changes in vegetation would still result where insects and disease are active, or where fire occurs. In this case, No Action would still result in visible and measurable changes caused by these events.

Work previously planned within the project area would still occur under this No Action Alternative (See Appendix C, Reasonably Foreseeable Activities). Effects of these activities are included in the cumulative effects discussions for this alternative in Chapter 3.

[22] As established in case law interpreting the National Environmental Policy Act, the phrase "all reasonable alternatives" has not been interpreted to require that an infinite or unreasonable number of alternatives be analyzed, but does require a range of reasonable alternatives be analyzed whether or not they are within Forest Service jurisdiction to implement.

Proposed Action[23] (B): The Proposed Action was designed to improve ecosystem integrity. It is the result of recommendations found in the Quartzite Watershed Scale Ecosystem Analysis Report.

Vegetation management proposals are designed to restore or maintain vegetation conditions consistent with fire ecology. Consequently, prescriptions vary across the area. Most commercial activities (4,254 acres[24]) would thin trees to reduce stocking and some small areas (up to 5 acres) would leave only a few trees to increase patchiness and mimic intense fires. Most non-commercial thinning and prescribed fire vegetation management proposals (6,342 acres) would come after commercial activities. Like the commercial proposals, these activities are designed to restore or maintain vegetation conditions consistent with fire ecology.

Road management proposals include the construction of 10.83 miles of new road. These roads are designed to improve the feasibility of vegetation management proposals while minimizing effects on wildlife, hydrology and native plants. Two segments of existing open road would be closed (1.8 miles total). 35.52 miles of existing road would be re-constructed.

Riparian/wetland management proposals in the Woodward Meadows riparian area include stream channel improvements, and planting native riparian plant species (roughly 100 acres). Other activities improve road drainage at six stream crossings (some outside NFS lands).

The Proposed Action alternative is consistent with the Forest Plan.

Upper Cottonwood (C): The Upper Cottonwood alternative was designed to limit the effects associated with timber harvest and road construction proposed in Betts Basin.

This alternative would implement the Proposed Action Alternative in all areas except the Betts Basin (as defined by ownership and hydrologic divisions). It would implement 2,877 acres of commercial harvest, and 4,784 acres of non-commercial thinning and fire. It would build 6.89 miles of new road, and re-construct 32.68 miles of existing road.

The Upper Cottonwood alternative is consistent with the Forest Plan.

Wildland (E): Alternative E broadens the range of effects the alternatives have on the unroaded area by excluding all proposed activities located within the unroaded area (as defined by the Quartzite Watershed Scale Ecosystem Analysis).

It would implement all other activities associated with the Proposed Action Alternative, including 1,748 acres of commercial harvest, and 3,020 acres of non-commercial thinning and fire. It would build 2.33 miles of new road, and re-construct 35.05 miles of existing road.

The Wildland alternative is consistent with the Forest Plan.

Vegetation (F): This alternative is designed to address forest health concerns. It would implement the Proposed Action Alternative plus additional commercial harvest areas where insects, disease, storm damage and overstocking occur.

[23] See Section 1.4 of this EIS.

[24] While the acres of treatment areas and miles of road construction appear exact, they represent best estimates, based on computer generated mapping and photo interpretation.

Unlike the Proposed Action, it would not close the two segments of existing open road. It would implement 5446 acres of commercial harvest, and 7,034 acres of non-commercial thinning and fire. It would build 18.37 miles of new road, and re-construct 35.54 miles of existing road.

The Vegetation Alternative is not consistent with Forest Plan water quality and visual resource management standards and guidelines. Because the alternative increases the chance of channel-forming flows resulting from timber harvest and road construction in four sub-watersheds, it would not meet Forest Plan water quality standards. Road construction would not meet Forest Plan partial retention visual standards in two areas. A Forest Plan amendment that exempts this alternative from water quality and visual standards would be required to implement this alternative.

Wildland Fire (J): This alternative uses fire to maintain desired vegetation conditions in the unroaded area. It would implement the Wildland alternative plus any maintenance fire areas within the unroaded area. It would implement 1,748 acres of commercial harvest, and 3,479 acres of non-commercial thinning and fire. It would build 2.33 miles of new road, and re-construct 35.05 miles of existing road.

The Wildland Fire alternative is consistent with the Forest Plan.

Existing Roads (K): This alternative is designed to reduce the effects of road construction. It would implement the Proposed Action Alternative except for any commercial harvest areas (and associated restoration fire areas) not feasible from existing roads. It would implement 3,753 acres of commercial harvest, and 5,635 acres of non-commercial thinning and fire. It would not build any new roads. It would reconstruct 35.52 miles of existing road.

The Existing Roads alternative is consistent with the Forest Plan.

2.2.2 Other Alternatives Considered

As noted above, the interdisciplinary team has the responsibility of providing the decision maker with a reasonable range of alternatives. In route to that end, they considered several proposals that were dismissed for a variety of reasons. The following section describes other proposals and the reasons they were dismissed from further analysis.

Commercial Harvest Acre per New Road Mile Ratio: The concept behind this alternative was to increase the acre/mile ratio in an effort to reduce road construction, while still improving vegetation conditions. It was not fully developed, because the interdisciplinary team determined that the result would be too similar to the Proposed Action.

Upper Cottonwood-Plus: This proposal would implement the Upper Cottonwood alternative plus additional commercial harvest, non-commercial thinning and fire areas within Betts Basin that are feasible from existing roads. It would implement 4340 acres of commercial harvest, 6120 acres of non-commercial thinning and fire and it would build 7.3 miles of new road. Because comments showed intolerance to both road construction *and* commercial harvest in Betts Basin, the interdisciplinary team determined this alternative did not expand the range of effects on the Betts Basin issue, and it was dismissed.

Southwest Slopes: This alternative was conceived to only improve the condition of vegetation that is furthest from its historic condition, and as a result limit road construction.

It would implement the Proposed Action minus any commercial harvest areas (and associated restoration fire areas) located on north and east facing slopes. It would implement 3350 acres of commercial harvest, 5130 acres of non-commercial thinning and fire and it would build 9.7 miles of new road. Following initial development, it was noted that the reduction in road miles from those included in the Proposed Action was not significant, and this alternative was dismissed.

Blend: This alternative would implement the Proposed Action with the exception of selected yarding and road changes (it eliminates one road in Betts Basin, and one in Horseshoe Basin, reduces the length of one road in Betts Basin and one in Horseshoe Basin and adds a road not included in any other alternative west of Betts Basin). It would implement 4730 acres of commercial harvest, 6510 acres of non-commercial thinning and fire and it would build 6.6 miles of new road. It was designed to provide a blend of effects on all three issues, however these are represented in other alternatives, and so it was dismissed because it did not increase the range of effects.

Southwest Slopes plus Forest Health: Implement the Southwest Slopes alternative plus additional commercial harvest areas, where insects, disease and storm damage occur. It would implement 4070 acres of commercial harvest, 5420 acres of non-commercial thinning and fire and it would build 9.7 miles of new road. This alternative shares the objectives of the Southwest Slopes alternative, while incorporating concerns associated with the Forest Health issue. But again, its effects on the key issues were so similar to other alternatives, that it too was dismissed.

2.2.3 Features Common to All Action-Alternatives

All the action-alternatives propose similar activities to varying degrees. This section provides a description of these and other activities that are common to all action-alternatives.

The timber sale activities included with the alternatives also share the same objective. The Forest Service uses a database and assigns purpose codes to track timber sales. The Timber Sale Periodic Information Reporting System purpose code for all commercial harvest units in all action-alternatives is Forest Stewardship[25].

Silvicultural Prescriptions

Silvicultural prescriptions (the practice of controlling what trees grow where and at what rate) provide the most effective means with which to achieve vegetation management objectives. All action-alternatives propose silvicultural prescriptions. However, they differ by how much area is affected. While the area varies between alternatives, silvicultural prescription definitions are consistent for all alternatives. These range from classic silvicultural textbook definitions, to project specific definitions.

[25] The Forest Stewardship purpose code is assigned to those timber sales that are designed to improve: forest and ecosystem health; wildlife habitat; and fisheries habitat and watershed function.

A variety of factors influence which prescriptions are used, including: the historic condition of the vegetation; the inherent disturbance regime; the present character of vegetation; project objectives and issues; the silvicultural prescriptions identified by the management area prescriptions (Chapter 4 of the Forest Plan); and prescription feasibility.

The mechanics of implementing silvicultural prescriptions involve felling and yarding. All six action-alternatives propose the use of these activities. Felling is self-explanatory and may be done manually with a chainsaw, or mechanically with a track or tire mounted vehicle with a cutting head. Yarding involves moving logs from their felling site to a landing, where they are loaded onto trucks. Track or rubber tired skidders that drag logs to the landings are most commonly used. Also, forwarders (self loading vehicles that transport logs in a bunk to landings) may be used. In some units, felled trees/logs would be suspended by one end from a cable, and transported along the cable to landings. In other units where helicopters are used, ground crews attach logs to a hovering helicopter, which then flies logs ½ mile or more to landings. The next section of this chapter displays yarding related mitigation measures (Also see the Best Management Practices in the Analysis File). Yarding methods for each unit in the six action-alternatives are noted in the alternative tables in Appendix B.

PRESCRIPTION	DEFINITION
HTH	**Commercial Free-thinning**: The removal of trees in even-aged or uneven-aged stands to control stand spacing and favor desired trees, using a combination of thinning criteria without regard to crown position. This prescription combines elements of crown and low thinning to achieve the desired results. The objectives are: to remove trees that exhibit poor form, vigor, or pose a significant risk of insect and disease mortality; reduce competition; and to increase growing space for the development of large trees. Up to 50 percent of existing trees would be harvested.
HSL	**Uneven Age Management**: The application of a combination of actions needed to simultaneously maintain continuous high-forest cover, recurring regeneration of desirable species, and the orderly growth and development of trees through a range of diameter classes to provide a sustained yield of forest products. Cutting is usually regulated by specifying the number or proportion of trees of particular sizes to retain in each area. Cutting methods that develop and maintain uneven-aged stands are *Single Tree Selection Cutting* - The removal of selected trees from specified size and age classes over the entire stand in order to meet a predetermined goal of size or age distribution and species composition in the remaining stand; *Group Selection Cutting* - The removal of small groups of trees to meet a predetermined goal of size distribution and species in the remaining stand. Up to 50 percent of the existing trees would be harvested in each unit, with up to 25 percent emphasizing regeneration objectives using group openings.
iHSH	**Irregular Shelterwood**: A variant of the Shelterwood Method in which some or all of the shelter trees are retained, well beyond the normal period of retention, to attain goals other than regeneration. The resulting stand may be two-aged or trend towards an uneven-aged condition as a consequence of both an extended period of regeneration establishment and the retention of reserve trees that may represent one or more age classes.
HSV	**Salvage:** These areas include forest stands in which the Douglas-fir beetle has led or contributed to high mortality in the stand. In addition to beetle, other disturbance agents, which have attributed to high mortality in the forest stands, may include wind, snow, ice, root pathogens or mistletoe. Two types of harvest would occur. A regeneration harvest where greater than 50% of the stand of trees is dead and a selective harvest where less than 50% of the stand is dead or dying or is expected to die from beetles and other disturbance agents. Some dead tree greater than 21.0 inches diameter breast height may be harvested after other resource considerations are made.
HCR	**Seed Tree**: An even-aged regeneration method in which a new age class develops from seedlings that germinate in a fully-exposed micro-environment after removal of all the previous stand, except for a small number of trees left to provide seed.
SPC	**Non-commercial Thinning**: Removing some of the trees in a stand (those that are too small to make a merchantable product) to allow the remaining trees to grow faster due to reduced competition for nutrients, water, and sunlight.

While the preceding definitions can be applied to those prescriptions identified in the alternative tables, forest stands within harvest units are not homogenous, and as a result,

silvicultural prescriptions vary within units. The prescription variation is noted in terms of the percentage of the unit area. It should also be noted that for various reasons (tree size, spacing, etc.) there would be areas within units where no silvicultural prescription would occur.

Post Harvest Activities

Post harvest activities would occur with all action-alternatives. They include fuel management, seedling site preparation, reforestation and cleaning.

Following harvest, prescribed fire is used to move fuels toward historic conditions. It is also used to prepare the site for tree seedlings; to improve big-game forage conditions; and to reduce tree stocking levels. To do this, field crews (and where appropriate, helicopters) generally work an area from the top down, lighting concentrations of slash[26] as they progress to the bottom. Care is taken to assure burning conditions and techniques accommodate silvicultural prescriptions.

Pile burning is designated elsewhere. Where cable or helicopter yarding is used, landing slash would be piled and burned at the landings. In other areas grapple piling[27] is used to manage excess fuel. In some units, trees that are not designated as leave trees and are not removed for commercial uses would be cut to move the remaining forest closer to historic conditions.

Where designated, shade intolerant tree seedlings (ponderosa pine, western larch, Douglas fir, western white pine) would be manually planted to augment the shade tolerant species (grand fir, western red cedar, western hemlock) that are expected to regenerate some sites. Where cleaning is designated, small diameter trees damaged by logging would be cut. Specific post harvest activities for each alternative are noted in the alternative tables, located in the appendix.

Road Development

New road construction or reconstruction of existing roadbeds is proposed by all but one[28] action-alternative. Mitigation measures note that *All newly constructed road segments and reconstructed closed road segments would be closed within one year of sale completion unless otherwise specified.* The disparity between the quantities of road construction proposed by the six action-alternatives is a response to the concern for the effects of roads. To respond to forest health concerns, one alternative proposes more road construction than the others. To reduce negative effects on wildlife, water quality and other resources, one alternative proposes no new road construction. Other alternatives minimize new roads by relying on alternate yarding methods or by limiting construction to specific portions of the project planning area. Each alternative description lists miles of road construction and reconstruction.

New construction falls into two categories: classified or temporary. Classified construction is controlled by contract specifications. Specified roads are classified roads[29], and are intended to serve multiple use needs as long-term facilities however, specified roads proposed with this project would include an intermittent service life, and as noted above,

[26] Slash is comprised of tree branches and tops, and small trees and brush that remain after harvest.
[27] An excavator equipped with a grapple, would pile slash, which would then be burned.
[28] Alternative K: Existing Roads, avoids new road construction.
[29] A classified road is constructed or maintained for long-term highway vehicle use.

would be closed one year after completion of the sale. Road design and location would be such that the roads would have a "free-flowing" alignment and "rolling" grades. The goal of these strategies is for the road to match existing topography, thus minimizing excavation. Drain dips would be used to move water off of the roadbed at regular intervals.

Temporary road construction is designed for the sole purpose of harvesting of a specific unit. The intent of these roads is for short-term use, after which they would be closed, effectively obliterated, seeded, and put back into resource production[30]. Since temporary roads are not intended to be a long-term facility, they would not receive periodic maintenance. Unlike classified roads, their construction is not controlled by contract specifications.

New road construction activities would start by removing right of way trees from the road location. Earth moving equipment (excavators, bulldozers) would then establish the roadbed, install drainage features and where appropriate, apply an aggregate surface. See the Mitigation Section of this chapter for road construction mitigation measures.

For this project, road *re*construction falls into two classes: *Light Reconstruction* would involve occasional construction of drainage features, with associated light blading and brushing on roads used for log haul. Most drainage features would be drain dips that are designed to reduce sedimentation by moving water off of the roadbed. Rocking of drain dips, and rocking of roadbed for grade and sub grade strength is also included. Based on similar past projects, it is estimated that the actual length of ground disturbance would be 20% of the length listed for "light reconstruction."

Medium Reconstruction would involve light reconstruction plus occasional cut bank and roadbed excavation to increase width (for safety). Reconstruction work would occur on most of the road length proposed for medium reconstruction. Road mitigation included with this project notes that following log haul, all new and presently closed *re*constructed roads would be closed. All alternatives would also include very short, temporary spur roads to access landings where logs cannot be skidded directly to roadsides, or where landings adjoin main public travel ways. These temporary spur roads would be obliterated immediately following logging activities.

Road/Stream crossing improvement

The action alternatives would make improvements to existing roads at six locations where roads cross streams. Road graders, excavators, dump trucks, and bulldozers would be used to modify road and ditch structures such that water is directed away from streams. Applications of crushed rock to the road surface in these areas would also reduce the amount of sediment that moves off roads during storms and spring runoff.

Road Closure

In Section 1.4 in Chapter One of this EIS the proposed action identified two roads for closure. This proposal is carried through all action alternatives, except for the Vegetation Alternative (Alternative F). As noted in Section 1.4, the Jay Gould Ridge road closure uses boulders to block access. With this closure, 10-20 off-site boulders would be strategically placed, using a backhoe or excavator. Little ground disturbance would occur.

[30] The National Forest Management Act of 1976 requires that all temporary roads be returned to resource production within 10 years after use.

The second closure, located adjacent to Woodward meadows, would erect roughly 200 feet of wooden fence above, across and below the road. Behind this fence, an excavator would be used to pull the existing road fill back up into place to re-establish the native slope contour. This would occur on a 500 foot section of road located immediately behind the fence. As with all soil disturbing activities, appropriate species would be used to re-vegetate this site[31].

Rock Pit Sites

Gathering rock for road construction and reconstruction is a component of the road construction proposals. Two new sites located on National Forest System Lands could be developed to accommodate these needs. One of these aggregate sources is adjacent to existing Stevens County Road #2888 (Mud Lake Road) in Township 32 North, Range 41 East, in the southwest 1/4 of the northeast 1/4 of Section 22. The other is adjacent to a proposed new road[32] located in Township 32 North, Range 40 East, in the southeast 1/4 of the northeast 1/4 of Section 9.

Document Checkpoint

This sub-section of Chapter 2 describes features common to all action alternatives. The mitigation sub-section comes next, which in turn is followed by Section 2.3: Monitoring.

Rock and crushed stone products would be loosened by drilling and blasting, then loaded by power shovel or front-end loader into large haul trucks that transport the material to the processing operations. Techniques used for extraction vary with the nature and location of the deposit. Processing operations may include crushing, screening, size classification, material handling, and storage operations. The area affected by each of these sites would roughly equal an acre; which is approximately 200 feet by 200 feet.

Non-Commercial/Restoration Thinning

Thinning is proposed where the trees are too small to provide a commercial product. Like all vegetation management proposals, thinning is proposed to improve ecosystem integrity. In the past frequent low intensity fire thinned small trees over a large part of the project area. In the majority of the areas proposed for thinning, chainsaws would be used to reduce the number of trees down to 250 to 450 trees per acre. In other areas, where tree stocking is excessive, mechanical thinning would be employed with the use of a rotating cutting head attached to a boom, which in turn is mounted on a track or rubber tired vehicle. The maps located in the appendix, display the proposed non-commercial thinning activities.

Maintenance Fire

Prescribed fire that is designed to maintain current desired conditions would occur outside commercial vegetation management areas. Existing fuel loads in these areas are low enough to conduct a burn that reduces these fuels, while maintaining desired vegetation conditions. The process used is identical to that discussed in the preceding 'Post Harvest Activities' section: field crews (and where appropriate, helicopters) generally work an area from the top down, lighting concentrations of slash as they progress to the bottom.

[31] See the Mitigation Measures sub-section for re-vegetation mitigation.
[32] This pit and associated road construction are only proposed with Alternatives B, C & F.
[33] Slash is comprised of tree branches and tops, and small trees and brush that remain after harvest.
[34] An excavator equipped with a grapple, would pile slash, which would then be burned.

Riparian/Wetland Management

All action alternatives propose improvements to Woodward Meadows. As noted in the 'Proposed Action' Section of Chapter One, these improvements include the installation of small earthen dams and the planting of riparian species. A track-mounted excavator would use on-site materials to construct up to ten small structures, placed across existing human-made channels in Woodward Meadows. Red-osier dogwood, black cottonwood, and other native (locally collected) riparian species would be planted where appropriate.

Wildlife Habitat Area Adjustments

Included with all action-alternatives is a proposal to adjust the boundaries of three pine marten habitat units and one pileated woodpecker habitat unit[35]. These minor adjustments in unit boundaries are proposed in areas where better habitat exists outside current unit locations. The proposed adjustments would include these areas, and exclude inferior habitat currently located within marten habitat units[36].

Also, all action alternatives stipulate that 260 acres contiguous to the MA-1 would be managed as barred owl habitat, on an interim basis, until the Forest Plan revision[37] considers Forest-wide barred owl habitat strategies.

Timber Sale Area Improvements

Other activities proposed to guide the character of the management areas toward their respective desired conditions would be financed by timber sale generated funding, if available. The Knutson-Vandenberg Act (KV) as amended by the National Forest Management Act of 1976 is the authority for requiring purchasers of National Forest timber to make deposits to finance sale area improvement activities needed to protect and improve the future productivity of the renewable resources of forest lands on timber sale areas. Activities include sale area improvement operations, maintenance and construction for reforestation, timber stand improvement, range, wildlife and fish habitat, soil and watershed, and recreation.

Activities required to be funded through KV collections are those needed to ensure reforestation of harvested areas. When KV collections exceed the level necessary for reforestation, other eligible sale area improvement activities may be funded. The interdisciplinary team lists these eligible activities by priority. The amount of available funding is dependent on the sale bids and timber market values. Beginning with the highest priority, projects are funded to the extent that KV funds are available. The activities are listed below by priority.

1) One hundred fifty acres of the non-commercial thinning discussed in Section 1.4 would occur to reduce inter-tree competition for water, nutrients and sunlight. These are included in Section 1.4 of this EIS.

[35] The Colville National Forest Land and Resource Management Plan established a network of wildlife habitat units distributed across the Forest. See the Species and Habitats discussion in Chapter 3 of this EIS for details.
[36] Maps and detailed descriptions can be found in the Project Wildlife Habitat Analysis, which is located in the analysis file.
[37] The Forest Plan revision is scheduled to start in 2003.

2) One hundred fifty acres of the prescribed fire for big-game winter range improvement discussed in Section 1.4 Prescribed fire for big-game winter range improvement would occur. These are included in Section 1.4 of this EIS.

3) The two road closures discussed in Section 1.4 of this EIS would occur. They are Forest Roads 4300.300 and 4342.250.[38]

2.2.4 Mitigation Measures

These measures are used to reduce negative effects on area resources. They are considered part of the alternatives and will be incorporated as such. All mitigation measures listed (some of which are the standard management practices included in both timber sale contracts and road construction contracts) are common to all the action-alternatives, unless otherwise noted. They would be required if one of the action-alternatives is implemented. In general, all action-alternatives incorporate the mitigation associated with Forest Plan standards and guidelines, as amended.

Mitigation measures pertaining to water quality are generated from a list of Best Management Practices (BMPs) that was developed by the interdisciplinary team. BMPs are the primary mechanism used to achieve water quality standards, with an emphasis on non-point pollution sources. The BMPs apply to specific situations that are predicted to occur if one of the action-alternatives were selected. They are incorporated into the structure of the action-alternatives and where necessary, contract provisions are included within those contracts associated with the proposed activities (timber sale contract, road construction contract, slash piling contract, etc.). The BMP process has been certified by the State of Washington as a valid method for protecting water quality within the State, thus meeting the requirements of the Clean Water Act. Through implementation and monitoring of the BMPs, compliance with the Clean Water Act would be achieved and State water quality goals and standards would be met.

To develop BMPs, the interdisciplinary team reviewed a list of general BMPs for applicability. Those relevant to the project were then modified to fit the conditions specific to the project area. Next, an effectiveness estimate was made for each BMP. This estimate showed that the modified BMPs have a high probability of reducing sediment delivery (the most common pollution associated with the non-point source activities proposed by the alternatives) to nearby streams. Complete BMP documentation can be found in the Analysis File.

Additional resource specific mitigation follows BMP mitigation.

BMP Mitigation

These measures are derived from the Best Management Practices and are referenced to the specific BMP.

1) In all harvest units including those utilizing ground based yarding systems, detrimental soil conditions (Compaction, displacement or puddling {see LRMP FEIS glossary-10}) would not exceed 20% of the total unit area. BMP PT-8 (Streamcourse and Wetland Protection), BMP PT-11 (Tractor Skid Trail and Temporary Road Location and Design)

[38] In the event that KV funding is insufficient, other funding would be used.

2) Skid trail networks, including forwarder trails, and temporary road locations would be approved in advance. BMP PT-11 (Tractor Skid Trail and Temporary Road Location and Design).

3) In all harvest units, equipment shall not be allowed to operate when ground conditions are such that excessive damage would result; all skid trails, forwarder trails and temporary roads and landings would be scarified and re-seeded after use; erosion control work shall be kept current, immediately preceding expected seasonal periods of precipitation or runoff. BMP PT-13 (Erosion Prevention and Control Measures During Timber Sale Operations), BMP PT-14 (Revegetation of Areas Disturbed By Harvest Activities), BMP PT-15 (Log Landing Erosion Prevention and Control), BMP PT-16 (Erosion Control on Skid Trails).

4) Riparian Habitat Conservation Areas would be identified on the ground where any harvest activity would take place adjacent to streams. Direction for management is found in the Colville Forest Plan (pgs. 4-53 & 4-54) and FEIS (Appendix G) and in the Amendments to the Forest Plan. BMP PT-7 (Riparian Habitat Conservation Area Designation and Protection).

5) Directional falling (away from stream courses) would occur in segments of stream courses designated on the Sale Area Map. This includes both perennial and intermittent streams. BMP PT-7 (Riparian Habitat Conservation Area Designation and Protection), BMP PT-8 (Streamcourse and Wetland Protection).

6) Where feasible, all landings would be located outside existing meadows and streamside management units so that designated timber can be yarded with minimal disturbance to the channels and meadows. BMP PT-17 (Meadow Protection During Timber Harvest) BMP PT-7 (Riparian Habitat Conservation Area Designation and Protection), BMP PT-10 (Log Landing Location).

7) Designated stream courses, wetlands, harvest unit boundaries, yarding methods and road locations would be included in all Sale Area Maps. BMP PT-4 (Use of Sale Area Maps for Designating Water Quality Protection Needs).

8) To protect water quality from degradation caused by tractor logging ground disturbance, tractor logging would be restricted to slopes averaging 35% or less. BMP PT-9 (Determining Tractor Loggable Ground).

9) Within areas designated as skyline or helicopter yarding, one end suspension of logs would be required to reduce ground disturbance. Where topography prevents one end suspension, intermediate supports would be used to attain suspension. BMP PT-12 (Suspended Log Yarding in Timber Harvesting).

10) Areas that do not meet Regional stocking standards after harvest would be reforested within five years to stabilize soils, increase ground cover, and provide improved soil infiltration. BMP PT-20 (Reforestation).

11) Refueling and servicing areas for all types of mechanized equipment would be located at a distance from streams such that a “worst case” fuel spill would not enter the stream. In the case of ground-based equipment, servicing and refueling would be done at landing locations where possible, and location of these areas would be agreed upon prior to harvest operations. Spill containment berms of appropriate size would be constructed around stationary on site fuel storage areas. A Spill Prevention Control and Countermeasure Plan, certified by a registered professional engineer, would be required if the volume of oil or oil products exceeds 660 gallons in a single container or if total storage at a site exceeds 1320 gallons. BMP PT-21 (Servicing and Refueling of Equipment), BMP PW-4 (Oil and Hazardous Substance Contingency Plan and Spill Prevention Control & Countermeasure Plan).

12) The following road design and location mitigation would be used to minimize soil erosion and sedimentation, BMP PR-1 (General Guidelines for the Location and Design of Roads):

a) New Traffic Service Level "D" roads with design speed of 10 mph or less would be located on a predominately non-geometrical horizontal and vertical alignment to minimize the amount of excavated material needed to construct the road.

b) The road grade would be rolling when possible between control points to provide roadbed drainage.

c) Generally roads would be located on flatter side slopes over steeper side slopes to limit soil movement outside of the road clearing limits.

d) Wherever possible roads would be located to utilize existing old road prisms rather than on "undisturbed" ground to minimize the amount of new slope construction.

e) New road alignments would enter and leave Riparian Habitat Conservation Areas in as short a length as possible given the constraints at the crossing location for relieving roadway drainage and road alignment into and out of the area.

f) Road location would take into account grade "runout" to facilitate design of sag curves in Category 1, 2, and 4 riparian habitat conservation areas.

g) New stream crossings would be located in areas of lower stream gradient over areas of higher stream gradient, to limit the amount of scour protection needed at the drainage structure outlet and in Category 1 riparian habitat conservation areas, and to facilitate fish passage through the drainage structure.

h) Road locations within riparian habitat conservation areas would be limited to stream crossings unless site-specific analysis determines otherwise.

i) Stream crossings would be minimized as determined by site-specific analysis.

j) Road design standards would be the minimum necessary to meet user and resource needs.

k) Culverts in Category 1 riparian habitat conservation areas would be installed to provide for upstream fish passage. At Category 1 riparian habitat conservation areas, stream crossings, temporary conduits would be used to divert water around construction sites until the culvert is in place. Sediment cachments would be placed below Category 1 riparian habitat conservation areas stream crossings, to capture sediment and minimize the length of stream affected by construction sediment.

l) Roadbeds would be protected within riparian habitat conservation areas, or contributing areas, by armoring with aggregate surfacing unless native material provides adequate protection.

m) Roadway drainage would be designed so that water concentrated by the road prism is dispersed prior to entering the stream channels.

n) Roads in Category 1, 2, and 4 riparian habitat conservation areas would be designed in such a way that stream flow will not be diverted down the road in the case of a crossing failure.

o) In Class 4 streams, the designed drainage would be a self maintaining type such as a drain dip or outslope drain. Culverts would be installed in ephemeral draws when the cost of stabilizing the roadbed and fill slope on drain dips and outslope drains are greater than for the culvert installation with scour protection.

13) Prior to starting road construction work, the contractor would be required to submit a plan of operation for road construction which sets forth general erosion control measures to be used. BMP PR-2 (Erosion Control Plan).

14) Road construction and reconstruction work would be accomplished between July 1 and November 30, to minimize sedimentation. Stream crossing construction in Category 1 riparian habitat conservation areas would be limited to times outside the spawning season for fish. Operations outside the normal operation season will require a written operating plan from the purchaser, outlining resource prevention measures. These operations will be permitted only when they can be conducted without damage to soil, water, and other resources. BMP PR-3 (Timing of Construction Activities).

15) The following road location, design and construction standards that affect the stability of constructed cut and fill slopes, and water areas, would be used to minimize long term soil erosion and slope failures and soil movement. BMP PR-4 (Location, Design and Construction of Stable Road Cut and Fill Slopes).

    a) Locate roads and waste areas on flatter side slopes over steeper side slopes to minimize the cut/fill slope area.

    b) Avoid where possible, road locations on inner gorge areas with side slopes over 50% to minimize cut and fill slope area and the risk of intercepting subsurface water in or adjacent to the riparian habitat conservation areas.

    c) Avoid where possible, road locations that would intercept subsurface flow on side slopes over approximately 30% to minimize the risk of long-term failure in constructed cut slopes.

    d) Avoid road locations through landforms, which show mass movement where the Forest Soil Scientist estimates there is a high probability of continued mass soil movement.

    e) The road designer will design to the steepest slope ratio for a given soil type which is mechanically stable given dry conditions and gives a seed bed which will reliably hold seed on the slope under a given seed application method.

    f) Revegetate cut and fill slopes, roadbed, and waste areas and ditches. Areas where cut and fill slopes are to be constructed in highly erodeable material should be identified in the pre-construction design walk phase, and special revegetation measures should be designed for these areas.

    g) Seed mixes and application methods will follow the “Colville National Forest Weed Prevention Guidelines” and the “Seeding and Planting Guide for the Colville National Forest.”

    h) Roadbeds of roads to be closed after the Timber Sale would be seeded at time of closure.

    i) Where roadbed drainage is concentrated on fill slopes the slope would be armored or filter material placed on it. This standard applies to new construction.

    j) Cut slopes with subsurface water present would be stabilized by flattening the slope ratio for slopes under 2’ in height or buttressed for slope heights over 2’. Where buttressing is utilized, water coming out of the slope would be filtered to prevent piping of material from the slope into roadway drainage.

    k) Waste areas would be located on flatter side slopes. Concentrated side hill or roadway drainage would not be dumped onto the waste area. Waste area slopes would be constructed no steeper than 1.5:1. Waste material would be layer placed, leaving the slope face in a roughened condition.

l) Embankments would be placed using side cast and end haul methods. Added compaction requirements may be required by the Forest Soil Scientist for construction of major embankments to assure the mass stability of the embankment.

m) Embankments would not be designed on side slopes over 70%, for those materials whose angle of repose is at 1.25:1.

16) To minimize the erosive effects of water concentrated by road drainage features, and to disperse run-off from the road, and to minimize soil movement outside the road clearing limits, runoff from the road template would be directed off the roadway and ditch relief would be provided at short enough intervals (based on soil type) that soil movement will be minimized outside the road clearing limits. Where it is impractical to relieve drainage in short enough intervals, ditches and roadbeds would be armored to achieve a more practical spacing of drainage structures. BMP PR-7 (Control of Surface Roadway Drainage).

17) Road location, design, and construction within Riparian Habitat Conservation Areas (riparian habitat conservation areas) would include the following: BMP PR-12 (Location, Design, and Control of construction in riparian habitat conservation areas).

a) Road locations in riparian habitat conservation areas will be avoided wherever feasible.

b) Roadway drainage will be designed so that runoff is filtered and sediment settled prior to entering stream channels. Where run-off cannot be effectively filtered by the forest floor, artificial sediment detention structures and/or erosion control measures such as brush blankets, filter windrows or fences, riprap blankets or sediment basins should be installed to accomplish the same goal. Construction slash may be placed in slash mats mulching the fill slope.

c) Minimize length of road surface and ditch line draining directly to stream channels.

d) Protect road crossing by armoring with surfacing and other methods to withstand a 100-year flood.

e) Roads crossing streams and RHCAs will be designed such that stream flow is not diverted down the road in the event of high flow and crossing failure. Existing crossings will be evaluated with respect to their level of failure risk, and will be reconstructed if substantial risk exists.

f) See BMP PR-2 for minimum construction methods required for construction in sensitive areas.

g) Stream crossings will be constructed “in the dry”. Water flowing into the construction area will be diverted around the area prior to pioneer road construction across the RHCA. Diverted water will be treated to remove sediment prior to flowing back into the creek.

h) No unprotected soil surfaces, such as road embankments, will be left within the 100-year flood plain.

i) Temporary bypass roads at creek crossings will be stabilized and revegetated after use.

j) Culverts will be bedded into the streambed sufficiently to avoid piping under the culvert. Construct energy dissipaters at culvert outlets to provide scour protection for 100-year peak discharges.

18) Construction slash would be placed in windrows at the toe of fill slopes or in slash mats, mulching the fill slope, to minimize the need to disrupt additional ground to bury or burn slash and to help retain soil eroded from fill slopes. BMP PR-15 (Disposal of Right-of-Way and Roadside Debris).

19) Road maintenance would be a timber sale contract requirement, to reduce sedimentation and erosion, during sale activities. BMP PR-18 (Maintenance of Roads).

20) Contractor operations would be limited in the Project Planning Area during wet periods. Roads would not be used for hauling or any other harvest-related activities when conditions are such that damage or erosion may result. BMP PR-20 (Traffic Control During Wet Periods).

21) All newly constructed road segments and reconstructed closed road segments would be closed within one year of sale completion unless otherwise specified.

22) Where necessary, logging slash would be burned, to reduce the risk of catastrophic fire and subsequent flooding and erosion. BMP PF-1 (Fire and Fuel Management Activities).

23) Prescribed fire activities would be designed with specific concerns for the protection of water, soils, and riparian vegetation. Design elements would include, but are not limited to, fire weather, aspect, vegetation moisture, and fuel moisture. Consideration of these elements would help protect riparian vegetation, maintain soil productivity, and minimize soil repellency and erosion. Elements would be designed to control fire intensity, rate of spread, residence time, and fuel consumption. BMP PF-2 (Consideration of Water Quality in Formulating Prescribed Fire Prescriptions), BMP PF-3 (Protection of Water Quality During Prescribed Fire Operations).

24) Riparian/Wetland Management activities in Woodward meadows would be designed with specific concerns for the protection of water, soils, and riparian vegetation. BMP VM-2 (Tractor Operation Excluded From Wetland and Meadows).

    a) Mechanical equipment in the meadow will be limited to a tracked excavator.

    b) Equipment operation will be restricted to

        - Winter months over a snow pack depth of not less than 20 inches or over ground frozen to a depth of 4 inches or more or low ground pressure equipment that exerts a track pressure not greater than 5 pounds per square inch.

        - A single pass along the area to be rehabilitated.

    c) In-channel work will occur during low flow periods to minimize off-site movement of sediment. Impoundment work will progress from downstream to upstream to provide sediment traps during project implementation. Impoundment structures will be designed and constructed to minimize maintenance disturbance.

Soil Mitigation

While Best Management Practices are primarily designed to achieve water quality standards, they also protect soil resources. Not all soil protection needs are covered by BMP mitigation however. The following mitigation measures complete those needs and insure that impacts to soils will remain within Forest Service guidelines.

Vegetation Management

Timber Sale

Felling and Yarding

25) Harvest units with high compaction potential would be treated using a variety of measures. Those units containing highly compactive soils are: 1, 4, 5, 7, 14, 17, 18, 23, 49, 50, 54, 57, 66, 68, 79, 94, 99, 113, 115, 123, and 127. Measures include:

a) Conventional tractor logging (130' skid trails) over snow depths of 20" or greater, or over ground frozen to a depth of 4" or more.

b) Cut-to-length equipment working on average slash depths of 12" or more on designated 40' trails

c) Or cut-to-length equipment working over snow depths of 20" or greater, or over ground frozen to a depth of 4" or more on designated 40' trails.

d) Conventional tractor logging with mechanical fellers restricted to designated 130' skid trails (hand-felling between) or hand-fall the entire unit.

e) Mechanical fellers with a static ground pressure < 5 psi in a single pass scenario throughout the unit.

26) The following mitigations apply to tractor units located on highly compactive soils within deer winter range.

a) Winter logging will be allowed in units 1, 4, 5, 7, 23, 66, 94, 113, 115, 123, and 127, subject to the above felling and yarding guidelines. If the purchaser decides to exercise the option of winter logging (Dec1 through March 31) in these tractor units, adjacent skyline and helicopter units will not be logged during the same season.

b) Winter logging (Dec1 through March 31) in units 66, 113, 115, 123, and 127 will not occur during the same season. Units 66, 123, and 127 will be logged during a different season or year than Units 113 and 115.

Grapple Piling and Pile Burning

27) Pile only debris concentrations or priority areas of units identified for post harvest site prep in order to reduce the total area impacted. Pile when soils are dry (> 2 bars moisture tension). Piling may occur over frozen ground (soils frozen to a depth of at least 4") as long as site preparation objectives can still be met. Use the lowest ground pressure equipment that will accomplish one pass piling. Require smaller and lower piles that produce flame heights of 2-4' to reduce burning time and heat intensity. Burn piles when soil moisture in the upper profile is high. Retain organic debris for nutrient cycling and long term productivity. Leave as much fine organic debris (<2" diameter) in addition to litter and duff as possible. Retain 10-20 tons/acre of larger woody debris (>6" diameter). Equipment should be required to utilize existing skid trails wherever possible. Require a revolving grapple head to avoid damage to the boles of residual trees. Alternative methods of site prep should be considered on high compaction potential soils. Post harvest soil surveys would be completed to monitor detrimental soil impacts from harvest activities on high compaction soils in tractor units prior to initiation of piling. If these surveys indicate detrimental effects to soils equal or exceed regional standards, alternative methods of site prep would be used. Seed burn piles, adjacent roads, landings and other disturbed areas.

Prescribed Fire and Non-commercial Thinning

Prescribed Fire

28) Burning prescriptions shall be designed to minimize severely burned soils (nutrient loss) and to reduce the risk of erosion. Duff reduction should average less than 50% of the original depth. Where silvicultural prescriptions recommend mineral soil exposure, a site-specific evaluation must be conducted to determine the risk of severely burned soils. Moisture in the top inch of soil should be at or above field capacity (0.1 bar moisture tension). Retain 12-14 tons/acre of larger woody debris (>6" diameter, large end diameter) for long term nutrient cycling and favorable micro sites for seedling establishment.

Non-commercial Thinning

29) Non-commercial thinning will be restricted to small diameter conifer species using manual cutting methods. Adverse soil impacts such as compaction will not be detectable as a result of this treatment.

Potassium Availability

30) Practice conventional bole removal rather than whole-tree removal. This technique should be used during intermediate operations (thinning) as well as final harvest operations.

31) Let slash remain on site over winter for most mobile nutrients to leach from fine materials into the soil.

32) Light, relatively cool broadcast/underburns should be used for nutrient release. Large woody materials should be left on site as habitat for forest soil biota and to provide organic matter and future nutrient source.

33) Avoid mechanical site preparation that results in soil displacement and slash piles wherever feasible.

Woodward Meadows Riparian/Wetland Management Activities

34) Large woody debris will be obtained on-site as close to the assembly point as possible and manual labor will be used in lieu of mechanized equipment wherever possible. Large woody debris selected for use on this project must not reduce the amount of existing shade along this reach of Cottonwood Creek.

35) Downstream sedimentation will be minimized through the use of straw bales, silt fences, and/or settling ponds.

36) Areas of disturbed soil will be revegetated as soon as possible. The Colville National Forest Seeding and Planting Guide will be used to determine appropriate species, methods, and timing for additional revegetation needs suitable to the site.

Air Quality Mitigation

The following mitigation measures insure that impacts to air quality will remain within Washington State and Forest Service guidelines. They apply to all prescribed fire activities including: maintenance prescribed fire, restoration prescribed fire, wildlife prescribed fire, and post harvest slash reduction prescribed fire, including grapple pile and landing pile disposal.

Prescribed Fire

37) To reduce the rate of release of smoke emissions the times and places of ignition will be staggered. Burning will also be done during optimum meteorological conditions when an unstable atmosphere is present to allow for mixing and dispersion of smoke emissions.

38) To meet National Ambient Air Quality Standards for PM10 (150 micrograms per cubic meter in a 24-hour period), prescribed fire is limited to 900 acres per day (24 hours) across the Three Rivers Ranger District.

39) Prescribed fire activities consuming more than 100 tons of fuel within a 24 hour period will acquire approval from the State of Washington prior to ignition.

Rock Pits

40) Water sources will be provided for rock pit dust abatement.

41) Washington State Department of Ecology will monitor rock pits to ensure air quality standards are maintained.

Noxious Weeds and Competing Vegetation Mitigation

In concert with alternative design and soil and water mitigation, noxious weeds and competing vegetation mitigation emphasizes prevention, early-treatment and correction.

42) Provide information to contractors and timber sale purchasers, as well as Forest Service employees conducting earth disturbing activities within the Quartzite Ecosystem Project area about existing noxious weed of concern, as well as about practices that they can take to reduce the introduction and spread of noxious weeds during their activities (Use the Colville National Forest Weed Prevention Guidelines).

43) Establish vehicle and crew staging areas, and helicopter bases in areas inspected and verified to be noxious weed-free whenever possible.

44) Minimize the removal of trees and other roadside vegetation during road construction and reconstruction, and during other ground disturbing activities. This is most important for southerly aspects. Design roads that are self-maintaining (outslope, rolling dips,) and take advantage of natural features. Minimize soil disturbance and conserve existing topsoil (A and B horizon soils) whenever possible. Reapply topsoil to increase revegetation success.

45) Use “Prohibited and Restricted noxious Weed Free Seed for the State of Washington” for revegetation activities.

46) Revegetate disturbed sites based on site-specific prescriptions and reduce the lag time between ground disturbing activities and revegetation.

47) Fertilize if it is determined to be beneficial. Consider the presence of noxious weeds that may be encouraged by fertilizer, the type of soil present, existing vegetation, and costs. If prescribed, fertilize one year after germination and establishment of vegetation.

48) Remove mud, dirt, and plant parts from all off-road equipment (road construction equipment, rock crushers, ATV’s, fire equipment, etc.) before moving into a new or different project area. This cleaning of equipment will not occur on National Forest System lands and should occur

somewhere where noxious weed seed removal will not create additional noxious weed problems. This measure does not apply to service vehicles that stay on the roadway, traveling frequently in and out of the project area. In addition, Forest Service employees need to inspect, remove, and properly dispose of noxious weed seed and plant parts found on their clothing and personal equipment prior to leaving a project site.

49) When possible, keep active road construction sites closed to vehicles not necessary for the project.

50) Use only noxious weed-free mulch on surface soil stabilization and erosion control projects. Minimize the use of straw unless the source is known to be noxious weed free.

51) Gravel and borrow sources are to be inspected before material is used. If noxious weeds are present, strip and stockpile the top 8 inches of contaminated material to reduce the transportation of noxious weed seed to other sites.

52) Seed disturbed sites immediately (prior to the soil crusting) with mixes that contain only seed labeled "Prohibited and Restricted Noxious Weed Free for the State of Washington". Use a mix of species appropriate for each site. Use species, whether native or introduced, that will occupy the site and compete successfully against noxious weeds. Select for low nutrient demanding species. Sites to be seeded include road right-of-ways, landings, temporary roads, earthen berms, skid trails, fire lines, etc. Some sites, such as temporary roads, may need seeding each time they are disturbed (at construction and at closure).

53) Use logging systems and prescribed fire methods that meet the objectives of the stand prescription while protecting the soil resource. Use equipment and methods that minimize noxious weed establishment or spread. Minimize, to the extent possible, the number of skid trails, the number and size of landings, and the amount and size of fire lines.

54) Inventory the area prior to initiation of activities and develop a site-specific plan for the treatment of existing noxious weeds.

55) Continue to encourage Stevens County to control noxious weeds on county road right-of-ways adjacent to and within the National Forest System boundary in the Quartzite Ecosystem Project area.

56) Keep active gravel pits and borrow sources in a noxious weed-free condition.

57) Close new roads upon completion of proposed activities. Close roads that are not necessary for Forest Service management or public use that are noxious weed free or at an unusually high risk to noxious weed invasion. Treat noxious weeds on these closures before the roads are made un-drivable. Monitor and retreat as necessary.

58) Seed or reseed any additional soil disturbances or treat noxious weeds found through post-timber harvest, regeneration, prescribe fire, or road activity monitoring. Use KV collections, if available; otherwise use appropriate or special project monies.

59) Immediately hand pull any newly invading noxious weed species before they become established if appropriate for the given species. Map the site so that it can be monitored. Some species that have a runner rhizomatous root system, such as orange hawkweed, should not be hand pulled.

60) Chemically spot treat newly invading noxious weeds, such as orange hawkweed and other species that cannot be hand pulled, if they enter the Quartzite Ecosystem Project area.

61) Pre-treat seed-bearing noxious weeds along existing National Forest System roads leading into and within the project area before construction, harvest, or burning activities begin. Pre-treat noxious weed infestations in areas to be used or disturbed for such activities such as landings, skid trails, and helicopter service areas.

62) Treat areas adjacent to areas that are to be revegetated.

Heritage Site Mitigation

The following mitigation measures ensure that the integrity of setting of seven heritage sites will be preserved until they can be formally evaluated for their potential as National Register sites.

63) All action alternatives would establish a 50-foot buffer around the seven heritage sites located within activity units. These buffers would exclude all project activities. (Consult with heritage resources for locations [This information is FOIA exempt]).

Scenery Mitigation

The following mitigation measures are designed to meet the visual objective of retention and partial retention. They should be applied as soon after project completion as possible to meet retention and within 1 year of completion to meet partial retention. The following items pertain to meeting scenery management objectives within these time frames.

64) Timber sale and prescribed fire units on the North, Northwest and Northeast aspects of slopes over 60%, will, where possible, mimic natural density changes adjacent to created openings, and retain natural variances within the stand.

65) Where possible, maintain hardwoods to preserve existing pattern and color variation.

66) The proposed fence closure at Woodward Meadows should utilize an alternative fencing style such as buck and pole or worm fence design.

67) Vary stand density near dispersed recreation sites to maintain natural appearance.

68) To meet the Forest Plan visual quality objective of retention along Flowery Trail Road:

    a) Earthen road closures will be placed out of sight of the Flowery Trail Road. Vegetation and boulders will be used within the first 100 feet, to eliminate access.

    b) Harvest debris should not be evident within the visible foreground, or may be evident, but must remain subordinate to the characteristic landscape.

    c) Cut low stumps (6-12") in visible portions of units along Management Area 3A travel corridors.

    d) Arrange tags, flagging, paint markings and stakes to minimize the visibility of these markings from Flowery Trail Road. Generally this means for the visible distance of up to 300 feet from the road.

69) Alternative specific scenery mitigation - To meet the Forest Plan visual quality objective of partial retention with Alternatives B and C:

    a) Cuts and fills potentially visible at the end of Roads #6 and #7 will be mitigated by shortening the roads to avoid steep side slopes (approx. 500'), and/or helicopter yarding that portion of affected units.

b) For the segment of road #6, above Devil's Canyon, limit the western boundary of Unit 23 to the road location.

c) Adjust road #6 location to the East as much as possible, to avoid the steep slopes and minimize the linear effect of road construction.

d) Adjust road #7 location higher on the slope between the existing openings, and use existing vegetation as a screen.

e) Preserve the existing vegetation below road #7 for screening.

Wildlife Mitigation

The following mitigation measures are designed to meet Forest Plan Wildlife Standards and Guidelines.

Management Indicator Species

Big Game

70) All new roads will be closed with a gate, an earthen berm or other effective closure device after they are built, opened for harvest activities, then effectively closed (by berms or other methods) after completion of management activities. In addition, those portions of all new segments in winter range (12, 13, 10, 16, 11, 5 6, 3, 2 and 17) will be closed from December 1 through March 31 each year even if management activity is occurring in other areas outside winter range. Road 4342250 should also be closed from December 1 through March 31 each year even if management activities are occurring in other areas. Road 4342250 should be closed as soon as practical after all management activities (including Woodward Meadows projects) are completed. Road 4300080 already has a winter range closure restriction and this should be maintained even if management activities are occurring in other areas outside of winter range.

71) All new roads will be closed effectively (with a gate, an earthen berm or other closure device) after they are built, then opened for harvest activities, then effectively closed after completion of management activities (berm or other method). Roads closed after the project is completed should be closed to all motorized vehicles including ATVs, motorcycle, trail bikes, etc. in order to maintain the current open road density. These closures will be CFR (Code of Federal Regulations) road closures with closure notification signs on the site.

72) New or reconstruction roads will be closed in winter range from December 1 to March 31 to maintain the open road density at Forest Plan standards while in use and permanently closed after that.

a) In general new roads are to be closed from December 1 through March 31 in winter range to maintain winter open road density standards, however, winter logging will be allowed in those units that are all or partly within Plan identified winter range (units 1, 4, 5, 7, 23, 66, 94, 113, 115, 123, and 127) subject to felling and yarding guidelines identified in soils mitigation. If the purchaser decides to exercise the option of winter logging (December 1 through March 31) in these tractor units, adjacent skyline and helicopter units will not be logged during the same season. Units 66, 123 and 127 will be logged during a different season or year than units 113 and 115 if winter logging occurs on any of these units from December 1 through March 31. If winter logging does occur in any of these units, the road segments to access those specific units will also be allowed to be used during this

normally restricted period (December 1 through March 31). Winter range restrictions will be in effect for other roads not needed for these specific units.

73) If constructed, segments 3, 6, 7, 13, 10, 5, 8, 9, 12, 13, and 14 will be bermed, gated or otherwise blocked until timber harvest activity commences. After work is completed these roads will be effectively closed and will have CFR (Code of Federal Regulations) restrictions posted on site stating that they are closed to all motorized use.

74) A minimum of 60% crown closure will be maintained where timber harvest and prescribed fire activities coincide with mapped winter-range cover.

75) In addition to the noxious weeds and competing vegetation mitigation, the following practices, will reduce the effects that roads will have to big game summer range:

a) Adhere to minimum clearing limits for rights-of-way on new road construction.

b) Leave hiding cover or buffers along open roads to reduce poaching.

Pine Marten/Barred Owl

76) Commercial harvest prescriptions for those areas that coincide with delineated corridors will retain the upper one-third of site potential canopy closure that the corridor requires so corridor integrity would not be compromised. Burn prescriptions will be designed to retain conditions equivalent to the upper one-third of site potential canopy closure that the corridor requires.

77) To insure MA-1 forage requirements are met, post-activity crown closure will exceed 60% on a total of 123 acres, some of which occur within portions of timber sale units 69, 70, 77, 78 and 81; and in portions of prescribed fire units 74, 76, 78, 82, and 85.

78) Timber sale and prescribed fire prescriptions will be modified, to ensure connectivity between late/old forest stands, MA-1, and Marten and pileated woodpecker habitat units. Commercial harvest and fire prescriptions will be designed to retain the upper one-third of site potential canopy closure, where corridors are mapped.

Northern Three-toed Woodpecker/Pileated Woodpecker/Other Woodpeckers

79) Snags will be created where timber sale units fail to meet retention standards, if candidate trees are present.

80) Where salvage prescriptions apply, 50% of the standing broken trees that are less than 40 feet tall will be left for habitat.

Large Raptors

81) Post Fledging Area (PFA) and nest area timing restrictions are in effect from March 1 through September 30 of each year and should be adhered to for all activities that could disturb goshawk. These activities include, but are not limited to harvest, road location/building or road use, and prescribed fire. Other disturbing activities include unit layout, traversing, cruising, marking, monitoring, and planting. Exemptions may be made on a case-by-case basis for specific activities (The birds are most sensitive to disturbance early in the season during pair formation and incubation. Later in the season, but especially after the young have fledged, some activities may have a low likelihood of disturbance, but exemptions should be dependent on the type of activity, topography, and other factors that might reduce the potential for

disturbance). For activities that remove habitat, a general guideline for timing restriction exemptions is no activities prior to August 31. For activities that do not remove habitat, a general timing restriction guideline exemption is no activity (except surveying or other low disturbance activities) prior to July 31. If a smoke plume will go away from the nest, the distance requirement for prescribed fire activities could be reduced.

82) In addition to the PFA timing restrictions, restrict all helicopter flying/yarding, etc. within the portions of the Betts Basin subwatershed (1702000358A) and the West Fork subwatershed (1702000358C) that are greater than ½ mile from the nests, from March 1 through May 31 each year. However, some parts of the West Fork subwatershed are far enough from the nest that timing restrictions should not be necessary (consult the Wildlife Biologist). A more restrictive MITIGATION is required for those portions of either watershed that are within ½ mile of the goshawk nests. No helicopter flying/yarding, etc. will be allowed within ½ mile of the nests from March 1 through August 31 each year. However, on a case-by-case basis easing timing restrictions later in a season may be considered starting with units farthest away and downhill from the nests. At the least restrictive, easing of helicopter timing restrictions should not occur any earlier than July 31 within ½ mile of the nest.

83) Road segment 13, near the eastern side of the PFA, now falls within the 30 acre nest protection area for the alternate nest found in 2000. In addition to the restrictions discussed for the PFA, the following mitigation is required. For those alternatives that construct this road, the road should be located on the ground to minimize the amount of area within the buffer that is affected by this road segment. Any design that can minimize the amount of habitat that is removed by the road construction is preferred.

84) Gates will be placed on each of the roads (segment 10 and 13) that occur within the PFA as soon as they are constructed. Gates with signs and CFR restrictions to all motorized use should be locked closed immediately after construction and should be locked closed weekends or any other time when the operator is not working. CFR closures need to restrict all motorized access from March 1 through September 30 each year until these segments are permanently and effectively closed to all motorized vehicles after harvest and associated activities are completed.

    a) These two roads (segments 10 and 13) should not be left open after the sale for firewood collection because snags and down material are important components of many goshawk prey species' habitats.

Blue Grouse

85) All action alternatives have units in the area identified as potential blue grouse habitat[39]. Within these areas, harvest prescriptions would maintain 8 mature limby Douglas fir or subalpine fir per acre where available.

Trout

86) Avoid sediment delivery to streams from the road surface. On new roads and reconstructed roads outsloping of the roadway surface is preferred, except in cases where outsloping would increase sediment delivery to streams or where outsloping is infeasible or unsafe. Route road drainage away from potentially unstable stream channels, fills, and hillslopes.

[39] See the document titled "Effects To Management Indicator Species," located in the project analysis file, for a list of units located within blue grouse habitat.

87) Avoid sediment delivery to Cottonwood Creek from haul activities on County Roads 2389 and 2441. This includes dust abatement on segments within 200 feet of the channel during July and August. Treatment type and frequency will be at the discretion of the Sale Administrator.

88) Avoiding side casting of soils or snow during plowing or reconstruction on road segments within or abutting Riparian Habitat Conservation Areas.

89) Construct new culverts, bridges, and other stream crossings to accommodate a 100-year flood, including associated bedload and debris, where those improvements would/do pose a substantial risk to riparian conditions. Construct and maintain crossings to prevent diversion of streamflow out of the channel and down the road in the event of crossing failure.

90) During project activities, do not create new dispersed recreation opportunities in RHCA's. This includes activities such as creating spots for camping or parking in RHCA's.

91) For rock sources, locate structures, support facilities, and roads outside Riparian Habitat Conservation Areas. Where no alternative facilities exist outside Riparian Habitat Conservation Areas, locate and construct the facilities in ways that avoid impacts to Riparian Habitat Conservation Areas and streams and adverse effects on inland native fish. Where no alternative to road construction exists, keep roads to the minimum necessary for the approved mineral activity. Close, obliterate and revegetate roads no longer required for mineral or land management activities.

92) Locate staging areas, helispots, and other centers for activities 300 feet away from water bodies. If the only suitable location for such activities is within the Riparian Habitat Conservation Area, an exemption may be granted following a review and recommendation by a fisheries biologist or hydrologist. The fisheries biologist or hydrologist would prescribe the location, use conditions, and rehabilitation requirements, with avoidance of adverse effects to inland native fish serving as the primary goal.

93) Design fuel treatment and fire suppression strategies, practices and actions so as not to prevent attainment of Riparian Management Objectives and to minimize the disturbance of riparian ground cover and vegetation.

94) Avoid delivery of chemical retardant, foam, or additives to surface waters. An exception may be warranted in situations where overriding immediate safety imperatives exist, or, following a review and recommendation by a fishery biologist or hydrologist, when it is determined an escaped fire would cause more long-term damage to fish habitats than chemical delivery to surface waters.

95) Allow low severity fire to back in to the RHCA's where preparation to keep the fire out of the riparian areas would cause more damage than letting the fire creep into the RHCA. This is to avoid fire lines that run 300 feet parallel to stream channels, using foam near stream channels, and running hose lays. These activities are more harmful than letting the fire die out in the RHCA. This is only to be used where there will not be more than a 10% mortality of overstory, a greater than 20% loss of large woody debris (>12" dbh), and a detrimental impact to the riparian soil. It is expected that there will be mortality of the shrubs and herbaceous plant material, however these species regenerate from roots or seeds quickly after fire within a week to a month.

96) 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.

97) Prohibit storage of fuels and other toxicants within Riparian Habitat Conservation Areas. Prohibit refueling within Riparian Habitat Conservation Areas unless there are no other alternatives. Refueling sites within a Riparian Habitat Conservation Area must be approved by the Forest Service and have an approved spill containment plan.

Threatened, Endangered and Sensitive Species

Gray Wolf

98) To maintain quality habitat for wolf prey (big game), noxious weed mitigation will be followed.

Canada Lynx

99) Road segment #9 (Vegetation Alternative [F]) will negatively affect a ridge-top travel corridor located within the lynx analysis unit. It is not possible to mitigate the short-term impacts of the road, however, the following measures for Alternatives F, will mitigate the long-term effects of the road:

a) After log haul, berm the road, issue a CFR closure, and plant trees on the first 500 feet of the roadbed.

b) To limit the length of disturbance, delay road construction until absolutely necessary.

Focal Species

Migratory Land Birds

100) Prescribed fire during the spring does not mimic natural events as much as burning in drier conditions, but may be necessary until stand conditions are restored to a condition where the risk of catastrophic burning is reduced. Fuels planners will work with biologists to develop burn plans that limit the effects from underburning to migratory birds. (A general guideline is no more than 10% of a 6th field watershed should be burned from April through June in a single year.)

Mineral Administration

101) Protect all existing or new mining claim corners or monuments, discovery monuments, or active workings during road construction, harvest, fuel reduction, site preparation, and prescribed fire. Notify known mining claimants of proposed activities. See standards and guidelines on page 4-57, Forest Plan.

Section 2.3 – Monitoring

The following monitoring will be conducted if any of the action-alternatives are implemented. This monitoring is designed to verify that the projects are implemented as designed, and are effective and efficient in meeting project and Forest Plan objectives.

The Colville National Forest has developed plans to monitor Forest Plan implementation, monitor the effectiveness of management practices implemented under the Forest Plan, and validate the assumptions and models used in planning. The Forest prepares an

annual Monitoring and Evaluation Report to document the results of this monitoring. For activities related to this project, all alternatives would comply with specific monitoring requirements identified by the Forest Plan for the Colville National Forest.

The length of time that monitoring is needed would be determined by the results and evaluation of what is being monitored. When it is certain that regulations and standards are being met, monitoring of a particular element will cease. If monitoring evaluations show that regulations or standards are not being achieved at the desired level, management intervention will occur.

Monitoring encompasses many activities and administrative processes. The monitoring identified in the monitoring and evaluation chapter of the Colville Forest Plan does not include all of the monitoring done by the Forest. Monitoring to address other laws, policies and site-specific decisions are part of forest-wide monitoring programs.

Forest Plan monitoring is not designed to validate our effects procedures. It is used principally to monitor changes that affect outcomes and outputs. Predicting the effects from our land management activities depends on research information. A large number of research findings were used for this project (see the resource reports in the analysis file).

The Colville National Forest has developed a plan to monitor Forest Plan Implementation, monitor the effectiveness of management practices implemented under the Forest Plan, and validate the assumptions and models used in planning. The Colville National Forest prepares a Forest Plan Monitoring and Evaluation Report to document the results of this monitoring.

The Forest Plan identified monitoring needs in Chapter 5, and the Colville National Forest Monitoring Guide describes this monitoring in more detail. This monitoring includes NEPA compliance, Best Management Practices, Water Quality, Heritage Resources, Threatened, Endangered and Sensitive Animals and Plants to name a few.

The following monitoring items are part of the monitoring needs identified in the Colville National Forest Monitoring Guide. These items are particularly pertinent to this project, and will be monitored.

Snag retention: The Forest Biologist recommends four to six snags per acre (depending on biophysical setting) be left to meet the Regional Forester's Amendment No. 2 wildlife standards. The Three Rivers District will perform a sample survey to monitor snag levels at different phases of the project. Monitor all work including harvest and closure. The minimum standard is an average of 4-6 snags per acre in the 15-inch size class (or next largest size, if 15+ inch size does not exist) within a timber sale unit.

Visual quality objectives: Visual monitoring will be done along the sensitive level I and II roads, from the dispersed campsites, and from all trails and trailheads to determine if the VQO's were met.

Soils: Field monitoring by the Forest Soil Scientist will be performed to ensure a minimum of 80% of the activity area will be left in a non-detrimentally impacted state. The highest priority will be those areas that might exceed 20% soil disturbance because of new techniques, known or unknown equipment used. Lower priority will be given to other areas.

Insect and Disease: Annually Forest Pest Management conducts aerial surveys to identify locations and severity of insect and disease problems. These surveys are reviewed by

district and forest personnel and sites visited to ascertain the extent of activity or damage. From this information, appropriate action is taken with the goal to prevent catastrophic losses. The Forest also provides an annual narrative report of Insect and Disease conditions.

Water Quality: To assure water quality meets established water quality goals Best Management Practices (BMPs) are the primary mechanism to enable the achievement of water quality standards. The Forest Service, Pacific Northwest Region (R6) has developed a set of general BMPs, described in "General Water Quality Best Management Practices, November, 1988. This publication describes the legal background of BMPs, including the role of BMPs in meeting the Clean Water Act, and the Memorandum of Understanding between the Forest Service and Washington Department of Ecology regarding the use of BMPs on Federal Lands (1978). The selection and design of BMPs are integral part of the Colville National Forest's Land and Resource Management Plan Standards and Guidelines for Soil, Water, and Air (Forest Plan, pages 4-50 to 4-54). The BMP process is described in the Forest Plan, page 4-51 item 3; and in the Forest Plan FEIS Appendix G. Many BMPs are included in the design criteria and mitigation measures. Many BMPs are standard timber sale contract provisions. The forest hydrologist and district personnel ensure use during implementation by checking project design and proposed contracts.

2.3.1 Project Implementation Monitoring

Mitigation: The District Ranger will ensure mitigation measures listed in this EIS are followed.

Timber Management: The District Ranger will ensure harvest prescriptions are in compliance with direction generated in this EIS and monitor survival of planted trees and stocking levels in any created openings in compliance with NFMA and the Forest Plan.

RHCA Protection: The District Ranger will ensure that riparian resources and water quality protection measures (Inland Native Fish Strategy and Forest Plan) have been correctly prescribed and implemented. A fisheries survey will be done on one station in Cottonwood Creek, to verify the conclusions drawn in this analysis about the effects of additional sediment introductions on cutthroat populations (size, weight, numbers, etc.). Riffle pebble counts and repeat monitoring of several benchmarked residual pool depth sites will be done in conjunction with these surveys.

Noxious Weeds: The District Ranger will ensure the monitoring for the presence and/or spread of noxious weeds along newly reconstructed roads, sale units, obliterated roads and other disturbed areas. Appropriate strategies will be followed if noxious weeds are detected.

Vegetation condition: The District Ranger will ensure the review of a sample of harvest and burn units, 3 to 5 years post-sale, to determine if resource objectives were met, and if the desired structural stage was achieved.

Air Quality: The prescribed fire managers for the Three Rivers Ranger District will ensure that the Washington State Smoke Management Guidelines for all prescribed burning projects located within the state of Washington are followed. Requests to burn are made

the previous day through the Colville National Forest Dispatch Center to the Washington State Department of Natural Resources (WDNR) in Olympia, Washington. The DNR administers the smoke management program and approves or denies prescribed burning based on weather and atmospheric conditions. The WDNR Smoke Management Program considers proximity to Class I airsheds, non-attainment areas and weather factors that may cause an intrusion into these areas. Based on the area/unit descriptions sent to the WDNR from the district, a determination will be made as to how many acres or which units can be burned and stay below NAAQS thresholds of PM10 products. In addition, the on-site prescribed fire manager may curtail burning, even with state approval, if conditions potentially could affect air quality.

Down Woody Material: The District Ranger will ensure that monitoring occurs for 10% of the areas to ensure adequate logs were left as specified in Regional Forester's Amendment No. 2 wildlife standards.

Water Quality: The District Ranger will ensure that water quality sampling for temperature and fecal coliform bacteria will occur at the forest boundary on Cottonwood Creek during and for a minimum of 5 years after completion of project activities, or until Cottonwood Creek is removed from the 303(d) list of impaired streams for these parameters. Sampling procedures must conform to the accepted Washington state protocol. Water quality standards must meet or exceed Washington State criteria for Class AA waters.

Section 2.4 – Alternative Comparison and Synopsis of Environmental Consequences

This section provides a cursory comparison of the alternatives, and a synopsis of issue related environmental consequences for the key issues[40]. The intent is to highlight the differences between the alternatives and between the effects the alternatives have on the issues. As the section title notes, this is a synopsis, for more detail, see the resource specific discussions presented in Chapter III.

The following tables present the values of the measurements of change, by alternative. All numbers in these tables are approximate.

2.4.1 Alternative Comparison

The following table presents a snapshot of the key features of all alternatives. Additional maps and tables located in Appendix B display more detail for each alternative.

Activity	Alternatives						
	A	B	C	E	F	J	K
Timber Sale Area (acres)	0	4,254	2,877	1,748	5,446	1,748	3,753
Prescribed fire and Non-commercial thinning (acres)	0	6,342	4,784	3,020	7,034	3,479	5,635
Woodward Meadows Riparian/Wetland Improvement (acres)	0	20	20	20	20	20	20
New road construction (miles)	0	10.83	6.89	2.33	18.37	2.33	0

[40] See Section 2.1 of this chapter.

Road/Stream Crossing Improvement (number of crossings)	0	6	6	6	6	6	6
Road Closures (miles)	0	2	2	2	0	2	2

2.4.2 Synopsis of Environmental Consequences

Road management Issue

Forest roads are an essential part of the transportation system in this part of Stevens County. They help to meet recreation demands and they provide economic opportunities. The proposal to build new roads and close existing roads caused concern for some. New road construction is viewed by some of the public to be inconsistent with ecosystem management. Would new roads reduce the quality of wildlife habitat? Would they reduce water quality? Also, two roads currently open would be closed by the proposed action. One is steep and unsafe for most vehicles and would be closed to protect unknowing travelers. The other would be closed to improve wildlife habitat and wetland conditions in the Woodward Meadows area. Some people would prefer these be left open for recreation, firewood gathering and wildfire access.

In addition, an unroaded area 4,801 acre in size is located on national forest system lands between the Upper Cottonwood Road, and the Cottonwood Divide Road. To improve disturbance ecology, the proposed action builds roads and cuts trees in this area and there is concern that these activities would reduce natural integrity, reduce the opportunity for solitude, and reduce primitive recreation opportunities. Some consider unroaded areas essential for both humans and wildlife. Should the improvements to disturbance ecology be forfeited to preserve this unroaded area? If so, are the risks of catastrophic fire acceptable? Can disturbance ecology be improved without building roads and cutting trees?

Environmental Consequences

Concern	Measurement of Change	Alternatives						
		A	B	C	E	F	J	K
Wildlife habitat & Water quality	Miles of road constructed.	0	10.83	6.89	2.33	18.37	2.33	0
Road access	Miles of existing open road	0	2	2	2	0	2	2

	closed by the alternatives.							
Unroaded area preservation	Acres meeting unroaded criteria.	4801	0	2701	4801	0	4801[41]	1466

Betts Basin Issue

The Betts Meadows Wetland Preserve is a 140-acre family trust, located on the 3,420 acre Upper Cottonwood Creek drainage. The purpose of the trust is to maintain the property as a wildlife refuge and native fishery. Many are concerned that building roads and cutting trees above this area would reduce water quality and degrade fish habitat in the preserve. Should the area above the Betts Meadows Wetland Preserve be exempted from treatment to establish baseline water quality information? Or conversely, would the proposed treatments reduce the possibility of an atypical fire event and its associated sedimentation

Environmental Consequences

Concern	Measurement of Change	Alternatives						
		A	B	C	E	F	J	K
Water quality & Fish Habitat	Percent increase in unforested open areas.	0%[42]	18%	0%	1%	27%	1%	12%

Forest Health Issue

There are areas where storm damaged trees; trees infested by Douglas-fir beetle; trees dying from root rot; and overstocked trees are not proposed for treatment. There are concerns that if left un-treated, forest health and productivity will decline. Should all areas with forest health problems be treated? Are certain amounts of these areas typical for the ecosystem? What role do they play in ecosystem functions and processes? If left un-treated, will these areas cause significant losses? If the trees are going to die anyway why shouldn't they be salvaged for human use? What is the difference between ecosystem health and forest health? Should tree vigor and forest health be given priority over ecosystem health?

[41] Without affecting unroaded criteria (any contiguous area greater than 1000 acres in size and greater than 100 meters from any existing road or harvest activity), the Wildland Fire alternative *does* implement 459 acres of prescribed fire in the Unroaded area.

[42] This measurement for the No Action alternative does not consider the effects of a fire event.

Environmental Consequences

Concern	Measurement of Change	Alternatives						
		A	B	C	E	F	J	K
Forest health	Acres of Douglas-fir beetle infestation included in timber sale units.	0	433	193	127	589	127	392

Section 2.5 – The Forest Service Preferred Alternative

The *Existing Roads Alternative* (K) was the Forest Service preferred alternative, during review of the draft environmental impact statement. This alternative would implement critical vegetation and wetland enhancement activities while maintaining valued watershed characteristics.

The Proposed Action Alternative (B) represents the agency's best recommendation for managing this particular piece of ground at this point in time. It is designed to achieve the objectives discussed in Section 1.3 (The Purpose and Need for the Proposed Action). However, after reviewing public comments generated during scoping, and considering the concerns and unresolved conflicts identified with the key issues, the Forest Supervisor recommended the *Existing Roads Alternative* (K) as the Agency's preferred alternative, when the draft environmental impact statement was released for public review on June 5th, 2002.

Document Check Point

This completes Chapter Two. It started by displaying public reaction to the proposed action by reviewing the scoping process and listing ensuing issues. It described the alternatives to the proposed action, and their associated activities and mitigation measures. It described Forest and project level monitoring. And this most recent section displayed a comparative synopsis of the environmental consequences of the alternatives. Chapter Three will describe the current status of the Quartzite watershed and describe in detail the effects the alternatives would have on the environment.

Chapter 3

Affected Environment and Environmental Effects

This chapter describes the existing conditions of specific resources and the direct, indirect and cumulative effects of alternative implementation. These discussions are designed to depict the affected environment against which change is measured and to project the effects the alternatives would have on these conditions. While all effects will be disclosed, the purpose-and-need and the key-issues focus analysis on pertinent resources.

To analyze the effects alternatives have on ecosystem function, change will be measured against both current and reference conditions. Like current conditions, reference conditions are not static. The reference conditions used for this analysis represent a range of landscape patterns and conditions that result from those disturbance regimes[43] characteristic of the current major climactic period. Reference conditions include human influence, but are limited to the influence of indigenous people.

Specific resources are grouped into three general categories: physical environment; biological environment; and human environment. For each resource, the affected environment is depicted first, followed by a discussion of direct, indirect and cumulative environmental consequences. Discussions will track analysis methodology and the logic used to determine effects.

Chapter Structure

Five sections comprise Chapter 3. A characterization of ecosystem conditions is described in Section 3.1. Section 3.2 discusses the affected environment and environmental effects for the physical environment. Section 3.3 displays these discussions for the biological environment. And Section 3.4 displays these discussions for the human environment. Section 3.5 summarizes adverse effects that cannot be avoided, irreversible effects, and irretrievable commitments of resources.

Section 3.1 – Characterization

This section provides a review of information contained within the Quartzite Watershed Scale Ecosystem Analysis Report and highlights the dominant features and ecological processes of the watershed.

[43] The dominant disturbance before 1885 was frequent low-intensity fire. The Pacific Northwest Research Station, Wenatchee Forestry Sciences Laboratory, completed a detailed fire history study of the analysis area on 26Sep00. The results of this study are documented in the *Report to the Colville National Forest on the Results of the Quartzite planning area Fire History Research*, which is included in the analysis file for this EIS.

3.1.1 Distinguishing Physical, Biological and Human Features

Geology

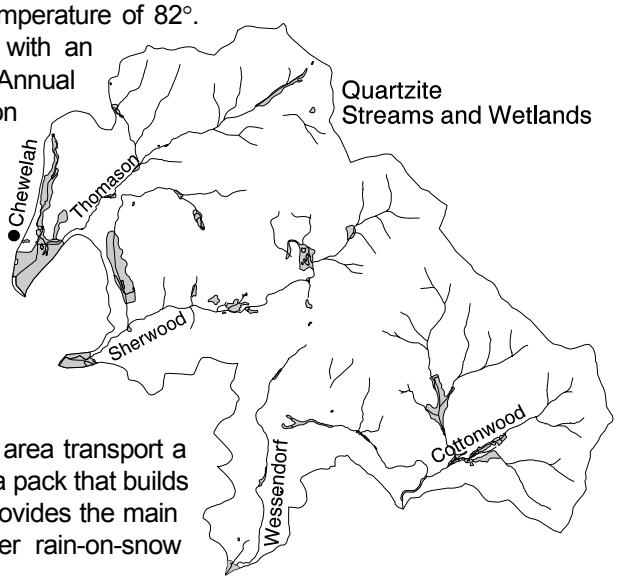
The geologic history of the Quartzite watershed began with the deposition of sedimentary rock in a shallow water environment over 600 million years ago. During the Cretaceous Period (100 million years ago), the North American plate began moving west and as the sinking Pacific plate melted, split and domed deep beneath the Quartzite area, the parent sedimentary rock was intruded by igneous rock. Additional deformation of the parent rock occurred up until 2 million years ago, and includes the broad folding and faulting that formed many of the mountainous landforms present today. These landforms have been modified over the eons by glacial events, the most recent of which occurred 14,000 years ago. The glacial ice during this event was at least 4,000 feet thick in the Colville River Valley, which means only the summit of Chewelah Mountain was above the massive ice sheet. As the glaciers receded and melted, small moraines, and outwash terraces and plains were left behind. Other landform modifications have occurred since then and are represented by alluvial fans, talus slopes, stream channels, wetlands and lakes.

Soils

Eight major soil series occupy the analysis area (Aits, Huckleberry, Donavan, Raisio, Rock Outcrops, Bonner, Newbell & Buhrig). Most share the attributes of being well-drained soils formed in glacial outwash or till, with a mantle of volcanic ash. While the unconsolidated glacial alluvium that underlies a majority of the soils in the analysis area is susceptible to mass gravity movement when disturbed or under cut, the potential for erosion of surface soils is higher than that for mass movement. The majority of the soils in the analysis area have a moderate to high potential to erode from bare slopes, as a result of water action. Vegetation, however is keeping surface erosion at bay and most human-caused erosion originates from roads.

Climate

Area weather patterns are influenced by a combination of maritime and continental air masses. The maritime influence from the Pacific Ocean is dominant in the summer, and in the winter, continental air from the north maintains the snowpack. Mild summers and cold winters typify the climate. The average summer temperature at Chewelah is 65°F, with an average daily maximum temperature of 82°. Winter temperatures average 28°, with an average daily minimum of 21°. Annual precipitation increases as elevation increases. Valley amounts on the west side of the area average 19", while amounts on the ridge to the east average 37". Most of this falls as snow in the winter, and rain in the spring. Two out of ten summers have less than 6" of rain.



Hydrology

Not surprisingly, the streams in the area transport a snow-dominated spring runoff from a pack that builds through the winter. Spring runoff provides the main flow event of the year. Mid-winter rain-on-snow

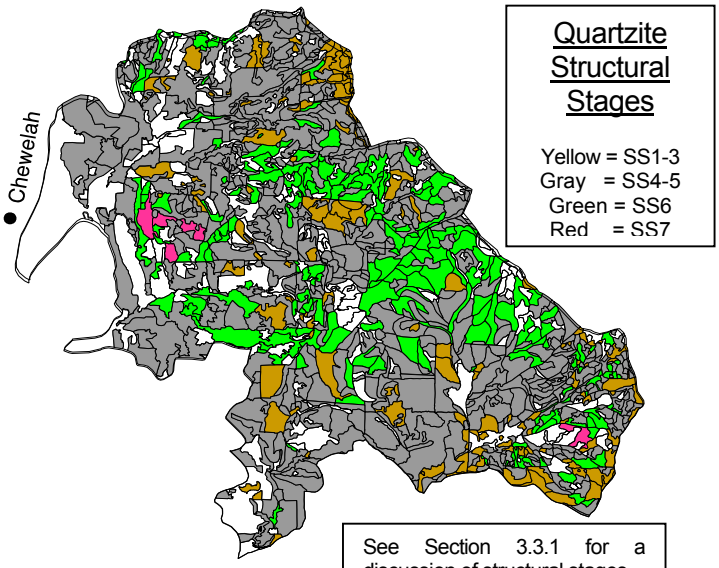
events are rare, but they can cause runoff damage from peak flows. More common late spring rain-on-snow events are confined to higher elevations, and peak flows are rarely excessive. A little over 60 miles of streams move water through the analysis area to the Colville River.

Fisheries & Wetlands

Of the thirty-three miles that run year-round, only 4.4 miles provide fish habitat. Native species in the Colville River include rainbow trout, large-scale sucker, sculpin, redside shiner and speckled dace. Non-native species include brook trout, brown trout, largemouth bass, pumpkinseed, yellow perch, brown bullhead, tench and black crappie. Because fish habitat in the area is poor, brook trout, which better tolerates degraded habitat, is the dominant fish species. The National Wetland Inventory classifies 853 acres as wetland. Most are located on the Colville River Valley floor, and have been converted for residential or agricultural uses. Other upland wetland areas are associated with low gradient streams and depressions. Many of these have been converted to meadows, to accommodate livestock grazing.

Vegetation

The composition and patterns of vegetation on the landscape are dynamic. However, the rate of change has slowed. Large-scale fire events have been absent for over 80 years. Today, eighty percent of the area under analysis is forested. Other areas include agricultural lands, residential sites, roads, rock and water. Within forested areas, ownership defines two general situations. Forests located on the steeper less accessible National Forest System Lands tend to be overstocked (compared to reference conditions) and include larger diameter trees. Forests elsewhere have typically seen some type of logging over the past 30 years; consequently they contain smaller-diameter trees.



See Section 3.3.1 for a discussion of structural stages.

Upland forests not associated with riparian areas can roughly be divided into two environments: south-facing slopes and north-facing slopes. South-facing slopes contain mixed conifers characteristic of the drier Douglas-fir plant associations, with ponderosa pine serving as the dominant seral species. On many of these south-facing sites, thickets of Douglas-fir grow beneath large diameter ponderosa pine, Douglas-fir and western larch. The remnants of trees damaged by storms, insects and disease contribute to the 10-25 tons per acre of fire-fuels found in

most stands. Cool, moist Douglas-fir plant associations[44] dominate north-facing slopes, with grand fir and western redcedar plant associations common in moist and protected areas. Fire-fuels trend toward larger diameter (> 3") pieces and range from 15-35 tons per acre.

Riparian forests are confined to the relatively narrow areas influenced by streams and wetlands. Western red cedar and grand fir create a dense conifer tree canopy here, with black cottonwood, birch and aspen scattered throughout lower gradient riparian areas. Due to their high productivity, these stands often carry heavy fire-fuel loads; up to 50 tons per acre in some areas.

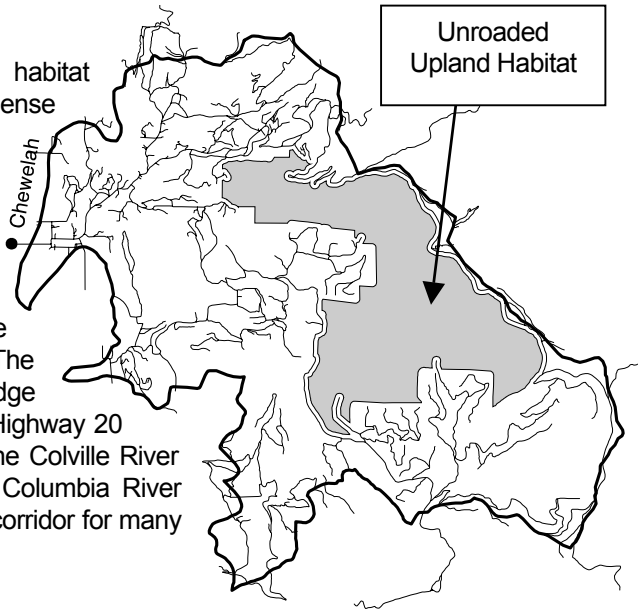
Late and old forest structural stages are characterized by large diameter overstory trees (8 trees per acre > 21"diameter). Four thousand acres of late and old forest are distributed across the analysis area, representing 17 percent of the total area.

Field surveys of National Forest System Lands yielded 20 populations of those plants recognized by the National Forest System as sensitive plants. All were located within three specialized habitats: forested riparian habitat; wetland/wet or dry meadow & pond habitats; and open forest and rocky outcrop habitat. Populations appear to be stable or slightly increasing, with the exception of those associated with open forest, which have declined.

Noxious weeds are species that have been introduced into North America from European, Asian, and Mediterranean countries. These species have little or no natural competition or controlling agents on this continent. Fourteen noxious weed species have invaded the area. Most are shade intolerant and opportunistic when soil is exposed. Problem populations are located along roads, and trails, near mines, in fields and meadows and previously logged areas.

Wildlife Habitat

The area has a variety of wildlife habitat types, ranging from high ridges to dense forests to cleared agricultural lands. The ridges and valley floor serve as travel corridors for many species. The ridge on the east boundary runs north to the Canadian border and provides a travel corridor for many species, which may include grizzly bear, gray wolf and lynx. The Flowery Trail road crosses this ridge within the analysis area and State Highway 20 crosses it 20 miles to the north. The Colville River Valley connects the area with the Columbia River Valley, and provides another travel corridor for many birds and other species.



[44] General Technical Report PNW-GTR-360, published by USDA, Forest Service Pacific Northwest Research Station in October of 1995 provides a classification of forest vegetation of the Colville National Forest. It describes 5 forest tree series and 39 plant associations or community types. Descriptions include information about plant association or community species composition, occurrences, distribution, environment, soils, forest productivity, management implications and relations to other classifications.

Roads, fields and logged areas, fragment much of the habitat. Road density across the Quartzite Analysis Area averages 3.84 miles per square mile. The road density on National Forest System Lands is 2.01 m/m^2. An isolated block of unroaded upland forest habitat (4801 acres) is located on National Forest System Lands on the east side of the area.

Wildlife species using the area include mule deer, whitetail deer, elk, moose, beaver, cougar, porcupine, chipmunk, black bear, bats, skunk, muskrat, coyote, bobcat, raccoon, ermine, squirrels, shrews, voles, mice, snowshoe hare, thrushes, sparrows, flycatchers, chickadees, wrens, woodpeckers, hawks, turkey vulture, swallows, hummingbirds, owls, Stellar's jay, crow, raven, juncos, warblers, waterfowl, salamanders, western skink, frogs, trouts, western painted turtle and snakes. For others, the habitat is available, but they have not been seen in the area.

Human Uses

Humans use the area for both recreation and subsistence. There are approximately 140 miles of roads in the area. Recreation activities include: firewood gathering, berry picking, snowmobiling, cross-country-skiing, bicycling, hiking, camping, off-road vehicle riding, horseback riding, and hunting. The forests in the northeast corner of Washington State are recognized as prime white-tailed deer habitat. Hunters from throughout the region travel here during the fall big-game hunt. During this time, most dispersed camping sites within the Quartzite area are occupied. Local residents value the unique features of the west side of Quartzite Mountain that faces the town of Chewelah. The vertical rock cliffs provide an aesthetic backdrop for the town as you approach from both the north and the south.

The town of Chewelah has been portrayed as an isolated trade center where employment is dependent on agriculture and timber. Other employment includes tourism, services, and mining. The resources in the Quartzite Analysis Area contribute to all of these. Roughly 50,000 skiers pass through the area per year, in route to the adjacent downhill ski area, which is located 15 miles east of Chewelah. Numerous fields and pastures and rangeland located on the west side of the area provide agricultural income. And an estimated 130 million board feet of merchantable timber is standing on 13,000 acres within the analysis area, 6,000 of these acres are on National Forest System Lands. Private landowners include timber companies, small parcel owners, and the State of Washington.

Section 3.2 – The Physical Environment

Section 3.2 depicts the affected environment and the effects alternative implementation would have on soil, water and air. It will track analysis methodology and the logic path used to determine effects. Where relevant, it will discuss the relationships these specific resources have with other resources and their synergetic influence on ecosystem functions and processes.

3.2.1 Soil Resources: Affected Environment

Geology

The analysis area is underlain by folded, faulted and regionally metamorphosed sedimentary and volcanic rocks of the Precambrian[45] era; folded and faulted Cambrian quartzite carbonate rocks of the Paleozoic[46] era; and intermediate plutonic rocks of the Mesozoic[47] era.

Precambrian rocks include the belt series, which is more than 8,000 feet thick. Argillite rock is 500 to 1500 feet thick alternating with units of inter-bedded quartzite. The argillite is well-stratified light green or dark gray to light gray in color. The quartzite is fine grained and contains 2 to 20% sericitic materials. White is the most common color, however light green and gray are common in the argillaceous quartzite.

Deer Trail rocks underlay the southern half of the analysis area and members include the Edna dolomite, consisting of dolomite, argillite, phyllite, and quartzite. The dolomite is finely laminated and impure. The argillite is undistinguishable from that of the belt series. The quartzite is glassy, coarse grained and thickly bedded. It is deformed and metamorphosed to a calc-silicite rock and schist. The thickness of this series is estimated between 1500 to 2000 feet.

The McHale slate member is uniform and consists of almost entirely dark gray and green argillite interspersed with beds of quartzite and siltstone, less than one inch thick. Many of these outcrops have a striped appearance.

The only Cambrian rocks in the analysis area are those of the Addy quartzite. It is medium to coarse-grained white or pink glassy orthoquartzite, commonly cross-bedded in appearance. At the base of this formation is approximately 150 feet of black-striped purple, which grades upward through pink and on into white quartzite. The greatest exposed thickness is 1600 feet on Eagle and Quartzite Mountains. At both locations the formation is truncated by faults. The quartzite is deposited over the McHale slate.

The Paleozoic rocks are carbonates, which include limestone, dolomite and a maroon slate. Most are a grayish, medium to fine grained and medium to thickly bedded except near contacts with intrusive rocks where they are coarse, crystalline, massive and mostly white. East of Chewelah the rock is sheared, brecciated and re-cemented. Between the faults that bound both sides of the carbonates the thickness is approximately 2,000 feet.

[45] The Precambrian Time occurred 4,500 to 544 million years ago.
[46] The Paleozoic era occurred 544 to 245 million years ago.
[47] The Mesozoic era occurred 245 to 65 million years ago.

The Quaternary[48] deposits include alluvial and glacial deposits. The alluvial deposits are confined to the immediate vicinity of present-day streams. The most abundant are sand and gravel in outwash plains, terraces and in-mantle deposits on hillsides.

Fine-grained lake deposits underlie parts of the Colville River Valley and an area between the carbonate rocks and the Addy Quartzite. Glacial ice covered the western half of the analysis area with a separate lobe extending into Burnt valley. Small moraines occur in the area north of Burnt valley. In other valleys glacial outwash was transported eastward.

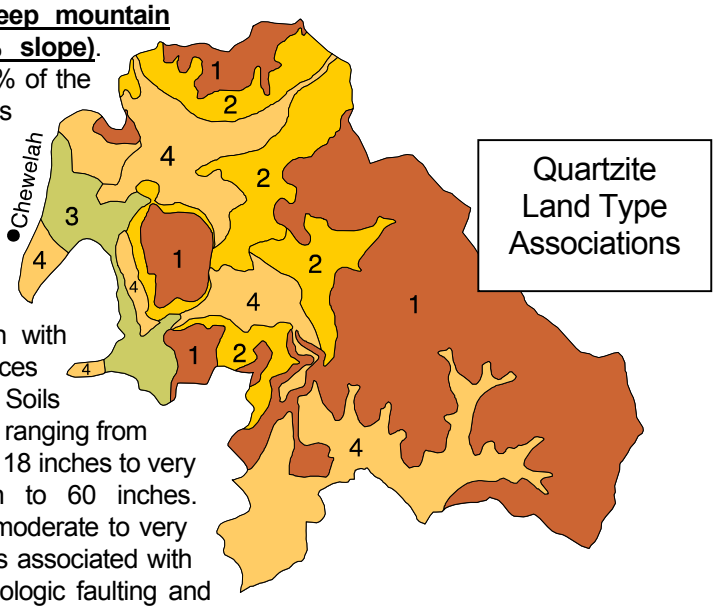
Structure

The complicated structure present in the analysis area, results from successive deformations ranging in age from the Precambrian era to the Cenozoic[49] era. Broad open folding and faulting occurred prior to the deposition of the Addy Quartzite. The west side of the area is faulted with normal faults forming natural stream corridors or weakness zones in the bedrock. The oldest faults in the analysis area are those that are trending north. The majority of the area is composed of argillite and quartzite with limestone and dolomite of the belt series.

Landtype Associations

There are four landtypes in the analysis area.

1) **Continentally glaciated steep mountain slopes and ridges (>40% slope)**. This land type makes up 48% of the analysis area, and includes steep mountain slopes, peaks and ridges. Slope gradient ranges from 40 to 90 percent. Slopes are generally convex in both the vertical and horizontal planes. Local relief is high with stream bottom to ridge distances varying from 300 to 800 feet. Soils are well drained with textures ranging from loam to silt loam in the upper 18 inches to very gravelly sandy loam down to 60 inches. Surface erosion potential is moderate to very severe. The parent materials associated with this landtype, that exhibit geologic faulting and landforms with parallel drainage patterns, tend to be prone to mass wasting.



2) **Continentally and alpine glaciated moderate mountain slopes (<40% slope)**. This landtype makes up 18 % of the analysis area, and includes extensive till and drift deposits on lower slopes. It is characterized by moderate to low mountain slopes, peaks and ridges that are generally convex to flat both in the vertical and horizontal planes. Soil tends to be very deep, well drained with textures ranging from loam to silt

[48] The Quaternary period occurred 1.8 million years ago to the present.
[49] The Cenozoic era occurred 65 million years ago to the present.

loam in the upper 18 inches to very gravelly sandy loam down to 60 inches. Surface erosion potential is slight to moderate.

3) **Low scoured hills.** This landtype makes up 6 % of the analysis area, and includes exposed bedrock with glacial valley fill in a complex of kames, terraces and low hills. Flat to low hilly slopes of residual bedrock generally convex in both vertical and horizontal planes. Soils are deep, well drained with textures ranging from loam to gravelly sandy loam in upper horizons to cobbly sandy loam and very gravelly coarse sandy loam up to 10 to 14 inches deep. Surface erosion potential is slight to moderate depending on the slope.

4) **Glaciofluvial or lacustrian terraces and alluvial deposits**. Located in the lower elevation bottomlands. Flat to gently rolling topography which is slightly convex both in the vertical and horizontal planes. Parent material is glacial/alluvial materials or stratified lacustrian deposits of local origin. Soils are very deep, somewhat poor draining, with textures ranging form silt loam to silty clay loam in the upper 10 inches, with silt clay for the next 15 to 20 inches. Surface erosion potential is dependent on slope. This landtype makes up 28 % of the analysis area.

Mass Wasting and Slope Stability

The analysis area contains three situations of concern for mass wasting and slope stability. The argillite/quartzite rock forms steep slopes, much of which is covered in talus. These steep talus slopes are unstable, especially at the toe of the slope and lower mid slope sections. Vegetation rarely covers these rocky areas. A second area of concern occurs where micaceous silt about 30 feet thick follows the thrust fault on Chewelah Mountain. This area is susceptible to a mass gravity movement due to the effects of mechanical weathering. The third area of concern is a glacial legacy. Glacial till and glacial outwash deposits are composed of well-rounded rock, with fragments ranging in size from fine sand up to boulders. These deposits are generally unconsolidated and are susceptible to slope failure when disturbed or undercut.

While these three situations are susceptible to mass gravity movement when disturbed or under cut, the potential for erosion of surface soils is higher than that for mass movement. Areas where soil erosion potential is highest are located in glacial outwash, till and alluvial deposits along streams, where sandy, silty and gravely soils exist.

Soil

Eight major soil series occupy 80% of the analysis area (Aits, Huckleberry, Donavan, Raisio, Rock Outcrop, Bonner, Newbell & Buhrig).

1) **Aits Series** (22%) The Aits soil series is a stony loam, which covers approximately 5200 acres. These are deep, well drained soils formed in glacial till with a mantle of volcanic ash and loess. The taxonomic class is a coarse-loamy, mixed, frigid Andic Xerochrepts. It is well drained, with slow to very rapid runoff and moderately slow permeability. Aits soils are located on glaciated foothills and mountain slopes at elevations of 2,000 to 5,000 feet. Slopes range from 0 to 65 percent. The volcanic ash and loess mantle ranges from 7 to 14 inches thick. Soils contain from 5 to 35 percent rock fragments. They are slightly acid or neutral throughout.

2) **Huckleberry Series** (15%) The Huckleberry series covers approximately 3500 acres. It consists of moderately deep, well-drained soils that formed in colluvium and

residuum from phyllite, shale, and quartzite with a mantle of loess and volcanic ash. These soils are located on mountainsides and ridge tops at elevations of about 3,000 to 6,000 feet, on slopes of 0 to 70 percent. The taxonomic class is ashy over loamy-skeletal, mixed Typic Vitricryands. The volcanic ash mantle is 14 to 22 inches thick. Depth to parent rock is 20 to 40 inches. The representative soil is silt loam or loam modified by 35 to 60 percent coarse fragments. The silty mantle overlies residuum and colluvium weathered from phyllite, shale, and quartzite. These soils are well drained, with medium to very rapid runoff and moderate permeability.

3) **Donavan Series** (13%) The Donavan soil series covers approximately 3000 acres. Soils in this series are well drained soils, formed in mixed glacial till with a component of loess and volcanic ash in the upper profile. They are located on toe-slopes, foot-slopes, and back-slopes of foothills and mountains that range from 0 to 65 percent at elevations of 1,800 to 4,000 feet. The taxonomic class is a coarse-loamy, mixed, mesic Vitrandic Haploxerolls. Rock fragments average from 10 to 35 percent and clay averages from 5 to 15 percent of the representative soil. These soils are well drained, with slow to very rapid runoff and moderate permeability.

4) **Raisio Series** (12%) The Raisio series is a shaly loam covering approximately 2900 acres of the analysis area. It consists of moderately deep, well-drained soils formed in residuum and colluvium from shaly rocks modified in places by glacial till and volcanic ash. Raisio soils are on generally south-facing footslopes, sideslopes and ridgetops of mountains, where slopes range from 0 to 65 percent. The taxonomic class is a loamy-skeletal, mixed, mesic Vitrandic Haploxerolls. The depth to bedrock is 20 to 40 inches. The representative soil has 35 to 80 percent shaly fragments and flagstones. It is slightly acid to neutral. These soils formed in residuum and colluvium from shaly rock (argillite, phyllite, slate and shale), modified in places by glacial till, volcanic ash and loess. They are well drained with medium to very rapid runoff and moderate permeability.

5) **Rock Outcrops** (7%) Rock outcrops cover roughly 1630 acres within the analysis area.

6) **Bonner Series** (5%) The Bonner gravely silt loam series covers approximately 1200 acres. It consists of very deep, well-drained soils formed in glacial outwash material derived dominantly from granite, gneiss and schist, with a mantle of volcanic ash and loess. These soils are on terraces and terrace escarpments, ranging from 2,000 to 3,200 feet elevation. Permeability is moderate in the solum and rapid to very rapid in the underlying material. Slopes range from 0 to 65 percent. The taxonomic class is ashy over sandy or sandy-skeletal, mixed, frigid Typic Vitrixerands. These soils are well drained. Runoff is slow on the terraces and ranges from medium to rapid on the escarpments.

7) **Newbell Series** (4%) This soil series is silt loam and covers approximately 900 acres. It consists of deep, well-drained soils formed in glacial till with a thin mantle of volcanic ash and loess. These soils are on toeslopes, footslopes, and backslopes of mountains, rangeing from 2,100 to 4,500 feet elevation on slopes of 0 to 65 percent. The taxonomic class is loamy-skeletal, mixed, frigid Andic Xerochrepts. It is a well-drained soil with slow to very rapid runoff and moderate permeability. Rock fragments average 45 percent of the representative soil.

8) **Buhrig Series** (2%) The Buhrig soil series is a very stony loam that covers approximately 500 acres of the analysis area. It consists of moderately deep, well-

drained soil formed in residuum and colluvium from igneous and metasedimentary rocks with a mantle of volcanic ash and loess. These soils are on mountain ridges and knobs at elevations of 3,000 to 6,500 feet, where slopes range from 20 to 65 percent. This series is a loamy-skeletal, mixed Andic Cryochrepts. Depth to bedrock ranges from 20 to 40 inches. Thickness of the volcanic ash is 7 to 14 inches. The representative soil has 50 to 90 percent acid igneous and metasedimentary rock fragments. More than half are cobble, flags and stones. The soil is neutral to moderately acid throughout.

Soil Compaction Potential

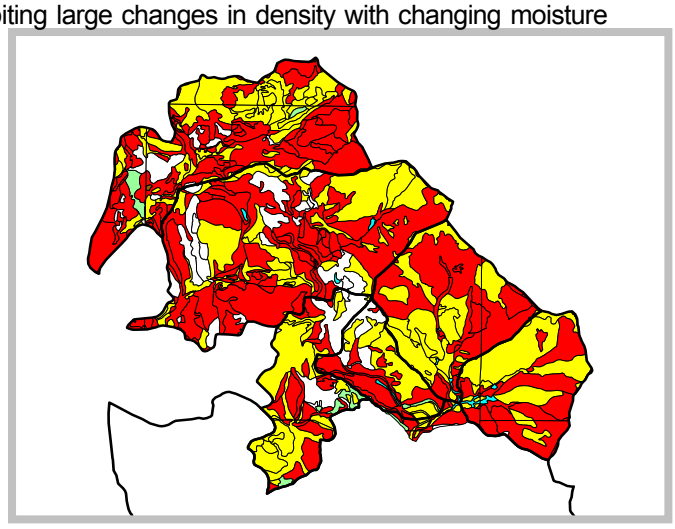
Soil compaction potential gauges the compaction of soil particles, and the resulting reduction of pore space in the soil. Compaction increases soil density, and can occur as a result of movement of wheeled and tracked equipment and other activities. Increased soil density inhibits plant growth by reducing the size of root systems, which in turn increases moisture and nutrient stress.

Compaction potential is categorized into three groups:

- **Low:** The potential for compaction is insignificant. This soil is able to support standard equipment with minimal compaction. The soil is moisture insensitive, exhibiting only small changes in density with changing moisture content.

- **Medium:** The potential for compaction is significant. The growth rate of seedlings may be reduced. After the initial compaction (i.e. the first equipment pass), this soil is able to support standard equipment with only minimal increases in soil density. The soil is an intermediate between moisture insensitive and moisture sensitive soils.

- **High:** The potential for compaction is significant. The growth rate of seedlings will be reduced following compaction. After initial compaction, this soil is still able to support standard equipment, but will continue to compact with each subsequent pass. The soil is moisture sensitive, exhibiting large changes in density with changing moisture content.



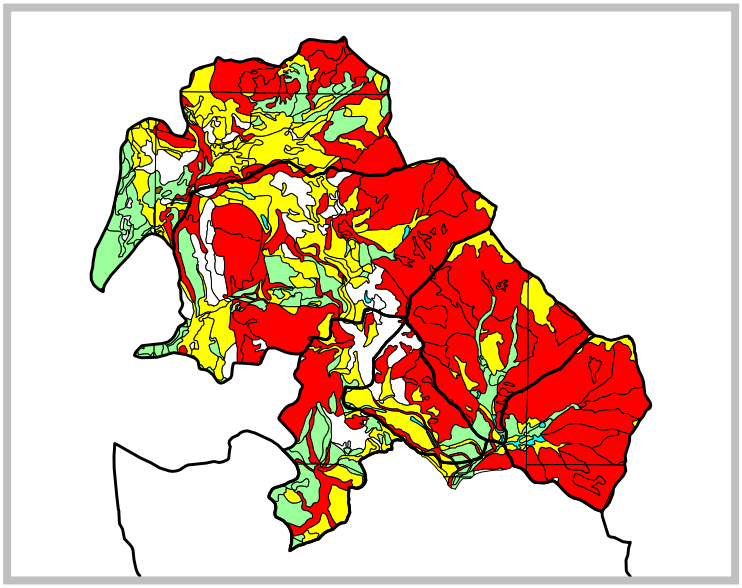
Most soils within the analysis area are rated by this system as having either high compaction potential (red) or moderate compaction potential (yellow). Green polygons are soils rated with low compaction potential while those shown in blue were not applicable to this rating system (primarily wetlands). Those soil polygons within the analysis area shown in white were not rated and consist mostly of rock outcrops and talus slopes.

Soil Erosion Potential

Soil erosion potential refers to the susceptibility of a soil surface to erode from bare slopes as a result of water action. Bare soil areas include log skidding trails, and yarding paths. The types of water erosion that can occur are sheet, rill, and gully erosion.

Like compaction potential, erosion potential is categorized into three groups:

- **Low:** The potential for surface erosion is insignificant. Erosion will be minimal.
- **Medium:** The potential for surface erosion is significant. Extensive erosion can occasionally occur on skid trails and yarding paths, but it can be reduced or limited by careful logging and by avoiding unnecessary surface disturbance.
- **High:** The potential for surface erosion is significant. Extensive erosion can frequently be expected to occur on all bare surfaces. Widespread erosion cannot be avoided unless logging practices that minimize surface disturbance are applied.



Soils within the analysis area with high erosion potential are shown in red. Those with moderate or low erosion potential are shown in yellow and green respectively. Soil polygons in white were not rated and consist mostly of rock outcrops and talus slopes.

Soil Erosion Processes

Surface erosion occurs when detachable soils on sufficiently steep slopes are exposed to overland flow and/or the impact of rainfall. Sediments introduced to streams from surface erosion processes are generally fine-grained and can influence water quality and aquatic habitat. Hillslope angle, soil texture, and climatic factors all influence the inherent erosion hazard of a site. These natural factors can be aggravated by forest management practices that accelerate soil detachment and transport. Such activities as road construction and maintenance, rock pit development, tractor skidding, and burning or piling for site preparation can expose bare mineral soil and compact and/or intercept subsurface flows and encourage overland flows. If forest harvesting is accompanied by extensive road and skid trail development, total infiltration capacity can become reduced. If such disturbance is widespread and in proximity to stream channels, surface runoff can be increased at the expense of subsurface and groundwater flow. The net effect of such activities depends on whether reductions in evaportranspiration or reductions in infiltration have the greatest impact on recharge. Signs of unacceptable levels of stream channel

sedimentation include: scouring (degradation), lateral bank cutting, bar building, filling of pools, covering of spawning gravels and riffles, and lack of or important changes to aquatic invertebrate populations.

The primary erosion processes under current climatic conditions within the analysis area are stream channel erosion, and sheet and rill erosion from roads.

Stream banks composed of unconsolidated sand and gravel in glacial deposits, terraces, and modern floodplains appear to be the main source of sediment delivered to streams. Present bank erosion is generally small in scale although widespread. There are very few locations where lateral channel migration has occurred. Because sand is a major component in stream banks, sand is present in the channel substrates of most streams. In areas of low stream gradients, sand is a dominant component of the surface of the channel bed. In higher-gradient reaches, sand collects in the lee of boulders, and the spaces between boulders and cobbles. Most channel segments in the watershed are capable of transporting sediment delivered by bank erosion.

Roads within these watersheds are also eroding and contributing sediment to streams, primarily at stream crossings. However, the number of stream crossings is low in relation to the total road mileage within the watershed. Sheet and rill erosion are the primary erosion processes affecting the travel surface of these roads as well as on cut and fill slopes. Aggregate or paved surfacing helps in mitigating these problems, as does the presence of cut and fill slope vegetation. Current and recent past log haul traffic patterns in the watershed have been low. In general, road sediments probably do not present a significant impact to streams except in localized areas.

Fine sediment from surface erosion from hill slopes exposed at harvest is a minor source limited to a few areas of recent harvest with little or no delivery to streams. Current forest practices that require buffering along streams (in conjunction with low impact yarding practices) have helped to minimize soil disturbance and transport of sediment to streams. Permeable soils and low stream densities in these watersheds also contribute to a lack of surface runoff and sediment delivery to streams.

DNR Erosion Model

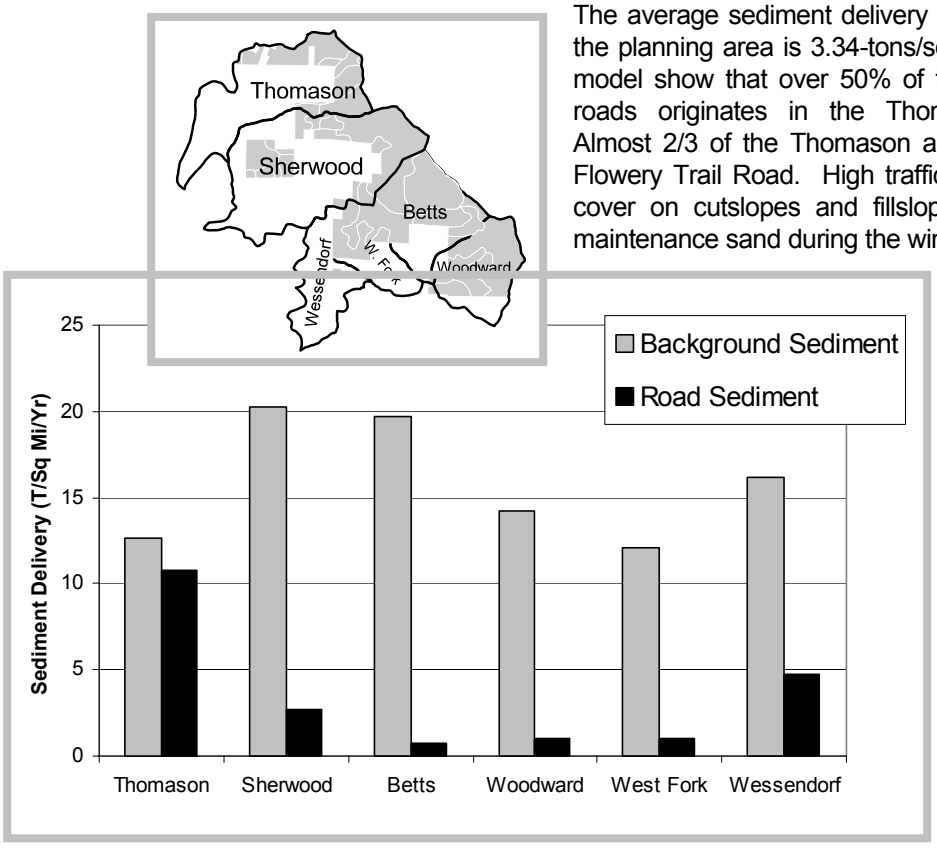
Because of the potential for sediment to impact aquatic resources, this analysis used the State of Washington, Department of Natural Resources, Surface Erosion model. The results produced by this model are for trends and watershed comparisons only.

The model uses road construction types, geologic parent material, stream class, road width, road segment length within 200’ of the stream, vegetative cover on cut and fill slopes, road surfacing material, and traffic levels to arrive at an estimate of sediment delivered to streams in tons/year. In addition to analyzing road sediment, a rough calculation of baseline sediment delivery to streams was conducted based on stream channel length, soil depth, bulk density, average slope, and creep rate. The following chart displays this, and other factors, in a sub-watershed context.

While the background sediment levels average 16.7-tons/square mile/year across the analysis area, there are differences between the watersheds. Variations in background levels range from a low of 12.1-tons/sq mi/yr in the West Fork watershed, to a high of 20.3-tons/sq mi/yr in the Sherwood sub-watershed. The higher background levels of sediment in the Sherwood and Betts sub-watershed are attributed to its higher stream

density, steeper slopes, and shallower soils. These factors increase the potential to deliver sediment produced under natural conditions.

Sediment delivery from roads does not follow the same pattern as the background estimates. Thomason Creek with the highest road density also has the highest contribution of sediment from roads. The Betts sub-watershed with the second highest background sediment rate has the lowest delivery attributed to roads due to its low road density.



The average sediment delivery from existing roads across the planning area is 3.34-tons/sq mi/yr. The results of the model show that over 50% of the sediment produced by roads originates in the Thomason Creek watershed. Almost 2/3 of the Thomason amount is produced by the Flowery Trail Road. High traffic levels, lack of vegetative cover on cutslopes and fillslopes, and the use of road maintenance sand during the winter, provides the additional source of sediment coming from this system even though this county road is paved. Road sediment in the Woodward sub-watershed is originating from one primary source, the #4342.250 road. Much of this road is located adjacent to or within the riparian areas associated with this tributary stream. It is contributing sediment due to poor location and lack of maintenance. Without the #250 road, sediment delivery in the Woodward subwatershed would be even lower than it is now. Road sediment delivery in the Wessendorf watershed is out of proportion to the size of the watershed due to the proximity of its road system to stream courses.

Potassium Availability

The nutrient environment is a function of parent material, soil characteristics, and nutrient demand by trees and plants growing on the site. The Intermountain Forest Tree Nutrition Cooperative, based out of the University of Idaho, noticed that severe tree root rot areas were associated with rocks-types that had low levels of potassium.

Bedrock geology of the analysis area indicates some of the soils in this area are low in potassium. These will most likely be found in the higher elevation headwaters of Cottonwood and Sherwood Creeks. Large areas of root rot have been identified in this area. Sites containing large pockets of severe root rot, especially in the headwater areas, should be treated as though they have low potassium.

In a forested Douglas-fir ecosystem on glacial outwash soils, about 45% of the potassium was being held in the trees, with the remainder held in subordinate vegetation, and forest floor and soil pools. Most potassium in a tree is found in the branches and foliage. The most common mitigation for low-potassium soils is to leave branches and foliage on the site to reduce potassium removal (use lop and scatter as opposed to whole-tree yarding). Slash should be left on the ground for one winter to leach the potassium from the slash into the soil before prescribed burning. Several studies have found that conventional harvesting with residue left on the site did not adversely impact the soil nutrient status. Nutrient stress may be partially controlled through selection of appropriate species composition and regulation.

Potassium availability will be evaluated in the analysis of alternatives based on the likelihood that low levels of potassium occur on soils within the planning area.

3.2.2 Soil Resources: Environmental Consequences

No Action Alternative (A)

If the no action alternative is implemented, none of the proposed management activities will occur. Fuel loadings in upland timber types will continue to increase as insects and disease continue to infect timber stands (primarily Douglas fir). The effects the No Action alternative would have on soil will be evaluated in three contexts: fire, roads, and Woodward Meadows.

Fire

Two scenarios exist with the No Action Alternative. The first is that no catastrophic fires will occur within the analysis area and the second assumes that some type of stand replacement fire would occur.

No-Fire Scenario

Without fire, the openings created by insects and disease will increase in size, but are expected to remain scattered and will migrate across the landscape over time. Brush, grasses, and other tree species will invade these sites as the larger overstory trees die and fall to the ground. Erosion processes will not change over existing levels because the amount of vegetative cover will remain essentially constant. Logging on private lands in these watersheds has probably reduced their overall susceptibility to insects and disease. Because of the lack of previous harvest activity, the upper Sherwood, Betts, and Woodward watersheds (in federal ownership) are probably the most susceptible portions of the analysis area to insects and disease.

Fire Scenario

The Forest Service portions of these watersheds are at high risk for severe stand replacement fires. During high hazard conditions, fires occurring in these watersheds may escape initial attack and result in substantial impacts to both soil and water resources. High intensity fires, particularly when associated with repeated occurrences, can significantly affect the potential of loss of soil productivity. The cold, dry climate of this region retards the process of decay, thus ensuring a natural role for fire, especially the carbon and nitrogen cycling processes. Soil recovery following such events is slow.

Depending on the size, location, and intensity of these fires, large areas of overstory vegetation and soil litter will be removed. A large portion of the area contains soils that have a potential for long-term, significant effects from severe fire.

Stream flows will be expected to increase as vegetative evapotranspiration decreases and induced non-wettability due to severe fire increases the water repellency of soils. Sheet, rill, and gully erosion from upslope soils exposed by extreme burning conditions (steep slopes and heavy concentrations of fuels) will directly increase sediment delivery to streams. Mass wasting (slides, slumps, and debris torrents) may increase in size and frequency. This will further increase sedimentation in streams and wetlands. The impacts of this scenario will indirectly affect downstream users. Fish habitat will decline as spawning gravels become embedded with fine sediments that decrease the inter-gravel dissolved oxygen.

Water and soil impacts due to fire will decrease over time as vegetation becomes reestablished. The cumulative effect of large fires in these watersheds is uncertain because of the difficulty in accurately predicting the size and location of such an event.

Roads

Under the No Action Alternative, Forest Road #4342.250 will remain open. This dead-end road is located within a riparian area and is delivering sediment to the stream from the travelway. Road #4342.300 will remain open. This road constitutes a public safety hazard due to steep road gradients and lack of maintenance. These factors are contributing to erosion gullies in the travelway.

Other existing roads adjacent to riparian areas will continue to deliver sediment, especially at stream crossings. No new roads would be constructed under this alternative; therefore road densities will remain unchanged.

Woodward Meadows

The presence or absence of fire is not expected to affect the wetlands portion of the analysis area due to its moist site characteristics. Artificial channels will continue to dewater adjacent wetlands and allow establishment of drier site species. Reed canary grass will continue to spread and occupy suitable micro-sites, although it is approaching its maximum range. Sediment coming from upstream sources will continue to aggrade portions of the human-made channels and over time they may fill in and reestablish the original wetland functions. This will not occur for a number of years since little progress has occurred since the meadow was homesteaded. The largest channel on the south side of the meadow has downcut to a clay hardpan. The stream occupying this ditch has probably reached equilibrium and further downcutting is not expected to occur. Fuelwood cutting in the riparian zone will continue to occur resulting in the continual decrease in large woody debris recruitment material. Vehicles will continue to pursue off-road “recreational opportunities” in the wet meadows resulting in puddling, compaction, and displacement of wetland soils.

Proposed Action (B)

The effects the Proposed Action (and the five other action alternatives) would have on soil will be evaluated in three contexts: riparian/wetland management, vegetation management, and road management. The Proposed Action alternative would implement

4254 acres of commercial harvest and 6342 acres of non-commercial thinning and fire. It would build 10.83 miles of new road.

Riparian/Wetland Management

Because riparian management activities are common to all action alternatives, the soil effects discussed here apply to all six action alternatives. Riparian/wetland management activities in the Woodward Meadows riparian area include: stream channel improvements to restore historic flow patterns; and the planting of native riparian plant species to mitigate high stream temperatures.

The riparian management activities in Woodward Meadows would affect three soils: Konner silty clay loam, Ponded Histosols, and Bonner silt loam. This proposal may cause compaction, displacement, and puddling of soils both on-site and adjacent to the proposed location. Off-site erosion is expected to be minimal due to low slope gradients and adequate vegetative cover. Soil disturbance caused by in-channel work will result in short-term sedimentation to downstream reaches of Cottonwood Creek. Road closure and partial obliteration (under all alternatives but F) will eliminate fuelwood cutting in the riparian zones and improve soil infiltration rates. Construction of a drift fence at the closure point on the #250 road would eliminate all but the most determined off-road vehicle users in the meadows.

Vegetation Management

Timber Sale

The Soil Disturbance Model[50] indicates that proposed harvest activities under this alternative, when combined with past management activities, will result in a 9.9% total soil disturbance[51]. It is estimated that logging will create 38 acres of landing piles that will require burning. In addition to landing piles, grapple piling for site preparation will occur on 103 acres. About 72% of the grapple piling will occur on highly compactive soils, that will require mitigation.

Prescribed Fire and Non-Commercial Thinning

This alternative would treat approximately 6342 acres using a combination of fire and mechanical, non-commercial thinning practices. Approximately 1168 acres would be maintenance/restoration burns outside of harvest units. The remainder includes post harvest burning/thinning activities located within timber sale units. About 83% of the prescribed burning in this alternative would occur on soils classified as “high” in the burn potential category. However, negative effects would be avoided when the soil mitigation measure listed in Chapter 2 is used.

Road Management

The Proposed Action would build 10 segments of new road totaling 10.83 miles. Other road management activities include road reconstruction, road closure and road improvements at stream crossings. The most sensitive soils impacted by new road construction within this alternative are Raisio-Rock outcrop complex, Huckleberry-Rock outcrop complex, Rufus-Rock outcrop complex, and Raisio shaly loam. These are shallow to moderately deep soils located on steep slopes (mostly 40-65%). These soils

[50] The Soil Disturbance Model is based on activity acres within the analysis area.
[51] The Forest Plan and Regional guidelines limit the total acreage of all detrimental soil conditions to 20% of the activity area.

are rated as severe for cut, fill, and sidecast hazard (if bedrock bedding is parallel to the slope) and very unstable for disturbed slope stability. All (except the Rufus-Rock outcrop complex) have high erosion potential.

Upper Cottonwood (C)

This alternative would implement the Proposed Action in all areas except the Betts Basin. It would implement 2877 acres of commercial harvest and 4784 acres of non-commercial thinning and fire. It would build 6.89 miles of new road.

Vegetation Management

Timber Sale

The Soil Disturbance Model indicates that proposed harvest activities under this alternative, when combined with past management activities, will result in an 11.2% total soil disturbance. It is estimated that logging will create 27 acres of landing piles that will require burning. In addition to landing piles, grapple piling for site preparation will occur on 75 acres. About 63% of the grapple piling will occur on highly compactive soils that require mitigation.

Prescribed Fire and Non-Commercial Thinning

This alternative will treat approximately 4784 acres using a combination of fire and mechanical, non-commercial thinning practices. Approximately 1168 acres will be restoration burns outside of harvest units. The remainder includes post harvest burning/thinning activities located within timber sale units. About 79% of the prescribed burning in this alternative will occur on soils classified as “high” in the burn potential category.

Road Management

The Upper Cottonwood Alternative will build 8 segments of new road totaling 6.89 miles. Other road management activities include road reconstruction, road closure and road improvements at stream crossings. The most sensitive soils impacted by new road construction within this alternative are Raisio-Rock outcrop complex, Huckleberry-Rock outcrop complex, and the Rufus-Rock outcrop complex. These are shallow to moderately deep soils located on steep slopes (mostly 40-65%). These soils are rated as severe for cut, fill, and sidecast hazard (if bedrock bedding is parallel to the slope) and very unstable for disturbed slope stability. The Raisio-Rock outcrop complex, and Huckleberry-Rock outcrop complex soils have high erosion potential.

Wildland (E)

This alternative would implement the Proposed Action in all areas except the Unroaded Area and associated buffered areas (as defined by the Quartzite Ecosystem Analysis). It would implement 1748 acres of commercial harvest and 3020 acres of non-commercial thinning and fire. It would build 2.33 miles of new road.

Vegetation Management

Timber Sale

The Soil Disturbance Model indicates that proposed harvest activities under this alternative, when combined with past management activities, will result in a 10.8% total

soil disturbance. It is estimated that logging will create 16 acres of landing piles that will require burning. In addition to landing piles, grapple piling for site preparation will occur on 88 acres. About 67% of the grapple piling will occur on highly compactive soils that require mitigation.

Prescribed Fire and Non-Commercial Thinning

Prescribed Fire and Non-Commercial Thinning would occur on 3020 acres, using a combination of fire and mechanical, non-commercial thinning practices. Approximately 710 acres will be restoration burns outside of harvest units. The remainder includes post harvest burning/thinning activities located within timber sale units. About 74% of the prescribed burning in this alternative will occur on soils classified as "high" in the burn potential category.

Road Management

The Wildland Alternative will build 6 segments of new road totaling 2.33 miles. Other road management activities include road reconstruction, road closure and road improvements at stream crossings. The most sensitive soils impacted by new road construction within this alternative are Raisio-Rock outcrop complex and Huckleberry-Rock outcrop complex. These are shallow to moderately deep soils located on steep slopes (mostly 40-65%). These soils are rated as severe for cut, fill, and sidecast hazard (if bedrock bedding is parallel to the slope) and very unstable for disturbed slope stability. Both soils have high erosion potential.

Vegetation (F)

This alternative would implement the Proposed Action plus additional commercial harvest areas where insects, disease, storm damage and overstocking occur. Unlike the Proposed Action, it would not close the two segments of existing open road. It would implement 5446 acres of commercial harvest and 7034 acres of non-commercial thinning and fire. It would build 18.37 miles of new road.

Vegetation Management

Timber Sale

The Soil Disturbance Model indicates that proposed harvest activities under this alternative, when combined with past management activities, will result in a 10.1% total soil disturbance. It is estimated that logging will create about 47 acres of landing piles that will require burning. In addition to landing piles, grapple piling for site preparation will occur on 102 acres. About 73% of the grapple piling will occur on highly compactive soils that will require mitigation.

Prescribed Fire and Non-Commercial Thinning

Prescribed Fire and Non-Commercial Thinning would occur on 7034 acres, using a combination of fire and mechanical, non-commercial thinning practices. Approximately 1168 acres will be restoration burns outside of harvest units. The remainder includes post harvest burning/thinning activities located within timber sale units. About 84% of the prescribed burning in this alternative will occur on soils classified as "high" in the burn potential category.

Road Management

The Vegetation Alternative will build 17 segments of new road totaling 18.37 miles. Other road management activities include road reconstruction, and road improvements at stream crossings. The most sensitive soils impacted by new road construction within this alternative are Raisio-Rock outcrop complex, Huckleberry-Rock outcrop complex, Rufus-Rock outcrop complex, and Raisio shaly loam. These are shallow to moderately deep soils located on steep slopes (mostly 40-65%). These are rated as severe for cut, fill, and sidecast hazard (if bedrock bedding is parallel to the slope) and very unstable for disturbed slope stability. All (except the Rufus-Rock outcrop complex) have high erosion potential.

Wildland Prescribed Fire (J)

This alternative would implement the 'Wildland Alternative' plus any maintenance fire areas within the Unroaded Area. It would implement 1868 acres of commercial harvest and 3479 acres of non-commercial thinning and fire. It would build 2.33 miles of new road.

Vegetation Management

Timber Sale

The Soil Disturbance Model indicates that proposed harvest activities under this alternative, when combined with past management activities, will result in an 11.5% total soil disturbance. It is estimated that logging will create about 16 acres of landing piles that will require burning. In addition to landing piles, grapple piling for site preparation will occur on 88 acres. About 67% of the grapple piling will occur on highly compactive soils that will require mitigation.

Prescribed Fire and Non-Commercial Thinning

Prescribed Fire and Non-Commercial Thinning would occur on 3479 acres, using a combination of fire and mechanical, non-commercial thinning practices. Approximately 1168 acres will be restoration burns outside of harvest units. The remainder includes post harvest burning/thinning activities located within timber sale units. About 76% of the prescribed burning in this alternative will occur on soils classified as "high" in the burn potential category.

Road Management

The Wildland Prescribed Fire Alternative will build 6 segments of new road totaling 2.33 miles. Other road management activities include road reconstruction, road closure and road improvements at stream crossings. The most sensitive soils impacted by new road construction within this alternative are Raisio-Rock outcrop complex, Huckleberry-Rock outcrop complex, Rufus-Rock outcrop complex, and Raisio shaly loam. These are shallow to moderately deep soils located on steep slopes (mostly 40-65%). These are rated as severe for cut, fill, and sidecast hazard (if bedrock bedding is parallel to the slope) and very unstable for disturbed slope stability. All (except the Rufus-Rock outcrop complex) have high erosion potential.

Existing Roads (K)

This alternative would implement the Proposed Action minus any commercial harvest areas (and associated restoration fire areas) determined to be infeasible from existing

roads. It would implement 3753 acres of commercial harvest and 5635 acres of non-commercial thinning and fire. It only reconstructs existing roads, without building any new roads or stream crossings.

Vegetation Management

Timber Sale

The Soil Disturbance Model indicates that proposed harvest activities under this alternative, when combined with past management activities, will result in an 8.6% total soil disturbance. It is estimated that logging will create about 32 acres of landing piles that will require burning. In addition to landing piles, grapple piling for site preparation will occur on 88 acres. About 68% of the grapple piling will occur on highly compactive soils that will require mitigation.

Prescribed Fire and Non-Commercial Thinning

Prescribed Fire and Non-Commercial Thinning would occur on 5635 acres, using a combination of fire and mechanical, non-commercial thinning practices. Approximately 1168 acres will be restoration burns outside of harvest units. The remainder includes post harvest burning/thinning activities located within timber sale units. About 77% of the prescribed burning will occur on soils classified as “high” in the burn potential category.

Road Management

No new road construction is proposed under this alternative. Soil impacts on the reconstructed segments of this alternative will mainly be confined within the existing clearing limits. These impacts will include compaction, displacement, and erosion on existing cutslopes, fillslopes, and travel ways. Other road management activities include road improvements at stream crossings.

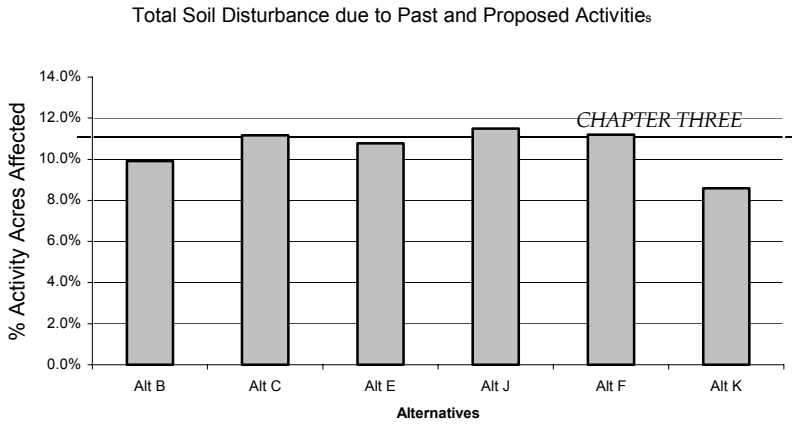
Summary of Soil Effects

Riparian/Wetland Management

Earth berm impoundments in artificial channels will help to reestablish hydrologic functions and control the spread of reed canary grass. Impoundments will serve as wildlife habitat ponds and sediment traps. Soil disturbance during implementation of this project will remain within regional guidelines with application of mitigation measures. Small areas of soil will be disturbed through the construction process. This will result in potential sites for noxious weed invasion since they are already present as a result of past and present activities. Timely revegetation of native and competing species should keep this to a minimum. Closing the #4342.250 road under all alternatives (but F) will result in a decrease in puddling, displacement, and compaction of wetland soils from off-road vehicles. This closure may not be effective due to low slope angles in the vicinity of the proposed closure location.

Vegetation Management

Timber Sale



The Chart displays the results of the soil disturbance model. Alternative K is somewhat lower in its overall disturbance primarily due to the lack of new road construction. Soils will be compacted, displaced and eroded due to timber harvest under all alternatives. Puddling may also occur, but can be mitigated. The differences between alternatives are a matter of degree. Most soils will recover from these impacts over time. The effects of compaction however, are long-term and compacted soils may not recover before the next cutting cycle in these stands. In that case compaction should be considered cumulative. Subsequent harvest entries must not exceed conditions existing prior to the next planned activity and should move toward a net improvement in soil quality.

Soil moisture regimes will also be altered as a result of harvest activities. Compaction and puddling reduce the ability of soils to capture and store moisture during precipitation events. Compacted areas will have decreased infiltration rates, and an increased risk of surface erosion. Ripping and reseeding major skid trails and landings, utilizing existing slash, and protecting existing vegetation will offset some of these impacts. The modeled results of all alternatives are within forest and regional guidelines.

Prescribed Fire and Non-Commercial Thinning

Jackpot burning and underburning will be prescribed except in those areas proposed for post harvest piling. This type of burning will result in a mosaic of burn patterns across the forest. Soil burn severity will be greatest where fuel concentrations are heaviest. The "O" horizon and the organic portions of the "A" soil horizons may be obliterated. In other areas of lower fuel concentrations these upper soil horizons will remain intact with only the upper layers being "scorched." Some islands within the fire area will remain unburned contributing to the mosaic effect. These unburned and lesser-burned areas will serve as buffers to retain off-site movement of soils. The most severely burned patches (beneath the heavy fuel concentrations) will be subject to induced non-wettability, nutrient loss, and surface erosion. This type of burn operation will affect mostly ground cover vegetation (grasses, forbs, and herbs) along with understory conifers and hardwoods. This process will impact very few overstory trees.

There is some risk that a prescribed burn may escape established control lines and become a wildfire. Should this happen, the effects will be the same as those described under the No Action Alternative. Fire effects will vary according to fuel loading, depth of the A horizon, slope, soil texture, duff thickness, and aspect. In general impacts will be greatest on coarse textured soils (sand, loamy sand, cobbly sandy loam, and sandy loam), on slopes >25%, on southeast, south, southwest and west aspects, and those having < 3" of duff and an A horizon < 4" deep. Little off-site movement of soils is anticipated from this activity. Severely burned areas located on soils with a high burn potential will likely have a longer recovery period, however these areas should remain small relative to the total area proposed for burning. No adverse soil effects are expected from the mechanical non-commercial thinning.

Potassium Availability

In mixed-conifer stands, the potential exists for shade-tolerant species to out-compete intolerant species for nutrients, particularly where the supply is limited. Shade tolerant species not only take up nutrients at higher rates than intolerants, but are also the most

likely to suffer nutrient imbalances, leading to root chemistry imbalances and increased susceptibility to root disease. This implies that a species composition shift towards shade intolerants would be advisable on sites where root disease has been a problem. Site quality is reflected in nutrient availability. Better sites have more nutrients, and will probably respond better to thinning.

To conserve nutrients during timber harvest activities, every effort should be made to leave branches, twigs, and foliage on site and remove only stems through conventional timber harvest. Slash residue left on the site has been found to leave a sufficient nutrient supply to support a second-growth stand for approximately 8-10 years. Thinning to maintain open crowns is useful for maintaining growth rates and minimizing nutrient competition. Site preparation also plays an important role in the growth and survival of stands. It is preferable to avoid mechanical site preparation that displaces the topsoil in order to leave as much soil on-site as possible and reduce off-site movement due to erosion. Fire is an important process by which nutrients held in the litter and subordinate vegetation are released and cycled back through the ecosystem. This is particularly important for pine stands, whose lower nutrient requirements probably reflect their evolution with frequent fires.

Studies indicate that burning released nutrients back into the system. Extremely hot burns can be detrimental to the status of nutrients by volatilizing elements, physically removing elements as particulate matter in ash in the smoke column, and creating an impermeable and sterile layer of soil. These conditions are most likely to occur under piles resulting from site preparation. Broadcast burning is preferable to piling and burning from both a temperature and nutrient distribution standpoint.

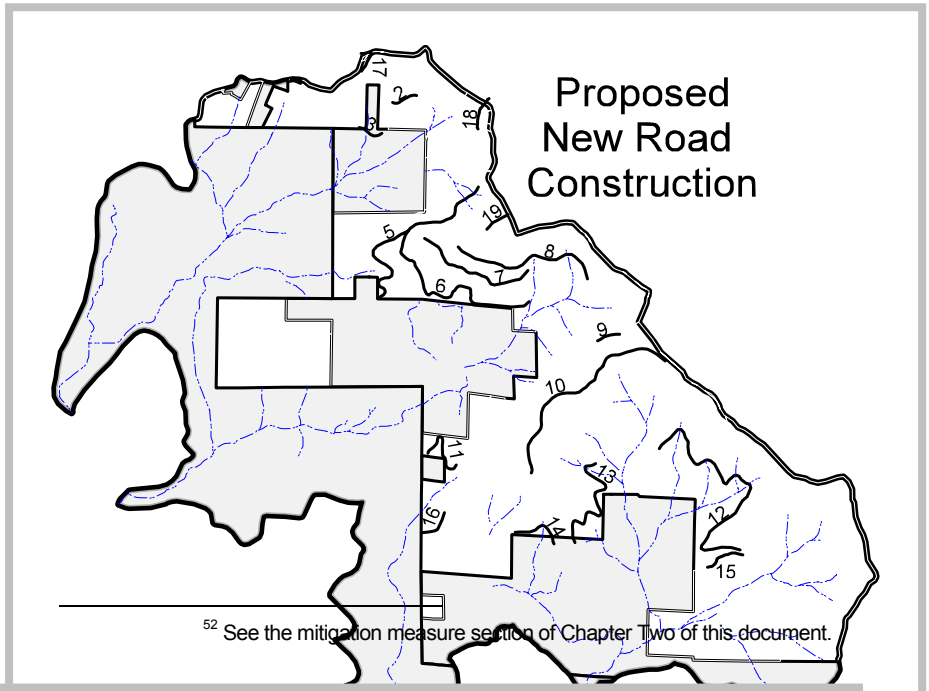
Two possible scenarios may occur under the no action alternative. If a catastrophic fire burns through portions of the analysis area, it will likely result in a mosaic pattern with extremely hot burns occurring in areas of heavy fuels. Burning under these conditions will remove potassium from these sites through volatilization. The possibility also exists under the no action alternative that no catastrophic fires would occur and potassium would remain at existing levels.

Under the action alternatives, conventional timber harvest (removing only the bole) will probably increase the amount of available potassium for 8 to 10 years following timber harvest due to nutrient leaching from foliage left on-site. This may result in an increased short-term resistance of residual conifers to root rot fungus. Long-term potassium levels will likely decrease over current levels by the amount removed in the bole of the trees (10-15%), however this decrease may be offset by a shift to intolerant species that make efficient use of limited levels of potassium. The cumulative effect of these short and long-term consequences is unknown. Potassium is seldom volatilized by fire except under extremely hot burning conditions. These conditions are seldom encountered under current prescribed burn policies, except under slash piled for site preparation. The amount of ground affected by piling is a small percentage of each action alternative and is not likely to measurably affect the overall potassium balance on the analysis area. No indirect effects (off-site) from potassium availability are anticipated to occur under any action alternative. Off-site movement of available potassium will be minimized and sufficient levels for future vegetative growth will be maintained by using the soil mitigation measures listed in Chapter 2.

Road Management

The impacts of road construction/reconstruction and rock pit development will be similar to those of timber harvest: compaction, erosion, and displacement. Compaction will occur along the travel ways of newly constructed road segments. These effects last a very long time even if the road is closed to vehicle traffic after haul is complete. Ripping, seeding, and installing additional drainage structures prior to closure will reduce, but not totally eliminate, these effects. Surface erosion in the form of sheet, rill, and gully erosion will occur along the travelway, as well as the cutslopes and fillslopes of both new and reconstructed road segments. Fill and cutslope failures may occur along road segments intercepting subsurface flows or containing inadequate drainage structures. Natural stream channels will essentially be extended unless roads, skid trails, and landings can be effectively disconnected from natural waterways. This may result in increased stream flows and will result in increased sedimentation. Any increased stream flows will be masked by natural variations in precipitation patterns. Sedimentation will decrease over time to a baseline level as vegetation becomes reestablished. Proper design, layout, and implementation of all phases of road construction and timber harvest will mitigate these effects[52].

A combination of factors was used to identify soils of concern for road construction. These factors include steep slopes; depth to bedrock; disturbed slope stability; cut, fill, and sidecast hazard; rockiness limitation; and drought potential. Three soils emerged from this screening: #6625 (Rasio-Rock outcrop complex); #3018 (Huckleberry-Rock outcrop complex); and #6859 (Rufus-Rock outcrop complex). These soils are located on steeper slopes (30 to >65%). They are shallow to moderately shallow soils (10”-40”). They have very unstable disturbed slope stabilities, severe cut/fill/and sidecast hazards, severe rockiness limitation, and high drought potential. Roads constructed on these soils will experience higher construction costs due to increased rock excavation costs. Full bench construction and end-hauling of excavated material will be necessary in these areas to avoid fill slope failures and excessive soil erosion on cuts and fills. Revegetation of constructed slopes may be difficult based on shallow soils, high rock content, and low available water holding capacity. This will be especially evident on south to west aspects. Segments identified with an X in the table indicate that this soil type affects a major portion of that segment. Segments identified with an (X) indicate that these soils impact only a small portion of the proposed road segment.



New road construction on sensitive soils predominantly occurs in the Sherwood watershed. Downstream reaches of this watershed are still recovering from the dam failure of Horseshoe Lake in

[52] See the mitigation measure section of Chapter Two of this document.

Sensitive	New Road Segments Affected																Alternatives Affected						
Soils	2	3	5	6	7	8	9	10	11	12	13	14	15	17	18	19	A	B	C	E	F	K	J
6625				X	X	X					(X)		X					X	X	X	X		X
3018										(X)				X				X	X	X	X		X
6859			(X)	(X)	(X)													X	X		X		

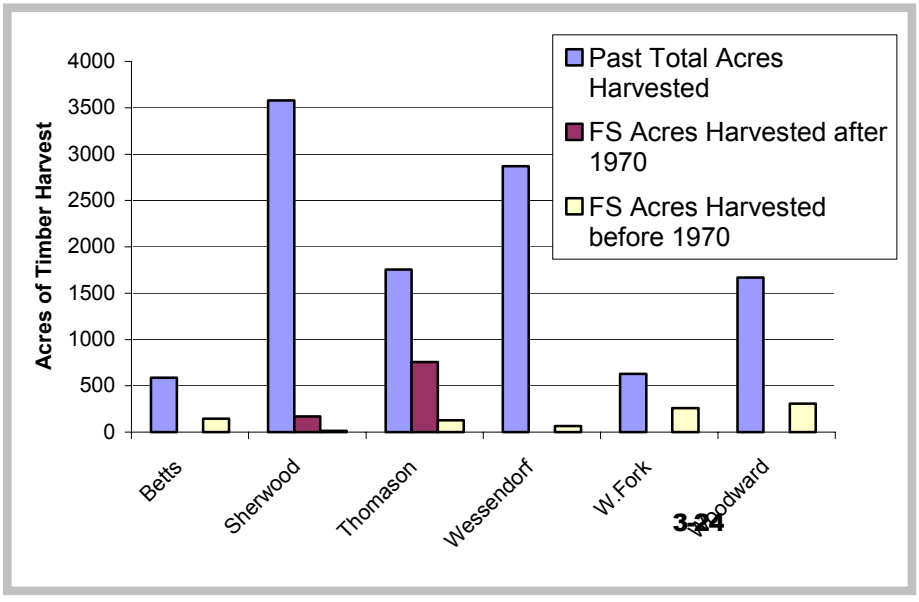
1974 and remain sensitive to changes in peak flows and sedimentation. The slope position of proposed road segments on the upper half, as well as the addition of only one stream crossing, will reduce the risk of impacts to lower reaches of Sherwood Creek. However, the "stacked" nature of these segments (along the contour) in some alternatives increases the risk that a catastrophic failure on an upper road will affect lower road segments and possibly reach Sherwood Creek. This would likely occur during large events producing significant runoff and saturated soil conditions. Field reconnaissance of road segments proposed for new construction did not reveal evidence of slope instability. Based on existing soils information and field reconnaissance, soil concerns can be mitigated through standard road construction procedures.

Road that cross geologic faults may increase the probability of ground water interception and the subsequent need to deal with concentrations of road drainage water, however these crossing points are at mid and upper slope locations. This will decrease the probability of interception of ground water.

Only one large natural mass failure has been identified within the analysis area. This was a natural debris flow that occurred in the Sherwood watershed in 1997. The soil is mapped as #6625 (Rasio-Rock outcrop complex, 40-65% slopes), one of the sensitive soils identified during this analysis.

Soil #6625 is a major component on four new road segments, and a minor component on one other. Soil #3018 is a major component on one new road segment, and a minor component on one additional segment. Soil #6859 is a minor component on three new segments. The same sensitive soils are common to Alternatives B, C, and F. However, because Alternative F proposes to build more new road segments than Alternatives B and C, it will impact the largest area of sensitive soils. The new road impacts to soils from Alternatives E and J are the same and include only two sensitive soils (#6625 and #3018). Alternative K has the least impact to soils (of the action alternatives) since it does not propose any new road construction.

Based on soil maps and ratings, Alternative F carries the highest risk of mass failures, failures due to concentrations of road drainage water, and surface erosion from cuts and fills. Other Alternatives (B, C, E, J, and K) carry a somewhat lower risk in their respective order based on the amount of new road construction and the sensitivity of the soils these proposed roads will cross. It is not possible to predict the frequency and size of such events since they are subject to external factors (such as weather) that are outside the scope of this analysis.



Soil Cumulative Effects

Cumulative effects occur when the effects of past activities are combined with proposed and reasonably foreseeable activities. The extent of the existing detrimental soil condition throughout

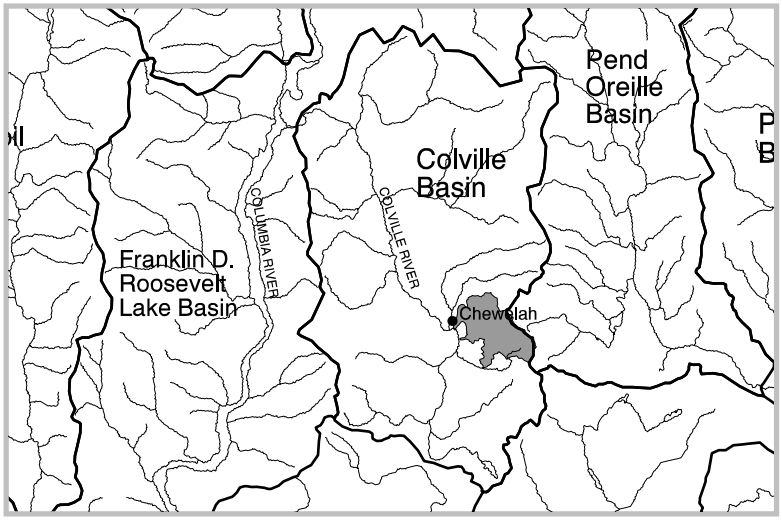
the analysis area was estimated from data gathered using aerial photo interpretation, the District's activity and road databases, and Washington State DNR forest practices applications. This data included past harvest activities on Forest Service, as well as state & private ownership; miles of existing roads; and concurrent actions within the analysis area such as the reconstruction of the Flowery Trail County Road. The data was then analyzed using the Colville National Forest's Soil Disturbance Model developed in 1990. This model also anticipates future Forest Service actions by calculating the effects of detrimental soil disturbance for each action alternative.

Over 11,000 acres of timber harvest activity has occurred within the analysis area during the last 50 or so years. About 83% of that has been on state and private land. Some areas have been entered more than once during this time period. The Sherwood basin has experienced the most activity with about 3500 acres harvested, primarily outside the Forest Boundary. Almost 50% of the harvest activity in the Thomason basin within this time period occurred on Forest Service land (755 acres).

Analysis shows that existing Forest Service activity units do not exceed soil quality standards. All action alternatives will produce an increase in detrimental soil disturbance (such as compaction and displacement) particularly on harvest units identified for tractor yarding. Minor levels of soil disturbance will occur on skyline and helicopter units. All action alternatives will meet Regional and Forest soil quality standards through the application of mitigation and Best Management practices. Many soils detrimentally impacted by timber harvest will recover over time, before the next cutting cycle. The effects of compaction however are evident even after long periods of time, and these soils are not expected to recover for many years. This will result in diminished soil productivity and fertility on severely compacted areas that may be evident through decreased growth rates of vegetation and increased susceptibility to insects and disease pathogens.

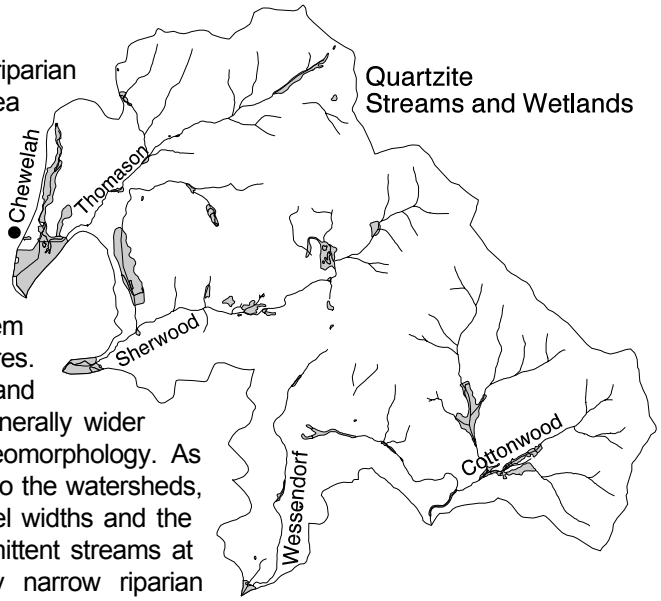
3.2.3 Water Resources: Affected Environment

The Colville River is one of the smaller tributaries to the Columbia River. It originates in southern Stevens County and flows north for 50 miles before emptying into the Columbia River, just south of Kettle Falls, Washington. The Colville drains a 1,007 square mile area, which represents 0.39% of the Columbia River Basin. Measurements taken from 1924-1979 show the Colville River had an average discharge of 302 cubic feet per second, compared to 179,800 cf/s for the Columbia.



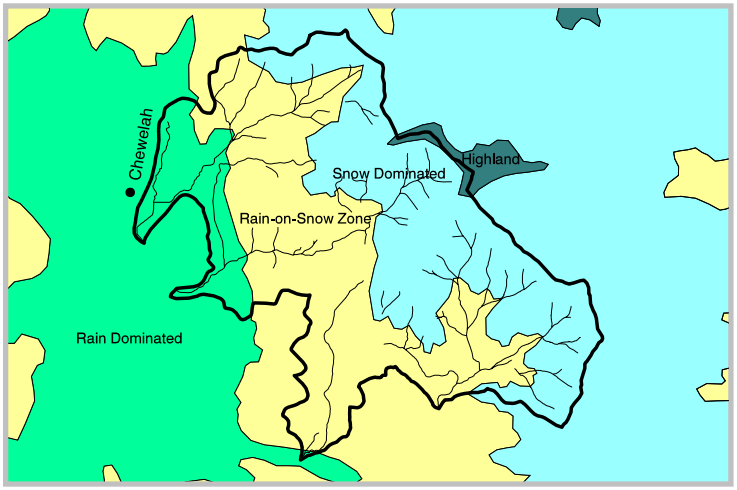
The Quartzite Analysis Area (36 mi.^{2}) occupies 3.6% of the Colville River Basin and is composed of three small west-flowing streams (Thomason, Sherwood & Cottonwood) that drain into the Colville River.

Channel Morphology



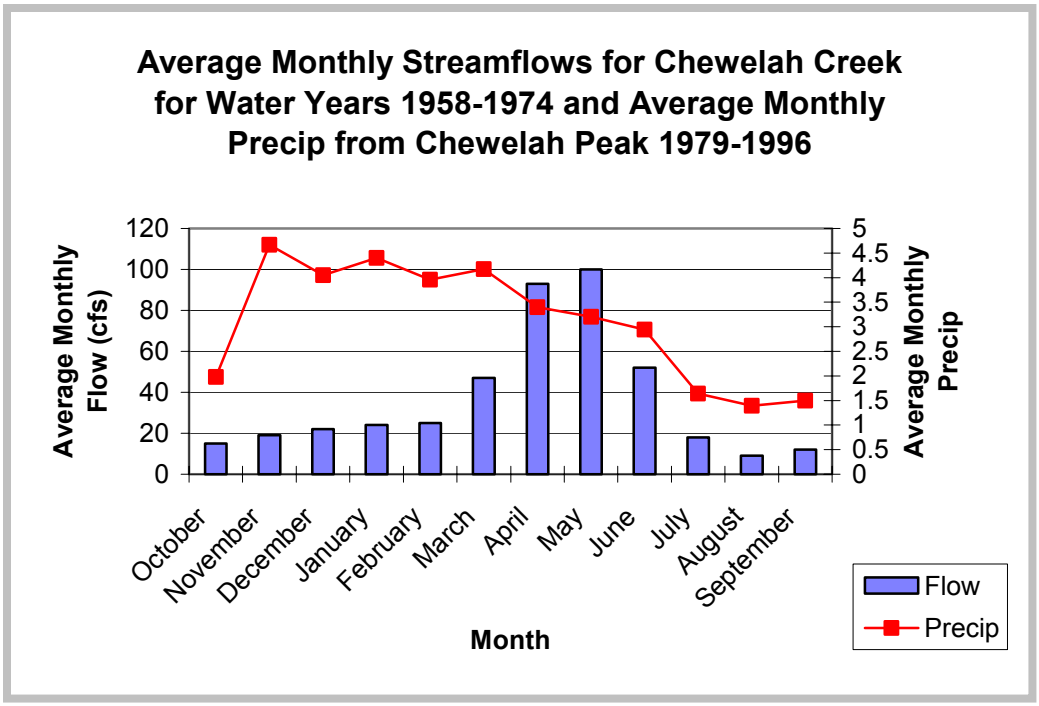
The streams and associated riparian systems within the analysis area continue to react to the influences of catastrophic fires, past logging, agricultural/grazing practices and ongoing residential development. The moist characteristics of some riparian zones on National Forest System lands, left them unaffected by fires. Lower gradient streams and associated riparian zones are generally wider due to geology, soils, and valley geomorphology. As stream channels extend higher into the watersheds, flows decrease along with channel widths and the zone of riparian influence. Intermittent streams at the upper elevations have very narrow riparian corridors, in some cases extending only a few feet on either side of the channel. Consequently, abrupt changes from riparian to upland vegetation may be encountered over short distances. The riparian zones in the upper portions of these sub-watersheds remain intact and relatively unaffected by past management practices.

The headwater streams of most of the Betts and Sherwood watersheds are operating at near reference conditions. Thomason, Wessendorf, and Woodward, while more affected by management activities are still in a properly functioning condition on NFS Lands. Streams and wetlands in this condition include attributes (landform, adequate vegetation, and large woody debris) that act to dissipate excess stream energy associated with high flows. These attributes also filter sediment, capture bedload, aid floodplain development, and improve flood-water retention and ground-water recharge. Root masses armor stream-banks against cutting action and large wood debris helps develop pools and channel characteristics that provide the water depth, duration, and temperature necessary for fish production and waterfowl breeding.



The streams in the analysis area have a snow-dominated runoff regime, fed by a snowpack that remains throughout the winter. Spring runoff is the main flow event of the year. Mid-winter rain-on-snow events are rare, but can cause runoff damage from peak flows. Late spring rain-on-snow events or warm air are more common but they are confined to the higher elevations and peak flows are localized and usually do not exceed bank width.

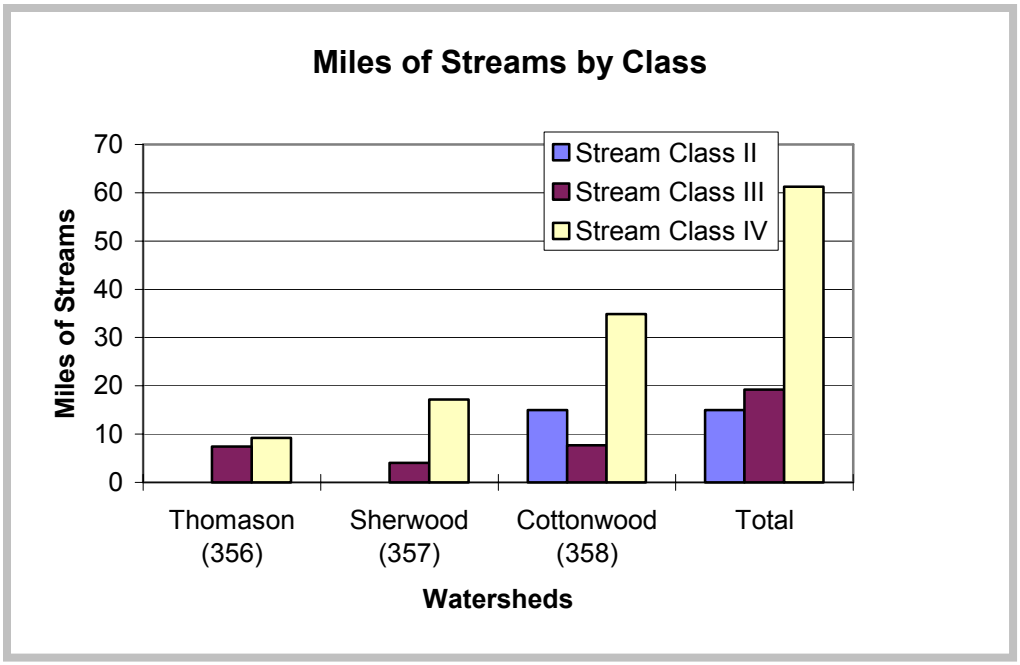
The nearest USGS streamflow-gauging station was maintained from 1958-1974 on Chewelah Creek, located just north of the analysis area. Data from this station shows the relationship between the average monthly precipitation and the average daily streamflow. Also evident is the delay in water release from the winter months when precipitation is highest, to the spring, when streamflow peaks.



Slopes in the upper portions of watersheds within the analysis area are steep, and runoff and sediment delivery are efficient; however, the area is buffered by glacial and valley features that act to moderate peak flows.

Annual peak flows can occur from January to May. The data shows the peak most often occurs during the month of May (7 years out of 17 years). Anomalies however do occur. A flood event on January 24th, 1974 recorded a peak flow of 392 cf/s. Most often, peak flows result from snowmelt, or snowmelt accompanied by rainfall and Chinook winds. Major flooding along Chewelah Creek occurs on an average of 15-20 years. From the turn of the century seven flood events have occurred: 1904, 1927, 1953, 1956, 1960, 1974, and 1997.

Stream classes for the three Quartzite sub-watersheds are displayed below. This graph includes the entire Cottonwood Watershed (21,340 acres), not just the portion within the Quartzite Analysis Area (10,466 acres). Class II streams are perennial, fish bearing streams; Class III streams are perennial, non-fish bearing; and Class IV streams are intermittent. Class IV streams comprise the majority of all streams in the analysis area and only the Cottonwood Watershed has fisheries within NFS Lands.



Thomason sub-watershed current condition

Area	5376 acres (8.4 mi^2)
Land-ownership	34.6% National Forest System (NFS) lands, 65.4% non-NFS Lands.
Elevation	Elevations range from 1640' at the mouth of Thomason Creek to 5123' on Jay Gould Ridge
Average Slope	22%
Aspect	West
Channel Type	1.1 miles of channels were surveyed within the watershed on NFS land. Most streams are Rosgen type A or Aa+. Channel substrate is sand/silt (Rosgen 5/6). Perennial Channels: 0.7 miles are Class 3, with an additional 0.3 miles classified as alternating between Class 3 and 4. Intermittent/Ephemeral Channels: 0.1 miles are Class 4, with an additional 4 channels classified as ephemeral with no length determined. Channel types and condition are unknown on non-NFS Lands.
Drainage pattern	Dendritic. This pattern is characterized by irregular branching of tributary streams in many directions and at almost any angle, although usually at considerably less than a right angle. They develop upon rock of uniform resistance and imply a notable lack of structural control.
Drainage Density	Accurate drainage density figures cannot be calculated due to the lack of data for streams on non-NFS land, however stream densities for NFS Lands are 1.98 miles of stream/mi^2.
Relief Ratio	0.1 (Relief Ratio is the quotient of height to length of a basin)
Road Density	Total = 5.55 miles of road/mi^2. Non-NFS land = 6.22 miles of road/mi^2. NFS land = 4.28 miles of road/mi^2.
Gradient	Valley gradients range between 8% and 45%.
Flow Patterns	Peak flows are moderate to low during most years and are moderated by subsurface flow in the glacial valley fill material. Occasional rapid snowmelt events originate from rain or warm winds.

Sherwood sub-watershed current condition

Area	7469 acres (11.7 mi^2)
Land-ownership	34.6% National Forest System (NFS) lands, 65.4% non-NFS Lands.
Elevation	Elevations range from 1650' at the mouth of Sherwood Creek to 5773' at the summit of Chewelah Peak.
Average Slope	34%
Aspect	West
Channel Type	3.4 miles of channels were surveyed on NFS land. Within the sub-watershed all streams are Rosgen Aa+. Channel substrate are all composed of bedrock or cobble (Rosgen 1/3). Perennial Channels: 0.6 miles are Class 3, with an additional 1.8 miles alternating between Class 3 and 4. Intermittent/Ephemeral Channels: 1.0 mile is Class 4, with an additional 4 channels classified as ephemeral with no length determined. Channel types and condition are unknown on non-NFS Lands.
Drainage pattern	Dendritic. (see Thomason Creek)
Drainage Density	Stream densities for NFS Lands are 1.81 miles of stream/mi^2.
Relief Ratio	0.1
Road Density	Total = 3.48 miles of road/mi^2. Non-NFS land = 4.97 miles of road/mi^2. NFS land = 1.16 miles of road/mi^2.
Graident	Valley gradients range between 25% and 55%.
Flow Patterns	(see Thomason Creek)

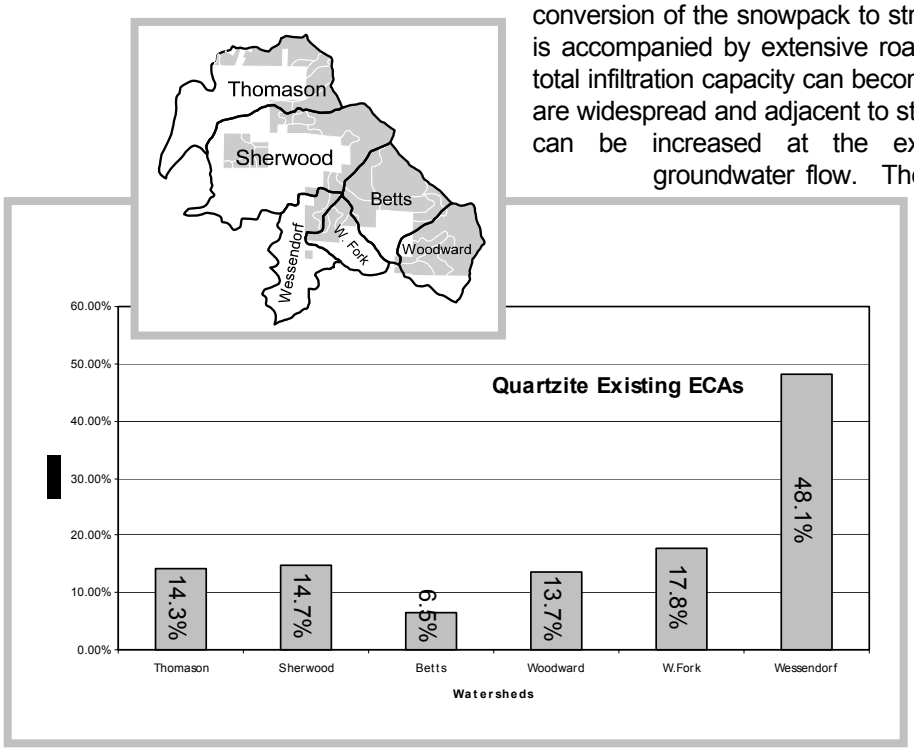
Cottonwood sub-watershed current condition

Area	10,466 acres (16.35 mi^2)
Land-ownership	55.4% National Forest System (NFS) lands, 44.6% non-NFS Lands.
Elevation	Elevations range from 1920' at the mouth Wessendorf Canyon to 5400' on the south ridge of Chewelah Peak.
Average Slope	33%
Aspect	West
Channel Type	14.3 miles of channels were surveyed on NFS land. Most streams are Rosgen Aa+. Channel substrate are all composed of cobble or gravel (Rosgen 3/4). Perennial Channels: 8.8 miles = Class 3 with an additional 1.4 miles of Class 2 (fish-bearing). Intermittent Channels = 4.1 miles are classified as Class 4 streams. Channel types and condition are unknown on non-NFS Lands.
Drainage pattern	Dendritic. (see Thomason Creek)
Drainage Density	Stream densities for NFS Lands are 1.84 miles of stream/mi^2.
Relief Ratio	0.1
Road Density	Total = 3.22 miles of road/mi^2. Non-NFS land = 5.19 miles of road/mi^2. NFS land = 1.63 miles of road/mi^2.
Graident	Valley gradients range between 1% and 65%.
Flow Patterns	(see Thomason Creek)

Streamflow Regime

Streamflow is the water produced from a drainage that makes it to a stream channel. Water yield equals drainage input (precipitation) minus losses (evapotranspiration) plus or minus storage (depressions, impoundments, and direct diversions).

Removal of forest vegetation increases water yield because of a reduction of transpiration rates, an increase in wind turbulence (which results in redistribution of snow and greater local snow accumulation), a reduction of snow interception losses, and a more efficient conversion of the snowpack to streamflow. If timber harvesting is accompanied by extensive road and skid trail development, total infiltration capacity can become reduced. If these activities are widespread and adjacent to stream channels, surface runoff can be increased at the expense of subsurface and groundwater flow. The net effect of such activities depends on whether reductions in evaportranspiration or reductions in infiltration have the greatest impact on recharge.



The Equivalent Clearcut Acre (ECA) model provides a snapshot in time of the amount of area in a watershed that exists in a *clearcut-condition*. ECA evaluates the likelihood of any increase in the average duration of near bankfull (channel-forming) flows, and the potential for increases in high magnitude peak flows due to rapid snowmelt. Past treatments such as timber harvest and road construction, when expressed as a percentage of the total watershed, provide a baseline against which proposed management activities can be compared. For purposes of this analysis, if ECA values exceed 25%, more intensive field investigations and evaluations may be required[53].

The ECA analysis for the existing condition consists of adding ECA's of roads, regeneration harvest units, and wildfires that have occurred over the last thirty years. ECA's are based on the number of acres treated, the percent of vegetation removed, and the year of treatment. As timber is removed and/or roads constructed, the amount of water yield may increase due to changes in interception, and evapotranspiration. These changes may cause peak flows that could potentially result in channel damage as the harvested area of a watershed exceeds 25% in an open condition. It is expected that a 25% dispersion of created openings will not cause significant adverse cumulative effects and will meet the water quality goals of the Colville National Forest Land and Resource Management Plan. As vegetation becomes reestablished over time, water yield

[53] See the page IV-17 of the Final Environmental Impact Statement for the Colville National Forest Land and Resource Management Plan.

decreases and the watershed "recovers" hydrologically. Recovery in the ECA model is considered complete when a fully stocked stand of new trees reaches a height of 35 feet.

All subwatersheds are currently below the 25% threshold of concern, except the Wessendorf subwatershed, which exceeds the threshold because of recent timber harvest on private lands.

Water Quality

The direct beneficial uses of water within the analysis area are stock watering, irrigation, fisheries, grazing, wildlife, residential, and dispersed recreation. Indirect beneficial uses downstream of the analysis area, within the Colville River Basin are residential/industrial, fisheries, mining, irrigation, livestock, and wildlife.

The physical properties and chemical constituents of water traditionally serve as the primary means for monitoring and evaluating water quality. Parameters such as pH, dissolved oxygen, conductivity, temperature, sediment, and bacteria are most commonly measured. Temperature is a key parameter that can be significantly altered as a result of timber harvest adjacent to the stream channel. Dissolved oxygen is a parameter that is critical to the health of aquatic ecosystems, but intergravel dissolved oxygen is more likely to serve as a useful measure of monitoring the effects of forestry activities. In forested areas, high levels of coliform bacteria are usually associated with inadequate waste disposal by recreational users, the presence of wild and/or domestic animals in the stream channel or riparian zone, or poorly maintained septic systems. Conductivity and pH are included because they are important indicators of the chemical and physical status of water, but they are much less sensitive to forest management activities than the other parameters.

An increased sediment load is often the most important adverse effect of forest management activities on streams. Large increases in the amount of sediment delivered to the stream channel can greatly impair, or even eliminate, fish and aquatic invertebrate habitat, and alter the structure and width of the streambanks and adjacent riparian zones. Sediment loads are often directly related to the load of nutrients and other chemical constituents that are sorbed onto fine particles. Increased sediment loads may indirectly result in increased stream temperatures and decreased intergravel dissolved oxygen.

Water Quality Standards

Waters within the analysis area must comply with Washington State water quality standards and the Memorandum of Agreement between the Forest Service (Region 6) and the State of Washington (Dept. of Ecology). In addition, WAC 173-201-070 states, "All surface waters lying within national parks, national forests, and/or wilderness areas are classified as Class AA or Lake Class.

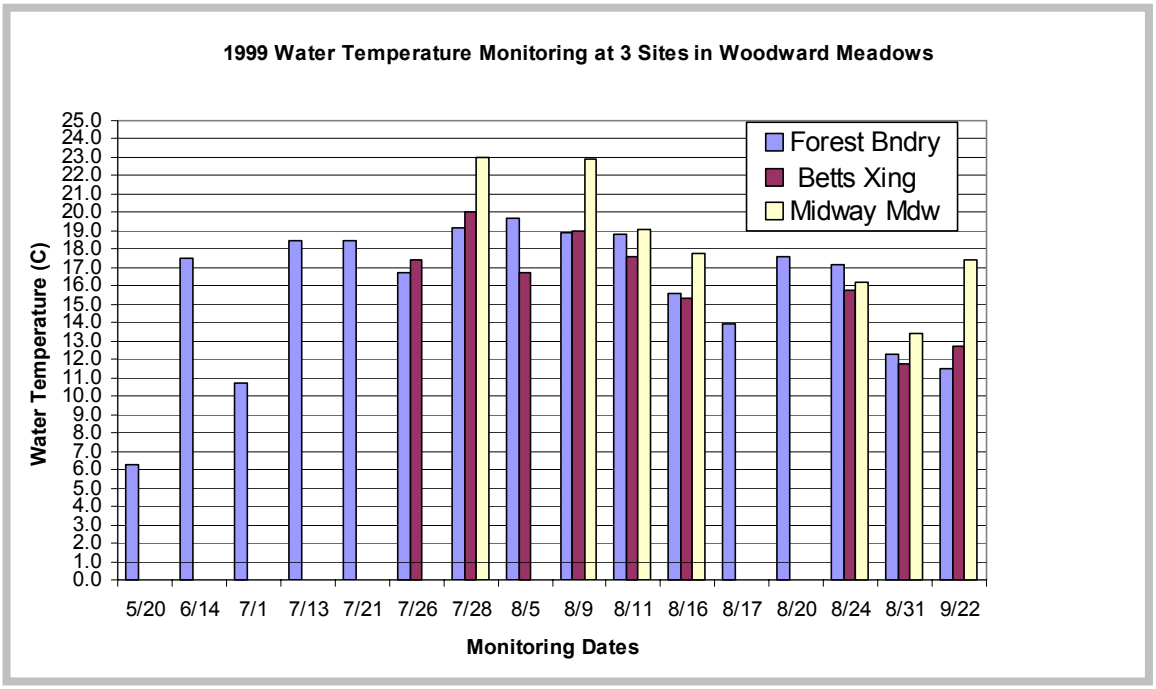
Water Quality Parameters

Parameter	AA Waters	Lake Waters
Bacteria	<50 organisms/100ml	<50 organisms/100ml
Dissolved O_2	>9.5 mg/L	No change from background
Temperature	<16°C	No change from background
pH	6.5-8.5	No change from background
Turbidity	<5 NTU	<5 NTU

Bacteria and Temperature

The 1998 Washington State Water Quality Assessment, Section 305(b) Report, lists Cottonwood Creek as impaired for fecal coliform bacteria above the forest boundary. Fecal coliform bacteria are derived from the feces of humans and other warm-blooded animals. These organisms enter stream systems through direct discharge from mammals and birds; from agricultural and storm runoff containing mammal and bird wastes; and from sewage discharge.

While water temperatures in the headwater portions of Cottonwood Creek are not currently listed as impaired by the state, recent sampling by the Forest Service indicates that stream temperatures in Cottonwood Creek are also exceeding state standards[54]. There is a strong probability that the next state listing of impaired water bodies (anticipated in 2001) will include Cottonwood Creek for temperature, as well as fecal coliform bacteria.



The National Forest has conducted water quality monitoring annually on Cottonwood Creek since 1996 when it was first listed as impaired for fecal bacteria by the state of Washington. The most recent data for 1999 confirms that this situation is continuing. Additional sites where selected for temperature monitoring in 1999 to attempt to isolate the source of the problem. The traditional monitoring site is located at the forest boundary, below the confluence of the Woodward Meadows Tributary and the Betts Meadows Tributary. In 1999 two more sampling sites isolated the Betts Meadows tributary and the Woodward Meadows tributary. Results from these additional sites incriminate both tributaries, as they both exceed State standards for temperature.

Concentrations of fecal bacteria follow the same seasonal trends as temperature, with peaks occurring in the middle of the summer. In forested areas, high levels of coliform

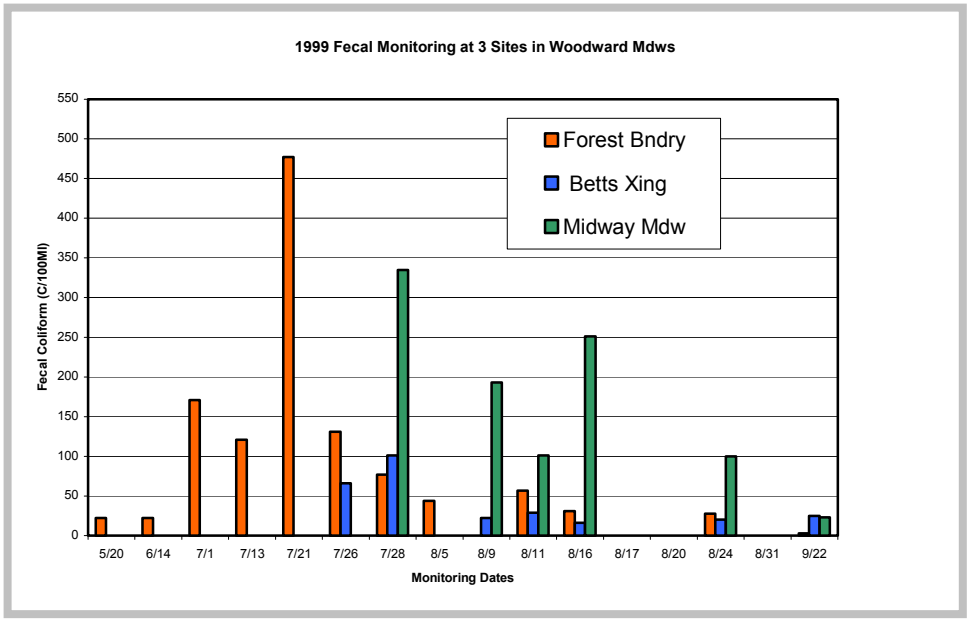
[54] When natural conditions exceed 16.0 degrees C., no temperature increases will be allowed which will raise the receiving water temperature by greater than 0.3 degrees C.

bacteria are usually associated with inadequate waste disposal by recreation users, the presence of livestock or other warm-blooded animals in the riparian zone, or with poorly maintained septic systems.

Livestock can be ruled out as the source for coliform bacteria. The Forest Service grazing allotment for this area has been vacant since 1986, and stream survey crews note no evidence of errant livestock. Human sources seem unlikely too. Dispersed recreation sites in Woodward Meadows are located on upland benches outside the zone of riparian influence. Stream surveys have indicated that dispersed recreation sites are not contributing to the elevated fecal counts in this watershed. The access into privately owned Betts Meadows is restricted by the landowners. No residential developments exist along either of these tributaries of Cottonwood Creek above the sampling sites.

Through a process of elimination the source of fecal coliform bacteria points to wildlife species that use the shallow beaver ponds of Betts and Woodward Meadows. The increased channel widths, shallow depths, decreased flow velocities, and dark bottom sediments that are associated with these ponds, not only provide excellent wildlife habitat, but also create optimal conditions for increased water temperatures and bacteria growth.

Since beaver activity is generally cyclic (depending on population levels, food supplies, and climatic conditions) these animals may not always be present. Their dams and ponds however, remain landscape features and will continue to influence wildlife, channel morphology, and vegetation over long periods of time.



A Water Quality Assessment was developed by the Forest Service in coordination with the Washington State Department of Ecology (DOE) to address the issue of fecal coliform bacteria in this watershed. This assessment requested de-listing of this segment of Cottonwood Creek due to natural conditions. The Washington State Department of Ecology is considering this request, and will issue a ruling sometime in the future.

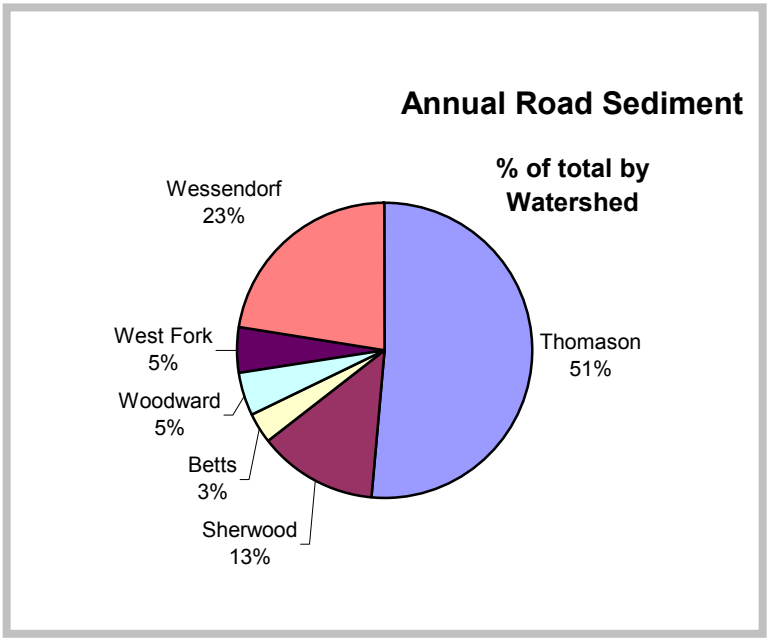
Turbidity and Sedimentation

There are natural (background) levels of sediment carried by each stream system based on soils, geology, and topographic features. Streams try to reach a dynamic equilibrium where the amount of cutting is balanced by the amount of deposition. Problems occur when the amount of sediment entering a system exceeds the stream's capacity to

effectively transport the material. This can occur following natural catastrophic events such as wildfire, or when land management activities such as road construction expose soils to erosive forces.

Washington State Water Quality criteria for sedimentation are currently measured by turbidity[55]. Like the USFS, the State has no standards for suspended and bedload sediment. Sources of sediment include roads, degraded stream channels segments, logging practices, agricultural grazing and cultivation, and natural processes such as soil creep and stream bank erosion. Stream erosion does not appear to be a problem in the smaller tributaries due to the lower drainage density and apparent influence of groundwater flows. Channel banks in these upper watersheds are composed of erodible materials, however they do not have a high sensitivity to peak flow events since most flows are dominated by a snowmelt regime.

The primary source of sediment entering stream channels is from natural background levels. Bank erosion occurs where obstructions such as woody debris divert flows against banks and causes lateral shifting and sedimentation. The greatest potential for sediment delivery occurs in the smaller perennial and larger intermittent streams located on glacial alluvium. The channels of these streams are relatively stable, but the peak flows they convey are capable of eroding banks and beds. These events occur on a small scale and are not likely to change dominant channel characteristics or processes. Larger perennial streams occupy channels formed during glacial periods of higher flows. Current peak flows in these channels do not reach the magnitudes that originally formed them and are consequently quite stable. The small intermittent and ephemeral streams carry surface water only during spring runoff, and even then, the magnitude of flow is small and incapable of providing significant erosion potential or sediment delivery.



Stream channel length, soil depth, bulk density, average slope, and creep rate were used to model the baseline sediment delivery to streams. The model shows that across the analysis area, 16.7 tons of baseline sediment per square mile per year are delivered to area streams.

Roads also deliver sediment to streams. Within the analysis area, there are numerous roads that cross or are located adjacent to streams. Those located within 200 feet of streams can provide sediment from their travel surfaces, and their cutbanks, fillslopes and ditches. Analysis shows that 3.34 tons of road-generated sediment per square mile per year are delivered to area streams. This road sediment varies by subwatershed, and is influenced by road density.

[55] Turbidity refers to the amount of light that is scattered or absorbed by a fluid, hence turbidity is an optical property of the fluid: Turbidity shall not exceed 5 NTU over background turbidity when the background turbidity is 50 NTU or less, or have more than a 10% increase in turbidity when the background turbidity is more than 50 NTU.

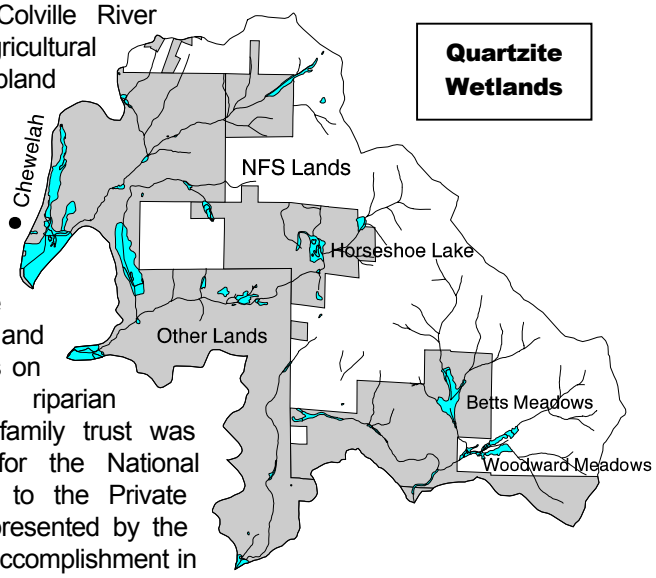
The disparity between road related sediments in the Thomason Creek watershed and the other watersheds is the result of higher road densities, the number of road/stream crossings, and the proximity of the Flowery Trail county road to Thomason Creek. The Flowery Trail Granodiorite in this watershed is a relatively non-resistant and easily weathered formation, which also has the potential to increase sediment loads to streams in this watershed.

Wetlands

Wetlands serve as a critical moderating component in a watershed's hydrologic budget. The "sponge" effect produced by these areas helps temper both high and low flows. When wetlands are associated with streams, they also exert a strong control on surface water quality. And because of their high moisture content, wetland soils are very sensitive to soil displacement and rutting, and to changes in the groundwater regime.

Approximately 850 acres of wetlands are located within the analysis area, representing 4% of the total area. Roughly 90% of these occur on private lands and are located on the Colville River Valley floor. Only 87 acres are located on NFS Lands, mostly in Woodward Meadows. All wetlands within the analysis area are classified as Palustrine. Palustrine wetlands are dominated by trees, shrubs, and persistent emergents (plant species like cattails, which normally remain standing until the beginning of the next growing season).

Within the analysis area, wetlands frequently occur in glacial outwash, or in beaver meadows at higher elevations. Characteristic of human land use patterns, most low elevation wetlands near the Colville River Valley have been converted to agricultural or residential use. Other upland wetlands have changed less. *Betts Meadows Wetland Preserve*, located on non-NFS Lands in the Cottonwood Creek sub-watershed is a 140-acre family trust. The purpose of the trust is to maintain the property as a wildlife refuge and native fishery, with an emphasis on fostering wetland and riparian environments. In 1994, this family trust was national individual runner-up for the National Wetlands Conservation Award to the Private Sector. This recognition was presented by the U.S. Fish & Wildlife Service for accomplishment in conserving and restoring wetlands to benefit wildlife and other resources. Horseshoe Lake is another non-NFS wetland located in the upper reaches of Sherwood Creek, north of Betts Meadows. Woodward Meadows, located in a similar setting, just south of Betts Meadows, is the largest wetland located on NFS Lands in this analysis area.



Betts Meadows

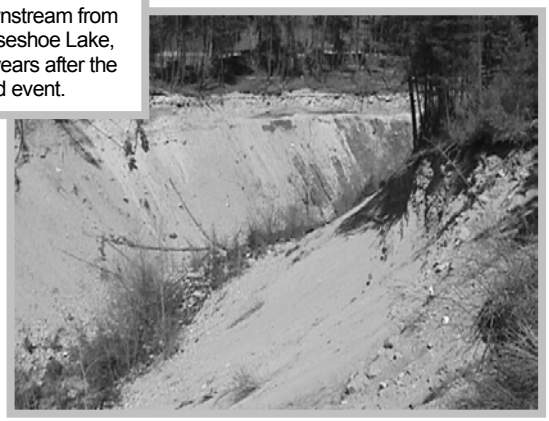
Betts Meadows was originally a swampy, shrub and hardwood/conifer bottomland, which has since been heavily grazed by cattle and sheep for more than eighty years. It had also been farmed with oats, timothy hay, and lettuce. Approximately fifty years ago the meadow was ditched for drainage purposes, which lowered the water table sufficiently to

allow the soils to dry for cultivation. Aerial photos taken in 1951 show several outbuildings located on the west side of the meadow. Between 1951 and 1994 clearing enlarged the meadow by 25 acres.

As part of their restoration process, the Betts Meadows Wetland Preserve constructed a low earthen dam at the southern (outlet) end of the meadow to raise the water table. The overflow structure associated with this dam serves as a barrier to fish passage. This has allowed the introduction of a genetically pure stock of West Slope Cutthroat Trout in association with The Washington State Dept. of Fish and Wildlife. A series of pothole reservoirs were also excavated in the meadow above the dam to provide open water for wildlife.

A substantial sediment pulse entered the stream below the earthen dam in the spring of 1999 when the dam's overflow structure proved inadequate and a portion of the earthen dam was cut away by overflowing water. The dam has not been reconstructed.

Horseshoe Lake



Sherwood Creek: Two miles downstream from Horseshoe Lake, 25 years after the flood event.

Prior to 1974, Horseshoe Lake in the Sherwood Creek sub-watershed was 20 acres in size. In the spring of 1974 a rain-on-snow event caused the lake to overflow and quickly cut through the glacial material at the outlet. Downstream reaches below the lake are still recovering from the major flood that resulted. Along some reaches, the channel cut as much as 60 feet, and massive deposition occurred in downstream low gradient valley reaches. The lake's outlet is still unstable and what remains today is a small young wetland.

Woodward Meadows

Like Betts Meadows and Horseshoe Lake, Woodward Meadows has changed relative to reference conditions. It was drained, seeded for pasture, and fenced in the 1950's. By 1963, National Forest System grazing records noted that the meadow was exhibiting a downward trend due to heavy cattle use and flooding by beaver. In 1966, clearing increased the meadow by 12 acres and today, there is twice as much land cleared around the perimeter of the meadow as existed in 1951. Beaver are present in the wetland as evidenced by the 6 intact dams along Cottonwood Creek.

Reference Conditions

Natural disturbances include fire (primary), weather-related events (wind, ice, and rain-on-snow), insects, and disease. The Quartzite Fire History Research indicates most of the area had a high frequency, low severity fire regime. These fires kept fuel build-up low in the uplands, while infrequently affecting riparian fuels. As a result, fuel loadings, snags, and the amount of instream large woody debris varied across the analysis area. Forest insect and disease disturbance events also waxed and waned in relation to fire events. Because of these influences, there was a mosaic of riparian vegetation age classes and species adjacent to the streams and wetlands. The presence of fire insured the availability and cycling of large woody material through the streams, causing channel adjustments, and trapping sediment behind debris jams. Current resource impacts are directly related to the susceptibility of existing vegetation to these influences.

Historically, sediment was delivered from landslides that occurred along the margins of the terraces, from natural downcutting and lateral movement along streams (especially where they cut through or along the edges of glacial terraces), and from surface erosion after disturbances such as fire. Sediment delivery due to surface runoff would have increased dramatically after fires. Removal of the surface organic layers by fire would have increased sheet, rill, and gully erosion rates. Subsequent decomposition of roots from trees killed by the fires would have also destabilized slopes until vegetation became reestablished. These processes were always part of the natural disturbance regime and played a crucial and beneficial role in flushing and rebuilding channels. These natural disturbances occurred at varying levels of intensity, but were separated by relatively long periods of recovery.

Evidence of historic beaver activity exists within the low gradient stream reaches of these watersheds. Beaver dams or their remnants are located in Woodward Meadows and in the low gradients reaches of Wessendorf Canyon. Aspen and other preferred food of the beaver are enhanced by site disturbances such as fire. Beaver ponds established in these areas would have provided improved fish habitat as well as serving as depositional traps for sediment moving through the system after these fires. These ponds also intercept and store water on its journey through the hydrologic cycle. Unless maintained, these dams eventually disintegrate allowing defined streams channels to again develop and downcut through previously deposited sediments.

Synthesis

Human activities such as logging, farming, ranching, road construction, and residential development are creating new disturbance regimes. These watersheds are experiencing chronic frequent sediment delivery, from smaller areas over shorter time spans. These new regimes function as a constant “press” rather than the periodic “pulse” common to natural systems.

Fire has played a large role in the development of these watersheds. Most historic fires in the riparian areas were probably low-intensity ground fires due to the moist environment. The effective suppression of fires over the last 80 years has increased fuel loadings in most areas of federal ownership. This has increased the risk of catastrophic stand replacement fires, which, if they occur, would also increase impacts to soils, streams, and riparian areas. High intensity fires in these areas would result in severely burned soils, increase the possibility of surface erosion, decrease site productivity and aquatic habitat, and retard the recovery of these sites compared to reference rates.

The headwater streams of most of the Betts and Sherwood watersheds are operating at close to reference conditions. Thomason, Wessendorf, West Fork, and Woodward, while more heavily impacted by management activities, are in a “properly functioning” condition on National Forest System lands. The term “proper functioning” means that riparian-wetland areas are functioning properly when adequate vegetation, landform, or large woody debris is present to dissipate stream energy associated with high flows; filter sediment, capture bedload, and aid floodplain development; improve flood-water retention and ground-water recharge; develop root masses that stabilize streambanks against cutting action; develop diverse ponding and channel characteristics to provide the habitat and the water depth, duration, and temperature necessary for fish production, waterfowl breeding, and other uses; and support greater biodiversity. This condition is based on the interaction of geology, soil, water, and vegetation.

3.2.4 Water Resources: Environmental Consequences

Riparian areas typically are a reflection of the overall health of the watershed and are critical to the well being of the communities who depend on them. These areas are usually among the most sensitive landscape features within a watershed, and also the first to show damage from improper management. While they cover only a small portion of the total analysis area, they nevertheless provide a disproportionate amount of public benefit in the form of wildlife habitat, recreation, clean water, and aquifer re-charge.

Best Management Practices

Best management practices (BMPs) are the primary mechanism that can achieve water quantity and quality standards. BMPs have been selected and tailored for site-specific conditions for the protection of water quality. Each BMP is adjusted to fit each site before implementation. Site-specific BMPs are implemented on the ground with project layout and input from resource specialists. BMP implementation monitoring occurs before, during and after resource activities take place. In the Colville National Forest Land and Resource Management Plan Monitoring Guide, monitoring item 25B is the mechanism for monitoring BMPs. The final step in this process is BMP evaluation and adjustment. If the evaluation of the monitoring indicates that water quality objectives are not being met and/or beneficial uses do not appear to be receiving adequate protection, corrective action will be considered.

Each BMP was rated by its ability to be implemented and its effectiveness as defined by General Water Quality Best Management Practices, Pacific Northwest Region, November 1988. Best Management Practices selected for this project, rated moderate to high in the ability to implement and in effectiveness. Through implementation and monitoring of site specific BMPs, State water quality standards will be met, including the Memorandum of Agreement between the Forest Service (Region 6) and the State of Washington Department of Ecology.

BMPs were reviewed and the Quartzite Project interdisciplinary team made appropriate selections to fit site-specific conditions. A complete description of each BMP can be found in the project analysis file.

No Action Alternative (A)

Two scenarios exist with the No Action Alternative. The first is that no catastrophic fires will occur within the analysis area and the second assumes that some type of stand replacement fire would occur.

No-Fire Scenario

Without fire, the openings created by insects and disease will increase in size, but are expected to remain scattered and will migrate across the landscape over time. Brush, grasses, and other tree species will invade these sites as the larger overstory trees die and fall to the ground. ECA's are not expected to change appreciably over existing levels. The no action alternative without fire will maintain water quality at existing levels, with a long-term upward trend. Water temperatures will moderate on stream reaches that currently exceed state standards as shade vegetation becomes reestablished along reaches affected by homestead activity. This recovery will require a minimum of 50-100 years, and will be interspersed with periods of vegetative decline subject to insects, disease, and wildlife predation. It can be assumed that stream temperatures and fecal

bacteria in these reaches have always exceeded state water quality standards because of their wildlife habitat, aspect, channel morphology, valley morphology, and flow patterns. It is impractical to expect them to ever attain the standards set by the State.

Fire Scenario

The accumulation of eight decades of live and dead fuel has predisposed these watersheds to atypical stand replacement fires. It is becoming more and more difficult *and dangerous* to suppress the natural and human-caused fire starts that occur within the analysis area. When it occurs, the effects of an atypical stand replacement fire will be more severe than timber harvest. During high hazard conditions, fires would result in substantial impacts to both soil and water resources.

Stream flows will be expected to increase as vegetative evapotranspiration decreases and hydrophobic soils increase. This will increase the risk of flooding, not only within the analysis area, but also in low-lying downstream areas as well. Peak flows could occur earlier in the year as a result of faster snowmelt rates. Snow depths would also be expected to increase due to the lack of interception by the forest canopy. Increased rates of bedload movement, scouring, bank erosion, and downcutting in the higher, steeper reaches of these streams will also occur as a result of increased flows. Sheet, rill, and gully erosion from upslope soils exposed by extreme burning conditions will directly increase sediment delivery to streams. Natural in-channel sediment storage areas will either be quickly exceeded in the small intermittent headwater channels, or washed out by the increased flows. Bedload and fines will be deposited on the low gradient depositional reaches of these systems. Bar formation will increase downstream as channels adjust to new sediment levels and flow regimes. A shift would be expected in the dominant streambed particle-size composition. Mass wasting (slides, slumps, and debris torrents) may increase in size and frequency, further increasing sedimentation in streams and wetlands.

The impacts of this scenario will indirectly affect downstream users. Fish habitat will decline as spawning gravels become embedded with fine sediments that decrease the intergravel dissolved oxygen. Riparian wildlife habitat will decline as beaver ponds fill in with sediment or if dams are breeched due to high flows. Stream temperatures will also increase due to increased sediment loads and the removal of vegetative shade. Water intakes for irrigation may become clogged with sediment. Road segments adjacent to streams and at stream crossings would be at higher risk of failing. The lower portions of Sherwood Creek contain the most sensitive reaches to the impacts of fire since they are still recovering from the outbreak of Horseshoe Lake in 1974.

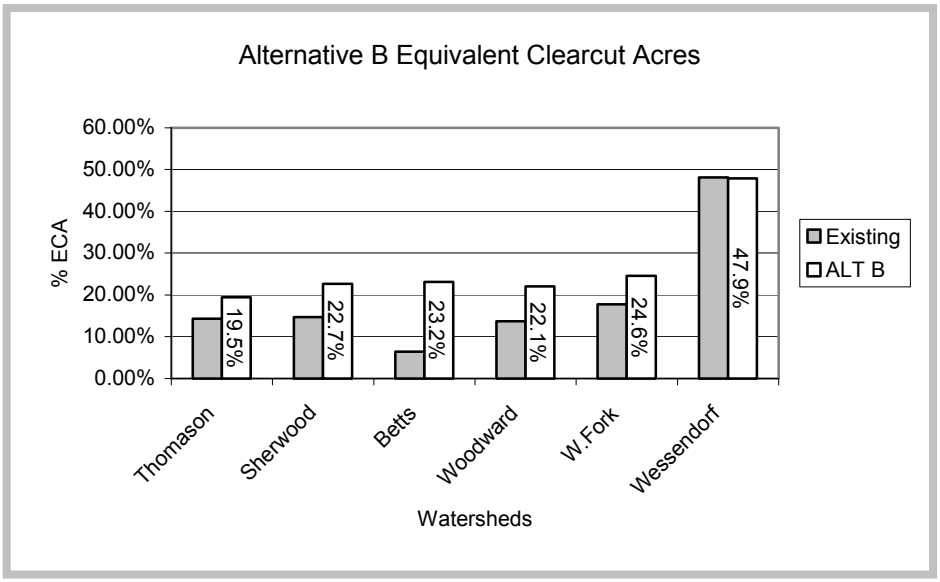
The no action alternative with fire will result in increased streamflows with a corresponding increased risk of flooding not only within the analysis area, but also to downstream users in the lower reaches of Cottonwood Creek. Increased bedload movement, scouring, bank

erosion, and downcutting will result from the increased streamflows especially in the upper reaches of the watershed. Erosion rates will increase dramatically as a result of soils exposed to intense burning activity. Mass wasting may increase in size and frequency. Along with this will be a corresponding decline in aquatic habitat. All of these factors affect water quality either directly or indirectly. In addition, stream temperatures will increase as sediment loads increase and vegetative cover is removed by fire. These effects of catastrophic fire will be evident for a long time (100 to 500 years) before hydrologic process would completely recover.

Proposed Action (B)

Stream Flow Regime, Channel Morphology and Water Quality

This alternative will result in increased ECA values in all watersheds except Wessendorf. The largest increases will occur in Betts, which will increase from an existing ECA value of 6.5% to 23.2%. Sherwood and Woodward will both increase about 8%.



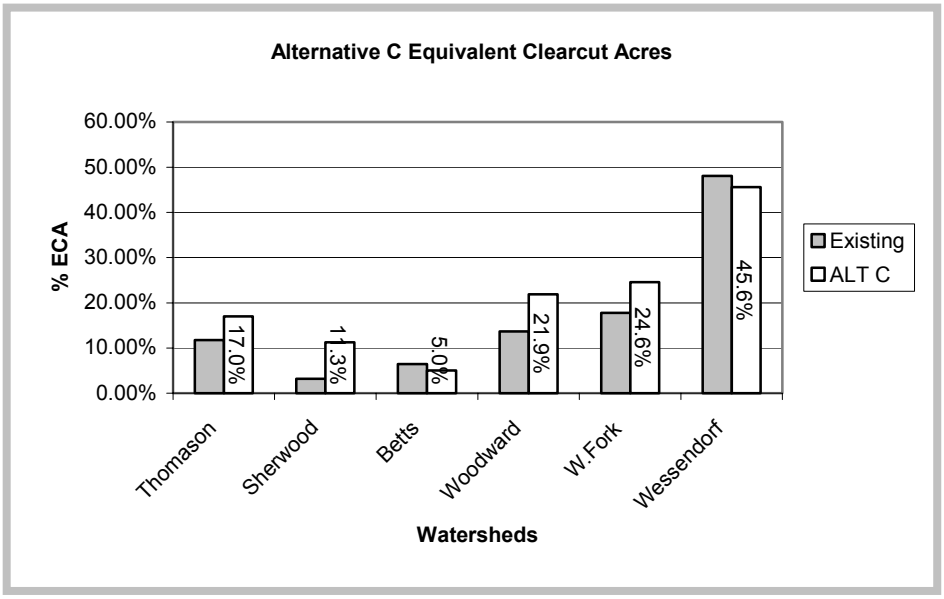
Based on the ECA model and field observations of watersheds displaying similar ECA values, any increase in the average duration of near bankfull (channel-forming) flows due to decreased evapotranspiration is not likely to occur. The potential for increases in high magnitude peak flows due to rapid snowmelt caused by snowpack exposure to rain or warm winds is somewhat more likely to occur since a reduction of stand densities will result in increased snow depths and increased solar radiation. Most of the activities proposed in this alternative, however, are located in the snow-dominated zone above 3000' and are therefore less likely to be influenced by such an event.

Implementation of this alternative will result in an increase in four new road/stream crossings. With a total of 104 crossings already existing in the analysis area, this represents a 3.8% increase Three of the new crossings being proposed by the *Proposed Action* alternative, are located in the Thomason Creek watershed and one is located in the Betts subwatershed. The DNR erosion model predicts that a 7.8% increase in sediment would result from the three crossings in Thomason Creek, and a 3.7% sediment increase from the new crossing in Betts basin. A 4.7% increase would occur across the entire analysis area because of these new crossings. Such increases would be expected to fall within the natural range of variation of sediment production within these watersheds, and will therefore be undetectable using current sampling techniques. Additional sediment produced, as a result of these new crossings will consist of sand and silt-sized particles that will be deposited in the low gradient reaches of Thomason and Betts drainages. Some aggradation of the channel and filling of sediment traps will be the most likely changes to channel morphology.

Upper Cottonwood (C)

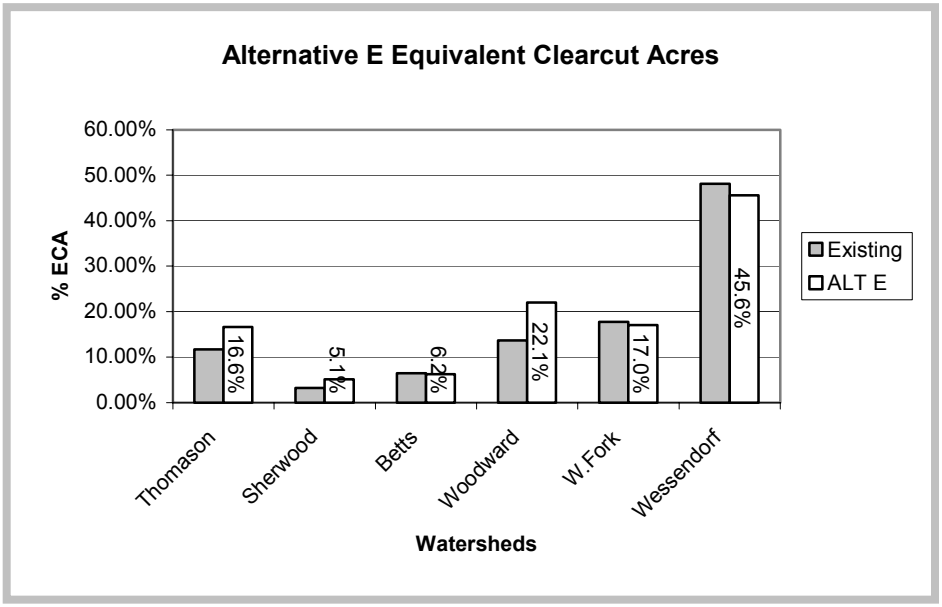
Stream Flow Regime, Channel Morphology and Water Quality

The largest ECA increase will occur in the Woodward watershed. Values will increase 8.2% (from 13.7% to 21.9%). Sherwood and West Fork drainages will also experience ECA increases of 6-8%. The Betts and Wessendorf subwatersheds will experience a decrease in ECA values: a result of maintaining and increasing vegetation. Increases in the average duration of near bankfull flows are not likely to occur in any watershed.



Some changes in channel morphology may occur as a result of new road/stream crossings since it proposes to build three new crossings. These three new crossing will all be constructed in the Thomason watershed. A 7.8% increase in sediment can be expected from these three crossings in Thomason Creek over the three-year time period the model uses. A 3.7% increase was modeled across the entire analysis area. Such increases would be expected to fall within the natural range of variation of sediment production within these watersheds, and will therefore be undetectable.

Wildland (E)



Stream Flow Regime, Channel Morphology and Water Quality

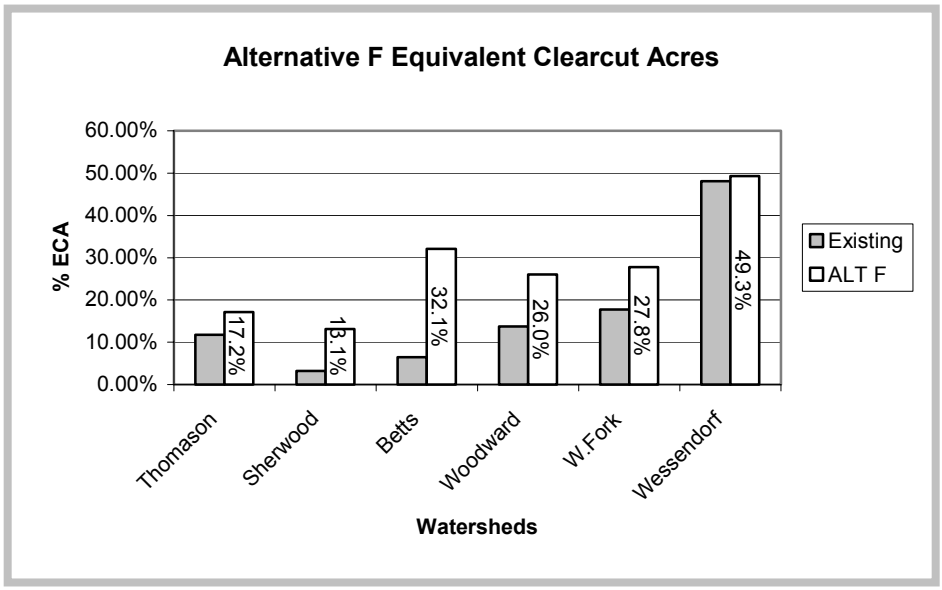
The largest ECA increase will occur in the Woodward watershed. Values will increase 8.4% (from 13.7% to 22.1%). Sherwood and Thomason drainages will also experience ECA increases. The Betts, West Fork, and Wessendorf watersheds will experience a decrease in ECA values: a result of maintaining

and increasing vegetation. Increases in the average duration of near bankfull flows are not likely to occur in any watershed.

Some changes in channel morphology may occur as a result of new road/stream crossings since it proposes to build one new crossing. This new crossing will all be constructed in the Thomason watershed. A 2.6% increase in sediment can be expected from this crossing in Thomason Creek over the three-year time period the model uses. A 2.1% increase was modeled across the entire analysis area. Such increases would be expected to fall within the natural range of variation of sediment production within these watersheds, and will therefore be undetectable.

Vegetation (F)

Stream Flow Regime, Channel Morphology and Water Quality



The largest ECA increase will occur in the Betts watershed. Values will increase 25.6% (from 6.5% to 32.1%). All other watersheds will experience increased ECA rates as well. Four watersheds will exceed the 25% threshold of concern (Wessendorf, Betts, Woodward, and W. Fork). Because this will increase the possibility of channel-forming flows resulting from timber harvest and road construction, Forest Plan standards would not be met. The two segments of existing open road (proposed for closure under the other action alternatives) would remain open under Alternative F. Road #4342.250 in the Woodward Meadows area would continue to provide access for illegal woodcutting in the riparian zone of this steam. This will result in the continued loss of large woody debris in the stream channel structure.

Implementation of this alternative will result in an increase in ten new road/stream crossings in the analysis area. Three of these are located in the Thomason Creek watershed, one in the Sherwood watershed, one in the West Fork Watershed, and five are located in the Betts subwatersheds. This alternative proposes to build the highest number of crossings of all the action alternatives. Baseline existing levels of sedimentation will increase in all the subwatersheds (except Woodward and Wessendorf) because of the new road/stream crossings. Road #4342.250 in the Woodward Meadows area would continue to contribute sediment to the adjacent stream.

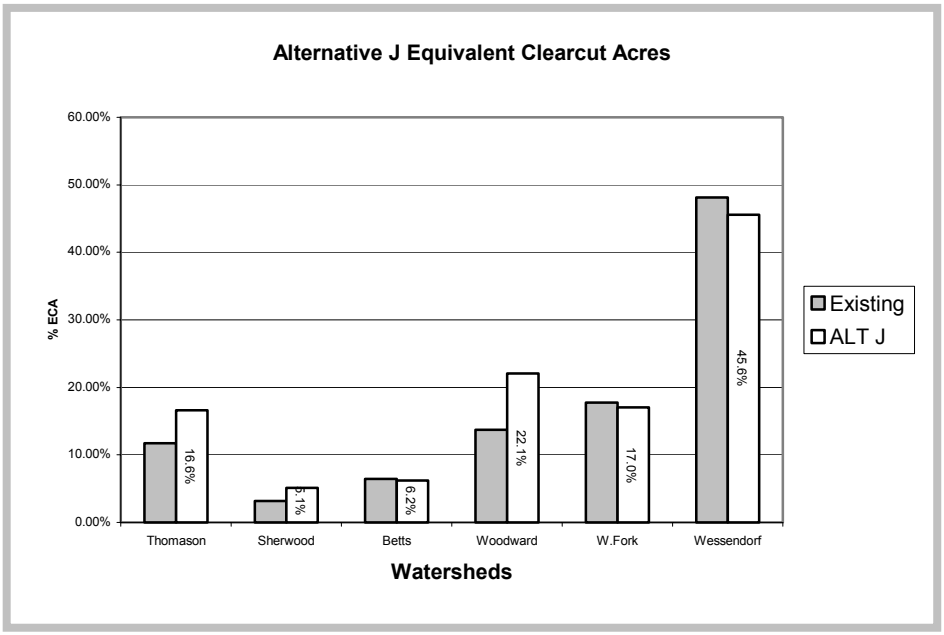
A 7.8% increase in sediment can be expected from the three crossings in Thomason Creek, a 64.8% sediment increase from the five new crossings in Betts basin, an 8.5% increase in Sherwood Creek, and a 34.5% increase in the West Fork watershed over the three year time period modeled in these watersheds. A 9.6% sediment increase was

modeled across the entire analysis area because of these new crossings during the same three-year period. Such increases would be expected to fall outside the natural range of variation of sediment production, and may therefore be detectable using current sampling techniques.

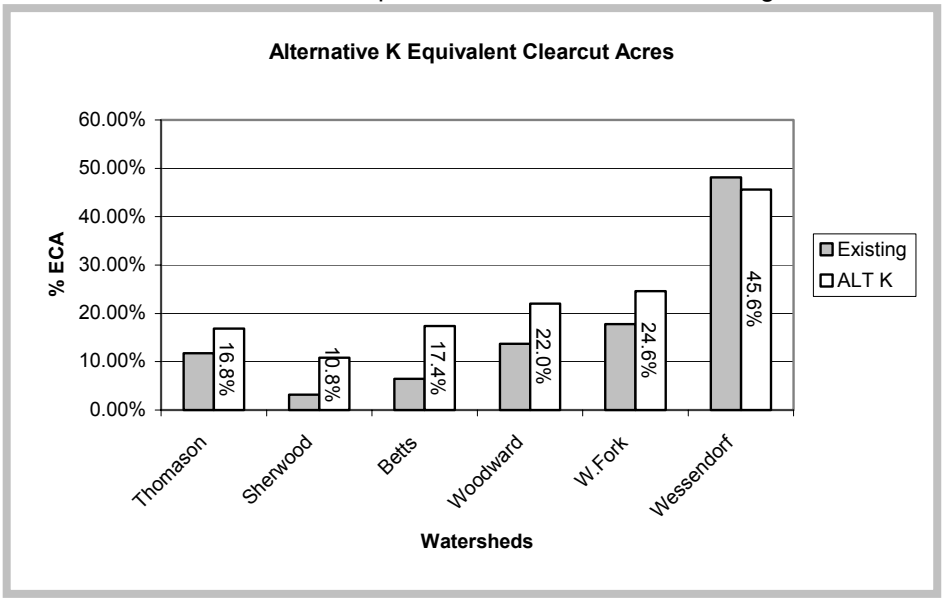
Wildland Prescribed Fire (J)

Stream Flow Regime, Channel Morphology and Water Quality

The largest ECA increase will occur in the Woodward watershed. Values will increase 8.4% (from 13.7% to 22.1%). Sherwood and Thomason drainages will also experience ECA increases. The Betts, West Fork, and Wessendorf watersheds will experience a decrease in ECA values: a result of maintaining and increasing vegetation. Increases in the average duration of near bankfull flows are not likely to occur in any watershed.



Some changes in channel morphology may occur as a result of new road/stream crossings since it proposes to build one new crossing. This new crossing will be constructed in the Thomason watershed. A 2.6% increase in sediment can be expected from this crossing in Thomason Creek over the three-year time period the model uses. A 1.2% increase was modeled across the entire analysis area. Such increases would be expected to fall within the natural range of variation of sediment production within these watersheds, and will therefore be undetectable.



Existing Roads (K)

Stream Flow Regime, Channel Morphology and Water Quality

The largest ECA increase will occur in the Betts watershed. Values will increase 11% (from 6.5% to 17.5%). All other drainages will experience

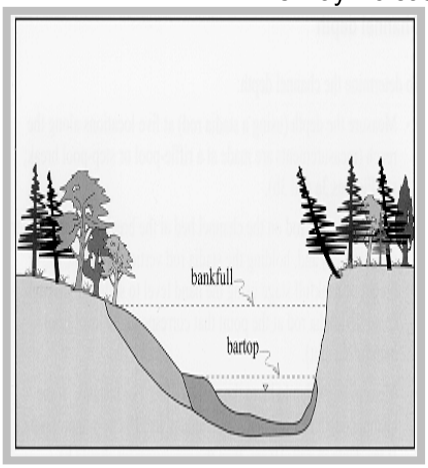
ECA increases except Wessendorf, which will experience a decrease in ECA values: a result of maintaining and increasing vegetation. Increases in the average duration of near bankfull flows are not likely to occur in any watershed.

No changes in channel morphology will occur as a result of new road/stream crossings since this alternative would not build any additional crossings. Sediment increases will occur as a result of timber haul over existing roads. Such increases would be expected to fall within the natural range of variation of sediment production within these watersheds, and will therefore be undetectable.

Summary of Water Effects

Channel Morphology

Timber harvest, road building, road maintenance, and other management activities often increase the amount of sediment delivered to the stream channel. Most of the material reaching the stream channel as a result of these activities will be sand-sized or smaller. This may increase the amount of fine sediment deposited around the coarser bed particles (embeddedness).



Management activities can also indirectly affect bank stability. A change in the size of channel forming flows or a change in the amount of sediment can alter channel morphology and hence bank stability. Stream channel morphology is affected more by management-induced changes in sediment than management-induced changes in flow. And both natural and management-induced factors influence embeddedness levels.

The No Action Alternative

The No-Action Alternative without fire is not expected to affect channel morphology beyond existing levels.

The No-Action Alternative with fire may result in degradation or aggradation, altered width/depth ratios, changes in sinuosity, and increased embeddedness. Downstream effects to channels will extend to the mouth of each watershed affected by the fire, depending on the size and intensity of the fire.

The Action Alternatives

Vegetation Management

Timber Sale

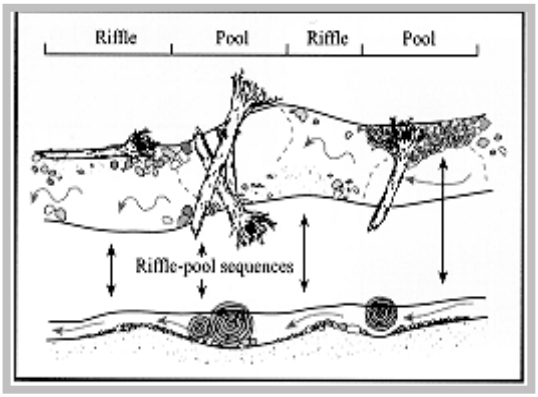
The Riparian buffers prescribed under INFISH[56] that are incorporated into all alternatives will restrict the amount of timber-sale-related sediment from reaching streams. The amount of sediment reaching waterways is expected to be insignificant compared to background levels. The effects of timber harvest on channel morphology will be undetectable for all action alternatives.

[56] On 28Jul1995 the Inland Native Fish Strategy (INFISH) amended the Colville National Forest Land and Resource Management Plan (see Chapter One of this EIS). INFISH protects habitat and populations of resident native fish by establishing riparian habitat conservation areas (RHCAs). RHCAs include riparian corridors, wetlands, intermittent streams, and other areas that help maintain the integrity of aquatic ecosystems. Timber harvest within RHCAs is prohibited, or severely limited.

Prescribed Fire and Non-Commercial Thinning

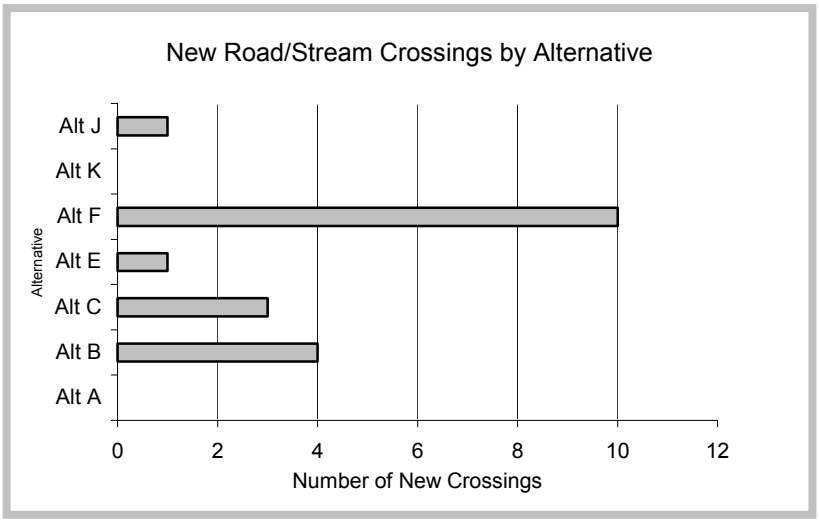
Similarly, no effects to channel morphology are expected as a result of non-commercial treatments in any action alternative.

Road Management



Road construction will affect channels through the input of road-generated sediment at stream crossings. Sediment inputs will result in increased deposition and bar building on downstream reaches. Width/depth ratios may be altered if large quantities of sediment are introduced and aggradation occurs. Channel embeddedness of spawning gravels and other impacts to the aquatic habitat may also occur. The amount of sediment reaching streams as a result of road construction will be greatly reduced through the use of BMPs. However, with the exception of the *Existing Roads* Alternative (K), some road construction sedimentation will result with the other action alternatives.

The number of stream crossings is directly related to the expected increase in sediment and its corresponding relationship to channel morphology. The *Vegetation* Alternative (F) with the most new stream crossing (10) will generate the most sediment and thereby have the most impact on channel morphology. The channels and downstream reaches in the Betts basin will be most affected by Alternative F because of the five new crossings it proposes in that watershed (the most of any alternative). The *Existing Roads* Alternative (K) will not generate any additional sediment from new crossings, above existing levels. The number of crossings and associated effects for the other action alternatives fall between these two extremes.



Rockpits proposed within the analysis area are located outside of riparian zones and will not contribute sediment to streams and wetlands

Riparian/Wetland Management

Restoration of sheet flows through the upper portion of Woodward Meadow's wetlands will result in backwater impoundments. While this will not be a complete return to historic conditions for this area, the restoration of sheet flow patterns will closely mimic historic flows. Channel morphology in the homesteader's drainage ditch will cease to exist and will be replaced by a series of ponds located behind the impoundment structures. This is expected to affect more than a quarter mile of the existing channel (drainage ditch) for all action alternatives. The *N-Action* Alternative (A) will perpetuate the existing situation.

Streamflow Regime

The No Action Alternative

The no action alternative without fire will maintain flow regimes at existing levels.

The no action alternative with fire will result in increase streamflows in direct proportion to the size, location, and intensity of the fire(s). Based on these factors, there is the possibility of an increased risk of flooding to downstream reaches. The effects of these flows will be somewhat diluted and diminished by the time they reach the Colville River.

The Action Alternatives

Vegetation Management & Road Management

Most of the changes in flow regimes will be due to timber harvest activities rather than road construction and non-commercial treatments. Some small watershed studies have shown that while snowmelt was accelerated by timber harvest (clear-cutting), snowmelt also occurred earlier, and the peak daily streamflows actually decreased slightly after the harvesting was complete. Research at the Benton Creek experimental watershed, Priest River, Idaho, has shown that clearcut areas on southerly aspects have melted out 3-4 weeks earlier than adjacent forested areas on the same slope. This acceleration of snowmelt, particularly at lower elevations in the watershed, will cause south aspect cutting units to release water to streamflow prior to the peak runoff period for the watershed. The net result of this change in the melt pattern is that although an increase in the total flow has taken place, this increase will occur at a time when the channel has more area to accommodate the flow. If this occurs, the increase in flow will have less erosion potential that if it had taken place during the peak runoff period. Similar trends are expected in the Quartzite analysis area, however increased flows would not be as pronounced because the harvest in the Benton Creek watershed removed all the trees, where harvest for the Quartzite action alternatives leaves 50% of the trees, on average.

Watersheds with deeper soils (60"+) may have extended periods of flow on intermittent channels, and longer, late season, minimum flows on perennial channels. Decreases in transpiration and interception, as well as increases in solar radiation, may broaden the base of the hydrograph with snowmelt and peak flows occurring earlier in the season. The greatest increases in water yield are expected on deep soils, on north aspects, and on those stands having the most trees removed. Most proposed north-slope harvest areas are located on soils of moderate depth (20-40") in the upper third of the watersheds. The Benton Creek study showed that there was no change in timing of snowmelt following clear-cutting on north aspects.

Only the *Vegetation* Alternative (F) exceeds the 25% threshold of concern through proposed activities. In Alternative F the Wessendorf, Betts, Woodward, and West Fork watersheds will exceed the threshold of concern for a period of time following tree harvest. Channel stability is one factor that influences the ability of a stream channel to withstand increased flows without a corresponding increase in detrimental impacts.

The ECA hydrologic model does not quantify the amount of increase in yield, peak flow, soil moisture or the amount of damage that can result. Rather it indicates whether or not a basin is in a recovered hydrologic state. The weighted channel stability ratings indicate that channels are in better condition for the Betts basin than for others in this analysis area. This indicates that even though this watershed will experience the largest ECA

increases in Alternatives B, F, and K, its channels are also in a better condition to withstand increased flows resulting from these alternatives.

Increased channel-forming flows are most likely to occur in Alternative F. It cannot be stated with any certainty that these increased streamflows will result in detrimental impacts. If such impacts do occur, the streams will be out of equilibrium, natural sediment traps will be full, banks will be undercut, and scouring and deposition will be common.

Any synchronization of peak flows originating from timber harvest in the three main watersheds (Cottonwood, Sherwood, and Thomason) will be absorbed in the extensive wetlands and extremely deep soils of the Colville Valley and will not appreciably affect downstream users.

An increased risk of channel-forming flows occurs when high ECA values remain above the threshold of concern for longer periods of time due to the increased possibility of weather related events.

Sherwood Creek is the most sensitive watershed to increased streamflows. Streambanks and channels in the lower watershed are unstable because they are still recovering from the 1974 Horseshoe Lake flood event. However, based on the ECA model and field observations of watersheds displaying similar ECA values, any increase in the average duration of near bankfull (channel-forming) flows due to decreased evapotranspiration is not likely to occur in the Sherwood watershed. The potential for increases in high magnitude peak flows due to rapid snowmelt caused by snowpack exposure to rain or warm winds is somewhat more likely to occur since a reduction of stand densities will result in increased snow depths and increased solar radiation. However, the majority of proposed harvest is located in the snow-dominated zone above 3000' and is therefore less likely to be influenced by such an event.

Cumulative effects of timber harvest are difficult to predict to due to the variability of harvest on private lands within a watershed. Harvest in the recent past on private land in the Betts, Woodward and West Fork subwatersheds essentially preclude significant activity for the next 10-15 years. This recent activity is captured in the ECA calculations, and by the design of the alternatives. Future projections of timber harvest on private land within the Sherwood and Thomason drainages indicate any increases in streamflow would be inconsequential to channel morphology.

Riparian/Wetland Management

No effects to flow regimes are anticipated as a result of proposed riparian treatments.

Water Quality

The No Action Alternative

The No Action alternative without fire will maintain water quality at existing levels, with a long-term trend toward improvement. Water temperatures will moderate on stream reaches that currently exceed state standards as shade vegetation becomes reestablished along reaches affected by homestead activity. This recovery will require a minimum of 50-100 years, and will be interspersed with periods of vegetative decline subject to insects, disease, and wildlife predation. Stream temperatures and fecal bacteria in these reaches have probably always exceeded current state water quality standards because of their wildlife habitat, aspect, channel morphology, valley morphology, and flow

patterns. It is impractical to expect these systems to ever attain the standards set by the state.

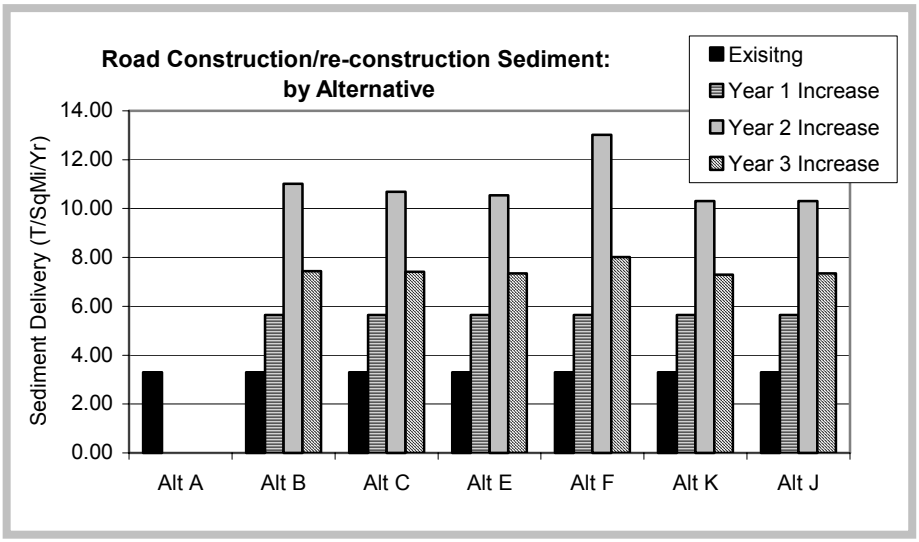
The No Action alternative with fire will result in increased streamflows with a corresponding increased risk of flooding not only within the analysis area, but also to downstream users in the lower stream reaches. Increased bedload movement, scouring, bank erosion, and downcutting will result from the increased streamflows especially in the upper reaches of the watershed. Erosion rates will increase dramatically as a result of exposed soils from intense burning activity. Mass wasting may increase in size and frequency. Along with this will be a corresponding decline in aquatic habitat. All of these factors affect water quality either directly or indirectly. In addition, stream temperatures will increase as sediment loads increase and vegetative cover is removed by fire. The effects of catastrophic fire will be evident for a long time (100 to 500 years) before hydrologic process would completely recover.

The Action Alternatives

Vegetation Management & Road Management

Stream temperatures will not be affected by timber harvest, prescribed fire or non-commercial thinning, because of the protection INFISH[57] provides to riparian vegetation. There is minor risk however that prescribed fire could escape control lines, causing stream temperatures and sediment to increase with the loss of vegetation. These effects would be similar to those described for the No Action alternative, but would be much more limited in scale. Timber harvest, prescribed fire or non-commercial thinning would not affect bacteria, dissolved O_2, or pH.

Sediment levels are affected more by road development than by timber harvest; and the greatest risk of sediment delivery occurs where roads cross streams. Most sedimentation however, can be mitigated. Compared to unsurfaced crossings, applying rock to road surfaces at crossing points will reduce sediment delivery to streams by 70-80% during the first year (See Mitigation Measure #12m). Sediment rates will continue to decrease over time as road margins become revegetated. The quality of rock, depth of lift, maintenance standards, traffic levels, and weather patterns will determine the degree of sediment reduction realized from this process.



While the DNR Erosion Model uses a three-year period when sediment-producing activities are predicted to occur, these effects will extend over a longer period (as much as five years) during the life of this project. This will spread the effects over a longer period of time for the whole planning area. Most of the construction

[57] See Chapter 1Section 1.2.

work and haul traffic can be expected to peak during the middle of the activity period (somewhere between year 2 and 4).

Closure and partial obliteration of the #250 road in Woodward Meadows after harvest will decrease sediment delivery to adjacent waterways by about half. This closure is included in all action alternatives except Alternative F.

Levels of fecal Coliform bacteria may increase as a result of increased watershed access via new road construction. New road construction is located outside of riparian zones (except at crossing points), and these segments will be closed upon completion of harvest activities. This decreases the opportunity for the long-term introduction of fecal material due to proposed activities. As a result, any actual increases in fecal coliform bacteria are expected to be undetectable over variations in natural background levels.

Rock pits proposed within the analysis area are located outside of riparian zones and will not contribute sediment to streams and wetlands.

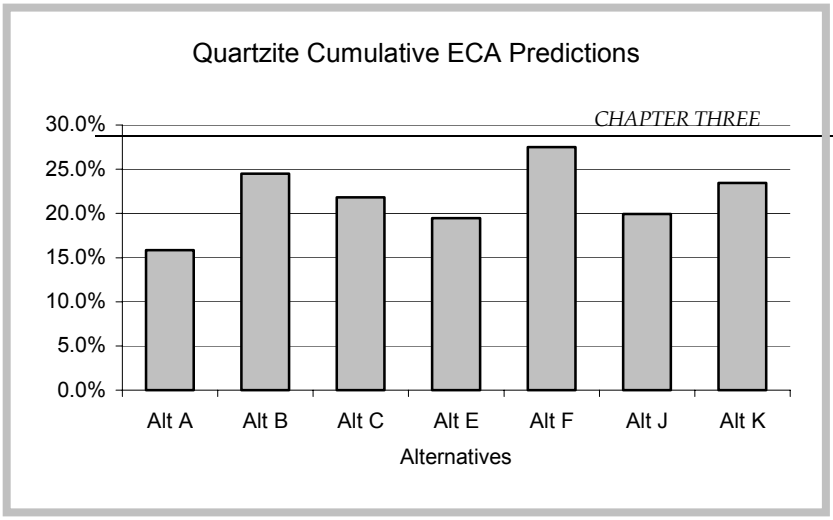
Riparian/Wetland Management

Woodward Meadows Wetland/Riparian Management Activities have the potential to halt the expansion of reed canary-grass in the meadow and reestablish historic flow patterns, vegetation, and shading.

Construction of diversion dams will potentially increase the numbers of fecal coliform bacteria in the waters of Cottonwood Creek by creating additional wildlife habitat (especially for waterfowl) behind the impoundments. The existing channel (in the old homesteader's ditch) is currently shaded. Re-establishment of historic flows will result in more of a shallow, sheet flow across the meadow rather than the current channelized flow in the constructed drainage ditches. This may increase groundwater recharge and subsurface flows. The effect this will have on surface water temperatures downstream is uncertain, but it has the potential to result in slight temperature decreases based on monitoring of similar upstream sites. It is important that existing levels of shade be maintained during and after implementation of this proposal.

Water Cumulative Effects

The cumulative effects of past and proposed activities on flow regimes were estimated using the Forest's Equivalent Clearcut Acre (ECA) Model. This model calculates the amount of area in a watershed that exists in a "clearcut condition," regardless of ownership. This procedure evaluates the likelihood of any increase in the average duration of near bankfull (channel-forming) flows, and the potential for increases in high magnitude peak flows due to rapid snowmelt caused by snowpack exposure to rain or warm winds. Past treatments such as timber harvest and road construction provide a baseline against which proposed management activities can be compared. If ECA values exceed 25%, more intensive field investigations and evaluations may be required.



Over 5,000 acres of timber harvest activity has occurred within the analysis area during the last 30 years. About 92% of that has been on state and private land. Some areas have been entered more than once during this time period. The Sherwood basin has experienced the most activity with about 3500 acres harvested, primarily outside the Forest Boundary. Almost 50% of the harvest activity in the Thomason basin within this time period occurred on Forest Service land (755 acres). Only Alternative F exceeds the Colville National Forest's ECA threshold of concern, and does not comply with Forest Plan standards. The model predicts a combined ECA of 27.5% for Alternative F in the subwatersheds of the Quartzite analysis area.

The DNR erosion model was used to estimate the cumulative effects of sedimentation on water quality and channel morphology. A rough calculation of baseline sediment supply to streams was conducted using stream channel length, soil depth, bulk density, average slope, and creep rate. Using these factors, the background rate of sediment delivery to streams was estimated to average approximately 16.7-tons/mile^2/year throughout the analysis area.

Road erosion was identified through field reconnaissance as the only erosion agent likely to influence sediment delivery to streams, and therefore was the only factor considered in this model. This model uses road construction types, geologic parent material, stream class, road width, road segment length within 200' of the stream, vegetative cover on cut and fill slopes, road surfacing material, and traffic levels to estimate sediment delivered to streams in tons/square mile/year. The amount of sediment reaching streams as a result of road construction will be reduced through the use of BMPs, however, minor increases in sedimentation will occur (even if no new road construction occurs) due to increased log haul traffic levels on existing roads.

3.2.5 Air Resources: Affected Environment

Fire generated air impurities were a natural by-product of the historic fires that frequented the Pacific Northwest over the past thousands of years. Prior to recent fire suppression, an average of 800,000 acres burned annually in the Pacific Northwest. Settlement and the dramatic increase in human population over the past 200 years have increased the concern for the effects of smoke on air quality and human health.

Smoke from prescribed fire and wildfire and dust from rock pits have the potential to cause negative effects on air quality. The use of prescribed fire for ecosystem restoration can produce enough fine particulate matter to be a public health and welfare concern. Fine particulates in smoke can travel downwind, impacting air quality in local communities, causing a safety hazard on public

roads, impairing visibility, and causing a general nuisance to the public.

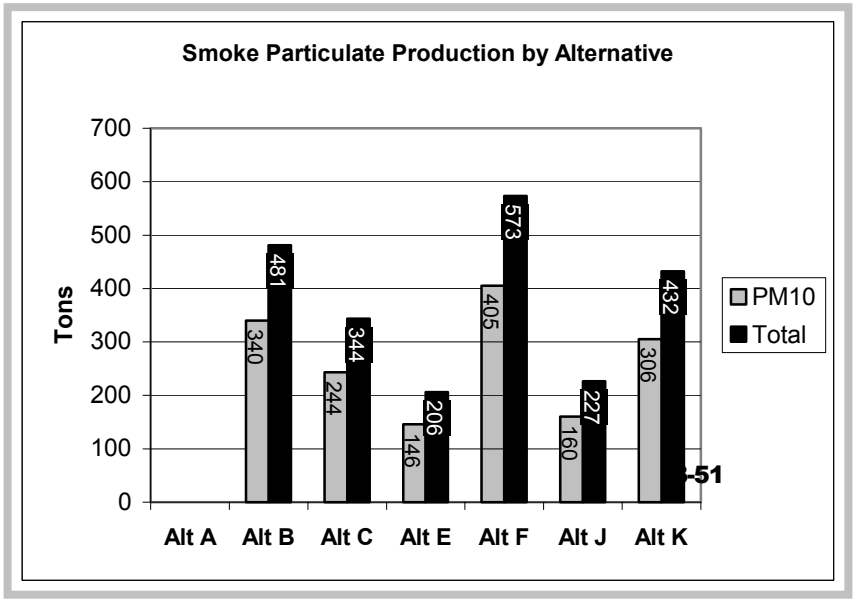
The Federal Clean Air Act, as revised in 1991, is a legal mandate designed to protect human health and welfare, and visibility from air pollution. The Act defines National Ambient Air Quality Standards as levels of pollutant above which detrimental effects on human health and welfare could occur. An area found to be in violation of standards is called a non-attainment area. Pollution sources in these areas are subject to tighter restrictions. The Quartzite Area is not located within a non-attainment area. However, the non-attainment area associated with the city of Spokane, Washington is located approximately 60 miles to the south.

The Clean Air Act also contains provisions to protect Class I airsheds, the nearest of which is associated with the Paysaten Wilderness Area, which is located 80 miles west of the project area. The analysis area lies within two air miles of the town of Chewelah (and Highway 395). The town of Colville is 20 air miles to the north. The town of Cusick and the Pend Oreille Valley lie 15 miles to the east. High-pressure inversions occur in both the winter and the summer, and during these events smoke and fog often settle in the local valleys and populated areas.

On 15 May 1998, the Environmental Protection Agency issued the *Interim Air Quality Policy on Wildland and Prescribed Fires* to address public health and welfare impacts caused by wildland and prescribed fires that are managed to achieve resource benefits. The *Interim Air Policy* was prepared in an effort to integrate the public policy goals of allowing fire to function in its natural role in maintaining healthy ecosystems and protecting public health and welfare by mitigating the impacts of air pollutant emissions on air quality and visibility. The *Interim Air Policy* calls on states to develop a smoke management program and for the Forest Service to participate in the state and tribal smoke management programs. The Colville National Forest ensures protection of the National Ambient Air Quality Standards by participating in the Washington State smoke management program.

3.2.6 Air Resources: Environmental Consequences

Air quality particulate standards were originally defined in terms of Total Suspended Particulate. More recently, the Environmental Protection Agency refined the particulate standard to focus on particulates less than 10 microns in diameter (PM10). These particles are too small to be effectively filtered by the human respiratory system and can cause respiratory problems, especially for those who are pre-disposed to respiratory ailments. Small smoke particulates are also suspended in the atmosphere for long periods, contributing to regional haze and reduced visibility.



National Ambient Air Quality Standards for particulates less than 10 microns in diameter have been established to protect human health. The 24-hour PM10 standard is 150 micrograms per cubic meter. Smoke dispersal and PM10

production rate calculations show that this standard can be met if burning is limited to 900 acres per day, for all alternatives[58].

The Paysaten Wilderness Area is located 80 miles west of the Quartzite Project Area, and prevailing winds blow from west to east. Consequently, smoke from prescribed fires proposed by the alternatives would not affect the Class I airshed associated with this wilderness area.

Smoke from prescribed fire has the potential to effect local communities and valleys. However, smoke management is controlled by the State of Washington, and any prescribed fire that consumes more than 100 tons of fuel within a 24-hour period requires approval from the State. By considering cumulative effects, ignition methods, timing, weather and smoke dispersion potential, the State maintains air quality standards and limits effects to acceptable levels. By coordinating with the State, and adhering to mitigation[59] that times burning with weather conditions that are optimum for smoke dispersion, the prescribed fire associated with the alternatives, would have little effect on local communities and valleys.

Drilling, blasting, crushing, screening and material handling at the proposed rock pit(s) can be significant sources of PM and PM10 emissions if uncontrolled. However, the Washington State Department of Ecology monitors emissions from all crushed stone processing activities to assure air quality compliance[60]. Consequently, air quality resulting from rock pit activities would comply with State standards. (Alternatives B, C, and F propose two pits; Alternatives E, J and K propose one[61])

Section 3.3 – The Biological Environment

Section 3.3 depicts the affected environment and the effects alternative implementation would have on plant and animal species and their habitat. It will track analysis methodology and the logic path used to determine effects. Where relevant, it will discuss the relationships these specific resources have with other resources and their synergistic effects on ecosystem functions and processes.

Vegetation Resources

3.3.1 Forests: Affected Environment

Landscape Vegetation Setting and Disturbance Relationships

Interior forest landscapes like the Quartzite Analysis Area developed from disturbances caused by nature and people. Humans have occupied lands in the area for at least 9,000 years. The physical imprint left by indigenous people is diffused and unobtrusive, however, landscape patterns following the in-migration of Europeans and others are more

[58] See mitigation # 34, in Chapter 2 of this EIS.
[59] See mitigation #33 in Chapter 2.
[60] See Air Quality Mitigation in Chapter 2.
[61] See Section 2.2.3 of this EIS: Features Common to All Action Alternatives.

easily recognized. The evidence of mining and logging operations, homesteads, livestock camps, roads, and trails, can be seen across the analysis area.

Natural plant communities occurring in the Quartzite Analysis Area are the result of variations in elevation, aspect, geology, slope, climate, and soil composition. About 80 percent (18,916 acres) of the analysis area is covered with forested vegetation, with trees making up at least 10 percent canopy cover. About two-thirds (2965 acres) of total non-forested areas (4392 acres or about 19% of the analysis area) in the analysis area are found on private ownerships. In comparison the potential vegetation zone map classifies about 575 acres (2%) of the analysis area as non-forest. The private non-forested areas tend to be in the lower elevations of the analysis area and have resulted from conversion of about 17% forest vegetation for other land uses.

Historically, landscape patterns were created and maintained by natural disturbance regimes. The primary disturbance processes affecting plant communities in the analysis area have historically been fire, grazing and browsing by ungulates, weather, insect/rodent outbreaks and disease epidemics, windthrow, flooding and erosion.

In managed landscapes, historic landscape patterns and often the underlying disturbance regimes are changed by society's choice of management philosophies. Landscape vegetation has been altered by such human-induced disturbances as: land use policies (Homestead Act, Depression, agriculture), livestock grazing, noxious weeds and other invasive species, mining, timber harvest, fires set by American Indians and early Euro-American settlers, as well as the success of fire prevention and suppression policies.

Timber Harvest

Records show that about 5,000 acres of timber harvest activity has occurred within the analysis area during the last 30 or so years. Proportionally about 92% of this harvest activity has been on non-federal lands. Some areas may have been entered more than once during this time period. The tables below summarize the harvest treatment activities by harvest type from the early 1970's to present. Only about 400 acres (2 percent of analysis area) was commercially harvested on Forest Service land since the 1970's. In the last 20 years or so harvest on Forest Service lands have focused on treatment of deteriorating, fire-generated lodgepole pine stands. Much of the commercial harvest activity on other ownerships has occurred from the 1980's to present.

Commercial Timber Harvest 1970 to 1999

Ownership	Total Acres Treated	Clearcut	Seed Tree	Overstory Removal	Preparatory Cut	Shelterwood	Thinning
Forest Service	396	184	7	0	0	66	140
Private	3714	221	50	19	0	21	3403
State DNR	950	283	194	0	25	65	383
Totals	**5060**	**688**	**251**	**19**	**65**	**152**	**3926**

The Forest's Fuel Inventory

Trees capture and store the energy contained in sunlight. They serve as the primary producers of forested ecosystems. Trees also take up and store mineral nutrients, which can only be released through decomposition or combustion. In the Quartzite analysis area decomposition is limited by cool temperatures and low moisture, and without fire, dead plant material and its nutrients build over time.

Fire History[62]

The fire history of an area is a function of forest type, topography, microclimate, ignition sources and past disturbance history. Knowledge of the fire history provides some insight into the kinds and pattern of vegetation that likely existed and provides land managers with information that can be used to create, restore, and maintain sustainable vegetation patterns. The inherent fire disturbance regime for an area is an important reference point for assessing changes in vegetation patterns and the concomitant risks of current vegetation patterns to catastrophic disturbances.

Ponderosa pine, Douglas fir and grand fir series forests have dramatically changed as inherent disturbance regimes have been altered through livestock grazing, roading, and fire suppression. Forests in these vegetation series have progressed farther along successional trajectories. Fire regimes in these forests have changed from frequent low-severity fires to a less frequent, but high-severity stand replacement fire regime.

The earliest fire documented within the Quartzite Planning Area occurred in 1384; fires were also documented from the fifteenth and sixteenth centuries. However, the number of surviving scar samples from the 14th, 15th and 16th centuries was too small to reliably infer fire frequencies or sizes for that time period.

The number and quality of the fire scar samples collected enabled the reconstruction of the fire history of much of the sampled portion of the Quartzite Planning Area back to 1671. The fire history analysis does not include fires that occurred after 1929, although several fires burned portions of the Quartzite Planning Area after that date. 1920 was chosen as the cutoff date because there was an abrupt change in fire frequency and size after that date. These changes have been documented across the west and likely result from a combination of factors, including livestock grazing, roading, and active fire suppression. These activities significantly altered inherent fire regimes. Including fires that occurred after 1920 would bias the fire history analysis.

Analysis shows a Mean Fire Frequency Interval (MFFI) of 2.8 years for the pre-settlement period and 2.3 years for the period of active settlement. These numbers reflect that, on average, there was a fire somewhere within the sampled area every two to three years.

Results from this analysis indicate that the inherent fire regime for the Quartzite Planning Area was one of high frequency, low severity fires. This type of fire regime is also typical of the dry forest types in the ponderosa pine, Douglas fir, and grand fir series along the eastern slopes of the Washington Cascade Mountains. Low MFFI's suggest that the Quartzite Planning Area was historically dominated by species more tolerant of fire such as ponderosa pine and western larch, since even low severity fires would kill trees that were more sensitive to fire. Douglas fir would have been a component of early forests, but since it is quiet intolerant of fire when very young, it would have been restricted to areas that burned somewhat less frequently or represented in discrete cohorts that established and persisted during one of the lengthier fire free intervals. Fire free intervals greater than about 17 years could have allowed Douglas fir to establish and grow high enough to create a fuel ladder to the overstory. Subsequent fires might then have become stand replacing in those areas. In many instances, the Quartzite Planning Area is out of synchrony with historic MFFI by a factor of 10. Vegetation is connected horizontally and

[62] The Pacific Northwest Research Station, Wenatchee Forestry Sciences Laboratory, completed a detailed fire history study of the analysis area on 26Sep00. The results of this study are documented in the *Report to the Colville National Forest on the Results of the Quartzite planning area Fire History Research*, which is included in the analysis file for this EIS.

vertically across the landscape, predisposing this area for fires that are of greater severity than those that occurred during the past several centuries.

Fire Suppression

The Forest Plan Standards and Guidelines call for all wildfires to receive an "appropriate suppression response, commensurate with land management objectives for the area on which wildfire occurs," and to "apply aggressive suppression action to wildfires that threaten life, private property, public safety, improvements, or investments."

From a fire suppression standpoint the analysis area is mostly inaccessible. Most access is at the perimeter of the analysis area with the middle being inaccessible by vehicle. Areas that take the longest to access a fire would be Jay Gould ridge, Devils canyon and the Cottonwood area. Initial attack response time to reach most fires that would occur adjacent to any roads in the analysis area would be approximately 1 ½ hours to 2 hours, and significantly longer if the fires must be reached on foot.

Forested Vegetation Condition and Trends

Upland Vegetation

Ecosystems and landscapes change over time as a function of vegetation characteristics (e.g. growth rates, shade and fire tolerances, and reproductive strategies and disturbance regimes (e.g. disturbance type, frequency, and extent). A sustainable landscape is one that changes within particular ranges of disturbance frequency, intensity, and extent. Sustainability is the ability to maintain a desired condition or flow of benefits over time. Historical ranges of variability refer to the composition, structure, and dynamics of ecosystems and landscapes prior to Euro-American settlement. Historical ranges of variability (HRV) provide a benchmark by which landscape sustainability may be evaluated. Management practices that move landscapes outside these ranges may not be sustainable.

With the lack of reference fire activity over the past seventy plus years, the successional forest sequence that leads toward "climax" species has proceeded unchecked across much of the analysis area. With this change comes an increase in root pathogens and insects, a loss of shade-intolerant species, an increase in shade-tolerant species, an increase in fuels, along with stand structures and species less adapted to inherent fire regimes. The current forest matrix on lands reflects a trend away from the early to mid successional stages associated with reference disturbances, with mid and late seral multi-stratum stages outside of reference conditions. In the lower portions of the analysis area, where land use conversions are common and where logging has occurred along riparian areas, reference vegetation structures have been replaced by a more uniform matrix of younger trees, or by non-forested patches.

The general vegetation trends are for increasing levels of root disease, increasing risk of insect attacks in overstocked multi-storied stands contributing to tree mortality, continued loss of seral species; a decreasing ability to maintain the large tree component and an increasing risk of effects from uncharacteristic fire events. The patch-corridor-matrix analysis of forest structural stages shows a decrease in patch definition and a corresponding increase in matrix uniformity across the analysis area.

Riparian Vegetation

Changes in riparian vegetation tends vary based on whether or not land use conversions, homesteading, logging or other human induced disturbances have occurred. Generally both dead and live fuels have increased in areas where riparian vegetation has not been removed or altered. Late multi-stratum stand structure found in the upland riparian areas tend to be within reference conditions. In contrast to this, late stand structure located within the lower elevation riparian corridors have been removed or altered over the past 70 years. Today, in the uplands, Betts (private) and Woodward Meadows remain the most visible old homestead sites. Analysis shows 60 miles of streams within the analysis area with 21 miles on Forest Service Lands (NFS). Under current INFISH standards on NFS lands, this would require a minimum of 673 acres where silvicultural treatment opportunities could not be considered.

Trends indicate riparian vegetation conditions in forested areas will continue to move toward reference conditions contingent upon the impacts of the uniformity of increasing vegetation densities and fuel accumulations across the uplands. In contrast, riparian vegetation conditions on non-forested pastureland or fields remain considerably altered and human use patterns indicate conditions will not change soon.

Biophysical Environments and Vegetation Structure

A biophysical environment (BPE) is distinguished by its *potential natural* vegetation and its fire ecology regime. The delineation of four distinct BPE's within the analysis area provides a context for the analysis of forest matrix, patches, and corridors over time. The composition, structure and density of vegetation for each BPE can be compared between reference conditions and current conditions by using forest structural classification.

Structural Stages

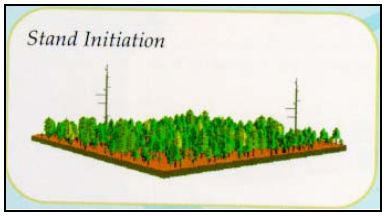
As forests grow, they progress through different developmental stages or structures. Although the word "stage" implies a simple linear sequence, contemporary ecological theory does not view it as such. When affected, forests do not immediately return to a single pathway of vegetative change (succession) or a single stable condition (climax). Instead, both natural and human disturbances have long-term influences on the appearance and composition of forests and on the successional pathways followed.

The process of forest aging called "succession" transforms the composition of forested ecosystems as biotic communities respond to and modify their environment. The process of succession is not restricted to plant communities. It occurs at all levels within the animal and microbial communities. These communities can experience sequential changes that are concurrent with the vegetative seral stage.

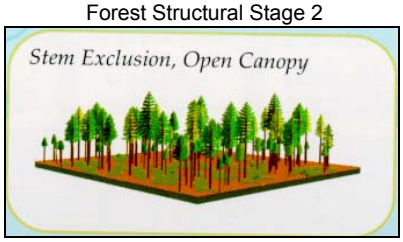
The following series of graphical examples depict points of structural stand development in a mixed conifer stand type. Each stage is defined by language in the Regional Forester's Amendment with considerations for local interpretation. Regeneration harvested areas can be classified a stage 1, 4 or possibly 5 based on the number of leave trees and cohorts. The Biophysical Environment determines the ranges of each structural stage that indicate a sustainable landscape. The biophysical condition would affect the longevity of the desired landscape character. Single-Stratum Late Structure (SS7) is not found within all biophysical environments. BPE 2 and 4 contain SS7; BPE 5 and 8 do not. SS7 in BPE 4 would historically have occurred on drier plant associations. For this analysis, the Colville National Forest Plan generally defines a late structural stage stand as having at least 8 trees per acre greater than 21 inches in diameter at breast height.

Mixed Conifer Structural Stages

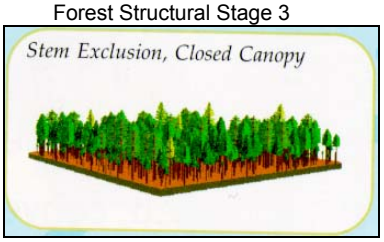
Forest Structural Stage 1



Forest Structural Stage 2



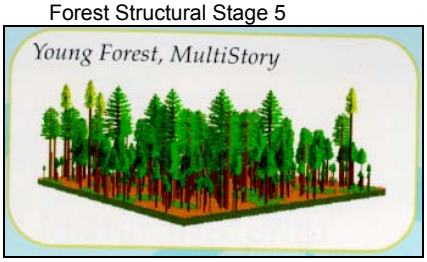
Forest Structural Stage 3



Stand Initiation through Stem Exclusion (Stages 1-3). These early stands are fully stocked by conifer trees that may range in size from seedlings through 15" diameter trees. The distinguishing characteristic is that all the trees are near the same age (same cohort), and all the trees are in the same canopy layer. A second canopy layer of shade tolerant trees has not yet started to develop in the understory.

Forest Structural Stage 4

Forest Structural Stage 5

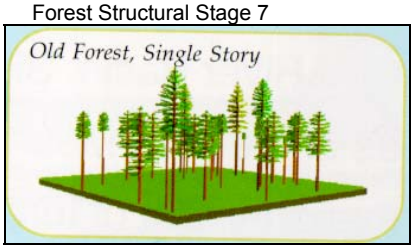


Understory Reinitiation and Multi-Stratum without Large Trees (Stages 4 & 5). A second cohort of trees is established under an older overstory in these middle stages. Openings start to appear in the canopy, and the amount of down wood increases. The trees in the overstory are typically seral (larch, pine, Douglas-fir, etc.) while the trees in the understory are typically shade-tolerant (western redcedar, hemlock). The stand may contain many sizes of trees, but large trees are uncommon.

Forest Structural Stage 6

Multi-stratum with Large Trees (Stage 6). These late and old stands contain two or more cohorts of trees, and trees of all sizes are present. The overstory canopy is discontinuous, and dominated by large trees.

Forest Structural Stage 7



Single-Stratum with Large Trees (Stage 7). A single layer of large seral trees is present in this late and old stage. The understory may be absent or may contain sparse or clumpy seedlings and saplings. These stands are sometimes called park-like.

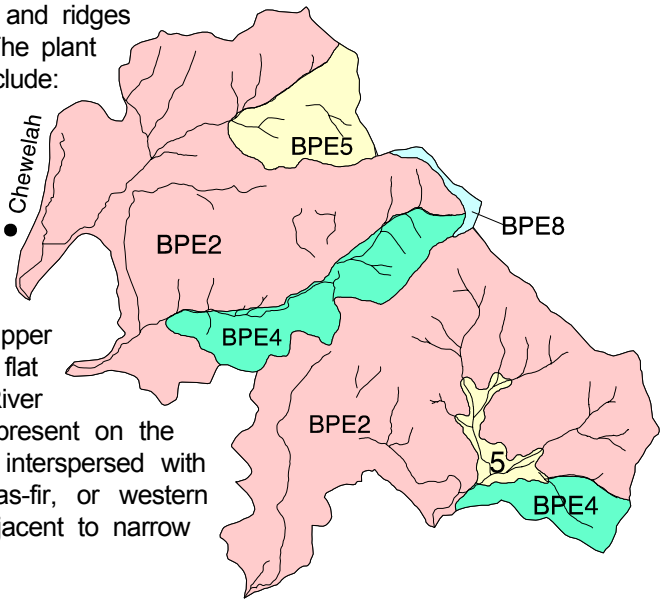
Biophysical Environments

Biophysical Environments (BPE) are used as the common unit with which to compare the distribution of the seven structural stages over time. Using *potential natural* vegetation and fire ecology, four BPEs were mapped in the analysis area.

Biophysical Environments					
Code	Biophysical Environment (BPE)	All Ownerships (Acres)	% Of Analysis Area	NFS Land (Acres)	% Of NFS Land
BPE2	Warm Dry PSME[63] Shrub	18802	81	8406	79
BPE4	Cool Mesic PSME Shrub/PSME-ABGR[64] Forb-Shrub	2588	11	889	8
BPE5	Cool Mesic THPL[65]- TSHE[66] Forb-Shrub	1764	8	1135	11
BPE8	Cold Dry ABLA[67]2 Shrub	153	<1	156	2
	Total	23311		10585	

BPE2 - Warm Dry Douglas-fir/shrub

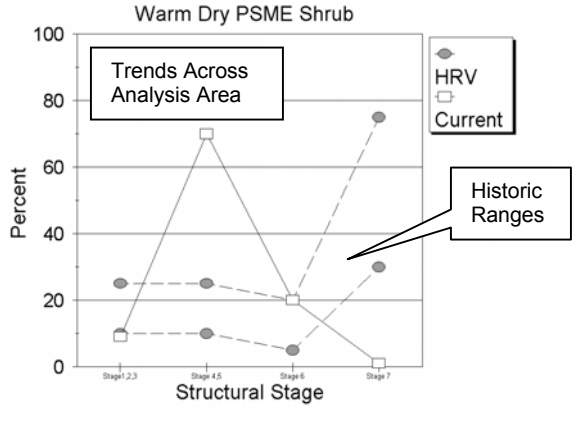
Over 80% of the analysis area (79% of NFS lands) falls within this BPE. It is characterized by warm Dry Douglas-fir/grand fir with shrub understories. This Biophysical Environment generally occurs on midslopes and ridges on south and west aspects. The plant associations for this group include: Douglas-fir/ninebark, Douglas-fir/ninebark-twinflower, Douglas-fir/common snowberry, Douglas-fir/mountain snowberry, and grand fir/ninebark. The Douglas-fir series is most conspicuous on the southerly slopes of upper Sherwood Basin and flat bottomland in the Colville River valley. Grand fir/ninebark is present on the south aspects of Betts Basin interspersed with more mesic grand fir, Douglas-fir, or western redcedar plant associations adjacent to narrow riparian areas.



Forest habitat types found on this habitat type group consist primarily of Douglas-fir, ponderosa pine, and western larch. Historically, these sites were maintained in grassy and more open stand conditions of large, old ponderosa pine and Douglas-fir (Fisher, 1987) with western larch mixed in on the more moist sites. Low intensity ground fires (underburns) significantly influenced the development of many stands within this Biophysical Environment maintaining an open stand structure (SS7). Fires generally kept

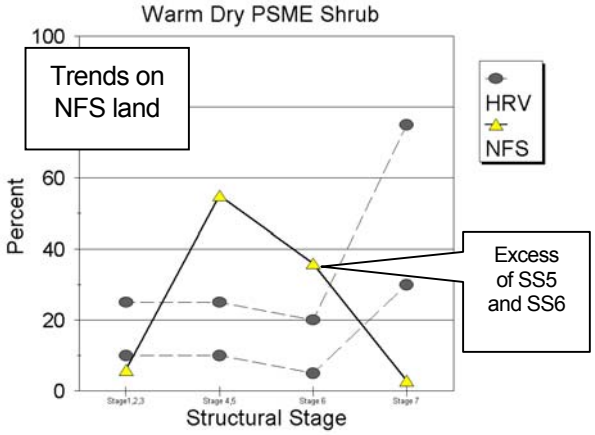
[63] PSME is an abbreviation of the Latin name for Douglas fir: *Pseudotsuga menziesii*.
[64] ABGR is an abbreviation of the Latin name for grand fir: *Abies grandis*.
[65] THPL is an abbreviation of the Latin name for western red cedar: *Thuja plicata*.
[66] TSHE is an abbreviation of the Latin name for western hemlock: *Tsuga heterophylla*.
[67] ABLA is an abbreviation of the Latin name for subalpine fir: *Abies lasiocarpa*.

stands open and free of fire-intolerant species, while maintaining seral species such as ponderosa pine, as well as larger diameter fire resistant Douglas fir. In some areas, low intensity fires stimulated shrubs and grasses, maintaining vigorous browse and forage. The shrub layer could either inhibit or contribute to potential fire behavior, depending on weather and live fuel moisture conditions at the time of the burn. Stands tended to have large diameter overstory trees, interspersed with areas of young pole and sapling-sized trees. When a low-intensity fire occurred these thickets of younger trees were often killed, maintaining stands of large diameter seral species in an open, park like condition. The absence of a dense understory prevented flame lengths from reaching the crowns of the overstory.



The distribution of forest structural stages during reference conditions (HRV) is a range, expressed as a percentage of the BPE area. During reference conditions, 10 to 25% of BPE 2 (Warm Dry PSME Shrub) was occupied by stages 1, 2 & 3. Ten to 25% of the area was occupied by stages 4 & 5. Five to 20% was occupied by stage 6 and 30 to 75% was occupied by stage 7. The range in percentages represents the dynamic nature of landscapes and highlights the interplay of potential natural vegetation and reference fire regimes within the ecosystem.

When we look simply at total acres of forest structural stages across the analysis area BPE 2 we see a disparity between reference conditions and current conditions for all but Stage 6. A closer look at the current spatial patterns of forest structural stages or juxtaposition of the Stage 6 reveals the changes from historic condition in the continuity of stands of SS5 and SS6 and the significant lack of SS7 stands. Reference conditions show a shifting mosaic of between 5,600 and 14,000 acres of Stage 7 in BPE 2. However today only 193 acres of Single-stratum SS7 are located in this BPE. Many SS6 stands are located on drier south and west facing sites, where fire historically maintained less dense, more open park-like SS7 stands of ponderosa pine, western larch, interspersed with other stages that had lower stocking and fuel biomass then exist today. The continuity of stands (homogeneity) with similar high fuel loadings and ladder fuels are contributing to an increased potential for large uncharacteristic stand replacement fires.



Structural stage development in BPE2 on National Forest Lands show trends similar to the entire analysis area. A notable difference is that all stages show a disparity between reference and current conditions. Fire exclusion has resulted in stand structures less adapted to frequent fires. The upland portions (NFS) of subwatersheds show a more pronounced departure from historic conditions. This shift toward homogeneous dense stands with a higher percentage of small trees and a species composition higher in Douglas-fir and grand fir has significantly increased the risk of lethal stand replacement fires, where low intensity non-lethal fires historically occurred. Historically insects and

pathogens played a role in forest ecosystems contributing to the development of important wildlife habitat, nutrient cycling, along with stand and landscape level structural diversity. Prior to settlement, insects and pathogens across much of BPE2 operated at the individual tree level or in small patches (generally less than 5 acres). Insect and pathogens acted in combination with fires to limit vegetation density. Armillaria root pathogens killed small number of trees weakened by overstocking, drought, or fire. Dwarf mistletoes were present but at much lower levels as a result of underburns and mixed severity fire. Various insects such as Douglas-fir beetle, and western pine beetle caused mortality in individual trees with low vigor. During pre-settlement fire regimes, endemic levels of root pathogens, dwarf mistletoes, and insects played a minor role. Today, the forest matrix in BPE 2 is more uniform and has fewer patches now compared to reference conditions.

Current structural stage distribution also shows the effects of ownership and accessibility on land use. Today, SS6 and SS7 stands are generally located on NFS Lands.

Fuel inventory

Reference Fuels

Fuel load can vary greatly, depending on stand density, species composition, age, and stand history, but are generally lighter than in other biophysical environments. Fuel loading tends to increase with stand age, longer fire return intervals and fire suppression. Increases in elevation, soil productivity, and more northerly aspects tend to reflect heavier fuel loading, mostly from increased shrubs, denser regeneration and overstory trees. On sites in Montana, which are similar to this biophysical environment, total woody fuels ranged from 2.5 to 27.3 tons per acre.

Historically, much of the fuels were in the smaller size classes whose flammability was greatly influenced by daily weather changes. On sites recently underburned, fine fuels consist mainly of litter and light duff. As time since fire increases, a dense growth of tall shrubs can develop; shrubs and regeneration reach into the stands only occasionally, so crown fire is unlikely.

The absence of dense understories results in reduced potential for crown fire, even in stands with substantial downed woody fuels. However, as fuel greater than 3 inches in diameter accumulates the potential for severe surface fire increases.

As fuels vary, potential fire behavior in these stands can carry from low intensity fires in lighter fuels such as grass and litter, to increased likelihood of crown fires as heavy duff and large fuels accumulate. In addition, the shrub layer can either inhibit or contribute to potential fire behavior, depending on weather and live fuel moisture conditions at the time of the burn.

Existing Fuels

Because of fire suppression, snow breakage and insect and disease attacks, down and dead fuel loading in the analysis area is much higher than for reference conditions. Fire suppression has also caused overstocking and the development of a dense understory which produces a high-hazard fuel array increasing the risk of crown fire. As fire exclusion continues duff loading also continues to increase. As dominance shifts during succession from ponderosa pine to Douglas fir, litter flammability also changes; pine litter is more loosely packed and dries more quickly than fir litter, which may not carry a surface fire until midsummer.

Historically in this biophysical environment there have been areas or stands that have had high fuel loading and dense understories of shade tolerant trees. The big difference between current and reference condition is the continuity of the heavy fuel loading and dense understory. Instead of small pockets of severe fire behavior taking place in isolated areas of high fuel loading, the whole analysis area is at greater risk for stand replacement fire.

As time since fire exclusion increases the fuel model profiles also change. Dead and down material begins to increase due to snow breakage, insect and disease attacks and natural thinning. The areas where fuel model 8[68] should dominate have become or are approaching fuel model 10[69]. This is a situation where severe surface fires can occur along with crown fire.

Reference Role of Fire

During pre-settlement times, much of this biophysical environment was characterized by low intensity fires due to the relatively light fuel loading, which mostly consisted of fuels less than 3 inches in diameter. Frequent, low-intensity fires generally kept stands open, free of fire-intolerant species, and maintained seral species such as ponderosa pine, as well as larger diameter fire resistant Douglas fir. In some areas, low intensity fires stimulated shrubs and grasses, maintaining vigorous browse and forage. The shrub layer could either inhibit or contribute to potential fire behavior, depending on weather and live fuel moisture conditions at the time of the burn. Stands tended to have older, large diameter overstory trees, interspersed with areas of young pole and sapling-sized reproduction. When a low-intensity fire occurred these thickets of younger trees were often killed, maintaining stands in an open, park like condition. The absence of a dense understory prevented flame lengths from reaching the crowns of the overstory. Colville National Forest "Fire History" records, June 30, 1916, mention "the fires on the south slope as a rule are mostly grass fires, while it burns the reproduction, brush and dead and down timber, it very seldom crowns. The greater damage which can be noticed throughout the district is to the reproduction." There are still some remnants of these parklike stands today on the lower south-facing creek bottoms, as well as on south-facing ridges.

The Quartzite Fire History Study reveals that reference frequent low-severity fires burned on average 54 to 1500 acres. Short-term increases in precipitation and relative humidity kept fires small and intensities low, while windy dry weather tended to dramatically increase fire size.

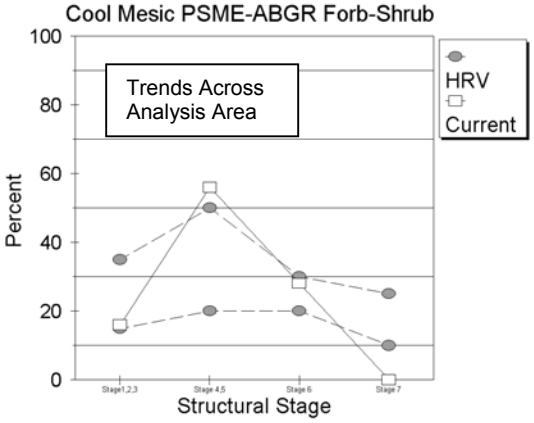
Severe high intensity fires, in which entire stands are often destroyed, were most likely to occur when succession had progressed without fire, causing an increase in surface and ladder fuels. It is unlikely, however, that these later successional stages occurred over a widespread area in the biophysical environment prior to 1900. As a result, stand replacement fires, which covered a large area, were probably less common than non-lethal underburns. As an example of the variability in fire regime in this biophysical environment, research in similar areas in Montana and Idaho show mean fire free intervals for non-lethal underburns ranging from 4 to 95 years. In another fire history study in a similar area, only two percent of the burns were stand replacement fires. And yet in another study in northwestern Montana, PSME/PHMA sites experienced one or two non lethal underburns per century and stand replacing fires at intervals of 170 years or more.

[68] Fire behavior predictions are based on 13 fuel models. Fuel loadings for Fuel Model 8 average 5 tons per acre.
[69] Fuel loadings for Fuel Model 10 average 12 tons per acre.

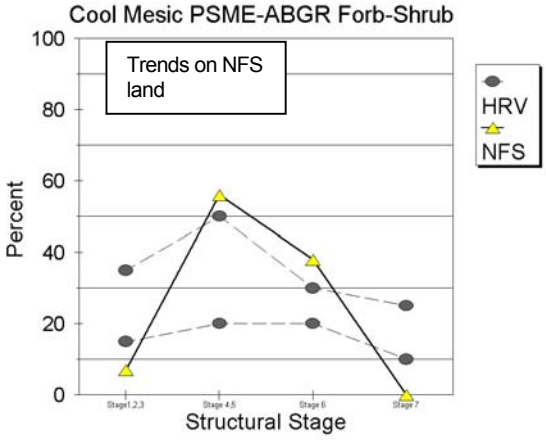
BPE4 - Cool Mesic Douglas-fir grand fir/forb-shrub

This biophysical environment occupies 11% of the analysis area and is characterized by Cool Mesic Douglas-fir/grand fir with forb-shrub understories. The plant associations for this BPE include Douglas-fir/dwarf huckleberry, Douglas-fir/big huckleberry, grand fir/queencup beadlily, grand fir/dwarf huckleberry, grand fir/big huckleberry, grand fir/Douglas-maple. It is typically found on more northerly aspects of the Quartzite analysis area. This Biophysical Environment generally occurs on cooler, drier benches of the analysis area.

Historically, fire behavior ranged from stand replacing fires to low intensity fires, producing a mixture of even-aged stands with occasional large, old trees and a species mixture of young trees. The fire regime was more variable in this Biophysical Environment than in BPE 2. Areas in BPE 4 that experienced frequent low intensity fires, typical burned from a few hundred to a few thousand acres. Areas with less underburning and more frequent stand-replacing fires were probably larger in size. Considerable variety can be found in structure and composition of mature forests in this Biophysical Environment. Two major successional pathways describe this process. In Douglas-fir, ponderosa pine or western larch successional pathways low intensity fires would remove most vegetation leaving scattered ponderosa pine and western larch. Fire thinned stands would mature into open forest with Douglas-fir and Engelmann spruce understories. In pathways dominated by lodgepole pine, stand-replacing fires renewed most stands.



During reference conditions (HRV), 15 to 35% of BPE 4 (Cool Mesic PSME-ABGR Forb-Shrub) was occupied by stages 1, 2 & 3. Twenty to 50% of the area was occupied by stages 4 & 5. Twenty to 30% was occupied by stage 6 and 10 to 25% was occupied by stage 7.



While not as extreme as BPE 2, the disparity between reference and current structural conditions in BPE 4 on National Forest Lands is most evident for Stages 1-2-3, 6 and 7. Once maintained by periodic low to moderate intensity fire, stands that would have been Stage 7, now have the structure of Stage 6 stands. These stands are becoming predisposed to higher severity fire due to higher fuel loading, ladder fuels, and seral species elimination due to logging, insects and disease. Like BPE 2, fire exclusion in BPE 4 has caused the current forest matrix to become more uniform with fewer patches. There is a decrease in the number of regeneration openings (Stage 1) along with a greater number of mid seral stand structures (Stage 5 & 6) compared to reference conditions and a deficit of late Stage 7.

Fuel inventory

Fuels are variable in this biophysical environment, but can range as high as 40+ tons/acre. Potential fire behavior is dependent upon the structure of the understory, i.e., the presence or absence of ladder fuels, and downed wood. In addition, deep duff can contribute to severe fires. The shrub layer can either inhibit or contribute to potential fire behavior, depending on weather and live fuel moisture conditions at the time of the burn.

Reference Role of Fire

As fuels vary, fire behavior historically ranged from stand replacing fires to underburns, producing a mixture of even-aged stands with occasional large, old trees and a mixture of species regenerating. The fire regime was more variable in this biophysical environment than in the warm dry Douglas fir grand fir biophysical environment. In ecosystems with frequent underburns, typical fires burned from a few hundred to a few thousand acres; areas with less underburning and more frequent stand-replacing fires were larger. Fire history studies in similar areas show stand replacing fires occurring at intervals of less than 100 to 141 years. Where fires burned in patchy mosaics of stand replacing and non-lethal severity, the mean fire-free interval was 50 to 100 years.

Fire's role in this biophysical environment, along with cycles of insect and disease, was to control forest composition and density. Stand replacing fires at intervals of less than 150 years favored lodgepole pine. If intervals were longer, Douglas fir, western larch, ponderosa pine, and grand fir prevailed, with dominance determined by fire severity, size of openings, understory species and the frequency of subsequent underburns. Ponderosa pine regeneration was unpredictable, depending on heavy cone crops and low levels of competition from herbs and shrubs, but mature ponderosa prevailed on sites frequented by underburns. Douglas fir established well where substantial duff remained, perhaps under the shelter of trees or shrubs; when mature, it could survive underburning.

In areas that previously underburned, stands that were once open and dominated by seral species have developed understories dominated by shade-tolerant species, in a manner similar to the Warm dry Douglas fir grand fir biophysical environment. Fuel loading and ladder fuels have also increased in these areas, and stand structure and composition has become more uniform over a landscape that was once characterized by mosaics due to fires of non uniform severity.

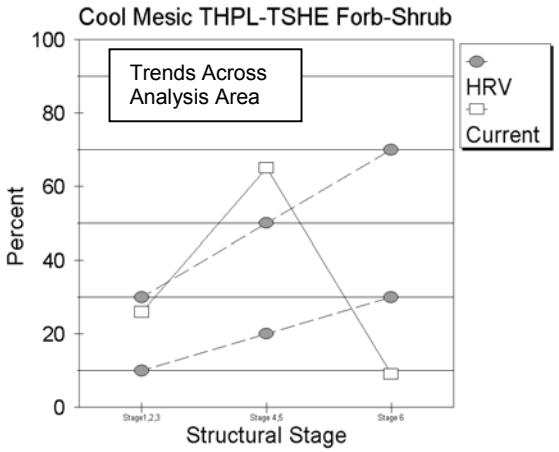
Where stand-replacing fires occurred on a more regular basis, not enough time has elapsed since the onset of effective fire suppression to cause any marginal increase in within-stand fuel loading between historic and current levels. What has changed since the suppression era is stand structure and composition, which are becoming uniform over the landscape, with the increase in stand age and species homogeny comes an increase in insect and disease mortality. Subsequently, larger areas may currently be more vulnerable to stand-replacing fire than they were in the past. In summary, stand-replacing fire frequency, size, and severity may increase in this biophysical environment as a result of fire suppression.

BPE5 - Cool Mesic cedar-hemlock/forb-shrub

This Biophysical Environment generally occurs on mid to lower slopes and generally on north and east aspects. It also occurs in valley bottom lands and lower slopes with high water tables. It includes wet meadows and alder shrublands. It is the third most widely distributed Biophysical Environment in the analysis area at 1,764 acres, or 7% of the analysis area. Cool Mesic Western Redcedar with forb-shrub understories characterizes this Biophysical Environment. The plant associations for this group include western

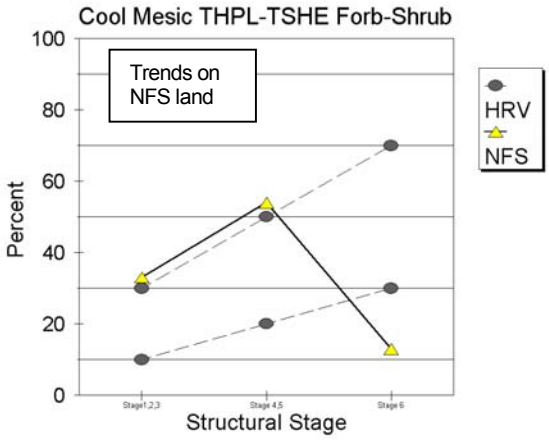
redcedar/queencup beadlily, and western redcedar/big huckleberry. Vegetation is diverse including western red cedar, western hemlock, Douglas-fir, western white pine, Englemann spruce, grand fir, lodgepole pine, and western larch.

These forest types are very productive and produce high levels of wood biomass between the long stand-replacement fire intervals. Although fuel loading can be quite high in these stands, fire hazard is usually low, due to the high humidity in the understory throughout much of the summer months. In addition, green shrubs and other understory vegetation help act as a "heat sink" in both young and older, "parklike" stands. Thus, older stands are often resistant to low-intensity fire, because the crowns of the larger trees can often survive torching of ladder fuels. However, during drought periods, when surface fuels dry out, fires may smolder for long periods of time, causing more severe fire effects. Once live fuel moisture decreases, conditions leading to stand-replacing fires will increase.



The structural complexity and species diversity of forests found within BPE 5, help create variable fire regimes. Although stand-replacement fire at intervals of 50-150 years may have generally been the case, historic fires varied in uniformity of severity with topographic influences affecting patch size and distribution. Upland sites with slopes greater than 30% were more apt to have stand-replacement events with patch sizes from 50-500 acres but with intermixed variable severity underburning. Even within a generally severe fire, non-lethal underburning could occur during moist periods and near the downslope and downwind edges. The more southerly aspects at lower elevations generally exhibited lower intensities, while low elevation riparian environments burned rarely.

During reference conditions (HRV), 10 to 30% of BPE 5 (Cool Mesic THPL-TSHE Forb-Shrub) was occupied by stages 1, 2 & 3. Twenty to 50% of the area was occupied by stages 4 & 5 and 30- 70% was occupied by stage 6. Stage 7 did not occur in BPE 5. Analysis area trends show the amount of Stages 4 & 5 combined at levels higher than expected and Stage 6 deficit.



On National Forest Lands trends are similar but not as pronounced. Current structural stage distributions in BPE 5 on National Forest Lands show a occurrence of, less structurally diverse stands (stages 1,2,3) slightly above historic trends. This in part is a result of the Goddard's Fire in 1934, which created large patches of lodgepole pine. The east six-mile timber sale regenerated a portion of these fire-generated stands on National Forest System land. The homogeneity of the forest matrix is also increasing in BPE 5, with fewer patches and structural complexities.

Fuel inventory

Due to their high productivity, the stands found in this biophysical environment often carry heavy fuel loading. Many stands have up to 50 tons/acre, much of it in the 3"+ category, and much of that rotten. In addition, there is usually a large component of twigs and small branchwood. These fuels are often the results of accumulated deadfall and natural thinning. Duff can be relatively deep and contains a high amount of rotting wood.

Stand-replacing fires do not usually consume the entire duff layer, and can actually increase the amount of dead and downed fuels, as snags and other dead wood fall over in the years following the burn. In addition, after a stand is opened to sunlight by fire or some other disturbance, it will dry more quickly during the season, and thus may be more susceptible to reburns and extreme fire behavior.

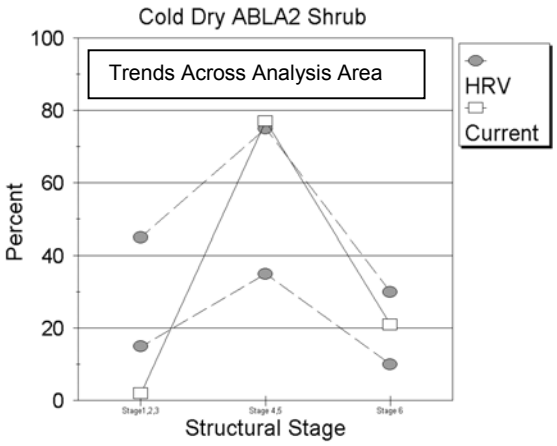
Reference Role of Fire

Almost every stand visited within the analysis area in this biophysical environment shows some evidence of fire, exhibited either by fire scarring on trees, or by charcoal in the soil, or by burned remnants of snags. However, fire scars on individual trees are not an indicator of fire regime, as individual trees tolerate fire differently. For example, western red cedar is surprisingly fire resistant and individual fire scars are not uncommon. Because fire intensity varies with slope, aspect, vegetation, and elevation, a mosaic occurs after large fires, ranging from complete stand replacement, partially killed overstory with more seral species surviving, underburning with little overstory mortality or no burning at all. All these conditions may exist within the perimeter of one large fire on all slopes, aspects, and elevations. The more southerly aspects at lower elevations generally exhibited lower intensities, while the riparian environments probably did not underburn.

Research findings in other similar disturbance regimes show average high-intensity patch size of less than 10 acres, with a variance of several hundred to perhaps one thousand acres. For riparian environments, patch size was probably significantly smaller. In addition, moderate to low intensity burns occurred either within or adjacent to stand replacement areas. These areas had greater numbers of residual trees. The result was a landscape composed of uneven-aged stands with a significant seral overstory adjacent to even-aged patches. Some stands remained in a middle structural stage, while those with little or no fire disturbance progressed to late or old structural stages.

Due to these variable fire patterns and intensities, patch shape and distinct edges between mosaics existed for several decades following disturbance. In areas that had a relatively long fire return interval, patch size and mosaic borders diminished significantly with time since disturbance. Due to the variable fire intensities, patch shape was very irregular and consisted of many islands and fingers of remnant structural characteristics.

BPE8 - Cold Dry subalpine fir/forb-shrub

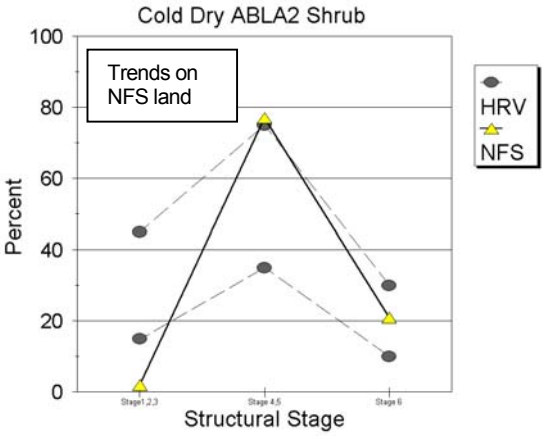


This Biophysical Environment makes up 1% or 156 acres of the analysis area. It is found on the upper un-glaciated slopes of the west ridge of Chewelah Mountain. Subalpine fir and western hemlock are the climax tree species. Early succession is mostly dominated by lodgepole pine or by a combination of other tree species including Douglas fir, Engelmann spruce, grand fir, western white pine, western larch and whitebark pine. The successional pattern for a particular stand depends

not only on habitat type but also on past fire history, seed source and local conditions.

The periodic fire disturbances and high amount of low to moderate fire severity favors species such as lodgepole pine, Douglas-fir and western larch.

During reference conditions (HRV), 15 to 45% of BPE 8 (Cold Dry ABLA2 Shrub) was occupied by stages 1, 2 & 3. Thirty five to 75% of the area was occupied by stages 4 & 5 and 10- 30% was occupied by stage 6. Stage 7 did not occur in BPE 8. While being the smallest BPE in the Quartzite Analysis Area, compared to other BPEs, the current forest structure condition of BPE 5 is closest to reference conditions. Deficits in early stages may be attributed to the suppression of ridge top lightening strikes in the recent past.



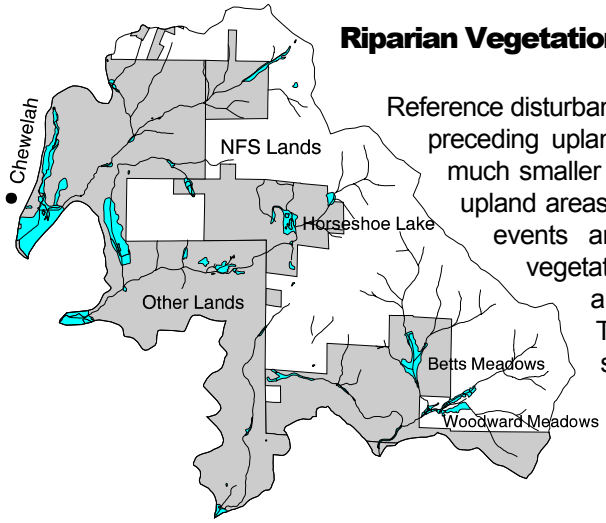
This biophysical environment only occurs on National Forest System Lands within the Quartzite analysis area. Portions of this biophysical environment extend across the Chewelah Peak ridge onto the Newport Ranger District.

Fuel inventory

Fuel loading in this biophysical environment can vary from 3 tons per acre to more than 35 ton per acre depending on species composition and age structure, fire history, natural thinning, snow breakage, levels of dwarf mistletoe and mountain pine beetle. An immediate source of dead material in a young lodgepole stand is the snags created by previous fire activity. Woody fuel arrangements are characterized by relatively large amounts of material 3 inches or greater in diameter. At least half of the total loading occur in large material. Dense understories of spruce and subalpine fir often develop beneath the overstory. If heavy surface fuels lay beneath these understory trees, the hazard of crown fire is increased.

Reference Role of Fire

Fire regimes in this biophysical environment are relatively complex. Large, stand-replacing fires burned through thousands of acres at intervals ranging from 117 years to 150 years. Although variable, the frequency of stand-replacing fires tended to decrease with increasing elevation because trees grow more slowly causing fuels to accumulate more slowly. Fires that started at higher elevations are usually lower in intensity; the stand-replacing fires were those that swept uphill from lower forests.



Riparian Vegetation

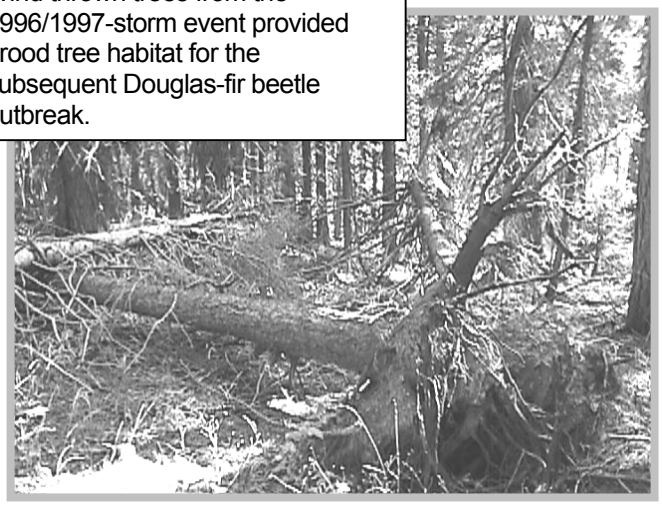
Reference disturbance events in riparian areas included fire, (see the preceding upland Forest BPE 5 discussion), but fire played a much smaller role in forest succession in these areas, than in upland areas. Other disturbances included peak-flow stream events and flooding by beaver. Reference riparian vegetation as well as corridor width varied by elevation and stream gradient. The lowest reaches of Thomason, Sherwood and Cottonwood Creeks shared the conditions of the Colville River Valley, where large diameter cottonwood trees,

ponderosa pine, and grand fir populated the broad riparian areas. As elevation and stream gradient increased, reference riparian zones became narrower and western red cedar replaced ponderosa pine and grand fir. The presence of cottonwood extended upstream where gradients flattened and riparian areas broadened. Forest structural stage 6 (multi-stratum with large trees) typified all but the upper most reaches of streams, where upland disturbance events overwhelmed most narrow riparian areas. Small breaks in riparian corridor continuity between the valley floor and the upper reaches occurred with beaver flooding and the rare stand replacing fire.

Like the distribution of upland structural stages, the condition of riparian vegetation today reflects the effects of land uses and resource management policies. Fields, pastures and homes have replaced the reference riparian vegetation in the low gradient low elevation areas on the west side of the Quartzite Analysis Area. Narrow strips of alder, cottonwood and conifers occur randomly in this valley floor area. Land uses, roads, pastures and logging, regularly interrupt the continuity of riparian vegetation between the valley floor and upland stream reaches. However, stands of mixed conifers are interspersed with these openings and as ownership changes to NFS Lands, structural diversity and tree diameters tend to increase. Conditions in the narrow upper stream reaches on NFS lands are near reference conditions, with many stands characterized as multi-stratum with large trees. But these too have been affected by fire suppression, the continuity of stands (homogeneity) with similar high fuel loadings and ladder fuels are contributing to an increased potential for uncharacteristic stand replacement fires and an increasing potential for uncharacteristic change or loss of vegetation and riparian functions.

Blowdown

Identifying distribution patterns of windfalls in the analysis area can help characterize and assess its role in shaping the landscape patterns of plant communities. During the winter of 1996/1997, a large-scale storm event (snow, ice, and wind) occurred across the northeastern portions of Washington and parts of Idaho. In the spring 1997, an aerial reconnaissance flight was made to evaluate the storm damage. Existing stand exam data and field reconnaissance were also used to evaluate the situation. Damage from the storm event occurred throughout the Quartzite analysis area with the highest concentrations along ridges and sub-ridges. Damage included blown down (primarily Douglas-fir trees), snapped off treetops and root sprung trees. The top 10 feet of many of the crop trees in Woodward Unit 3 (overstory harvested in 1965; activity stand 1000326) were broken off in the storm event.



Wind thrown trees from the 1996/1997-storm event provided brood tree habitat for the subsequent Douglas-fir beetle outbreak.

Old Growth

A structural stage was assigned to each of the 1286 stand polygons in the watershed by the project silviculturist. Structural stages were arrived through use of inventory data, stand exam data, aerial photo interpretation, and specific field knowledge of the analysis area. Stand exams were done on approximately 5600 acres (representing 53% of forested acreage) of Forest Service land within the project area. As per Forest direction,

late and old forest structural stages are characterized by the criteria of 8 trees per acre greater than 21 inches diameter at breast height. Under the wildlife standard of the Regional Forester's Amendment No. 2 (RFA#2), live trees over 21 inches diameter breast height are to be maintained. GIS map layers and associated attributes tables were used to identify candidate late and old structural stage and NIZOG stands. The project silviculturist then evaluated each candidate stand to determine if the stand met the minimum criteria for NIZOG.

Three out of the 338 stands examined (a total of 60 acres) qualified under North Idaho Zone Definitions (NIZOG) as old growth within the Quartzite Project Planning Area. It is unknown whether any old growth stands exist on other ownerships. There are many more late structural stands than those that qualify as NIZOG old growth. Many late structural stands do not qualify as old growth because of an insufficient number of large diameter trees.

For most stands in the analysis area, the minimum criteria for old growth characteristics for large tree age is 150 years and 10 trees per acre greater than 21 inches diameter at breast height. The majority of late and old structural stage stand did not meet NIZOG because the age of the large tree component was less than 150 years and/or less than the required 10 trees per acre greater than 21 inches diameter at breast height. The intent of Eastside Screens is to maintain the large tree component of stands that are an important stand component of old growth.

Snag Levels[70]

The Douglas-fir beetle outbreak has produced a substantial number of dead larger diameter (greater then 27.0" DBH) Douglas-fir trees. Where accessible, it is anticipated these dead trees will be taken as firewood. Western pine beetle is attributing to mortality of individual or small groups of large diameter ponderosa pine. Selection of snags and live tree replacements would emphasize practices that assure the highest probability for long-term retention. Retention practices would focus on late seral ponderosa pine, western larch, and recently dead or dying Douglas-fir when possible. Pull-back of slash from legacy or relic ponderosa pine and western larch live trees may be considered to help protect them from potential adverse effects of fire.

Terrestrial Woody Debris

Coarse woody debris is important to a wide variety of wildlife species. It is also essential for long-term soil productivity, and supplies habitat and food to a large number of invertebrates and microorganisms. On the existing open ponderosa pine/Douglas-fir stands on Quartzite Mountain, the ground-wood levels are close to reference conditions. In contrast, ground-wood levels are elevated across large contiguous portions of the uplands where successional forest sequence has proceeded unchecked and the natural fire regime altered. Trees damaged in the winter 1996/1997-storm event have contributed additional down material. In the short term recruitment of down material is likely to increase to levels outside of historic ranges as a result of fall down from tree mortality attributed to Douglas-fir beetle outbreak as well as other damaging agents.

[70] Refer to wildlife analysis for specifics on snag levels across the analysis area. Snag levels on state and private lands are not known.

Management Considerations

As noted in Chapter One of this EIS, the Forest Plan includes two amendments that influence the management direction for this project. *The Regional Forester's Forest Plans Amendment #2* and the *INFISH Direction* are collectively referred to as "Screening Direction."

The Regional Forester's Forest Plans Amendment #2's wildlife standard emphasizes the protection of large trees, the development of and enhancement of late and old structure (LOS) and the protection of goshawks. Live trees over 21 inches diameter at breast height (DBH) are to be maintained. Connectivity is to be maintained between LOS stands, pine marten management areas, pileated woodpecker management areas and MA-1. Snags are to be retained at levels to provide 100% population potential for primary cavity excavators. Down logs are to be protected at levels specified in the Regional Forester's Amendments Nos. 1 and 2. Goshawk nest sites are to be protected.

When one or both types of LOS are below the historic range of variability in a particular Biophysical Environment within the analysis area, then there should be no net loss of LOS from timber sale activities. It is allowable to manipulate one type of LOS to move stands into the LOS stage that is deficient if this meets historical conditions.

Outside LOS, many types of timber sale activities are allowed.

Disturbances related to fire and insect /disease mortality have played an important role in determining forest composition in the analysis area. A key finding of the watershed assessment is that the forested ecosystems within the analysis area have become more susceptible to uncharacteristic fires and outbreaks of insects and diseases.

Late Structural Stage Stands

Structural Stages 6 and 7 are considered to be late or old structures (LOS), and are the focus of the ecosystem and wildlife standards in the Regional Foresters Amendment #2 (RFA#2). RFA#2 compares the acres of late structural stages in the analysis area with the Historic Range of Variability (HRV) for that stage. The Colville National Forest Plan defines late structural stage stands as any area with eight live trees per acre ≥ 21.0 inches diameter at breast height. On cold dry subalpine fire plant association (ABLA2/VASC) types, due to limitations in site and growing conditions, a large tree is 13 inches DBH. Historic Range of Variability calculations under the Regional Forester's Amendment #2, apply only to National Forest System lands. In part, the rationale is based on how the biophysical condition would affect the longevity of the desired landscape character. Proposed harvest activities on National Forest System lands cannot cause the amount of late and old structure to fall below the HRV for a given Biophysical Environment. It is important to keep in mind that HRV serves as a reference point from which change can be measured, rather than a condition that ecosystem management tries to attain. The existing condition shows about 3025 acres of SS6 and 186 acres of SS7 on NFS lands across the analysis area. 84 percent of SS6 and 100 percent of SS7 is presently found in Biophysical Environment 2, which represents 80 percent of the analysis area.

The 1936 inventory map and aerial photos from 1943 show a landscape with vegetation patterns markedly different than we see today. These 55 year old images help illustrate the point that landscapes are dynamic and disturbance is an integral ecosystem process. Today much of the analysis area is characterized by a predominance of middle structural stage stand (SS5) and multi-stratum late structural stage (SS6) stands. The analysis of

the current conditions of late structural stages within the Quartzite Project Area reveals that while there is an excess of multi-stratum structure with large trees (SS6) concurrently there is a significant shortage of single-stratum stands with large trees (SS7) along with the arrangement of these structural stages.

Existing conditions indicate the distributions as well as percentages of structural stages within each BPE are outside HRV. Departures from HRV include an excess 2228 acres of structural stages 4 and 5; an excess of 1181 acres of late stage 6 in BPE 2 and 4 along with a significant deficit of 4829 acres late structural stage 7 in BPE2; and a surplus of 235 acres of early stages 1,2, and 3 in BPE 4. In the late/old and mid-stand structures, 7217 acres are estimated to be at moderate to high risk of insect and disease infestations.

A landscape is a "heterogeneous land area composed of a cluster of interacting ecosystems"; landscape pattern or landscape configuration refers to the spatial relationships among the ecosystems that make up the landscape. It is also evident that if one type of disturbance is suppressed, another type will try to imitate its effects. Over the past 20 years, many large diameter trees have succumbed to root disease, dwarf mistletoe, insects (spruce budworm, Douglas-fir beetle, Western pine beetle) and competition for limited site resources (moisture, nutrients, etc). Others are dying due to more recent infestations of Douglas-fir bark beetle and to a lesser extent western pine beetle. The susceptibility of trees to Douglas-fir tussock moth is also increasing. Recent stand exam data combined with field reconnaissance indicate many larger diameter (greater than 25" dbh) Douglas-fir trees killed by Douglas-fir beetle. Due to resource management policies and land uses, the vegetation composition and density within the analysis area continues to depart from the historic ranges of variability that serve as a measure of ecological sustainability. Vegetation continues to be stressed by the ongoing drought conditions.

Not only has the fire interval changed from historic regimes, tree densities and species compositions have also changed dramatically. The effects of fire exclusion and preferential harvest of early-seral conifers, such as ponderosa pine and western larch, has allowed contiguous acres of stands to develop further along their successional pathways than in the past. This allowed more shade tolerant species such as Douglas-fir and grand fir an advantage. Consequently, disturbance events such as insect outbreaks, tree-killing pathogens, and weather events are expected to continue to change the structure and composition of forest stands in the analysis area in uncharacteristic ways. The number of acres affected by Douglas-fir beetle, root pathogens, western pine beetle, spruce budworm, and dwarf mistletoes is expected increase. The potential for tree mortality attributed to Douglas-fir tussock moth as well as other agents is increasing.

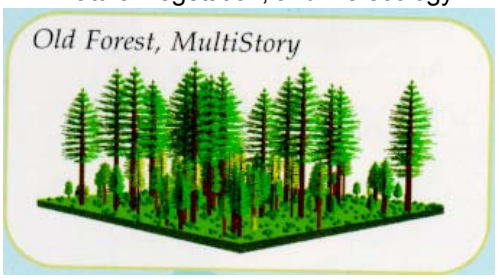
The diversity of native species and their total numbers vary greatly with successional stage. Native wildlife adapted to fire and the resulting range of habitat patterns over the past thousands of years. A long history of ecological studies already indicates the strong association between disturbance processes and species survival. Ecological processes, such as hydrologic and nutrient cycles, also are adapted to disturbance.

Weather conditions, land use and fire prevention and suppression policies coupled with natural succession processes have altered the existing vegetative structure and patterns in ways markedly different for the ranges of reference conditions. Most notably is Biophysical Environment 2 that represents 79 percent of NFS lands.

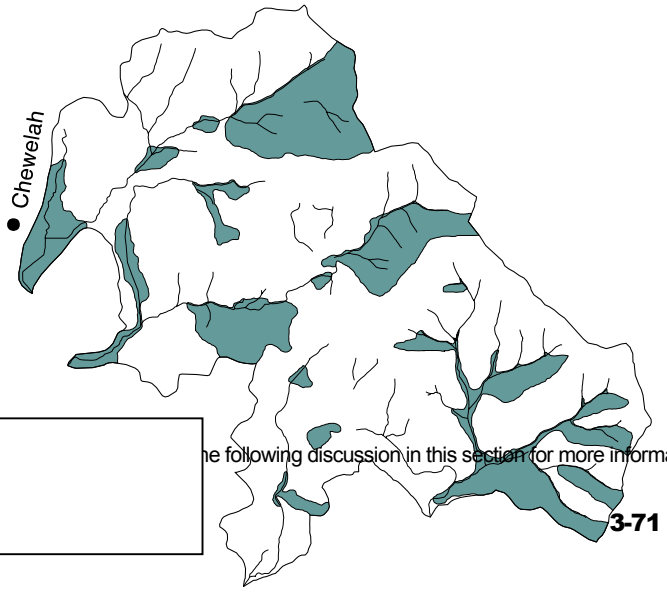
Over much of the upland portions of the analysis area, the current species mix and array of vegetation has created large contiguous plant communities that are susceptible to the current outbreak of Douglas-fir beetle[71] and well as an uncharacteristic crown fire. The Douglas-fir beetle outbreak is reshaping species composition; stand structures, and vegetation patterns. Within the Douglas-fir series, disturbances that reduce soil organic matter and soil wood reduce site capacity to support trees. The potential for extensive and persistent shrub fields may resist reforestation efforts. Shrub fields may be an essential part of the sere functioning to restore organic matter and nutrients before forest restoration. These uncharacteristic changes have the potential to alter the natural disturbance ecology of the analysis area in ways that are so far out of sync with inherent disturbance regimes that we may lack the technological capability to eliminate severe fire effects. Recovery from a fire disturbance that is not inherent to the natural systems could produce habitat patterns and attributes of the landscape that may not be beneficial.

Multi-stratum Habitat with Large Trees

The reference distribution of SS6 across the landscape was dependent on potential natural vegetation, and fire ecology. The amount of SS6 stands in BPE 2 ranged from 5% to 20%; BPE 4 carried 20-30%; BPE 5 carried 30-70%; and BPE 8 carried 10-30%.



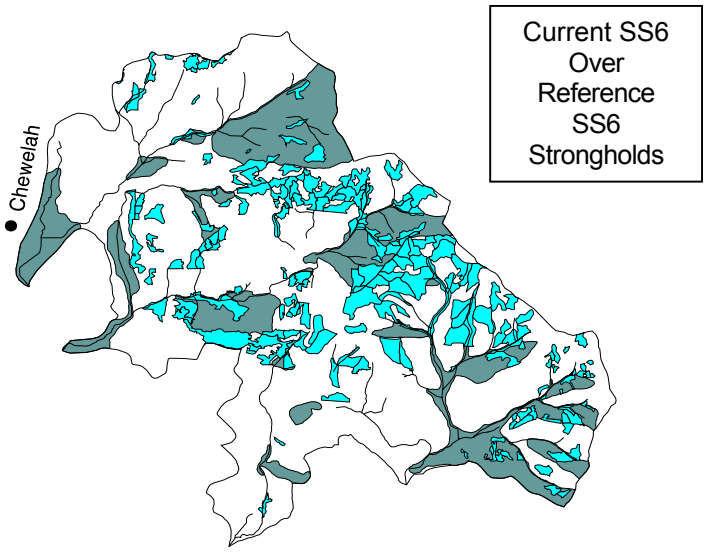
Because all forest structure is dependent on disturbance ecology, the quantity and distribution of SS6 stands varied. Some areas, because of aspect, land form, proximity to riparian areas, elevation, etc. had a higher probability to carry SS6. The “stronghold” or refugia concept (Camp 1995) was used to help identify area where the potential vegetation and forest structure stage 6 would maintain its functions in the face of change or disturbance. Multi-stratum habitat with large trees was not always present in these strongholds, but SS6 habitat was more likely to occur here because these areas were less likely to experience structure changing fire events at longer fire return intervals or site limitations. It is also important to note that these areas are not protected islands but occur as a continuous condition across the landscape. Disturbances across the broader landscape can alter the habitat potential of these areas. A combination of riparian corridors and the background forest matrix provide travel linkages between SS6 patches, with occasional interruptions by early structural patches. Hunter (1991) suggested maintaining historical landscape patterns and the underlying processes under which the regional biota evolved as a “coarse filter” approach to conserving biological diversity.



The current condition vegetation analysis shows

he following discussion in this section for more information.

that reference SS6 *quantities* for all but BPE 5 (7% of the analysis area) are within or above reference ranges. However, the current *location* of SS6 and lack of SS7 serves as the basis for including it as a habitat of concern for the Quartzite Analysis Area. The current Douglas-fir beetle outbreak is also decreasing the number of large diameter Douglas-fir trees on the drier Douglas-fir and grand fir habitat types across the analysis area. Presently, few SS6 stands occur outside of NFS Lands at the lower elevations, and most occur outside areas where there is a higher probability to carry SS6. Some of these SS6 stands in BPE 2 (80% of the analysis area) are located on drier south and west facing sites, where fire historically maintained less dense, more open SS7 stands of ponderosa pine, western larch, and Douglas-fir. Fire suppression and prevention policies and the accumulation of over 60 years of both dead and live fuels in these areas has increased the threat of stand replacing fires over large contiguous areas of the analysis area.



The continuity of riparian travel corridors between the Colville River Valley and existing SS6 stands is compromised by land uses, homes, roads, pastures, and logging. The background forest matrix however, in most riparian areas is intact and linkages between SS6 habitats exist. These diverse SS6 stands offer foraging and/or denning and nesting habitat for pileated woodpecker, pine marten, northern goshawk, lynx and barred owl as well as invertebrates and microorganisms.

Single-stratum Habitat with Large Trees

Single-Stratum Late Structure (SS7) is not found within all biophysical environments. This habitat type is generally limited to drier, moisture - limited sites within BPE 2 and BPE 4. Reference fire regimes included frequent, low intensity fires that favored fire resistant ponderosa pine and western larch and allowed large trees to develop with little competition from below. These conditions were relatively common, especially at lower elevations where summer temperatures are high and precipitation is low; and on south and west facing slopes, where solar radiation dries fuels. Reference condition vegetation analysis shows that SS7 habitat occupied from 30-75% of the analysis area in BPE2.

Current vegetation condition analysis shows that *less than 1%* of the analysis area has single stratum habitat with large trees. Most reference SS7 habitat located outside NFS Lands was removed over the past 100 years because of land use policies, or converted to

other land uses or its commercial value. Most reference SS7 habitat located within NFS Lands has acquired a second or third cohort and as noted in the preceding discussion, has become SS6 habitat. Using the precept that these native species have evolved with reference disturbance regimes and with the SS7 landscape patches that result from them, the decline in habitat infers a corresponding decline in the number of white-headed woodpecker, flammulated owl, mule deer, and other native species dependent on this habitat type. The abundance, distribution, and interrelationships of all structural vegetation stages are important to sustainability, conservation of plant and animal species, and ecosystem processes.

Forest Health Factors

Forest Health is a measurement of the condition of stands or landscapes of trees. Generally, it is defined as a measure of the robustness of forests in terms of their biological diversity, soil, air, and water productivity, disturbance ecology, and capacity to supply a sustainable flow of goods and services for humans.

Stands were evaluated based on forest health parameters. By treating stands to improve the residual stand health; the overall health of the landscape is improved. In the short term (1 to 3 years) some levels of insects and diseases may increase. However, over the long-term, the ecosystem would become less susceptible to insect, disease, and fire damage as stocking levels moved closer to site capacity. As this lessening of susceptibility occurs, the probability of stands reaching late structure in the future *improves*. Forest health improvements include:

Stocking control within the landscape. Stands which have high tree densities tend to encounter many problems including increased susceptibility to insect damage, increased chances that endemic diseases cause tree mortality, less tolerance to drought because of high levels of competition for moisture, poor crown ratios due to crowding, and slow growth and poor vigor due to high competition for nutrients both above and below ground. Stocking control can reduce many of these problems within stands. By managing stand densities at levels that allow for tree growth rates of one inch or greater diameter growth per decade, younger stands can be maintained with the prospect of reaching and maintaining late structure in the future over a series of treatment regimes.

Increasing the percentage of seral species within the landscape. The number and size of seral species trees within the area have declined greatly in the past 60 years or so. Although a wide variety of species can and should be grown in the area, the seral species, particularly western larch and ponderosa pine, are the most resistant to the common pathogens that are present in the region. Seral species can be managed through thinnings to maintain stocking control, and tend to respond to thinnings with increased growth and individual tree vigor.

Decreasing the percentage of shade tolerant species within the landscape. The decline in seral species trees has been accompanied by an increase in more shade-tolerant species, particularly Douglas-fir. Douglas-fir is more susceptible to insects and diseases than western larch or ponderosa pine in this area. Western red cedar and other shade tolerant trees tend to grow in dense understories, competing for nutrients with the larger overstory trees. Cedar, hemlock, true firs, and Engelman spruce tend to respond differently to thinning compared to seral species. These species may sunscald after thinning, or may not respond with increased growth. More shade tolerant species may become established after thinning under the residual

stand, resulting in dense understories. Left unmanaged, stands composed primarily of shade tolerants tend to grow very slowly, and may take decades longer to reach late structure compared to stands composed of seral species.

Removal of diseased and insect-infested trees from the landscape. By removal of selected diseased and insect-infested trees when stands are treated, the overall health of the ecosystem can be improved. Over a series of treatments spanning many decades removal of these trees may have a profound effect upon the overall forest health, and upon the ability of stands to continue growing toward late structure. Currently the Douglas-fir beetle outbreak in the analysis area is causing mortality in many of the larger diameter Douglas-fir trees that serve as a valuable component of the desired late stand structures.

Silvicultural treatments to counter the effects of fire exclusion. Fire suppression and resource management policies have dramatically altered the uplands from stands dominated by a mosaic of stand types with early seral fire-adapted species to a patchwork of homogeneous stands with high densities and a fuel component that promotes high severity fire regimes. Long term silvicultural treatment program is essential to the prevention of the host of undesirable ecological changes that fire exclusion has fostered.

Douglas-fir Beetle

Douglas-fir beetles are a normal component of northeastern Washington ecosystems. At low or endemic levels, the beetle infects scattered trees, including windfalls, and trees injured by fire scorch, defoliation, or root disease; or in a weakened condition due to drought. Where such susceptible trees are abundant, beetle populations can build up rapidly and spread to adjacent green, standing trees. Douglas-fir beetle outbreaks generally start from a single disturbance event.

Susceptibility is greatest in stands having the following characteristics:

- Basal area[72] is greater than 120 square feet per acre
- Douglas-fir comprise up more than 30% of the total trees present
- Douglas-fir trees are more than 14 inches in diameter
- The stand of trees is more than 90 years old

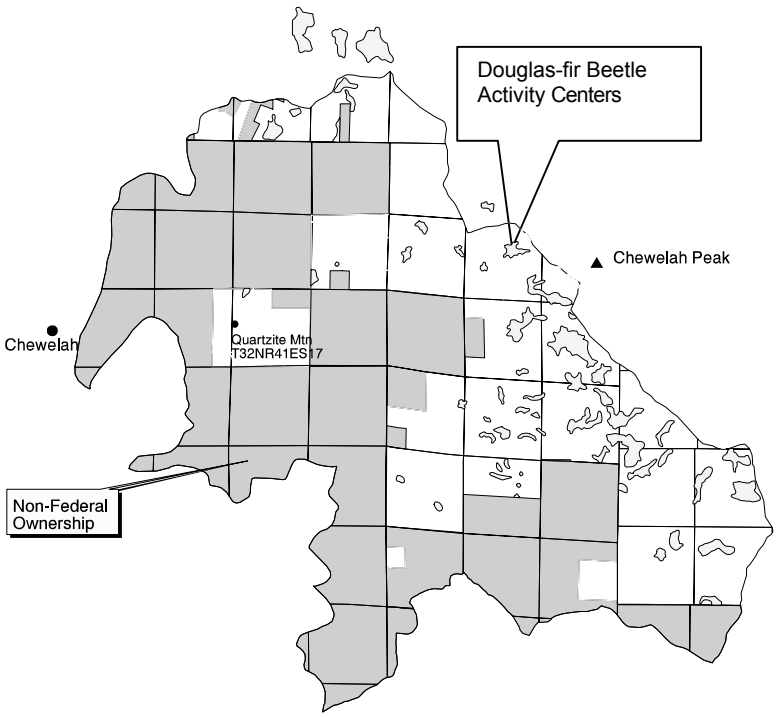
The majority of stands in the dry Douglas-fir or grand fir habitat types within the analysis area have moderate to high susceptibility to Douglas-fir beetle due to the stand characteristics described above. Stand susceptibility is highest on Forest Service lands in the Betts, Woodward, Sherwood, and Thomason subwatersheds. The current outbreak of Douglas-fir beetle in the analysis area is significant and predicted to create additional tree mortality over the next several years until the suitability of food source (Douglas-fir trees available as brood trees) diminishes or weather/disturbance event alters beetle population dynamics. Generally, this would occur when trees less than 9.0 inches in diameter are the only available food source, or when climate or weather influence beetle populations.

[72] Basal area is the area of the cross-section of a tree at a height of 4.5 feet above the ground, generally written as the total of the basal area of the trees in a stand.

Resistance of live trees is the most important natural factor controlling Douglas-fir beetle populations.

Snow, ice, and wind during the winter of 1996-97 damaged trees in Northern Idaho and Eastern Washington, setting the stage for a rise in the number of beetles in the forest. In 1997, Douglas-fir beetles entered storm-damaged (generally down trees) Douglas-fir and produced broods. In 1998, beetles emerged from the storm damaged trees and began attacking live standing Douglas-fir. Historically, in eastern Washington, Douglas-fir beetle outbreaks that begin from a single event such as fire or weather are expected to last approximately four years. Drought, additional wind-thrown trees, or defoliation can prolong outbreaks. Within the Quartzite Analysis area Douglas-fir and grand fir has been replacing western larch, ponderosa pine, and western white pine. Many of the stands in Quartzite are infected with Armillaria root disease, caused by *Armillaria ostoyae*. Douglas-fir trees infected with Armillaria root disease are predisposed to attack by Douglas-fir beetles. Stand hazard and risk to Douglas-fir beetle remains high. The species composition of Douglas-fir in many stands exceeds 50% with stand basal areas greater than 150 square feet per acre. Although Douglas-fir beetles are native to eastern Washington, the current outbreak cannot be construed as entirely natural, due to the significant changes in stand structure, composition, and hazard that have occurred as a result of human actions. Severe overstocking and a shift in tree species composition have created large homogeneous areas within the analysis area predisposing stands to risks of insects and disease.

Douglas-fir beetle mortality is likely to occur in groups of trees being killed; generally 60 to 80 percent of the largest Douglas-fir trees may be killed in a group. Smaller diameter trees are also often attacked when they occur near these groups, especially in denser



stands. Douglas-fir beetle thins from above or “high grades” a stand generally using the largest diameter Douglas-fir for brood trees. This results in regenerating or moving the stand back toward the early structural stages. The Douglas-fir beetle larvae girdle the

phloem tissue. The crowns of trees killed by Douglas-fir typically remain green and begin to fade the following spring. The crowns turn yellow, then reddish-brown and eventually lose their needles.

As the outbreak continues the beetles will travel across the landscape toward the most favorable brood tree habitat. A number of factors influence the course of the Douglas-fir beetle outbreak (stand density, susceptibility of attacked trees, average tree age exceeding 90 years, plant association, etc). Presently, close to 90 percent of the Douglas-fir beetle activity groups in the Quartzite analysis area are found on federally owned lands.

It appears that the outbreak has peaked, but small pockets of new infestations will continue for several years and new areas of dead trees will become evident. The highest concentration of tree mortality is in Betts basin, Woodward and upper Sherwood subwatersheds, the north side of Jay Gould ridge the south side of United Eagle Mountain.

Under each action alternative the silvicultural prescription salvage harvest (HSV) was used to help identify existing treatment groups (greater than 2 acres in size) in which Douglas-fir beetle has led to or contributed to high tree mortality in the stand. Generally, these are stands at least five acres in size where greater than 50% of the stand of trees are dead or dying or are expected to die during the current Douglas-fir beetle outbreak. Harvest involves removing most of the dead trees and some green trees for the purposes of removing brood trees, reducing stocking levels on drier Douglas-fir and drier grand fir habitat types between 40 and 90 square feet basal area or to provide growing space for planted seedlings to become established. Species planted would include western larch, ponderosa pine and western white pine.

It is important to recognize the interplay of ecological systems is complex and dynamic. Therefore, the actual size and site-specific locations of silvicultural treatments *will vary* based on the course of the outbreak and time between implementation of any proposed treatments. Consideration will be given to ensure that both snag and down material levels are met or exceeded. Douglas-fir trees or stand conditions that are promulgating the outbreak, *including dead trees greater than 21.0"diameter breast height may and will likely be designated to harvest* under all action alternatives.

The action alternatives take an adaptive approach by proposing treatments in stands that are at high risk to Douglas-fir beetle if they should become infested, or if infestation levels in these stands increase during this outbreak. Likewise it is important to note that the crowns of trees killed by Douglas-fir beetle start to fade the following spring. It is predicted that a significant number of crowns will turn reddish-brown for at least the next two years. Therefore, the acres that would meet the silvicultural prescription salvage harvest (HSV) will increase proportionate to the timeframe a selected treatment is implemented or forgone. A preventative strategy of reducing stocking is preferred. However, current conditions necessitate action to remove brood trees, reduce live tree stand densities, and fuel biomass to sustain a resilient ecosystem.

Updated mapping of Douglas-fir beetle activity on National Forest System Land shows 55 polygons totaling 821 acres within the Quartzite analysis area.

The estimated volume of merchantable timber on National Forest land within the Quartzite Project Planning Area from the current Douglas-fir beetle outbreak is 6.2 million board feet (6.2 MMBF), or 1.19 million cubic feet (11,900 CCF), using current minimum merchantability standards (7" diameter at breast height (DBH), with the exception of lodgepole pine which is 6" DBH). It is estimated that volume amount will increase an additional 3 to 7 million board feet. The potential for additional volume resulting from the

Douglas-fir beetle outbreak will likely be in excess of 15 million board feet. This would occur both within and outside proposed treatment units.

3.3.2 Forests: Environmental Consequences

Vegetation Management Objectives

To accomplish desired future conditions commercial and non-commercial thinning would reduce stand density and advance regeneration. Regeneration treatments would allow the stands to develop toward late structural stage, and prescribed burning would reduce tree competition and provide opportunities to enhance winter range.

Plant associations and applied silvicultural treatments strongly influence a stand's total productivity potential and the ability to meet multi- resource objectives. Low impact thinning regimes could maintain and improve stand health and vigor. Suppression mortality generally occurs when stocking reaches 65% of the potential basal area a site can support. Existing basal areas in stands within the proposed project area are exceeding or approaching this threshold. Growth rates from stand exams support this trend. Treatments to stands would provide an opportunity to manage species composition and density levels in order to promote vigor and reduce susceptibility to damaging agents and large-scale disturbances. This would be achieved by maintaining 25% to 60% of maximum stand density index, and promoting live crown ratios greater than 30% in trees greater than 5 inches DBH.

In order to facilitate the analysis process, priority to treatment was based on several factors: *Group 1* stands generally exhibit poor vigor and are threatened with significant mortality within the next ten years. This would include insect or pathogens present in the overstory, such as mistletoe or root pathogens, threatening the crop tree understory. Many of these stands lack a healthy seral component that could be retained and treated to promote stand vigor. In many cases a regeneration harvest is preferred but other management objectives may dictate otherwise. The objective of the regeneration prescription is to create an earlier succession state where seral species are more abundant. *Group 2* stands would show an improvement in vigor with treatment. Included in this group are commercial thinnings to prevent stagnation, pre-commercial thinning to prevent stagnation, and final removal of earlier shelterwood with low vigor. Stands projected for regeneration in the near future, with numerous trees nearing merchantable size are included in group 2. These stands could be treated now if stand conditions or resource objectives warrant, but consideration is given to deferring harvest to increase available merchantable volume. *Group 3* include mature stands with reduced growth or mortality. Many of these stands are classified as SS6/SS7, where treatment is deferred. *Group 4* stands are those with an acceptable state of vigor and would not require treatment based on concerns for forest vegetation. These stands are composed of young vigorous trees, or have been harvested within the last fifteen years. Harvesting of these stands may result in benefits to other resources.

There is a direct relationship between stocking level control and stand vigor. Stand vigor could improve after a percent of acres of slow growing or stagnant stands are brought under stocking level control. Through managing stocking levels, some stands would become less susceptible to large scale insect and disease attacks; landscapes could become less homogenous, and the likelihood of uniform fires occurring across broad landscapes could be reduced. These effects should move the landscape toward its

historic range. Treatment should increase the likelihood of moving a percent of the area toward single stratum late and old structural stages.

Analysis

A sustainable landscape is not a static entity but one that changes within particular ranges of disturbance frequency, intensity, and extent. Alternative proposals are analyzed against the objectives of maintaining and improving the distribution and representation of structural stages within the Historic Range of Variability as appropriate to each Biophysical Environment and/or acres that show indications of high risk of insect and disease epidemics as well as the extent in which prescribed fire is used to reduce fuel levels.

Effects of the No Action Alternative (A)

Forests

If the no action alternative is implemented, none of the proposed management activities would occur. Although the words "no action" implies a simple "natural" or passive management approach, due to the existing condition, contemporary ecological theory does not view it as such. Taking "no action" could have significant long-term negative impacts to ecosystem functions and processes in upland forest environments and to the native species that inhabit them. The primary objectives of the proposed treatments are to create a sustainable matrix of stand structures and reduce fuels so that plant communities function more closely to their historic disturbance regimes. Accomplishment of these desired outcomes requires a combination of actions, including commercial timber harvest and other cultural treatments.

Under Alternative A, the landscape and the ecosystems that compose it would continue to "age". The process of forest aging called succession transforms the composition of forested ecosystems as biotic communities respond and modify their environment. Stand vulnerability to disturbance is increasing along with the potential for a stand replacement fires verses a stand-maintaining surface fire that was historically common in interior Douglas-fir and ponderosa pine forests. Successional pathways in many stands have developed further than would have occurred under natural conditions. Dense multi-layered canopies across larger contiguous portions of the landscape have resulted. With these changes has come a propensity to host tree-killing insects and pathogens as well as increasing the probability of an uncharacteristic fire event. Current forest understories have grown dense with fire-susceptible species, and "fuel ladders" from the ground to the tree canopy. Results of analysis show increasing risk of insect/disease, fire, or both across the analysis area in the uplands.

Stands would become increasingly susceptible to tree-killing insects and pathogens particularly mountain pine beetle, Douglas-fir beetle, and root pathogens. Changes in vegetation would continue to be markedly out of sync with sustainable mixes. The aspen component of the landscape would diminish over the next 20 years. In the short term, the landscape vegetation would continue to become increasingly homogeneous. A shift in plant and animal species would correspond to the shift in vegetative habitats. Also, the exclusion of fire supports increased levels of dead trees and down material compared to historic levels.

Alternative A, has the potential to allow further reductions of late and old structural stage stands to levels well below their historical ranges along with reducing vegetative diversity below natural ecological levels. It would result in fragmentation of late and old structural stage stands. Alternative A decreases resiliency and the ability to maintain or enhance these areas.

Most reference SS7 stands located within NFS Lands have acquired a second or third cohort and have become SS6 stands. Using the precept that native species have evolved with reference disturbance regimes and the SS7 stands that result from them, this transition from SS7 to SS6 infers a shift in the native landscape and corresponding biological diversity, raising a concern for the displacement of various plant and animal populations.

Scattered "legacy" ponderosa pine and western larch exit in the analysis area. The ability to maintain these valuable trees is decreasing due ladder fuels, uncharacteristic build up of duff and litter, excessive down material, atypical competition for limited nutrient and water, and the increasing risk of uncharacteristic fire disturbances (stand replacement verses lower intensity or mixed severity fire). As a result the ability to maintain these remnant trees would continue to diminish. The success of fire exclusion on dry sites has resulted in an increase in the nutrient capital by allowing additional organic material to build up on site. While this may be a short-term positive effect it cannot be sustained.

Current forest conditions over much of the area are so far out of sync with inherent disturbance regimes that we may lack the technological capabilities to eliminate severe fire effects. Loss of ecological integrity and resiliency would remain high under the no action alternative.

The vegetative reproduction strategy gives species such as pinegrass, common snowberry and others a competitive advantage over species that rely entirely on seeds. Reduction of soil organic matter and soil wood has the potential to reduce site capacity to support trees on dry Douglas-fir ninebark sites. The potential result of an uncharacteristic fire could be extensive and persistent; shrub fields that are unable to support trees for years could result. Intense fires favor lodgepole pine development.

The delay in active management of NFS lands in the analysis area has allowed for the Douglas-fir beetle outbreak to cause extensive mortality to Douglas-fir trees (estimate 30%). The existing HRV trends show a significant excess of Structural Stages 4 and 5. Mortality in the larger diameter Douglas-fir trees is converting some Structural Stage 6 stands back to Stages 4 and 5 where there are already significant excesses. Analyzed against the objectives of maintaining and improving the representation of structural stages within the Historic Range of Variability as appropriate to Biophysical Setting, this alternative would provide the lowest level of ecological integrity. The vegetative tend is for the majority of the uplands to be a large homogenous block of structural stages 4 and 5 verses the mosaic of structural stages present during historic levels. Existing patch sizes tend toward the lower range of what historically occurred.

Under the Forest Plan, 20 percent (MA7, 2130 acres) of the analysis area is to be managed to achieve the production of timber products combined with 37 percent (MA5, 3975 acres), where scenic and wood products are emphasized. However, there is no timber harvest proposed with *this* alternative, and consequently, no recovery of timber volume. It would be unlikely any planting of seral tree species would occur to provide diversity and help ensure they are retained. Without treatment, species such as aspen, western white pine and western larch would continue to diminish in numbers. In turn, their

absence would allow certain insects and pathogens to play a more decisive role in shaping vegetation patterns on the landscape.

Riparian areas are an important part of a properly functioning ecosystem. They are interspersed with other vegetation types and conditions. Currently, upland riparian areas are in good condition. However, under the no action alternative, because the continuity of fuels across the landscape is found in the canopy and the spread of catastrophic fire tends to be affected more by weather than existing vegetation structure, there is an increased probability of an uncharacteristic high intensity fire being carried through the riparian systems, with detrimental effects. The loss of vegetation cover would alter riparian canopy functions; alter nutrient recycling, and ecological integrity.

Fuels and Fire Behavior

Neither the proposed action nor any action alternative would be implemented. Fuels treatment would not occur.

Continued fire suppression would perpetuate the ingrowth of climax regeneration and shrubs in addition to increasing fuel loading over time. Multi layered stands also create ladder fuels which increases the risk of higher intensity crown fires. These type of fires will cause greater resource change and increase suppression costs, workload and safety concerns over historic disturbances.

Without fire, as fuel biomass and ladder fuels increase, a more uniform stand structure would be created over a landscape where mosaics of fires with varying intensities and effects were once common. The frequency, severity, and size of stand replacing fires may increase.

Effects Common to the Action Alternatives

The objective of silvicultural treatments are to improve ecosystem integrity by moving the vegetation toward the natural range of variation; by developing forest matrix, patches and corridors that are consistent with fire driven landscapes; and by improving the landscape patterns of native species habitats. Silvicultural treatments are designed to restore or maintain vegetation conditions consistent with the natural disturbance ecology. Treatments are designed to accomplish these same goals between action alternatives but vary by the scale and location at which they reduce the percentage of at-risk and/or forested acres outside of HRV.

The Forest's Fuel Inventory

Timber sale and road construction activities would bring an immediate increase to the amount of slash in the planning area. Risk of resource damage due to wildfire occurrence would also be increased until the slash is treated. Slash treatments include underburning, jackpot burning, machine piling at landings, grapple-piling slash in harvest units, or leave tops attached.

Vegetation management projects are designed to mimic natural disturbance regimes by maintaining and enhancing conditions commonly found in low-intensity fire regimes. They also would begin to restore the open park-like stands common to frequent low-severity fire regimes. These stands were composed of seral species such as ponderosa pine and western larch, and occasional large diameter climax species such as Douglas fir and grand fir.

Late Structure –SS6 and SS7

Generally, standards require that coniferous forest stands with 8 trees greater than 21 inches in diameter at breast height, in the overstory be classified as late structure. Detailed information on late structure and biophysical environments can be found in section 3.3.2 of this EIS.

A key finding within the watershed assessment suggests that selected stands of late SS6 in BPE2 need to be moved toward late SS7. It is also acknowledged that a strategy should consider the implications to adjacent vegetation types, vegetation structures, and landscape features. Currently, within portions of the SS6 stronghold areas a moderate to high risk of mortality in larger diameter trees exists due to stand susceptibility to insects and disease pathogens (specifically: Douglas-fir beetle, Douglas-fir Tussock moth, spruce budworm and root pathogens). Timber sale activity is proposed in SS6 stands that are within or above HRV. Treatment goals are to maintain structural stage 6 characteristics and improve the distribution and percentages of SS7 toward historical ranges, and use of prescribed fire to reduce the long-term fire hazard. No SS6 stands were proposed for harvest in Biophysical Environment 5.

Under historic conditions, frequent lower intensity fires maintained late SS7. Use of prescribed fire in those areas adapted to low and moderate fire regimes was considered foremost. Prescribed maintenance fires are proposed across the analysis area where the role of fire could help maintain current desired conditions. Existing fuel loads in these areas are low enough to conduct a burn that reduces these fuels, while maintaining desired vegetation conditions. Within the analysis area approximately 1201 acres are identified where the use of prescribed fire alone could maintain current desired conditions. Alternatives B, C, F, J and K propose maintenance prescribed fire treatment covering 1201 acres while Alternative E proposes this treatment in 743 acres. In areas proposed for commercial treatment followed by post harvest jackpot burning, fuel levels are anticipated to be excessive such that prescribed fire cannot be successfully used until these other treatment activities take place first.

Legacy Trees

Special consideration was given to maintain large diameter “legacy” (relic) tree component that is considered at risk from ladder fuels; uncharacteristic build up of duff and litter surrounding tree boles; excessive down material adjacent to trees; and stocking competition. In general, the removal of all live trees less than 20 inches DBH within one tree length surrounding a “legacy” tree is proposed. Pullback of slash and special considerations in burn plans is proposed.

Riparian, Ecosystem and Wildlife Standards

The Regional Forester’s Amendments assess the consistency of proposed commercial timber sales with ecosystem management principles. Special emphasis is given to maintain wildlife habitat associated with late and old forest structural stages and to protect native fish habitats. Under the wildlife standard the emphasis is to protect large trees, develop and enhance late and old structure (LOS) and protect goshawks. Live trees over 21 inches diameter at breast height (DBH) are to be maintained.

Dead trees greater than or equal to 21 inches diameter may be harvested after other resource considerations are made. This would generally occur where tree mortality is attributed to Douglas-fir beetle or root disease; for removal of brood trees; where dead or

dying trees pose safety risks during logging operations especially in helicopter units; to prepare site for prescribed fire and/or regeneration with seral tree species.

Non-commercial and Post Harvest Treatments

Non-commercial treatments fall into the following categories: prescribed maintenance fire, prescribed restoration fire, prescribed fire non-commercial mechanical thinning treatments, post harvest jackpot burning, post harvest grapple piling and burning and non-commercial mechanical thinning. The majority of the prescribed fire treatments would only be implemented after commercial treatments reduced stocking levels to acceptable levels. Planning and use of an approved burn plan to meet resource objectives has the potential to produce effects similar to those desired by the historic fire intervals. Jackpot burning will be the prescribed fire treatment of choice except in those areas proposed for post harvest piling. Jackpot burning will result in a mosaic of burn patterns across the forest. Burn severity is predicted to be greatest where fuel concentrations are heaviest. This type of burn operation will affect mostly ground cover vegetation (grasses, forbs, and herbs) along with understory conifers and hardwoods. Prescribed fire treatments will be designed to minimize the potential of mortality in larger diameter overstory trees.

Non-commercial thinning is designed to improve the health and vigor or timber stands. It increases resilience, enhances shrub/forb diversity, accelerates development of sapling to pole-sized material, and promotes stand differentiation. By reducing the risk of insect or disease infestations, non-commercial thinning is an effective tool for protecting and enhancing ecosystem health. Stands that differentiate maintain a higher level of growth and vigor along with increased resistance t damaging agents. A vigorous stand also offers the most options for future treatment and the most flexibility for meeting management objectives.

Riparian Treatments

INFISH direction requires no treatment areas; these vary from 50 feet to 300 feet each side of intermittent and perennial streams. This standard directly effects no treatment of 673 acres on National Forest System lands in the analysis area. The wetter vegetation conditions within riparian areas quickly transition to dry upland vegetation conditions. Generally, late structural stage stands found in these narrow upland riparian areas are within reference conditions.

Riparian/wetland management proposals in the Woodward Meadows riparian area include stream channel improvements and planting native riparian plant species. Other proposals would improve road drainage at stream crossings. This proposal has the potential to halt the expansion of Reed canary grass in the meadow and reestablish historic flow patterns, vegetation, and shading to Woodward Meadows.

Construction of riparian improvements will potentially begin to restore vegetation conditions from the altering that occurred during from homesteading and subsequent land use conversions. The existing channel (in the old homesteader's ditch) is currently shaded both topographically and by vegetation. Reestablishment of historic flows will result in more of a shallow, sheet flow across the meadow rather than the current channelized flow in the constructed drainage ditches. This may increase groundwater recharge and subsurface flows. It is important that existing levels of shade be maintained during and after implementation of this proposal.

Wildlife Corridors

The ecosystem standard under the Regional Foresters Amendment calls for protecting connectivity between different wildlife designated habitats and late structure stands by maintaining wildlife travel corridors that are at least 400 feet wide (1/13 mile wide). Silvicultural treatment opportunities are limited by requiring at least 50 percent canopy cover be maintained within the corridors or discouraging management treatment. Mapped wildlife corridors in the Quartzite analysis area directly affect 1132 acres within the Quartzite analysis area.

From a silvicultural perspective, the current goal to increase amounts and connectivity of late structure for the benefit of species associated with late-successional habitat may elevate the risk of insect outbreaks, tree-kill pathogens, and catastrophic wildfires.

Effects of The Proposed Action (B)

Under this alternative vegetation management proposals would begin the process of restoring and maintaining a sustainable matrix of forest vegetation conditions consistent with the disturbance ecology of the area. This alternative focuses on restoring resiliency to the ecosystem. The primary objective is the reduction of fuels so that plant communities function more closely to their pre-settlement disturbance regimes. Alternative B schedules 4264 high-risk acres. Treatments would reduce inter-tree competition, improve stand vigor, and increase stand resilience to insect and disease infestations. This alternative restricts treatment of late stage 6 in critical wildlife habitat, within INFISH no-treatment stream buffers, and as appropriate, by HRV. Accomplishment of these desired outcomes requires a combination of actions to restore and maintain sustainable vegetation patterns across the landscape, which includes active management to reduce stocking levels.

Prescribed maintenance fire would occur outside commercial vegetation management areas to retain current desired conditions. Existing fuel loads in these areas are generally low enough to conduct a burn that reduces these fuels, while maintaining desired vegetation conditions. The effects would be a reduction in the amount of existing fuels, competing and undesired tree regeneration, shrubs and ladder fuels. This would help reduce the risk of an uncharacteristic fire disturbance, maintain larger trees component, reduce the encroachment of shade tolerant tree species, maintain insect and pathogen activity at endemic levels, help maintain ecosystem functions and process that are operating efficiently, and native the species that have evolved on these sites. Direct effects would be prescribed fire 10% of NFS lands. The landscape scale effects would be bound by the extent of proposed treatments to adjacent habitat types, vegetation structures, and landscape features.

Commercial vegetation management is designed to maintain or improve vegetation conditions consistent with disturbance ecology. Generally, existing vegetation conditions (species composition, tree densities, and juxtaposition of stand types) and fuel loading levels are too high to successfully implement maintenance prescribed fire or non-commercial restoration thinning treatments. Commercial timber harvest is used as an “intermediate” step to reduce stocking levels and to begin to modify the effects of 80 years of effective fire exclusion. Treatments would result in short-term increases in fuel loadings from post stand treatment generated slash combined with existing fuel loads. In the short term the stand treatment generated slash would increase the risk of adverse effects if a fire occurred. However, after stand treatment, prescribed fire and grapple piling would be used to reduce post harvest treatment slash for planting and natural regeneration, and to reduce fuel loadings to acceptable levels.

The units proposed for commercial treatment were identified on a landscape basis to move the landscape toward a range of conditions where the normal role of fire can help maintain a sustainable ecosystem. Site-specific conditions, wildlife species needs, and land allocations were important considerations in shaping the proposed treatment units. The negative direct effects of potential silvicultural treatments are minimized by project guidelines and design prescriptions. Soils potentially sensitive to compaction are identified and will follow mitigation measures. Soil mitigation measures include logging on frozen soil, or on snow, or on a required slash depth.

The restoration prescribed fire method would be used to treat natural and harvest generated fuels along with killing small patches of encroaching small trees that create ladder fuels, and to control regeneration of excessive seedlings or shade tolerant tree species. The objective of this treatment is to restore the role of low intensity fire regimes and create open stand structures.

Most non-commercial thinning in existing regeneration harvest units and prescribed fire vegetation management proposals would come after commercial activities. Like the commercial proposals, these activities are designed to restore or maintain vegetation conditions consistent with disturbance ecology.

Restoration non-commercial thinning and other prescribed fire proposals occur in areas where existing fuel loads are outside historic fuel loads. In most instances, they follow commercial vegetation management, and are designed to restore fuel conditions consistent with the fire ecology of the area.

Jackpot burning and underburning prescribed fire are proposed to help reduce fuels so that fire can function more closely to its historic disturbance role and regime. Prescribed fire is intended to reduce natural dead and down fuels, ladder fuels, along with stand treatment generated fuels. Generally, prescribed burning reduces the short-term growth of overstory trees and improves many browse species. Some mortality of the larger diameter tree component could occur, generally this is less than ten percent of trees greater than 19" diameter. Prescribed burn plans are prepared to ensure multiple resource objectives and concerns are addressed.

Alternative B schedules 1416 acres of commercial timber harvest in late multi-stratum structural stage 6 within BPE's 2 and 4 for development of late single-stratum structural stage 7 structural characteristics. This alternative schedules treatment of all the surplus structural stage 6 in BPE 2, and moves the level of SS6 at or near the upper percentage ranges of HRV.

This alternative schedules commercial timber harvest in the surplus of middle structures and would enhance structural characteristics of approximately 2161 acres by reducing stocking levels to site capacity; reducing risk of insects and disease infestations and moving stands toward the desired mix of mid and late structural stages. Under this alternative the 212 acres of surplus early structure is scheduled for commercial timber harvest. Post harvest jackpot burning and underburning prescribed fire treatments are designed to reduce fuel loads and move the landscape toward its ability to support the low intensity fires that characterize warm dry habitat types. Under this alternative the combinations of commercial harvest and prescribed fire treatments would move SS7 within the lower percentage range of its historic level. Treatments would improve tree vigor by reducing stress of overstocked stands that have resulted from suppression of fires that would have thinned seedlings and saplings. Treatments would reduce intertree competition and crown densities, thus reducing the risks of epidemic levels of insect and disease. Fifty three percent or 433 acres of the area affected by Douglas-fir beetle

infestation are included in timber sale units. The alternative would reduce the percent of forested acres outside of HRV and/or risk of insect and disease infestation. Treated acres represents about 40 percent of the NFS land in the analysis area.

The objective of vegetation management is to improve ecosystem integrity by moving the vegetation toward the historic range of variation; by developing forest matrix, patches and corridors that are consistent with fire landscapes; and by improving the landscape patterns of native species habitats.

Treatments would improve the health of late-old stands by removing insect and disease host species, reducing stand density, addressing related soil moisture stress concerns, reducing fuel loadings and maintaining or enhancing structural diversity. The resulting lower tree density would create favorable conditions for growth on remaining trees. Treatments would enhance ponderosa pine and western larch survival in the overstory while encouraging regeneration of these desired species. Planting of these species is also scheduled to promote species diversity and accelerate the desired species mix and structural development. Western larch is near its drought tolerance level on many of the dry Douglas-fir site. Hence, ponderosa pine would be planted on these sites. Natural Douglas-fir regeneration is anticipated. Treatment would remove many of the trees that make up the vegetative ladder fuels, thereby reducing the potential of crown fires. In the short term fire risk would increase as a result of logging slash. Over the long term the landscape would be able to support the natural fire disturbance regime. This alternative would improve vigor by reducing stress of overstocked stands due to suppression of fires that historically would have thinned seedlings and saplings. Treatments would also reduce intertree competition and crown densities, thus reducing risks of epidemic infestations of insects and disease. With these changes would come the reduced risk of insect and disease infestations as well as risks associated with an uncharacteristic high severity fire.

Fuels and Fire Behavior

Vegetation management proposals imitate historical fire patterns. They are designed to restore or maintain vegetation conditions consistent with fire ecology.

Treatment of selected harvest units may help maintain or lower wildfire resource damage to adjacent areas, because fires occurring in treated harvest units generally have a lower intensity and rate of spread than in untreated units

For the proposed action, stand treatment (harvest) and prescribed fire will lower the risk of catastrophic fire in the Quartzite Project Planning Area. It is true that stand treatment will bring an immediate increase in risk from damage to wildfire from slash but the long term effects outweigh the short term risk. The combination of stand treatments, which reduces ladder fuels, and prescribed fire, which reduces stand treatment created slash, ladder fuels and dead-down material, will move the planning area back toward its historic level of fuel loading.

Effects of the Upper Cottonwood Alternative (C)

This alternative was designed in response to public comment requesting that no treatment activities be proposed in Betts basin above Betts Meadow.

A key precept of the ecosystem approach is the need for projects to be implemented on a landscape basis. The overall strategy of the proposals is applied and success measured

on a landscape basis. Constraining management to the area surrounding Betts subwatershed, while not simultaneously addressing the same conditions and concerns in the Betts subwatershed narrows the effectiveness of the ecosystem strategy and proposed treatments. Based on the synthesis of information, ecosystem trends in Betts and Sherwood subwatersheds have departed most from the broad range of conditions that would indicate a resilient ecosystem. The analysis indicates Betts subwatershed as the highest priority watershed to manage. This is an important landscape consideration when comparing effects of the action alternatives and taking steps toward a sustainable environment in which ecological integrity and human needs are concurrently maintained over generations along with other key findings of the watershed analysis.

From the aspect of maintaining and restoring forest vegetation, this alternative is not consistent with applying many of the key findings in the watershed assessment. Under reference conditions a key role of fire was to control ingrowth of trees and maintain SS7 by frequent low intensity fires that killed very few of the large trees. Long-lived seral species such as western larch and ponderosa pine were common. Due to the success of fire suppression, Douglas-fir trees have grown into these stands altering the successional pathway over large contiguous areas of the uplands. The Betts Basin represents 30% of national forest service lands in the analysis area and is the key area identified to restoring late structural stage 7 and the natural role of fire to reestablish the proper functioning of natural ecosystem process and the native species that have evolved in this system.

The pattern and arrangement of structural stages is key to the success of maintaining the resiliency of the ecosystem. In the context of a dynamic ecosystem separating the Betts subwatershed as a “preserve” carries the risks and difficulties maintaining the existing uncharacteristic vegetative conditions on a site where natural biological conditions would create much difference patterns. Considerations need to be made with respect to the increased risks of the effects of an uncharacteristic fire event, loss of remnant trees and large diameter trees, the diminished ability to maintain late structure and old growth, detrimental effects to soils and well as riparian aquatic and plant communities and native wildlife species. Reflection needs to be made regarding our ability and the inherent difficulties in “preserving” dry habitat sites, where human intervention through suppression of fire, has contributed to conditions that are out of sync with historic disturbances processes. The majority of the current outbreak of Douglas-fir beetle in the analysis area occurs within the Betts subwatershed. Douglas-fir beetle reduces stand density by thinning from above removing the larger diameter Douglas-fir stand component. This alternative proposes to treat 87 acres of the 325 acres of Douglas-fir beetle outbreak. It is anticipated that the Douglas-fir beetle outbreak will increase before it begins to subside. This current beetle outbreak is part of a series of symptoms of a landscape replacing the natural role of natural process that balance stocking levels. At risk are the large diameter and remnant trees that provide important structural characteristic to landscape resiliency. At endemic levels native insects and pathogens play a key role in maintaining proper functioning ecosystems. However, what has changed in this analysis area is the continuity of one part of the landscape vegetation mosaic. Directly linked to vegetation patterns are the uncharacteristic fire patterns that may result for large homogeneous mosaics of vegetation conditions that would promote crown fires. It is important to recognize that what has changed from pre-settlement conditions and continues to change is the context and intensity of natural disturbances and their effects. Without active management it is anticipated that we will lose the late SS7 component that exists while increasing the homogenization of uplands toward an unsustainable mix with 70 percent of the acres in middle and late structural stage 6. The potential for extensive and persistent shrub fields that may resist reforestation efforts would increase.

Alternative C schedules 840 acres of 1181 surplus acres of late structural stage 6 within BPE 2 and 4. Late structural stage 6 would continue to be in excess of historic conditions within BPE 2 and 4. Percentages of late structural stage 7 would remain below the historic range. Treatments are scheduled on 1769 acres of middle structure deferring treatment in 457 surplus acres of SS4/SS5. Prescribed maintenance and restoration fire treatments would be similar to Alternative B. Mechanical treatment non-commercial treatment would not occur but acres are so small effects would be the same as Alternative B. Harvesting and prescribed fire treatments in the dry site structural stage 6 stands will move stands toward late structural stage 7 characteristics by removing much of the ingrowth of Douglas-fir and understory trees that are creating a fuel ladder. This will create open stands of ponderosa pine and Douglas-fir similar to historic conditions. Twenty three percent or 193 acres of the area affected by Douglas-fir beetle infestation are included in timber sale units.

Fuels and Fire Behavior

Vegetation management proposals imitate historical fire patterns. They are designed to restore or maintain vegetation conditions consistent with fire ecology.

Timber harvest and prescribed fire will lower the risk of catastrophic fire in the Quartzite Project Planning Area. However, the area excluded above Betts Basin would make this alternative less effective in bringing the analysis area back to historic condition than the proposed alternative. It is true that stand treatment will bring an immediate increase in risk from damage to wildfire from slash but the long-term effects outweigh the short-term risk. The combination of stand treatments, which reduces ladder fuels, and prescribed fire, which reduces stand treatment created slash, ladder fuels and dead-down material, will move the planning area back toward its historic level of fuel loading.

Effects of The Wildland Alternative (E)

This alternative would implement the Proposed Action in all areas except the 4801-acre unroaded area (as defined by the Quartzite Ecosystem Analysis).

Harvesting and prescribed fire treatments in the dry site structural stage 6 are designed to enhance late structural stage 7 characteristics. Proposed treatments will remove much of the ingrowth of Douglas-fir and understory trees that are creating a fuel ladder. This will create open stands of ponderosa pine and Douglas-fir similar to historic conditions. Alternatives E and J schedules 316 acres (26 percent) of excess late structural stage 6 within BPE 2 and 4 to late structural stage 7. Late structural stage 6 would continue to be in excess of historic conditions by 865 acres within BPE 2 and 4. Structural Stage 7 would remain below its historic range.

These alternatives will also enhance characteristics of approximately 912 acres of SS5, to reduce stocking levels to site capacity and move stands toward late structural stages. Treatment of these stands would be accomplished by selective harvest and underburning. This treatment will likely increase the acreage of future dry site late structural stage and old growth. Fifteen percent or 127 acres of the area affected by Douglas-fir beetle infestation are included in timber sale units.

Fuels and Fire Behavior

Timber harvest and prescribed fire will lower the risk of catastrophic fire in the Quartzite Project Planning Area in very specific areas. This alternative does a less effective job,

over the whole landscape, of returning the area to a historic condition than the proposed action. It would move the planning area back toward its historic level of fuel loading in a smaller capacity than the proposed action.

Effects of The Vegetation Alternative (F)

This alternative will implement the Proposed Action plus additional commercial harvest areas where insects, pathogens, storm damage and overstocking occur. Unlike the Proposed Action, it would *not* close the two segments of existing open road. This alternative was developed similarly to Alternative B, but Alternative F takes a more aggressive approach to address forest health concerns.

Harvesting and prescribed fire treatments in the dry site structural stage 6 stands to restore late structural stage 7 characteristics will remove much of the ingrowth of Douglas-fir and understory trees that are creating a fuel ladder. This will create open stands of ponderosa pine and Douglas-fir similar to historic conditions. Alternative F schedules to move 1931 acres of late structural stage 6 within BPE 2 and 4 to late structural stage 7. Late structural stage 6 and 7 would move to within of historic conditions within BPE 2 and 4. Under this alternative the combinations of commercial harvest and prescribed fire treatments would move SS7 within the lower percentage range of its historic level. Seventy two percent or 589 acres of the area affected by Douglas-fir beetle infestation are included in timber sale units.

This alternative will also enhance characteristics of approximately 2348 acres of SS5, to reduce stocking levels to site capacity and move stands toward late structural stages. Treatment of these stands would be accomplished by selective harvest and underburning. These treatments will likely increase the acreage of future dry site late structural stage and old growth.

Fuels and Fire Behavior

The combination of stand treatments, which reduces ladder fuels, and prescribed fire, which reduces stand treatment created slash, ladder fuels and dead-down material, will contribute in bringing the planning area back to its historic level of fuel loading. This alternative is as effective in moving the project area back toward a historic condition as the proposed action.

Effects of The Wildland Prescribed Fire Alternative (J)

This alternative would implement the Wildland Alternative E plus any maintenance fire areas within the unroaded area.

Alternative J differs from Alternative E in that it identifies 458 acres of prescribed maintenance fire within what is labeled the “unroaded” area. The effects would be similar to Alternative E. Fifteen percent or 127 acres of the area affected by Douglas-fir beetle infestation are included in timber sale units. The prescribed maintenance fire would occur in a mix of structural stages, SS2, SS5, SS6, and non-forested areas. Some benefits could be gained by stimulated browse for wildlife. However, the overall effects are limited by the lack of treatments proposed in the adjacent stands. The fire treatments would increase the risk of fire damage to adjacent structural stage 6 stands.

Fuels and Fire Behavior

This alternative does a less effective job, over the whole landscape, of returning the area to a historic condition than the proposed action. It would move the planning area back toward its historic levels of fuel loading in a smaller capacity than the proposed action.

Effects of The Existing Road Alternative (K)

This alternative would implement the Proposed Action minus any commercial harvest areas and associated restoration fire areas determined to be infeasible from existing roads.

Harvesting and prescribed fire treatments in the dry site structural stage 6 stands are designed to move stand toward late structural stage 7 characteristics. Treatments would remove much of the ingrowth of Douglas-fir and understory trees that are creating a fuel ladder. This will create open stands of ponderosa pine and Douglas-fir similar to historic conditions. Alternative K proposes to move 1233 acres of late structural stage 6 within BPE 2 and 4 to late structural stage 7. Late structural stage 6 would be within historic conditions within BPE 2 and 4. Forty percent or 392 acres of the area affected by Douglas-fir beetle infestation are included in timber sale units. Under this alternative the combinations of commercial harvest and prescribed fire treatments would move SS7 within the lower percentage range of its historic level.

This alternative will also enhance characteristics of approximately 1712 acres of SS5, to reduce stocking levels to site capacity and move stands toward late structural stages. Treatment of these stands would be accomplished by selective harvest and underburning. This treatment will likely increase the acreage of future dry site late structural stage and old growth.

Fuels and Fire Behavior

Timber harvest and prescribed fire would lower the risk of catastrophic fire in the Quartzite Project Planning Area. It is true that stand treatment will bring an immediate increase in risk from damage to wildfire from slash but the long-term effects outweigh the short-term risk. The combination of stand treatments, which reduces ladder fuels, and prescribed fire, which reduces stand treatment created slash, ladder fuels and dead-down material, will contribute in bringing the planning area back to its historic level of fuel loading. It will also move the planning area back toward its historic condition.

Comparison of Action Alternatives

The key issues that developed the action alternatives are road management, Betts Basin, and forest health. The key driver between all action alternatives is to minimize new road construction while ensuring ecological integrity (near-reference levels of productivity, biodiversity, water, and soil characteristics) and ecosystem resilience (the ability of an ecological system to maintain its functions and processes in the face of disturbance). The historic range of variability is used as a baseline to rate each alternative for ecological integrity. Analysis shows current forest conditions notably out of balance with historic conditions. The analysis area setting shows a patch-corridor-matrix of forest structural stages where patch definition has decreased with a corresponding increase in matrix uniformity. Most notably within the uplands of Betts, Sherwood, and Woodward subwatersheds where the current forest matrix reflects a trend away from the early to mid successional stages associated with reference disturbances, toward mid and late seral

stages. Patch size may exceed historic ranges if an uncharacteristic high intensity fire were to occur. A key precept of the ecosystem approach is the *need for projects to be implemented and success measured on a landscape basis*.

Distribution of Forest Vegetation Structural Types

Each action alternative proposes silvicultural treatment opportunities designed to improve or maintain ecosystem integrity. Analysis shows that there is currently an excess of 3,409 acres of structural stages 4, 5, and 6, compared to historic conditions. This represents 37% of the 9,158 acres of forested NFS lands within the analysis area. Indicative of a system out of sync is the fact 7,217 acres are at a moderate to high risk of insect and disease infestations.

Under Alternative A, no treatment opportunities would be prescribed for the Quartzite Project Planning Area. This strategy allows the processes in place to drive landscape changes. Direct effects of implementation of this alternative would include no treatments to any of the 7, 217 acres of stands that meet criteria for improvement under the Desired Future Condition. There would be a decrease in late structural stage 6 and an increase in the continuity of middle structures landscape patterns increasing the potential for uncharacteristic disturbance events and decreasing landscape resiliency. In Alternative B implementation of silvicultural treatments would occur on 42 percent of the project planning area to promote forest health and vigor, maintain and/or move landscape patterns toward historical conditions. In Alternative C schedules silvicultural treatment opportunities in 29 percent of the project planning area. All areas are the same as identified in Alternative B with the exception that passive management would occur in the Betts Basin subwatershed (3420 acres which represents 30% of the NFS land in the analysis area). Alternatives E and J schedule silvicultural treatment opportunities in 18 percent of the project planning area. A passive management strategy would occur in 52% of the project area. Alternative F is similar to Alternative B but differs in that it proposes additional acres of treatments to address forest health concerns. Alternative F schedules silvicultural treatment opportunities in 52 percent of the project planning area. Proposed treatments in Alternative F would provide the greatest degree of forest health. Alternative K proposes less commercial vegetation treatments in Betts Basin and increases acres of helicopter logging. Alternative K schedules silvicultural treatment opportunities in 37 percent of the project planning area. Compared to Alternatives B and F, Alternative K proposed fewer acres of stand treatments in Betts Basin where the highest concentrations of Douglas-fir beetle activity and associated tree mortality occur. However, it proposes more than Alternatives A, C, E, and J.

Fuels and Fire Behavior

The following table estimates the existing natural fuels for all units. It also estimates created activity fuels for all units receiving stand treatments. Fuel consumption for jackpot burning, grapple pile burning and landing pile burning are also estimated. Estimates for consumption on natural and activity fuels are based on size class. Sixty-five percent of 0 to 3 inch fuels will be consumed and less than 10 percent of the 3-inch plus material will be consumed.

	No Act	Alt B	Alt C	Alt E	Alt F	Alt J	Alt K
Natural Fuels	75,703	75,703	47,178	28,257	91,893	33,362	62,945
Activity Fuels	0	45,459	31,378	19,205	53,492	19,205	39,568
Total Tons	**75,703**	**121,162**	**78,556**	**47,462**	**145,385**	**52567**	**102,513**
Tons Consumed	0	33,774	25,930	17,539	43,541	17,397	32,914

	No Act	Alt B	Alt C	Alt E	Alt F	Alt J	Alt K
Jackpot and grapple piling							
Tons Consumed Landing piles	0	1557	1107	702	1971	702	1314
Total Consumption	**0**	**35,331**	**27,037**	**18,241**	**45,512**	**18,099**	**34,228**

All alternatives show an increase in fuel loading from stand treatment. A certain amount of residue needs to be left on site to benefit multiple resources such as soils, hydrology, wildlife and long-term nutrient recycling. The size class that will remain on site will be the 3-inch and larger material. It is anticipated that less than 10 percent of these fuels will be consumed during jackpot burning. These larger fuels will not be continuous and do not significantly affect fire spread. For fuels reduction activities the 0 to 1 inch materials are specifically targeted. These fuels significantly contribute to fire spread. The reduction of the 0 to 1-inch fuels will break up the continuity stopping or slowing rate of spread and reducing flame lengths.

Commercial stand treatments, non-commercial thinning and prescribed fire underburning or jackpot burning will be the main tools used to treat stands. The purpose of the stand treatments will be to begin the process of restoring open, parklike stand structure that is less susceptible to catastrophic wildfire. This desired condition resembles fire-maintained stands that existed prior to the era of fire suppression. Currently these stands are in a condition to accept prescribed fire and commercial stand treatments as an initial management strategy. It is not expected that this initial treatment will move the analysis area to the desired future condition, but that it will move it closer. It will take subsequent treatments to get the analysis area to the desired future condition.

Alternative F will help move the project area closest to the desired condition. It treats the broadest area while reducing ladder fuels, naturally occurring fuel loadings and activity created fuel loadings. This alternative treats insect, disease and storm damage areas, which contribute to stand replacing wildfires. This alternative will leave adequate large material on site for other resource benefits.

Alternative B will also move the project area closer to the desired condition, but not as much as F. It does not treat the disease, insect and storm damage areas but it does treat a broader area of the analysis area than the rest of the alternatives.

Alternative K uses only existing roads, no management activities would occur unless it was feasible from existing roads. This alternative will be effective in moving the analysis area closer to the desired future condition but not as effectively as B and F because it leaves out some key areas of stand treatments.

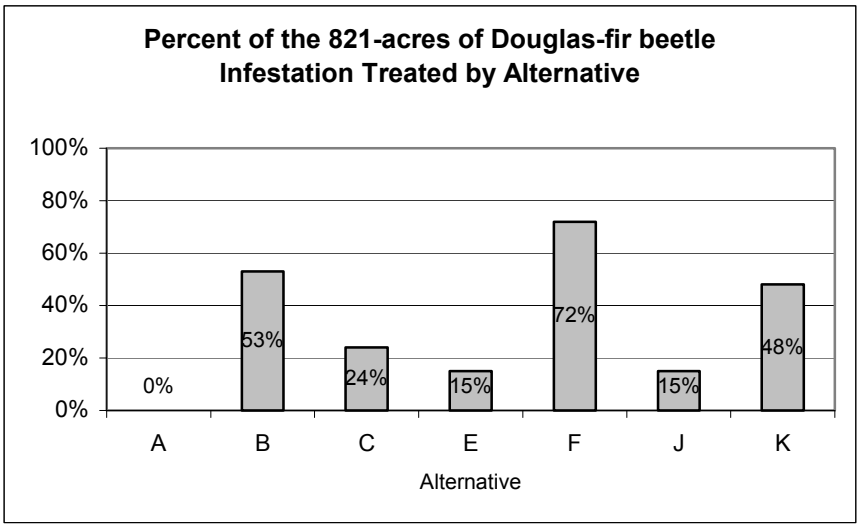
Alternatives C, E and J will meet the desired condition in specific regions of the project area, but leave out some key strategic places: the unroaded area and Betts basin. These areas are key to reducing wildfire risk to the project area as a whole.

Douglas-fir Beetle Infestation

As the outbreak continues the beetles will travel across the landscape toward the most favorable brood tree habitat. A number of factors influence the course of the Douglas-fir beetle outbreak. Consequently, the size and exact locations of beetle activity will vary, based on these factors (stand density, susceptibility of attacked trees, average tree age exceeding 90 years, plant association, etc). Presently, close to 90 percent of the Douglas-fir beetle activity groups in the Quartzite analysis area are found on federally owned lands. On private lands within the analysis area, 7 groups totaling 47 acres were found. It is

predicted that the outbreak will continue with the area affected with new areas of Douglas-fir beetle induced tree mortality. It is likely that additional fading of crowns will occur on the south side of United Eagle Mountain, the north side of Jay Gould ridge, and increase in size and locations in Betts and Woodward subwatersheds.

Under each action alternative, the silvicultural prescription salvage harvest (HSV) was used to help identify existing treatment groups (greater than 2 acres in size) in which Douglas-fir beetle has led to or contributed to high tree mortality in the stand. Generally, these are stands at least five acres in size where greater than 50% of the stand of trees are dead or dying or are expected to die during the current Douglas-fir beetle outbreak. Harvest involves removing most of the dead trees and some brood trees. Most of the areas would be planted with ponderosa pine with some western white pine and western larch. Residual dead as well as live trees would be irregularly spaced to provide wildlife habitat needs, maintain visual quality, woody debris for long-term site productivity, and shade for planted trees or a seed source for natural regeneration. The intent of actively treating the outbreak is to reverse trends concerning long term forest health problems, which focus around forest composition and stand density. It is important to recognize the interplay of ecological systems is complex and dynamic. Therefore, the actual size and site-specific locations of proposed treatments would vary based on the course of the outbreak and time between implementation of treatment. Consideration will be given to ensure that both snag and down material levels are met or exceeded. Douglas-fir trees or stand conditions that are promulgating the outbreak, including dead trees greater than 21.0”diameter, may be designated to harvest.



It is important to understand that the action alternatives take a more adaptive approach by proposing treatments in stands that are at high risk to Douglas-fir beetle if they should become infested, or if infestation levels in these stands increase during this outbreak.

Cumulative Effects of Alternative Implementation

Fire exclusion across much of the Quartzite Analysis area has fostered a host of undesirable ecological changes, most notably the potential for an exponential increase in the size and intensity of wildfire. Without treatment of landscape structure and fuel conditions, the probability of returning to the succession/disturbance regimes that existed historically will be difficult to achieve or unattainable. See Appendix C of this EIS for the list of past, present and reasonably foreseeable actions that contribute to the cumulative effects on vegetation.

Cumulative effects under Alternative A would include the continued state of susceptibility of many stands to Douglas-fir beetle, spruce budworm or western pine beetle damage and diseases such as root rots and dwarf mistletoe. Failure to treat stands under one of the action alternatives would have the cumulative effect of increased risk of forest health problems across the uplands and in adjacent untreated stands. Because the duration or severity of an insect outbreak cannot be predicted, it is impossible to predict all of the cumulative effects that could accompany an insect outbreak. A Douglas-fir tussock moth outbreak could more easily move through the area into other watersheds or into private land in the future under Alternative A, than if stands were treated under the action alternatives. Alternative A's reliance on "natural" disturbances within the context of current fire suppression policies may have a greater short term effect of lengthening the time required prior to achieving ecological sustainability. Under the existing stand densities and structures, this would also hold true if a wildfire was not suppressed through initial attack.

From a stand structure perspective, the deficits in existing late structural stage 7 would continue, with a conversion of many of late structural stage 6 converted to middle and early structure. As suitable upland conditions decreased, insects would move to suitable riparian areas causing an increase in tree mortality. Over time, growth rates would decline in some stands where treatment would have prevented stagnation. Implementation of Alternative A increases the risk of damage to stand structure from pathogens such as Douglas-fir beetles, which tend to attack the larger trees in stands. The cumulative effect is a risk of loss of late structure both in stands which would have been treated under action alternatives as well as surrounding stands in the landscape. Middle structural stands could also be so damaged as to lessen the likelihood of those stands reaching late structure. Although the proposed treatments under the action alternatives cover up to 30 percent of the entire acreage within the analysis area, implementation of Alternative A may have much broader cumulative effects and consequences to surrounding stands.

Cumulative effects under Alternatives B, C, E, F, J and K would result in less severe effects from an insect outbreak and existing diseases such as dwarf mistletoe and *Armillaria* compared to implementation of Alternative A. This is due to treatment of stands, which would lessen the risk of pathogens spreading to other stands in the same area, and possibly other watersheds under severe conditions. By lessening the risk of pathogens being spread to adjacent stands, the risk of damage to structural integrity of those adjacent stands is also reduced. The action alternatives all would result in increased amounts of woody material upon the landscape, to be greatly mitigated by post-sale fuels treatments. Because an amount of freshly created slash will exist on most units after harvest, there is an increased short-term risk of wildfire should a lightning strike or man-caused incident occur in the immediate vicinity of harvesting. This will be particularly true in the interim between harvest and post-sale fuels treatments. Prescribed fire is likely to increase the risk of bark beetles and root disease in the short-term (one to three years). In the long term, tree mortality from prescribed fire and associated insects would work together to reduce stand densities and the risk of bark beetle outbreak for 15 to 25 years. The reduced density of conifers extends the opportunity for seedling ingrowth and herb/shrub component enhancements, which increases structural complexity and species diversity. Complexity and diversity are important in maintaining long-term site productivity. The silvicultural treatments would tend to reduce stand density to a prescribed level on a somewhat consistent basis across treatment areas. Prescribed fire would tend to reduce stand densities on a more random basis.

The proposed treatments in Alternative F would provide the greatest degree of vegetation sustainability. Followed by Alternatives B, K, C, J, and E. Alternatives E and J would result in half the amount of treatment extended by alternatives F, B, and K. Although alternatives B and F have a similar amount of the total treatment acres affecting tree

density, Alternative F would provide the most beneficial mix of treatments to address the Douglas-fir beetle outbreak and the host undesirable ecological changes fire exclusion has fostered.

Alternatives E and J do not consider timber harvest within a 4801-acre block of land (45% of the project planning area). This excludes 1861 acres of MA5, 902 acres of MA6, 1392 acres of MA7, and 638 acres of MA8, which emphasize specific resources through management prescriptions. Under the existing vegetative conditions the goals of these prescriptions would be compromised by not considering active management. Timber harvest from the analysis area is considered a component of the allowable sale quantity of the Colville NF LRMP. Thus, there would be a cumulative effect to other national forest lands to compensate for the reduced sale quantities.

Stand structures have been, and will continue to be, affected by the Douglas-fir beetle-caused mortality. Since the beetle targets Douglas-fir trees in the largest size classes, the effect has been to kill the large trees that define LOS stands, returning the stands to structural stages 4 and 5 and 1. This is resulting in changes to stand structure to a younger age class or a more open canopy. In most stands where over 50 percent of the basal area is killed by Douglas-fir beetles, the dominant species following the beetle infestation is likely to be grand fir. In the absence of further disturbance these stands are likely to regenerate to Douglas-fir and grand fir so there would be no long-term shift in species composition. In those stands in which ponderosa pine or western larch are an important component, there could be an improvement in stand conditions over the short term as competition between Douglas-fir and these species is reduced. However, few stands in the project area have large concentrations of healthy western larch and ponderosa pine. In the absence of further disturbance, regeneration of shrubs or shade tolerant Douglas-fir and grand fir is likely to proliferate. This, in conjunction with high fuel accumulations would result as dead Douglas-fir fall to the ground, could lead to higher severity fires that under normally fire-resistant pine and larch may not survive. Alternatives F, followed by B then K would best address the Douglas-fir beetle outbreak.

The effects of Douglas-fir beetle mortality on other ownership within the analysis area are difficult to ascertain due to the lack of detailed information on current conditions and how private land owners will treat beetle killed trees. In general, non-industrial forest owners and industrial forest owners have aggressively harvested dead and dying trees. Although it is impossible to predict exactly what will happen on private lands, it's is likely that the inherent disturbance regimes and ranges of variability in vegetation will not return on the landscape level. At the same time, it is not biologically possible for National Forest System Lands to carry all the late structure desired.

The long term application of the silvicultural treatments prescribed in Alternatives F, B, and K should lead to achieving vegetation sustainability as addressed in the Colville National Forest LRMP, as amended. Alternative A's reliance on "natural" disturbances may also lead to sustainability, although the effects of the ongoing insect and disease outbreaks and the magnitude of fire may have greater short term effects, lengthening the time required prior to achieving sustainability. In Alternative A the desired landscape character, as well as the historic ranges of variability would be set back much further in the successional process.

Timber Land Suitability

The Timber Land Suitability Map utilized by the Colville National Forest during the land management planning process identified areas to be unsuitable in the project planning

area. Using field reconnaissance, aerial photo interpretation and the Timber Land Suitability Map, 1494 acres, or approximately 14% of the planning area, was currently identified as unsuitable for timber production.

The Code of Federal Regulations 36 (219.14) states that "lands which are not suited for timber production shall be identified in accordance with the criteria in paragraphs (a) (1) through (4) of this section shall be identified as not suited for timber production:"

- The land is not forest land as defined in CFR 219.3.
- Technology is not available to ensure timber production from land without irreversible resource damage to soils productivity, or watershed conditions.
- There is not reasonable assurance that such lands can be adequately restocked as provided in CFR 219.27(c)(3).
- An Act of Congress, the Secretary of Agriculture or the Chief of the Forest Service has withdrawn the land from timber production.

None of the action alternatives propose harvest on any of the acres identified as unsuitable for timber production. In addition, these acres will be noted on the Forest Geographic Information System control map, to update the Forest suitability inventory.

National Forest Management Act

Culmination of Mean Annual Increment

Stands selected for even-aged regeneration harvesting have reached 95 percent of mean annual increment (MAI).

Ability to Restock

All stands treated will have the ability to be restocked within five years. A combination of natural and artificial regeneration is scheduled. A primary objective of the artificial reforestation is to plant western larch and rust resistant western white pine to maintain the role of these species in the landscape.

Even-Age Unit Sizes and Adjacency

The proposed alternatives meet the National Forest Management Act restrictions for adjacent created openings.

3.3.4 Sensitive Plants: Affected Environment

The Colville National Forest has 45 sensitive species[73] that are either documented or are suspected to occur on the Forest. Twenty-eight of these could occur on the Three Rivers Ranger District and potential habitat for 26 of these is included within the Quartzite project area.

[73] The most recent list of sensitive species was issued by the Regional Forester in May of 1999.

Section 7 of the Endangered Species Act of 1973 requires federal agencies to "ensure" that actions authorized, funded, or carried out by them are not likely to jeopardize the continued existence of Threatened or Endangered species or result in the destruction or adverse modification of their critical habitats. In addition, the Forest Service has established direction to ensure that species considered "sensitive" do not become threatened or endangered. The Forest Service has established direction for Threatened, Endangered, and Sensitive (TE&S) species and habitat management, which identifies the process, objectives, and standards for conducting a "Biological Evaluation" (BE). The four-step process for conducting the Biological Evaluation follows:

1) Prefield Review of existing information

2) Field Reconnaissance of the project area

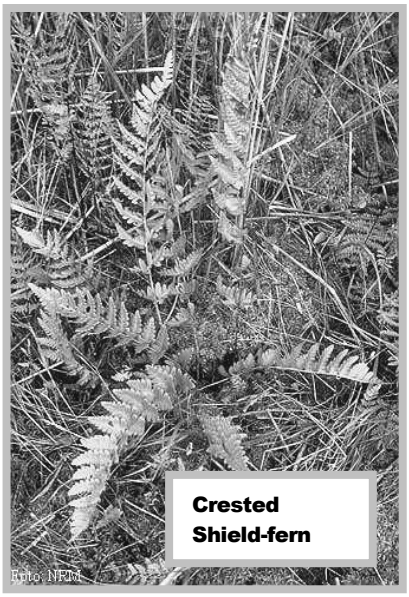
3) A Risk Assessment if species or habitat is present

4) A Biological Investigation may be required if insufficient data exist to complete step 3.

After completing any one of the first two steps, a determination may be made that a project will have no effect on a TE&S species or its habitat. The following discussion documents the review and findings completed for the proposed activities. For detailed analysis and risk assessment documentation, see the Biological Evaluation located in the analysis file.

Step one, the Prefield Review identified 26 sensitive plant species and related habitats that may be found within the project area. Step two, Field Reconnaissance, uses intuitive-controlled surveys to detect sensitive species during their blooming periods or other conspicuous times. Surveyors first visit areas where potential habitat occurs. Then, a more complete examination concentrates on areas where proposed ground-disturbing activities could affect plants or potential habitat.

The 26 sensitive plants that are suspected to occur within the Quartzite project area are located within three specialized habitats: forested riparian habitat; wetlands/wet or dry meadows/pond habitats; and open forest and rocky outcrop habitat.



Forested Riparian Habitat

The species included in this habitat group favor the multi-stratum forest stands of large diameter western red cedar that are commonly found near streams. This habitat occurs primarily along Cottonwood, Sherwood, Thomason Creeks, and their tributaries. Currently, there are roughly 200 acres of this habitat type located on National Forest System Lands.

Suspected sensitive species in this habitat include: Botrychium crenulatum (dainty moonwort), Botrychium lineare (slender moonwort), Cypripedium parviflorum (yellow lady's slipper), Lycopodium dendroideum (treelike clubmoss) and Sanicula marilandica (black snakeroot).

Step two of the Biological Evaluation, *Field Reconnaissance of the project area,* discovered no sensitive species in this habitat group.

Wetlands/Wet or Dry Meadows/Pond Habitat

This habitat is primarily located in Woodward Meadow and isolated small wetlands scattered throughout the Quartzite project area. Other habitat includes private lands in the Colville Valley and Betts Meadow.

These sensitive species include: Antennaria parvifolia (Nuttall's pussy-toes), Botrychium ascendens (upswept moonwort), Botrychium hesperium (western moonwort), Botrychium paradoxum (paradox moonwort), Botrychium pedunculosum (stalked moonwort), Carex comosa (bristly sedge), Carex flava (yellow sedge), Carex foenea (bronze sedge), Carex rostrata (beaked sedge), Cicuta bulbifera (bulb-bearing water hemlock), Dryopteris cristata (crested shield-fern), Eriophorum viridicarinatum (green-keeled cottongrass), Geum rivale (purple or water avens), Ophioglossum pusillum (northern Adder's-tongue), Salix candida (hoary willow), Salix maccalliana (MacCall's willow), Sisyrinchium septentrionale (blue-eyed grass) and Teucrium canadense ssp. viscidum (wood sage).

Step two of the Biological Evaluation, revealed a population of Dryopteris cristata (crested shield-fern), in a forested swamp adjacent to a protected wildlife area on National Forest System Lands. No other species in the habitat group were detected.

Open Forest and Rocky Outcrop Habitat

This habitat occurs primarily in the Quartzite Mountain and Eagle Mountain areas, on Jay Gould Ridge and on rock outcroppings scattered throughout the project area.

Suspected sensitive species include: Cryptogramma stelleri (Steller's rock brake) and Physaria didymocarpa (common twinpod).

Step two of the Biological Evaluation, detected neither of the two species included in this habitat group.

3.3.5 Sensitive Plants: Environmental Consequences

The *No Action* Alternative (A) retains all habitat and sensitive plant populations in current conditions. None of the action alternatives directly impact sensitive plants, but they all have varying effects on potential habitat, some beneficial and some detrimental.

Alternatives that reduce the threat of severe wildfire benefit *Forested Riparian Habitat* and *Wetlands/Wet of Dry Meadows/Pond Habitat*. Historically, frequent low intensity fire kept upland fuels low and consequently the risk of fire encroaching into wet habitats was low. As fuels in neighboring upland areas have increased over the decades, so has the threat of fire to these wetter habitats. The action alternatives use thinning, commercial thinning and prescribed fire to move vegetative conditions toward historic conditions in upland areas. Those that affect more acres, reduce the threat of fire in wet sensitive plant habitat more than those that affect fewer acres.

Detrimental effects to sensitive plant habitat accompany road construction because roads have historically served as vectors for noxious weeds. Mitigation for noxious weeds is expected to be very effective[74]. However, the potential still exists for some weeds to

[74] See the Noxious Weed and Competing Vegetation Mitigation listed in Chapter Two of this EIS.

occupy sensitive plant habitat, and displace native sensitive plants. All but one of the action alternatives propose new road construction. Intuitively, the more roads an alternative constructs, the higher the potential that weeds could invade sensitive plant habitat.

Forested Riparian Habitat

Step two of the Biological Evaluation, *Field Reconnaissance of the project area,* discovered no species in this habitat group. Considering these findings, the Likelihood of Adverse Effects is "None" (0), and a risk assessment is not necessary. "No impact" to these sensitive plants is anticipated, and the proposed activities are not likely to lead to loss of viability or cause a trend towards federal listing.

Wetlands/Wet or Dry Meadows/Pond Habitat

Step two of the Biological Evaluation, revealed a population of Dryopteris cristata (crested shield-fern), in a forested swamp adjacent to a protected wildlife area on National Forest System Lands. No harvest or management is proposed by any action alternative in this area. Therefore, the Consequence of Adverse Effects is rated as "Moderate" (5) because of possible effects to habitat. The Likelihood of Adverse Effects is "Low" (1). The resulting Risk Assessment value is 5. Considering these findings, the proposed activities "may affect individual plants, but are not likely to cause a trend to federal listing or loss of viability" to the population of Dryopteris cristata.

No other species in the habitat group were detected. Considering these findings, the Likelihood of Adverse Effects is "None" (0), and a risk assessment is not necessary. "No impact" to these sensitive plants is anticipated, and the proposed activities are not likely to lead to loss of viability or cause a trend towards federal listing.

Open Forest and Rocky Outcrop Habitat

Step two of the Biological Evaluation, detected neither of the two species included in this habitat group. Considering these findings, the Likelihood of Adverse Effects is "None" (0), and a risk assessment is not necessary. "No impact" to these sensitive plants is anticipated, and the proposed activities are not likely to lead to loss of viability or cause a trend towards federal listing.

Sensitive Plants: Cumulative Effects/Conclusions

Like other situations in the analysis area, the current condition of sensitive plants is the result of fire suppression. Habitat for species that evolved with frequent fire has diminished. Sensitive plants that occupied open stands of Ponderosa pine have declined. Habitat conditions for sensitive plants that evolved in riparian and wetland areas remain static.

The Colville National Forest Land and Resource Plan reduces cumulative effects to sensitive plants across watershed boundaries. Since 1991, a 250-foot no-harvest buffer has been applied to sensitive plant populations found on the Three Rivers Ranger District. Other protection for species associated with riparian, wetland and upland habitat is provided by ecosystem and fish habitat amendments to the Colville National Forest Land and Resource Management Plan. These Forest-wide protections, coupled with project specific mitigation serve to limit the cumulative effects ground disturbing activities have on sensitive plants and their potential habitat.

Overall, the proposed activities "may affect individual plants, but not likely to cause a trend to federal listing or loss of viability" to any sensitive plant populations within or near the project area. The Dryopteris cristata population found in the Quartzite project area will maintain its present population level and viability.

3.3.6 Competing and Unwanted Vegetation: Affected Environment

"Native species are often valued more highly than exotic species because they represent the unique biological heritage of a region. Often, native species have co-evolved or developed close mutualistic relationships with one another, so that the loss of one may result in the loss of other species dependent on it.

Exotic species are generally considered to be a problem: when they interfere with human activities; when they change ecosystem function in negative ways; and when they cause the extinction or reduce the abundance of valued native species.

For ecosystem management purposes, dealing with exotics according to their relative threat or value, and striving to maintain or restore the native species of the area, is a more rational approach than trying to achieve a certain number of species or to eliminate all non-native species."[75]

Noxious Weeds

A weed is a plant growing where it is not desired; or any plant that is a nuisance, a hazard, or causes injury to humans, animals, or desired plants. Noxious weeds are defined by law as being non-native, undesirable, or difficult to control. They are species that have been introduced into North America from European, Asian, and Mediterranean countries. These species have little or no natural competition or controlling agents on this continent and are often considered weeds in their native environments because of their invading, pioneering, or aggressive characteristics.

Reference conditions for noxious weeds are easily described: Noxious weeds did not occupy the Quartzite Analysis Area until the in-migration of Europeans and others. The current condition however, is the result of a century of activity in the analysis area. Many species arrived on the North American continent with settlement by Europeans. Mode of arrival included contaminated grain and seed, ship ballast, livestock hay or feed, and sheep wool, attached or not. Some weeds arrived intentionally for ornamental or landscaping uses. These introduced species then invaded the continent in a "reverse watershed" pattern, generally following the waterways from the coast to the headwaters, following settlement patterns. Improved methods of travel, including the railroads and steamboats, promoted this spread.

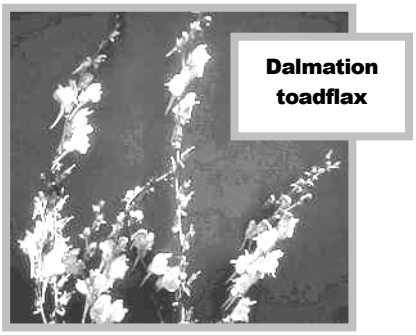
Orange Hawkweed

In addition to the natural movement of seed and plant material by wind and animals, there are many other mechanisms for movement. These include trapping, homesteading haying of meadows, road and trail construction, mining, gravel pits, timber harvest and regeneration, prescribed and other man-caused fires, fire protection, a variety of recreation activities, livestock grazing, pasture improvement, and soil cultivation.

[75] Excerpted from "Ecological Stewardship: A common reference for ecosystem Management," 1999 Elsvier Science Ltd.

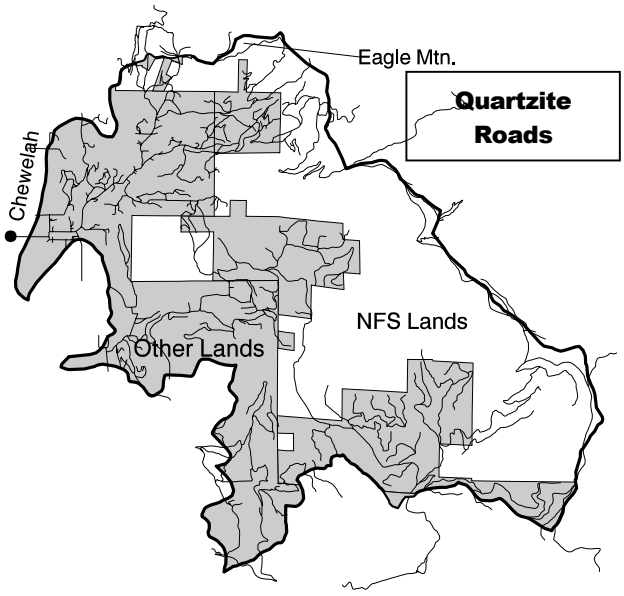
Areas with soil disturbance or vegetation loss are the most susceptible to noxious weeds and repeated soil disturbance or loss increases susceptibility. Changes in vegetation type or site health also makes sites more susceptible to noxious weeds. Most noxious weed species prefer open, hot, dry, or well-drained sites, however, there are noxious weed species within the analysis area that are adapted to moist sites. Cool-mesic and closed canopy sites are most resilient to noxious weeds. Sites with an open canopy and either hot to dry or very moist conditions are most susceptible.

The equipment, animals and humans that expose bare soil and thus create habitat for noxious weeds are also vectors for noxious weeds. Vehicles and equipment move seed, including those not directly involved in soil disturbances or loses of vegetation. Seed is carried by snagging vegetation with seed heads or in dirt found on the frame, undercarriage, grill, or internally on vehicles and equipment. This may happen with non-motorized as well as motorized vehicles and equipment used on or off designated roads. Hay and feedstuffs used for livestock may contain noxious weed seed. Livestock that have been on infested pasture or have eaten contaminated hay or feed stuffs within a few days before entering or moving within the analysis area may pass seed through their manure. Humans may carry barbed seeds in their gear, clothing, or shoes. Recreationists import seeds on tents, ATV's, and other equipment from other areas. The use of seed that is not free of noxious weed seed for construction or restoration projects are another contributor to the introduction of noxious weed seed, as is the dumping of refuse or yard trash.



Dalmation toadflax

Almost all human activities have concentrated along the transportation systems (roads and trails), meadows, and creeks within the watershed. Many of the current transportation routes lie along the same routes, as did historical ways, trails, and roads. In recent decades, expansion of these routes and additions of new routes have occurred. It is not a coincidence that noxious weeds have expanded the same way.



Noxious weed surveys on both NFS Lands and other lands in the Quartzite Analysis Area identified diffuse and spotted knapweed, yellow hawkweed, dalmatian toadflax, oxeye daisy, goatweed, hound's tongue, tansy ragwort, bull and Canada thistle, common tansy, mullein, orange hawkweed, and reed canary grass.

Noxious weed infestations of knapweeds and goatweed are degrading the vegetation and soil condition in lower elevations along travel corridors and up on the slopes of Eagle Mountain in and around past mining activity. This degradation comes from competition to other more desirable vegetation. Knapweed has in many places nearly excluded other vegetation. Because of the large interspaces between knapweed

plants, these sites have a large amount of bare soil that is susceptible to erosion and nutrient leeching. In places, this erosion is contributing to the sediment in streams.

Reed canary grass infestations in Betts and Woodward Meadows are well established and continue to displace native wetland species.

Prior to the 1984 the Colville National Forest applied herbicide to some noxious weed infestations along roads within the Quartzite Project Area. Since then, the Forest has not used herbicides to control weeds within the project area. However, Stevens County has applied herbicide along County Road 2888, where it crosses NFS land at least two times since 1999.

The damage threshold for a given noxious weed occurs at the point when the noxious weed is out-competing desirable vegetation on a given site. It is also the point when a significant amount of wildlife forage is being lost. Damage thresholds are being exceeded within the Quartzite Project Area for diffuse knapweed, especially in the openings on the dry, south facing slopes of Jay Gould Ridge and Quartzite Mountain. Yellow hawkweed is pushing the threshold in Woodward Meadow.

Site Preparation and Vegetation Management

Site Analysis

The following situations describe the nature and role of competing and unwanted vegetation in the project area.

A. Slash that would be at an acceptable level for stand management needs after treatment. The residual fuel loadings would be commensurate with stand regeneration, fire protection, and long-term site productivity needs. Under the screens down logs greater than or equal to 12 inches dbh should be left at an average of 20 pieces per acre in mixed conifer stands.

B. Slash that would be at an unacceptable level from the standpoint of Fire prevention following harvesting. An unacceptable level is generally defined as 25 tons per acre of residual slash, with a significant component in fine fuels (less than 3" in diameter). Reduction of this fuel load would be accomplished by: cut-to-length harvest systems, whole tree yarding, post harvest treatments (grapple piling) and by prescribed fire (grapple pile/burn, jackpot burn).

C. Acceptable levels of slash from the standpoint of fire prevention, but at an unacceptable level for stand regeneration. In this situation, Knutson-Vanderberg (KV) funds would be used to pay for both mechanical and prescribed fuel treatments to accomplish regeneration objectives.

Items A and B fall outside the scope of the Final Environmental Impact Statement for Managing Competing and Unwanted Vegetation (VEG FEIS), USDA- Forest Service, Pacific Northwest Region 1988, and the accompanying Mediated Agreement, 1989. Item C falls within the scope of the VEG FEIS and is the subject of this analysis.

The Need for Vegetation Management

As stated above, logging slash, together with woody material on the site prior to harvesting, is predicted to create unacceptable fuel loading for the establishment of

regeneration in specific units within the analysis area. A threshold level of slash has been established at 25 tons per acre, with a significant component in fuels less than 3 inches in diameter. For the purposes of this analysis this level serves as a threshold for action. Fuel loadings below this level would not be considered prohibitive to successful seedling regeneration.

In planting of seedlings, predicted slash loading in excess of the threshold level would cause a reduced number of planting spots. This would reduce the number of planted seedlings to the point that stocking certification at the third year after planting would be unlikely.

In the case of natural regeneration, slash loadings in excess of the threshold level would constitute prohibitive ground cover. The potential for seedling establishment would be greatly reduced due to a lack of open patches of bare ground. Those seeds reaching mineral soil would receive severely reduced sunlight and precipitation, thus inhibiting germination and establishment. Predicted fuel loadings are anticipated to be in excess of the threshold level on portions of these units and would be jackpot burned or grapple piled.

Some areas may have a layer of established shrubs and/or grasses (particularly pine grass) on the floor of the stand that is inhibiting the establishment of conifer seedlings. In some cases, harvesting of timber alone would cause some established plants to flourish. When this condition is evident, measures would be taken to ensure establishment of natural regeneration, or aid in site preparation for planting. Stand underburning (or jackpot burning) would be one treatment that has produced good results in site preparation over the short term. This is particularly applicable when there is no established desirable regeneration that could be damaged by fire. Natural debris under some stands may be so light that the additional slash caused by harvesting may be necessary just to carry an underburn through the area. Within a few years of underburning, many shrub and grass plants will recover and/or other plants will inhabit the site. Thus underburning may be desirable where a short term "window" for seedling establishment is needed.

Mechanical means may be employed to scarify the site, particularly when very little ground disturbance is expected from harvesting. Some species, such as western larch, require mineral soil and open crown conditions in order to regenerate. Mechanical means, such as grapple piling or a scarifying may be used to obtain adequate soil disturbance without compacting or damaging the ground such as can be done in machine (tractor) slash piling. Hand slashing and/or piling may also be used in critical situations when mechanical or fire methods are not feasible; however this is very expensive, which limits the use of this method over large areas. Where access or topography limits use of mechanical methods, fire may best meet the needs for site preparation. Some stands may have a combination of residual slash and shrub/grass competition problems.

Selection of Vegetation Management Strategy

Prevention

Logging slash from timber harvests could create a problem for seedling regeneration or artificial planting. Prevention of this condition could be accomplished by either of the following: no harvesting of timber (no action Alternative A), or modifying the harvest prescriptions or logging methods to decrease the amount of logging slash to an acceptable level.

The selection of Alternative A (No Action) would negate the concern for short-term increased fuel loadings resulting from harvesting. However suppression mortality would continue to occur and would naturally increase fuel loadings.

Prescriptions within the action alternatives have been proposed to best meet the identified issues along with standards and guidelines of the Colville National Forest's Land and Resource Management Plan (LRMP), as amended, and Regional Forester's Amendments 1 and 2.

Early Treatment

Logging slash would be a problem from the moment of its creation in harvesting. Early treatment, i.e., initiation of action to control unwanted vegetation (slash) before the damage threshold is reached, could be accomplished only by whole tree removal harvesting. Whole tree yarding could be used to reduce residual slash loading on all units where it is feasible. Under certain harvesting methods (helicopter, skyline logging with limited landing space) whole tree yarding would not be feasible. Despite this treatment, however, the residual fuels in some stands are predicted to exceed the damage threshold from the standpoint of stand regeneration needs. This early treatment, however, does mitigate the effects of proposed treatments by lessening the amount of slash that needs to be treated by other methods (mechanical or burning). In certain cases, it may be possible to whole tree yard, but the additional slash loading may be needed to create enough heat during prescribed burning to kill undesirable shrubs or grasses.

Maintenance

Maintenance strategy would support the current conditions. No maintenance strategy exits that would reduce or keep predicted fuel levels below the threshold level.

Correction

Correction is action taken after the damage threshold has been exceeded. Proposed treatments include grapple piling and jackpot burning and judicious use of prescribed fire to break down concentrations of slash and open patches of mineral soil as an aid to attaining natural regeneration. If logging occurs, grapple piling and jackpot burning is proposed in each action alternative.

No Action

A "No Action" strategy would result if Alternative A were selected. Use of a no-action vegetation management strategy under any of the action alternatives could result in creation of openings that would not be fully stocked with seedlings due to site occupancy by slash. Under this scenario, full stocking could be delayed by twenty years or longer in these areas. Natural creation of openings would be extremely difficult to stock with desired seedlings within a three-year period to meet reforestation requirements. Brush species would likely become established, delaying adequate stocking. Alder, ninebark, along with a number of rhizomatous species are well established in portions of the analysis area. In portions of the watershed the composition of the natural regeneration would be predominantly Douglas-fir, grand fir, and lodgepole pine. Artificial planting of western larch, ponderosa pine and rust resistant western white pine would provide opportunities to enhance and maintain these valuable seral species. Douglas-fir beetle outbreak will continue to effect vegetation structures, functions and patterns in ways that are uncharacteristic of the natural disturbance ecology of the area.

Project Design

The proposed early treatment or correction strategies, included with the action alternatives, appear to be the best feasible ways to deal effectively with residual slash or established shrubs and grass. Information was gathered by formal stand examinations and on-site inspections. The predicted additional slash loadings were calculated based on the live tree volume and harvest prescriptions of proposed units. Herbicide use is not proposed for any site preparation treatment.

Prescriptions within the action alternatives have been proposed to best meet identified issues and the standards and guidelines of the LRMP. The act of implementing these prescriptions would cause slash to be created. In certain units, this would set up a situation that would fall within the scope of the VEG FEIS, where the opportunity for prevention would be foregone. In other units, an inhibiting grass/shrub condition already exists. Alternative B has 77 units that fall within the scope of the VEG FEIS; Alternative C, 56 units; Alternative E and J, 41 units; Alternative F, 83 units; and Alternative K 72 units.

3.3.7 Competing and Unwanted Vegetation: Environmental Consequences

Noxious Weeds

The noxious weed management strategy for the Quartzite Project uses the *Environmental Assessment for Integrated Weed Treatment*[76], and the *Colville National Forest Weed Prevention Guidelines* in its design and is consistent with this direction.

The noxious weed management strategy included with the action alternatives focuses on the prevention of noxious weeds by using weed-prevention tactics and mitigation for all ground disturbing activities. These are designed to keep noxious weed seed from entering the area; to reduce soil disturbance; and to revegetate disturbed sites. The Quartzite noxious weed management strategy also prescribes early treatment of existing noxious weed populations by various methods. Other early treatment methods and long-term management of noxious weeds is covered in the *Environmental Assessment for Integrated Weed Treatment.*

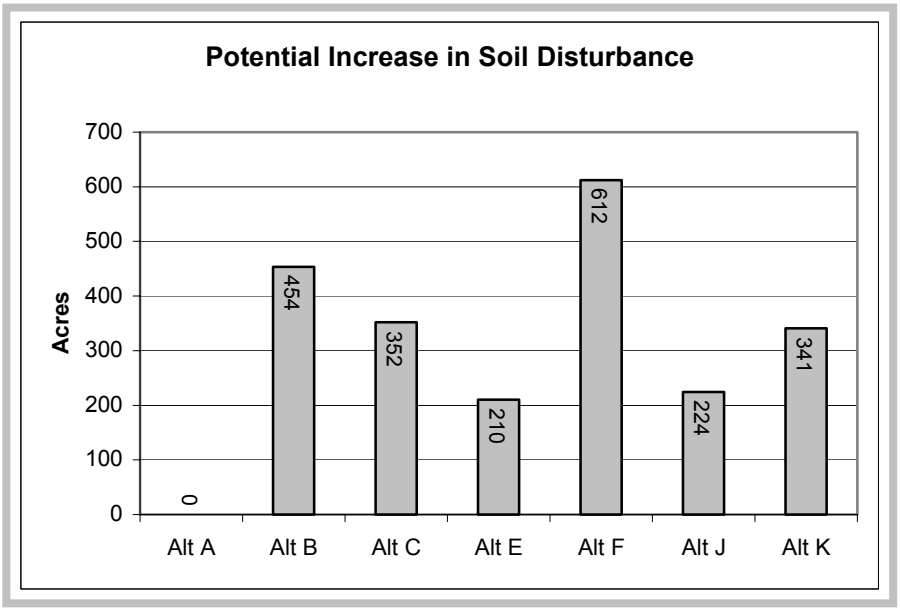
Natural controls influence the consideration of noxious weed management strategies. An existing, dense forest canopy on undisturbed sites provides a natural shade deterrent to noxious weed invasion. Open canopies provide less of a shade deterrent. As open sites grow and close in, more shade will be provided in these areas, forcing such common noxious weeds as bull thistle and mullein out. Where weed-free, competitive understory exists, and especially where it receives light disruption, vigorous re-growth of shrubs and grasses will also deter noxious weed invasion. Of the four biophysical environments, the warm dry PSME-ABGR/shrub will be most susceptible to invasion by noxious weeds.

Alternative effects vary. Areas undisturbed by proposed harvest or restoration activities will continue along current successional lines. Harvest and restoration units will recover along various successional lines depending on the plant associations involved and

[76] The Forest Supervisor signed the decision notice for the Forest-wide "Integrated Noxious Weed Treatment" in 1998.

prescribed silviculture, fire, or vegetation management treatment. During the first 20 to 30 years after harvest or restoration activity, transitory range for wildlife may be provided. Areas affected by proposed activities that result in less than a 50 percent tree or shrub cover will be susceptible to invasion of unwanted vegetation such as noxious weeds.

With establishment of desirable vegetation on disturbed sites and other prevention measures[77], the spread of noxious weeds will not occur or will be minimal. This will contribute to a healthy, stable ecosystem with reduced sedimentation and sufficient forage for wildlife. The early treatment of newly invading species is expected to reduce the risk of noxious weed spread, to reduce the threat to wildlife forage, and to reduce the visual and physical impacts.



The Vegetation Alternative (F) has the greatest potential for noxious weed invasion because of the amount of overall harvest and prescribed fire combined with the amount of new roads. The No Action Alternative (A) has the least potential for noxious weed invasion because of no new roads, harvest, or prescribed fire.

Site Preparation and Vegetation Management

Anticipated Resource Output

The anticipated result of proposed vegetation management would be acceptably stocked stands in regeneration units within five years after harvest without slash to hinder growth. Site preparation and artificial planting should reduce the potential of establishment of competing vegetation. Seeding of any new roads, landings, skid trails, and existing roads where soil disturbance occurs should be seeded to stabilize soils and reduce the potential for unwanted vegetation. Proposed action alternatives should reduce concerns regarding competing conifer seedlings.

[77] See the noxious weed mitigation in Chapter Two of this EIS.

Potential Risk to Human Health

Alternative A

The "No Action" Alternative would not implement timber harvest activities. No vegetation management would occur.

Alternatives B, C, E, F, J and K

All action alternatives would have similar effects on a per acre basis. Most of these alternatives would employ both early treatment and correction strategy to meet site preparation needs. The overall differences between alternatives could be viewed from a cumulative standpoint, i.e. total treatment acres.

Yarding trees with tops attached would accomplish mechanical treatments. This is a common type of treatment used in logging operations. Limbs and the top would be lopped at the landing site rather than in the units. The same e risks to human health exist in terms of use of a chainsaw for limbing regardless of the whether it takes place at the landing or in the woods. There are slightly higher risks to human health in skidding trees with tops attached, in that the dragging of tops creates a wider path. This could knock down more vegetation, including small trees, in the skidding process. Extra care by operators is usually required when skidding tops attached to trees. Again, this is a widely used requirement with which most loggers are familiar. Other mechanical treatments would be for site preparation and include the use of chainsaws, and/or a grapple-piler. Workers using this equipment are generally skilled in the use of this equipment, however there is the chance of accidents happening. While there are dangers to individuals employed in this line of work, there are no dangers to the human environment from this activity.

Underburning would be another treatment used to treat stands after harvest. Forest workers participating in the proposed burning would set fire to residual slash in the units with the objective of burning the slash and some of the residual vegetation on the site so as to create opportunities for natural regeneration or the planting of seedlings. Workers would be most at risk from inhalation of smoke, burns caused by flame or hot debris, and/or miscellaneous injury associated with hand or power tools in fire management. These risks are analyzed in workers' job hazard analysis, position descriptions, and the USDA-Forest Service Health and Safety Code Handbook. Employees participating in this type of project work are trained in all aspects of safety concerning burning operations. Underburning and jackpot burning prescriptions tend to entail cooler fires, and are concerned with saving numerous residual trees on the site while reducing the slash loading. It is possible that some ash from the burning could be washed into nearby streams, although burning would not be permitted in riparian areas. The amount of ash that would actually reach flowing water is predicted to be very small, and would be easily dissolved by the flowing water or deposited as part of normal siltation, much as would be the case during any rainfall or snowmelt event.

The risk to human health under the action alternatives would not be significant due to:

- The short-term duration of possible impacts,
- The type of operations being conducted by trained workers,
- The total predicted amount of harmful residues (smoke, ash) to reach and affect humans;

- The limited scope of the proposed treatments within the watershed.

Risk of Environmental Damage

Potential risk of environmental damage from prescribed fire has been described and documented in Chapter IV of the Colville National Forest Final Environmental Impact Statement (FEIS) for the Land and Resource Management Plan. Potential effects have also been disclosed in Chapter IV of the VEG FEIS. Specific impacts to other resources are addressed in relevant sections of this EIS.

In general, the predicted environmental impacts from the proposed vegetation management activities would be low.

Conclusions

The competing vegetation strategies designed for the Quartzite Project, comply with the provisions set out in the document entitled "Exhibit A to Mediated Agreement", Supplement to the Final EIS for Managing Competing and Unwanted Vegetation. The noxious weed management strategy for the Quartzite Project uses the *Colville National Forest Weed Prevention Guidelines* and the *Colville National Forest Weed Prevention Guidelines* in its design and is consistent with this direction. By using these strategies, noxious weed rate of spread is not expected to increase, nor is the threat of competing vegetation. Damage thresholds would not be exceeded.

3.3.8 Wildlife and Habitat: Affected Environment

TABLE 4.4

HABITAT CAPABILITY OBJECTIVES

Species or Group	Habitat Capability Objective
Deer	120% of 1980 level
Elk	118% *
Forest Grouse	100% *
Waterfowl	110% *
Beaver	105% *
Snag Dependent	60% of population potential throughout lands from which timber is harvested; 100% of potential on other Forest lands (see Desired Future Condition, this chapter).
Old-Growth Species	Sufficient suitable habitat to insure viability of all species dependent on these habitats and to maintain a diversity of climax ecosystems across the Forest. 73 pairs of barred owls (1st decade)
Trout	Maintain or improve habitat. Emphasize native species.
Caribou	30 animals.
Grizzly Bear	12 animals.
Bald Eagle	4 potential nesting territories.
Pileated Woodpecker, Marten, Northern Three-toed Woodpecker	As described under Forestwide Standards and Guidelines in this Chapter.
Large Raptors and Great-blue Heron	Protect existing nesting habitat and maintain at least 75% of the 1980 habitat capability.
Northern Bog Lemming	100% of the 1980 level.

An ecosystem is an area where species interact with the physical environment, and a community is the assemblage of interacting species in an ecosystem. A precept of ecosystem analysis is that native species have evolved with reference disturbance regimes and the landscape patterns of habitats resulting from those regimes. Native species diversity and associated ecosystem functions and processes therefore are inextricably linked to the spatial patterns of patches, corridors and matrix across the landscape.

The Quartzite Analysis Area has a variety of wildlife habitat types, ranging from high ridges to dense forests to cleared agricultural lands. The ridges and riparian vegetation serve as travel corridors for many species. The Colville River valley connects the area with the Columbia River valley, and provides access to the area for many birds and other species. Fields and logging areas create patches in the background forest matrix and roads interrupt many riparian corridors. Road density across the Quartzite Analysis Area averages 3.84 miles per square mile. The road density on National Forest System Lands is 2.01 m/m^2. An isolated block of unroaded upland forest

habitat, 4,801 acres in size is located on National Forest System Lands on the east side of the area.

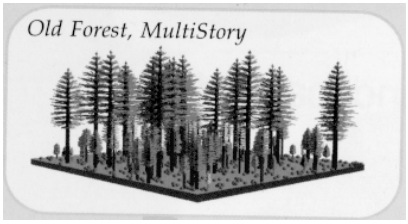
Forest Plan Management Indicator Species

The Colville National Forest Land and Resource Management Plan, as amended, has identified 14 management indicator species or groups of specie to represent the wildlife found on the Colville National Forest (p. 4-38 through 4-43). The rationale and purpose for the selection of management indicator species is detailed in Appendix F of the Final Environmental Impact Statement (FEIS) for the Land and Resource Management Plan and summarized in Table 4.3, p. 4-11 of the Forest Plan. Habitat capability objectives listed in the Forest Plan, Table 4.4, p. 4-13 and are based on 1980 population estimates. Management Requirements to maintain viable populations can be found in Appendices H, I and K of the FEIS. Forest Plan Standards and Guidelines are designed to provide direction to meet these objectives. Additional recommendations are included when this direction does not provide adequate consideration. Habitat for all but one of the 14 Forest Plan Management Indicator Species occurs within the analysis area. Effects to Northern Bog Lemming will not be considered because habitat is absent.

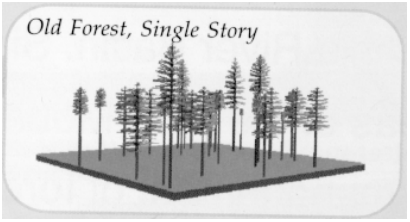
Because the National Forest is responsible for habitat management versus managing wildlife populations, habitat capable of supporting the desired populations is adopted as the objective for each indicator species. The effects of activities associated with the alternatives on these management indicator species habitats is the focus of the project wildlife analysis, documented below.

Old Growth Dependent Species

The FEIS for the Colville National Forest selected three species to represent old growth dependent species. These are barred owl, pileated woodpecker and pine marten. With the objective of developing and maintaining habitat for old-growth forest dependent species, the Forest Plan designates more than 300 habitat management units across the Colville National Forest. Seven of these habitat units occur in the project area. Five of these are managed to meet the habitat requirements for pine marten and its associated species group. One is a pileated woodpecker habitat management unit, and one is a barred owl habitat management area (MA-1).



Marten, pileated woodpecker and barred owl were chosen to represent the host of species dependent on old *multi*-story forest habitat. The effect the project has on species dependent on old *single*-story forest habitat is included in a discussion that focuses on white-headed woodpecker habitat.



Barred Owl: Affected Environment

Suitable barred owl habitat is based on definitions found on p. 4-70 & 4-71 of the Forest Plan. An established network of old growth management areas (MA-1) is designed to meet habitat capability objectives listed in the Forest Plan. Thirty-six areas were selected Forest-wide and comprise the inventory of this

management area. Each area is further outlined as 600 acre areas managed as a whole or separated into "core" and "forage" areas, with core areas of 300 acres or more, generally no more than twice as long as wide. Forage areas of 30 to 300 acres in size would then comprise the remaining acreage and be within 0.4 miles of the core perimeter. These stands will ideally consist of old growth timber types or mature stands with crown closure exceeding 60%. Standing dead snags and debris will also be considered as an integral habitat component.

The USFS selected the barred owl as an indicator of low elevation mature and old growth forests. The habitat capability objective listed in the Forest Plan is sufficient suitable habitat to sustain a viable population. The Plan also has a forest-wide goal of 73 pairs for the first decade of the plan. An assumed objective is habitat capable of supporting a pair of barred owls and their young within each MA-1.

Effects to barred owl habitat are considered in two areas:

- MA-1 areas
- Low elevation large-tree and old growth habitat

The best barred owl habitat lies in warm or moist biophysical environments. The cold subalpine fir biophysical environments provide poorer barred owl habitat and will not be considered in analysis of barred owl habitat.

MA-1 Areas

One MA-1 area exists in the Quartzite Planning Area. All biophysical environments represented in the MA-1 support barred owl habitat. About 20% of the existing MA1 consists of large tree (SS6) habitat. This MA-1 is 217 acres. Because of a land exchange in the 1990s, it is smaller than the requisite 300 core acres identified by the Forest Plan[78].

Monitoring in the Woodward MA-1 for the presence of barred owls in 1991 yielded positive responses to calling within and adjacent to the MA-1 boundaries. Subsequent monitoring has not occurred.

Good habitat (SS6) occurs on 43 acres within the MA-1. Fair/moderate habitat (SS4 and SS5) occurs on 109 acres of the MA-1. Poor habitat (SS1, SS2 and SS3) occurs on 44 acres of the MA-1. The balance of the area is in a non-cover type such as wetlands and meadow openings that are acceptable but don't meet the Plan cover requirements. The MA-1 is in BPE4 and BPE5; both of these biophysicals are more likely to support SS6 structure over the long term. No past harvest has been occurred in the MA1.

Low elevation large-tree and old growth habitat

Approximately 30% of National Forest System Lands (all Management Area designations) consist of large sized trees that are suitable for barred owl habitat, and another 47% contain medium-sized trees that provide poorer habitat.

[78] The Forest Plan states: Old growth management areas will be at least 600 acres in size. They may be managed as a whole or separated into a core area and foraging areas. Core areas are delineated on planning maps and allocated to Management Area 1. Core areas will consist of old growth forest in a contiguous unit of 300 acres or more. Foraging areas will be of sufficient acreage when added to the core area to make the total size of the management area 600 acres.

Pileated Woodpecker: Affected Environment

Pileated woodpeckers were selected as indicators for Douglas-fir and cedar/hemlock old growth dependent species. Forest Plan Standard and Guidelines 4-39 (a) discuss the requirements for pileated woodpeckers. Three hundred contiguous acres of pileated woodpecker habit will be managed for reproductive habitat and associated species. This habitat should be mature to old growth and within the Douglas-fir and cedar/hemlock working groups. There should be a minimum average of two hard snags per acre more than 12 inches DBH (diameter at breast height) within the reproductive area. Forty-five of these 600 snags should be more than 20 inches DBH.

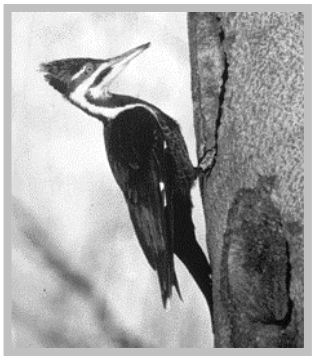
The management objective for pileated woodpecker habitat is to provide sufficient habitat to maintain populations of low elevation mature to over-mature timber dependent species at viable levels. Habitat units for barred owls also support pileated woodpeckers. However, dispersal distance for the owl habitat is greater than that for the woodpecker, so additional units are needed to meet management objectives for pileated woodpeckers. Standards and guidelines for pileated woodpecker habitat require that habitat be spaced no more than five miles apart.

Effects to pileated woodpecker habitat are considered in three areas:

- Pileated woodpecker MR areas, and MA-10 and MA-11
- Old growth and MA1 areas
- Total snag habitat

Pileated woodpecker MR areas, and MA-10 and MA-11

The pileated woodpecker MR is located within an area identified as SS6 reference "stronghold". This "stronghold" habitat has a higher probability of carrying structural stage 6 habitat based on criteria such as elevation, aspect landform, proximity to riparian areas, etc. The pileated woodpecker reproductive area (PW03) has a high proportion of moderate to good habitat and about 77% of the total pileated woodpecker area is in a biophysical environment (BPE5) that is predicted to provide SS6 habitat over a longer period of time. Down wood is present in the core pileated woodpecker area.



Old growth and MA1 areas

Only 60 acres of National Forest System Lands meet the NIZOG[79] criteria for old growth. See the preceding *Barred Owl: Affected Environment* discussion for a description of the single MA-1 that is located within the analysis area.

Total Snag Habitat

Snag levels are rated adequate-to-high across the National Forest System Lands in the Quartzite Planning Area due to active fire suppression and limited harvest history. Only about 6% of NFS land has been harvested within the last 30 years. Snag levels on NFS lands are higher in riparian areas, disease pockets, or areas where insect outbreaks are occurring. There are generally adequate amounts of snags and large down woody debris to support pileated woodpeckers on NFS lands. More harvest in Quartzite Watershed has occurred on private/other ownership.

[79] See Section 3.3.1 of this EIS (Forests: Affected Environment), for a discussion of North Idaho Zone Old Growth (NIZOG) definitions.

About 19% of the Cool Mesic Douglas-fir-grand fir and Cool Mesic cedar-hemlock biophysical environments contain stands (SS6) that may support the larger snags required by pileated woodpeckers for feeding and nesting. An additional 43% of these two biophysicals is in SS4 and SS5 that can provide additional foraging opportunities for pileated woodpeckers. The best pileated habitat occurs in riparian or other wet areas that support larger, soft-wooded trees. Many portions of the Warm Dry Douglas fir biophysical currently contain stands that provide pileated woodpecker habitat, especially within reference "SS6 strongholds". Currently 2549 acres of BPE2 are in SS6 and 186 acres are in SS7 habitat. An additional 3925 acres of BPE2 are in SS4 and SS5. Most of the SS6 in BPE2 is not within reference "SS6 strongholds" and is less likely to sustain SS6 habitat over time.

Marten: Affected Environment

Pine marten serves as an indicator of mature and old growth coniferous forest with an abundant down log component. Distribution of marten habitat is more critical than the barred owl and pileated woodpecker indicator species groups because marten is a less mobile species. Forest Plan standard and guideline 4-40 (k) states that marten habitat units shall be distributed every 2 to 2 1/2 miles and be a minimum of 160 acres in size. These units are located within various Management Areas. The Forest Plan also specifies that these areas will be composed of conifers in old growth or mature successional stages with a crown closure of 50 to 100 percent. Pine marten habitat units are generally 480-acre areas, subdivided into 2 or 3 blocks (A, B & C) of approximately 160 acres each. A 180-year rotation scheme is projected over time so there is always a 160-acre block that supplies pine marten habitat.

Effects to marten habitat are considered in four areas:

- Mesic Large Tree and Old Growth Forest
- Marten and Pileated Woodpecker Habitat Units
- MA1 Units
- Travel Corridors

Mesic Large Tree and Old Growth Forest

Biophysical environments consist of geographic areas with similar plant association characteristics. Three biophysical environments within Quartzite Watershed could best support marten habitat. These are the Cool Mesic Douglas fir grand fir/forb-shrub biophysical (BPE4), the Cold Mesic subalpine fir/forb-shrub biophysical (BPE8), and the Cool Mesic cedar-hemlock/forb-shrub (BPE5). These habitats lie mainly on northerly aspects or at higher elevations, and occupy 19% of the analysis area.

Within each broad biophysical environment, a cover type describes stands conditions. Cover types provide an indication of the tree size currently on that site. Cover types are further divided by canopy closure, from very dense to very open. Marten generally occupy older stands that contain multiple stories of trees and abundant down wood. They mainly locate their natal dens (dens in which they give birth) in holes in down or standing trees, the entrance to which usually lies beneath the snow. During winter, marten hunt on and below snow, accessing subnivean areas (under the snow) through conduits such as live trees, snags and rocks. Several of their main prey species inhabit riparian areas.

Large tree, multi-storied, closed-canopy cover types support good marten habitat. Medium-sized tree multi-storied, closed-canopy cover types support fair/moderate marten habitat. Even-aged, closed-canopy stands are used by marten when preferred habitat is scarce. An abundance of large, down wood is key in supporting marten. Strom damage and insect infestations have combined to produce adequate amounts of this key component across the National Forest System Lands in the analysis area. Over the last seven decades, timber harvest on other lands has reduced mesic large tree and old growth forest habitat. Consequently, 90% of the habitat within the Quartzite analysis area is located on National Forest System Lands. Seventy-seven percent of this is categorized as moderate to high quality habitat. However, some of this large tree, multi-storied, closed-canopy habitat has developed as a result of fire suppression, and consequently its longevity is at risk.

Marten and Pileated Woodpecker Habitat Units

As noted above, the Forest Plan states that 160-acre marten habitat units shall be distributed every 2 to 2 1/2 miles. The Forest Plan also states that 300-acre pileated woodpecker habitat units shall be distributed every five miles.

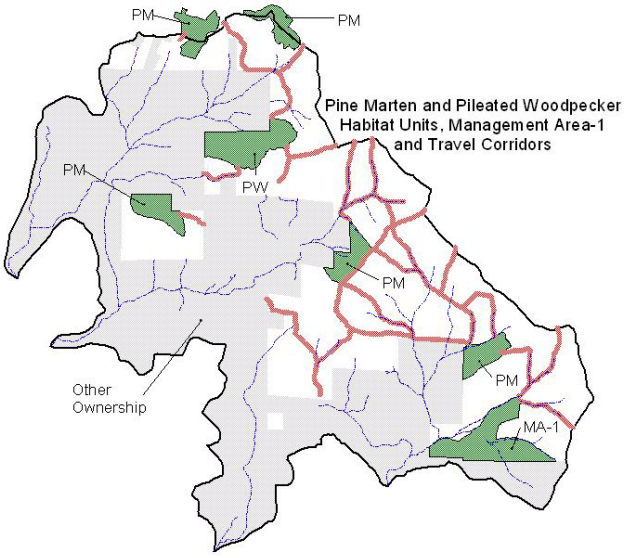
The Quartzite analysis area contains one pileated woodpecker habitat unit, three complete marten habitat units, and portions of two other marten habitat units. Large tree, multi-storied, closed-canopy cover types support good marten habitat. All six habitat units were evaluated and rated for these conditions.

Marten and Pileated Woodpecker Habitat Units			
	High Quality	**Moderate Quality**	**Poor Quality**
Pine Marten Unit #01	56%	38%	9%
Pine Marten Unit #02	47%	53%	0%
Pine Marten Unit #04	24%	76%	0%
Pine Marten Unit #05*	0%	84%	16%
Pine Marten Unit #06*	30%	35%	15%
Pileated Woodpecker Unit	49%	35%	16%

*Only those portions of PM units 05 and 06 located within the Quartzite Analysis area are evaluated here.

MA1 areas

See the preceding *Barred Owl: Affected Environment* discussion for a description of the single MA-1 that is located within the analysis area.



Travel Corridors

Wildlife corridors link late structure stands, marten and pileated woodpecker habitat units and the MA-1. This connectivity serves a variety of indicator species associated with eastside old forest habitats including northern goshawk, pine marten, pileated woodpeckers and three-toed woodpeckers. Other ownership, Flowery Trail Highway and other roads in the analysis area disrupt continuity in a few places. Douglas fir beetle mortality also affects some corridors. Where these dead trees occur in corridors, canopy cover has been reduced. In most instances, those patches of beetle-killed trees will function as corridors (canopy closure will

remain within the top one-third of site potential). The travel corridor network crosses existing roads in 20 places.

Outside the corridors, live tree densities provide sufficient cover over most of the area. Additionally, many riparian areas support relatively dense understories. However, over 80% of the analysis area is classified in the Warm Dry Douglas-fir/shrub biophysical environment (BPE2) and historically only 5-20% of BPE2 was occupied by stands meeting travel-cover.

White-headed Woodpecker: Affected Environment

White-headed woodpecker is not a Colville National Forest Management Indicator Species. It is included here to monitor the effects to open, park-like stands of ponderosa pine.

White-headed woodpeckers utilize mature open, park-like stands of ponderosa pine. Quartzite Watershed is composed primarily of the Warm Dry Douglas-fir/shrub biophysical (BPE2). During reference conditions, approximately 30 to 75% of this BPE was occupied by structural stage 7, the open park-like single stratum late structure. Today, only about 186 acres of the single-stratum SS7 occurs in BPE2 in Quartzite. White-headed woodpeckers use this watershed, but significantly less than during reference conditions.

White-headed woodpeckers use ponderosa pine (with which they are primarily associated) and mixed conifers for reproduction and feeding. They prefer mature (80 to 159 years) and old (160+ years) trees. These narrow requirements mean that they are relatively sensitive to habitat manipulation. Territory size is averages 20 acres per pair. To manage for 100% of the potential population there need to be 2.25 snags per acre greater than 10 inches diameter in ponderosa pine stands.

Quantity of Nesting Habitat

Less than 1% (186 acres) of the analysis area provides large diameter single-stratum white-headed woodpecker habitat. This habitat occurs on Quartzite Mountain and on some south facing slopes east of Woodward Meadows.

Fire suppression over the last 70-80 years has allowed more shade tolerant Douglas fir to interpose into historic ponderosa pine sites. This shift in vegetation corresponds with a significant loss in large diameter single-stratum white-headed woodpecker habitat. When frequent low-intensity fire occurred unabated, up to 60% (6,305 acres) of the analysis area supported large diameter single-stratum white-headed woodpecker habitat.

Primary Excavators

Northern three-toed woodpeckers and other primary cavity excavators that are dependent on dead or defective trees for breeding and forage habitat represent this group of indicator species.

Northern three-toed woodpecker: Affected Environment

Little high-quality Northern three-toed woodpecker habitat exists in Quartzite. The Cold Mesic subalpine fir/forb-shrub biophysical is only 156 acres in size in the

Quartzite Watershed and only 26 of these acres meet habitat needs. Elsewhere, few stands of pure lodgepole or mixed lodgepole pine stands occur on NFS lands.

Northern three-toed woodpecker habitat is considered by examining:

- Marten Habitat Units
- Snag Numbers

Marten Habitat Units

See the preceding *Marten: Affected Environment* discussion for a description of marten habitat units located within the analysis area.

Snag Numbers

See the preceding *Pileated Woodpecker: Affected Environment* discussion for a description snag habitat within the analysis area.

Other Woodpeckers: Affected Environment

Other Woodpeckers were selected as indicators because of their dependence upon snag habitat. The Forest Plan as amended specifies that standing dead and green replacement/roost trees ≥15 inches in diameter shall be retained to provide for 100% population levels in harvest areas. Three Rivers Ranger District guidelines state that a minimum of 4 large snags and 8 replacement trees per acre would be left, where available. Existing snag levels are considered to be at the 100% level in un-entered areas.

See the preceding *Pileated Woodpecker: Affected Environment* discussion for a description snag habitat within the analysis area.

Big Game

The Forest Plan selected deer and elk as management indicator species to represent the group of animals that includes moose, bighorn sheep and mountain goats. They comprise the most popular big game animals for hunting, viewing and photographing on the Forest.

The Forest Plan identifies winter range as the limiting factor for management of this group of species, because of its importance as a regulator of population. Quality winter range can support animals through the lean months, in good enough condition to carry and bear healthy offspring. Consequently, big game habitat management and analysis focuses on winter range. Thousands of acres of winter range (MAs 6&8) are designated across the Colville National Forest. These areas are typically located on south facing slopes at low elevations, where winter snow depth is minimal, and browse is accessible in the winter.

Deer and Elk: Affected Environment

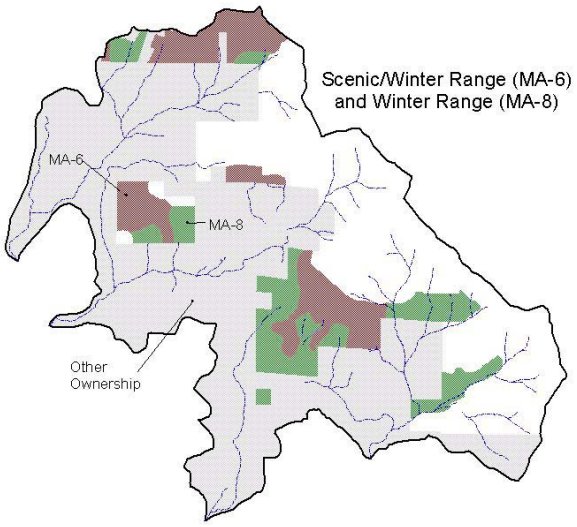
Effects to deer and elk are considered in six areas:

- Winter Range Area

- Population
- Winter Range Cover Quantity and Quality
- Winter Range Cover Distribution
- Condition of Winter Range Understory Vegetation
- Roads in Winter Range

Winter Range Area

The Forest Plan allocated 37% of the analysis area (3,954 acres) for big game winter range (MA6 and MA8). Small pockets of winter range habitat are also scattered throughout the planning area, especially on more open south and west aspects. Most of these small pockets are located in higher elevations, on the ridges between sub-watersheds. These areas provide winter range for mule deer rather than white-tailed deer, which tend to winter at lower elevations. A small herd of mule deer uses the Eagle Mountain area. Other mule deer winter range habitat occurs on the south side of Quartzite Mountain and in steeper areas between Horseshoe Lake and Roundtop Mountain, above Wessendorf Canyon.



Population

In general white-tailed deer have increased their distribution in northeastern Washington. Their population tends to be stable or on the increase, with infrequent interruptions to this trend imposed by hard winters that reduce their numbers. Mule deer have generally declined due to increased roading and fire exclusion.

Winter Range Cover Quantity and Quality

Cover consists of stands with a canopy closure that exceeds 60%. This *blanket-for-big-game-animals* helps to conserve the energy animals use to maintain body temperature. *Snow-intercept* thermal cover provides the best thermal cover. Forest stands that provide *snow-intercept* thermal cover include several canopy layers that catch and trap snow before it falls to the ground. Thermal cover on MA6 and MA8 in the planning area is less than 50%. Much of the thermal cover is in poor condition due to the effects that insects and pathogens have on the coniferous forest canopy.

Fifteen percent of MA6 & MA8 qualifies as true cover (593 acres). The remaining 85% is forage. Sixty seven percent of which is classified as “forested-forage.” The remainder is open forage. To provide conditions that maximize utilization of forage, the Forest Plan winter range cover/forage ratio goal is 50:50. No standard exists for forested-forage.

Most of the watershed and all of the designated winter range is in the Warm Dry Douglas-fir/shrub biophysical that, in reference times, had frequent low intensity fires which reduced

cover and maintained much of the area in open park like stands. Most of the stands in this biophysical are not predicted to maintain higher stocking levels over a long period of time. Some of the stands that now provide cover now will not in the near future, with or without management. Root rot and Douglas-fir beetle infest several stands within the winter range. Though these infestations create conditions that benefit other wildlife, they reduce a stand's potential for providing big game cover over the long-term. Stocking levels in many of the cover and forage stands is good, however, insect and disease infestations may prevent some of the areas currently identified as forested forage from growing into cover stands.

Commercial thinning in 1998 on National Forest System land occurred on winter range on the south side of Eagle Mountain.

Winter Range Cover Distribution

The Interspersion of "effective" habitat (the "edge" or ecotonal area between cover and forage patches) is relatively poor, due to the lack of true cover and open forage. As noted above, 57% of MA-6&8 is "forested-forage." This habitat type provides a combination of forage and cover, but does not meet the requisite 60% canopy-closure to qualify as true cover. Consequently, the edge habitat is blurred, making the distinction between true cover, and open forage indiscernible within this "forested-forage" habitat.

Condition of Winter Range Understory Vegetation

Woody forage occurs in many places in the watershed, though much has grown beyond the reach of big game and should be regenerated. In many places, especially drier sites, fire suppression has allowed shade tolerant conifer species to out-compete forage species.

Noxious weeds have increased since reference times and they pose a competitive threat to herbaceous and grassy forage. On some lower elevation sites, knapweed and St. John's-wort dominate large areas, including the south-facing slopes of Eagle Mountain. Other noxious weeds infestations include yellow hawkweed, dalmation toadflax, oxeye daisy, hound's tongue, tansy ragwort, bull and Canada thistle, common mullin, and reed canary grass. Vehicles, and in some places, ungulates themselves are the vectors of weed seed dispersal. Correspondingly, the greatest concentration of noxious weeds in winter range is found along roads.

Roads

Roads cause direct and indirect effects to big game and big game winter range. Even though some open forage results from road construction, there is a direct loss of the habitat occupied by the roadbed. Indirect effects include the potential for increased noxious weed competition (indirect loss of forage) and the indirect effects associated with an increase in vehicular traffic (noxious weed vector, hunting pressure, and disturbance).

Two of the winter range blocks (one north of Betts Meadows and one on Jay Gould Ridge) are almost entirely without roads. Other mid-sized designated winter range areas have roads in some portion. Ten and four tenths miles of road occur within the composite MA-6&8. Seven and seven tenths miles of this is open all year. The remainder is closed from 01December through 31March.

The winter road density for the composite MA-6&8 within the analysis area is 1.2 mi/mi$^{2.}$ The Forest Plan Standard for deer winter range road density is 1.5 mi/mi^2. The lifting of the *winter* road closure on Eagle Mountain increases composite MA-6&8 road density to 1.6 mi/mi^2 *during the summer*.

Avian Species

Several species of birds have been adopted as management indicator species by the Colville National Forest to represent various habitat types.

Large raptors and great blue heron: Affected Environment

Great blue heron habitat is negligible or non-existent within the analysis area; consequently, analysis for this MIS group is limited to large raptors.

Effects to large raptors are considered in two areas:

- Nesting Habitat
- Current Habitat Use

Nesting Habitat


Northern Goshawk

Forest structural stages can indicate where, and how much raptor nesting habitat occurs within the analysis area. Cooper's and sharp-shinned hawks are more likely to use overstocked sapling, pole and small tree stands (SS1, SS2, SS3 and S4) for nesting habitat. Currently, twenty two percent of the analysis area is composed of SS1, SS2, SS3 and S4.

Forest stands classified as multi-stratum with large trees (SS6) provide nesting habitat that is preferred by northern goshawk. Currently, SS6 occurs on 28% of the analysis area. However, much of this occurs on dry upland sites that historically did not support multi-stratum stands.

Current Habitat Use

Two fledgling goshawks were observed in a nest in 1997 that was located on NFS lands, in the Betts drainage. Subsequent surveys in 2000 detected a second active goshawk nest approximately 0.4 mile from the first nest. A red-tailed hawk nest was located in the Woodward drainage. Cooper's hawks have also been observed in the area.

Blue grouse: Affected Environment

Blue grouse was selected because of its dependence on winter roost habitat and nesting habitat. Winter roost habitat is described as mature limby trees or clumps of trees along ridge tops. Nesting habitat is open meadows or shrub habitats. Forest Plan standard and guideline 4-40 (e) states that blue grouse habitat should be managed by providing a minimum of eight mature limby Douglas-fir or subalpine fir trees per acre on or near ridge tops in park-like or open timber stands. It also states that hiding cover around at least 50 percent of the perimeter of springs or other water sources should be maintained with no break in cover exceeding 600 lineal feet along the waters edge.

Winter roost habitat is important because winter is the "bottleneck" period when food resources are least but energy demands on the birds are greatest. In winter, adult male and female and juvenile male blue grouse tend to feed most frequently in ponderosa pine trees, and juvenile females feed most frequently in Douglas-fir trees. The majority of blue grouse habitat is found along the Cottonwood Divide Road and the upper elevation areas above Horseshoe Basin, Betts Basin and Woodward Basin including parts of Jay Gould Ridge

and the ridge that separates Horseshoe and Betts basins. There are other areas on Quartzite Mountain and Eagle Mountain that also provide potential habitat on NFS lands.

Franklin's grouse Affected Environment

Franklin's Grouse was selected as an indicator species to represent lodgepole pine dependent species. Habitat for this species consists primarily of young, dense lodgepole pine stands interspersed with mature spruce. This habitat is often the result of stand replacement fires. The Forest Plan (page 4-40) directs that large areas dominated by lodgepole pine be managed to maintain 20% in young age classes.

Quartzite Analysis Area currently provides little of this type of habitat. Very few acres (less than150 acres) of smaller tree, even-aged stands of lodgepole pine or mixed lodgepole pine/larch occur on NFS land in Quartzite. These are small stands that have developed from fingers of previous wildfires. Most are concentrated in the north and northeast parts of the watershed. Their size and distribution make Franklin's grouse habitat relatively insignificant in this watershed.

Riparian Species

The Forest Plan identifies two species groups to represent riparian habitats, beaver and trout.

Beaver: Affected Environment

Beaver was selected as an indicator of species dependent on riparian areas dominated by aspen and willow. They inhabit streams where deciduous vegetation is abundant. Beavers construct dams and create wetlands, help stabilize water levels, and help prevent streambed erosion. The Forest Plan standards and guidelines 4-40 (g) direction requires that we "maintain or enhance beaver habitat".

The major drainages in the Quartzite Watershed are Thomason, Sherwood, Wessendorf and Cottonwood Creeks. Reference beaver activity occurred along low gradient streams in the analysis area with the Colville Valley being the source for beaver populations moving into these tributary watersheds. Beaver currently inhabit the Betts and Woodward Meadows areas in the upper Cottonwood Creek drainage. Within the last decade, beaver have also been trapped and removed at the outlet of Horseshoe Lake. Aspen, willow and cottonwood trees do not dominate overstories along the most of the banks of the creeks, though several sections contain good stands of these trees and shrubs.

Trout: Affected Environment

Trout management indicator species include the aquatic sensitive species of Redband and Westslope Cutthroat trout. In addition to these native species, this Affected Environment discussion considers native rainbow trout and non-native brook and brown trout.

The Colville River

The historical distribution of salmonids within the Quartzite Watershed area is strongly tied the Colville River. Currently Meyers Falls on the Colville River at Kettle Falls is a barrier to upstream migration of salmonids and other fish. Historically, after the last glacial retreat, Meyers Falls may have been passable to fish. This is supported by the presence of native fishes in the Colville River. Genetic studies on rainbow trout in the North Fork of Chewelah Creek show some remnant genes from redband trout, a native trout. Redband trout could have been stocked at some time, but the presence of some non-game fish such as redside shiners, sculpins, largescale suckers, and speckled dace indicate that the falls would have been passable.

Non-game fish are usually not stocked. Because fishes in the Columbia would have had access to Meyers Falls, the native trout would have had the opportunity to move into the Colville River. Historically then cutthroat trout, bull trout, rainbow trout, and the non-game fish mentioned above could have occupied the Colville River. There are no fish blockages on the tributaries to the Colville in the Quartzite Watershed. It is assumed that the coldwater fish such as trout in the Colville River migrated freely into the Quartzite tributaries. Even though Bull trout may have been able to access the Colville Watershed, there is no historical written record of the species in the Colville Watershed. They are assumed to be extirpated from the watershed or have never occupied the watershed. The fish bearing streams in the analysis area are Cottonwood Creek, Thomason Creek, and possibly the lower end of Sherwood Creek.

The Colville River has changed from its reference condition. However the stream is widening, becoming shallower, and is slowly disconnecting from its floodplain. The riparian vegetation has been altered from cottonwood forests and marshlands to pasture and farmland. There are still locations were cottonwoods line the river. In areas were there are no large trees, there is bank erosion, shallower glides, and lack of fish cover (woody debris). Woody debris is also less now that large sections of the riparian area are no longer contributing woody debris. Lack of woody debris has caused bar formation to decrease, fish cover to decrease, and channel diversity to decrease.

The Quartzite area makes up 5 percent of the area of the Colville Watershed.

The Colville River has both native and non-native fisheries. Currently the native fish species in the Colville River include rainbow trout, largescale sucker, sculpin, redside shiner, and speckled dace. Non-native fish species in the Colville River include brook trout, brown trout, largemouth bass, pumpkinseed, yellow perch, brown bullhead, tench, and black crappie. Westslope cutthroat trout are located in two tributaries of the Colville River. Early records of salmonid stocking in the Colville River above Meyers Falls and its tributaries begin in 1933 and 1934 with the stocking of brook trout, rainbow trout, brown trout, and cutthroat trout. Steelhead was stocked in the Colville River in 1933 and 1935. No fish blockages exist on the tributaries to the Colville in the Quartzite Watershed

Redband may have replaced existing populations of Westslope cutthroat trout. The Columbia River redband trout evidently replaced the interior cutthroat trout in most areas where they came into contact. Widespread sympatric[80] occurrence of both native redband and native cutthroat trout is known only in the Salmon and Clearwater drainages of Idaho and, to a lesser extent, in the John Day drainage of Oregon and in the headwaters of the Wenatchee and Methow drainages, Washington. Redband trout may have severely reduced the cutthroat and bull trout fishery, but habitat degradation has probably reduced

[80] Occupying the same or overlapping geographic areas without interbreeding.

native fish populations the most on the Colville National Forest in areas that were previously excluded to Redband trout migration.

Brook trout out-compete native fishes in degraded habitats. Brook trout, the dominant fish species, has probably eliminated the cutthroat and bull trout fishery. The rainbow trout fishery is present in very small numbers. Cutthroat trout cannot compete with brook trout. Instead they move into the steep tributaries where the brook trout do not do well. In this analysis area, the tributaries have subterranean flow blockages. Bull trout hybridize with brook trout. These hybrids do not reproduce. Degraded habitat cannot support the fish for the length of time needed to produce a mature bull trout. No bull trout have been caught in the Colville River Watershed.

Cottonwood Creek

In general riparian timber harvest, grazing, and roading have degraded the stream below NFS Lands. The stream has widened and the banks are eroding. As seen across the Foreset, in areas of degraded habitat, brook trout are the dominant fish species.

The fish bearing streams in the analysis area are Cottonwood Creek, Thomason Creek, and possibly the lower end of Sherwood Creek. However only Cottonwood Creek is a known fishery on National Forest System lands. In 1992, the Forest Service surveyed Cottonwood Creek at the Forest Boundary and above the beaver pond at Woodward Meadows. Fifty-one brook trout and 2 Rainbow trout were found below Woodward Meadows on reaches 1 and 2. The largest fish, a brook trout, was 9 inches, but most fish averaged 4 to 6 inches. Young of the year brook trout were common. The rainbow trout measured 3.75 and 4.75 inches long. The habitat is supporting brook trout better than rainbow trout.

Brook trout out-compete rainbow trout in certain habitats. Rainbow trout do best in fast water, deep pools, and clean gravels. Brook trout survive best in lower gradient streams and can compete well in shallow habitats. The 1992 habitat survey shows active and old beaver dam development. In the first reach from the Forest Service boundary to road 4342, the riparian vegetation is alder and grass. The substrate is gravel and sand. Between beaver ponds the habitats are long and shallow. There are no fast waters habitats for the rainbow trout. This is brook trout habitat. There were 14 pools per mile, and 63 pieces of large woody debris (LWD) per mile.

The second reach started at road 4342 and ended at the bottom of Woodward Meadows. Again there is beaver dam construction. The riparian vegetation is alder and Hawthorne. The stream is braided and is probably cutting its way through an old beaver dam. The riffles are long and shallow. There was 1 piece of LWD and 3 pools per mile. The stream attributes are more suited for brook trout.

In Woodward Meadows, red-sided shiners and brook trout were found in the 1992 fish survey. No rainbow trout were found. The habitat and brook trout competition may have excluded them from this reach. The presence of shiners indicates shallow warmer water habitat. Ponds occur mainly on the lowest and uppermost ends of the reach. The surveyors noted beaver activity and fish in the ponds. In 1997 Cottonwood Creek showed no signs of beaver activity. These ponds contribute to the warming of the water. Rainbow trout do not compete well against brook trout in warmer water habitat.

When Woodward Meadows was homesteaded the stream channel was rerouted to run on the southern edge of the meadow. The new channel cut down over 6 feet causing the water table to drop in the meadow. The channel is very sandy, and spawning habitat is

limited. The water depth decreased as the channel widened. Because of the poor habitat, the reach does not meet the LWD or pool RMO for INFISH.

Woodward Meadows is a hot spot for sedge and grass diversity. The riparian vegetation consists of alder, grasses, and sedges. As the water table has dropped, Reed Canary grass has invaded the meadow and has replaced many of the sedge and grass communities.

Above Woodward Meadows, the stream goes subsurface on an alluvial fan. This blocks fish passage to the upper reaches. The riparian vegetation consists of grasses and lodgepole pine. The stream flows on the surface only during high spring flows. In 1999, ponds were built on this area to form seasonal wetlands.

The stream is perennial above the alluvial fan. The riparian plant association is cedar/queencup-beadlily. It is a Rosgen B3 channel type. Woody debris and roots form pools and riffles. Firewood cutting in the riparian area reduces the amount of woody debris. This has affected channel stability.

The next reach also crosses an alluvial fan and is dry. An old logging road affects the stream. Channel stability ratings on this reach is poor.

At the top of Woodward Meadows, the southeast tributary enters Cottonwood Creek through a wet cottonwood marsh. This may be the result of beaver activity. Fish are present. In a 1998 topography survey, the wetland marsh was the same elevation as the meadow. On the southeast end of the meadow, a large berm was created during the rerouting of the channel. The marsh is behind the berm.

Betts Meadow is not on Forest Service land, but activities in the watershed influence the fisheries of the Meadow. Brook and cutthroat trout reside in the meadow. An intensive effort is under way to eradicate the brook trout. The landowner intends to restore the meadow to a native cutthroat trout fishery.

In the tributaries to Cottonwood Creek above Woodward and Betts Meadows, the channels are similar to the upper portions of Sherwood Creek. Bar formations behind debris jams create multiple channels. The riparian vegetation consists of cedars and forbs. Very little management has occurred in these areas causing the somewhat reference condition of these streams. These streams carry high amounts of gravels. This causes the water to go under ground. Fish only occupy the channels up to the first few subterranean flow barriers. They provide excellent seasonal spawning habitat. These channels move high amounts of bedload.

Class 3 (non-fish bearing) and class 4 (intermittent) streams

Class 3 (non-fish bearing) and class 4 (intermittent) streams are steep, narrow, and located in v-shaped valleys. The class 3 and 4 streams include the named streams, Thomason Creek and Sherwood Creek, their tributaries, and the unnamed tributaries of Cottonwood Creek. The steepness of the valleys translates into steep channel gradients putting the streams into the Rosgen A channel type. Wood and boulders form step pools and cascades. Even though these streams were classed as non-fish bearing, they supply gravels and cool water to the fish bearing sections.

Historically, low-intensity fire and other natural forces crept into the riparian vegetation from upland sources. The riparian zone was very narrow. The narrow valleys tend to have a tunneling effect on fire, causing a stand replacement fire. These fires were important sources of large woody debris. The fires were infrequent. Because of the

steepness of the valley and the high energy of the system, after a fire, debris torrents occurred.

Sherwood Creek

The Horseshoe Lake dam broke in 1974 and caused the major channel-defining event in Sherwood Creek. The channel cut down as much as 60 feet in places. Massive deposition occurred in low gradient valley sections destroying fish habitat. Effects from the floods can still be seen. Currently the fish distribution on private land is unknown. Seasonal use by trout occurs in spawning habitat near the confluence with the Colville River. Fish were not found in surveys done in 1997 on National Forest System Lands.

On National Forest System Lands, the channels in the Sherwood Creek watershed do not support a fishery. Three and four tenths miles of channels were surveyed on federal land within the watershed. They are very steep bedrock and cobble streams. Stream types represented include Rosgen Aa+ and B or D streams. Of the streams surveyed 0.6 are perennial non-fish bearing channels (class 3), with an additional 1.8 miles alternating between Class 3 and 4. There is 1 mile of intermittent/ephemeral channels. Four channels are classified as ephemeral.

Riparian inventories were done in 1997 on the class 3 and 4 channels. The riparian plant association was western red cedar/devil's club. B or D channel types exist where the valleys are wide enough to allow meandering. A channel types dominate in the very narrow valleys. They depend on woody debris for channel forming structure. Woody debris and roots form jams that build up sediment behind them. In many cases a large segment of stream may go underground (up to ½ mile) because of high numbers of debris jams. These channels move high amounts of materials. These channels usually appear very unstable because of braiding, but they are actually in balance. Even the R1 Channel Stability ratings are high (>100) for these channels, but this is because of the high amounts of materials that these channels deposit each year and the high numbers of debris jams. The subsurface nature of these channels makes them unsuitable for fish. However these channels are extremely important for the gravels, other materials, and cool water that they carry down to the fish bearing channels. These are highly efficient and stable channels.

Thomason Creek

The Chewelah Creek Watershed Management Plan in December of 1993 analyzed Thomason Creek. It noted "Thomason Creek flows through forested, agricultural, and rural residential areas before flowing through a sparsely developed portion of the city. It flows adjacent to Flowery Trail Road for a portion of its length. This road carries much traffic to the 49 Degrees North ski area in the winter and is well maintained by plowing and sanding. The spray of snow and sand thrown up by the plowing operations has the potential of hitting the creek in limited areas. Thomason creek flows through a sod farm prior to entering the Colville River. The intermittent branch flows through agricultural land adjacent to the high school, a sports field complex and the hospital prior to joining the mainstem." Aquatic plant growth is thick at the mouth of Thomason Creek near the Washington Water Power building. High levels of nitrate and phosphorous levels are causing this. This vegetation reduces fish habitat by blocking fish passage and depleting oxygen during certain parts of the day. It was recommended on page 41 of the Chewelah Creek Watershed Management Plan, December 1993, that the aquatic vegetation at the mouth of Thomason Creek be removed. The Watershed management plan also recommended upstream source controls to reduce nutrient loading, and harvesting of

existing vegetation till it is no longer a problem. The vegetation was removed in 1995, and has not returned to the point where it causes violations in water quality or fish blockage.

The channels on the Forest Service System Lands are stable Aa+ channels with moss covered undercut banks. Tree roots stabilize the banks. Woody debris form structure in the way of pools and debris jams. The bankfull width to depth ratio is low. The substrate is cobbles and gravels. The riparian plant association is cedar/lady-fern. On National Forest System lands, the creek is too small to support a year round fishery, but could support seasonal spawning. The fish blockage at the culvert on the Cottonwood Creek Road limits fish access to lower reaches.

Threatened, Endangered and Sensitive Species

Under Section 7 of the Endangered Species Act of 1973, as amended; federal agencies are required to "ensure" that actions authorized, funded, or carried out by them are not likely to jeopardize the continued existence of Threatened or Endangered species or result in the destruction or adverse modification of their critical habitats. In addition, the Forest Service has established direction to ensure that species considered "sensitive" do not become threatened or endangered. The Forest Service has established direction for TE&S species and habitat management, which identifies the process, objectives, and standards for conducting a "Biological Evaluation" (BE). The four-step process for conducting the Biological Evaluation follows:

1) Prefield Review of existing information

2) Field Reconnaissance of the project area

3) A Risk Assessment if species or habitat is present

4) A Biological Investigation may be required if insufficient data exist to complete step 3.

After completing any one of the first two steps, a determination may be made that a project will have no effect on a TE&S species or its habitat. The following discussion documents the review and findings completed for the proposed activities. For detailed analysis and risk assessment documentation, see the Biological Evaluation located in the analysis file.

The Colville National Forest contains habitat for five threatened, one endangered and nine sensitive animal species and 54 sensitive plant species. The Quartzite Project Planning Area was examined for likely habitat for those species. The Prefield Review (Step 1 of the BE process) determined that suitable habitat for woodland caribou, American white pelican, and California bighorn sheep does **not** exist within or adjacent to the analysis area. The project area is not located within any federally designated recovery areas. Provisions are made for the protection of individual animals that may be found outside of recovery areas, and for protection of their critical and essential habitats.

Bald Eagle: Affected Environment

(Threatened-Federal)

Bald eagle habitat is managed in accordance with the Pacific States Bald Eagle Recovery Plan (USFWS, 1986) and the Bald Eagle Management Guidelines for Oregon and Washington. Bald eagle habitat on the east side of the District consists of nest sites and winter roost sites.

Nest Sites

No bald eagle nest sites have been found on the east side of the District. Nests occur along the Columbia River, 25-30 miles to the west, and along the Pend Oreille River, 15-20 miles to the east.

A Montana study revealed that all bald eagle nest sites were within the topographic line-of-sight of water, none were more than 450' in elevation above the associated body of water, and 90% were located within 2000' of the associated body of water. There are no large lakes in the watershed, but smaller lakes/wetlands do contain fish. Streams in the watershed are not large enough for foraging by bald eagles. The Colville River is used by winter foraging bald eagles.

Roost Sites

The Quartzite analysis area does not contain good quality roosting habitat, or a significant roost site for wintering bald eagles. In winter, forage opportunities attract bald eagles to the Colville River, where they have been observed, west of the analysis area.

Grizzly Bear: Affected Environment

(Threatened-Federal)

Historically, the grizzly bear ranged over much of what is now the Colville National Forest. As part of the overall grizzly bear recovery effort, specific "grizzly bear ecosystems" have been identified. Recovery areas have been delineated within those ecosystems and classified into "Management Situations," based on the needs of the bears and the capabilities of the areas to supply those needs. The only Recovery Area on the Colville National Forest is located seven miles east of the analysis area, on the east side of the Pend Oreille River. Grizzly bears are protected outside of the recovery areas, but they are not specifically managed for or encouraged there. The analysis area falls within management Situation #5 under Interagency Grizzly Bear Guidelines (Interagency Grizzly Bear Committee 1986). A Situation #5 category infers that grizzly bears do not occur, or occur only rarely in the area, and if suitable habitat is present, it is unoccupied.

Grizzly bear habitat use is dictated by isolation from human disturbance, food distribution, and food availability. Generally, grizzly bears move seasonally, using low-elevation riparian areas and meadows in the spring and higher elevations in summer and fall. Spring habitat use (from den emergence until late June), is concentrated in snow-free sites where forb and grass forage is abundant. These are generally the low-elevation, flat riparian areas, but meadows and south facing ridges are also used. After "green up" of vegetation, bears generally forage above 3000 feet where they seek grasses, forbs, and shrubfields. They also use forested areas for feeding, traveling and bedding. In the fall, bears feed on huckleberry, serviceberry, rose, and strawberry. Fall habitat occurs in mixed shrub fields, snow chutes, old burns, meadows, and cutting units. Grizzly bears den on all aspects, but more commonly on north aspects above 6000 feet elevation.

Seclusion

The disruption of solitude, through human disturbance, is known to affect grizzly bear use of habitat. The degree of seclusion (lack of exposure to humans) within an area depends on the road and trail network within that area. Exposure to humans increases with roads.

Exposure decreases after a road is closed, however, even after closure; the roadbed continues to provide new access to people on foot, ATVs, bicycles, or horses. For this analysis, habitat lying further than 0.3 miles from a road that is more than ten acres in size is considered seclusion habitat. Using this criterion, roughly 1/3 of the NFS Lands in the analysis area qualify as seclusion habitat.

Grizzly bears may use/occupy the watershed. However, the Natural Heritage Program Database lists no sightings within the Quartzite Watershed.

Gray Wolf: Affected Environment

(Threatened-Federal)

The Northern Rocky Mountain Wolf Recovery Plan identifies three areas for wolf recovery: Yellowstone, northwest Montana, and central Idaho. Washington State does not contain any wolf recovery areas. Gray wolves occupy a broad spectrum of remote habitats, however they prefer habitat that includes an adequate prey base and is isolated from human activities. Sightings of gray wolves are reported on the Colville National Forest nearly every year. During the mid-1990s a confirmed sighting was made 10 miles east of the watershed boundary.

Ungulate Prey Base

Within the northern Rocky Mountains, wolves depend on big game as a year-round food source. On a biomass basis, ungulates comprise more than 90% of wolves' diets. The deer fawning and winter range areas located within the analysis area, provide prey for wolves the entire year. See the section titled *Forest Plan Management Indicator Species/Big Game/Deer and Elk Affected Environment* in this EIS for a complete discussion of the current habitat condition of these primary wolf prey species.

Denning and Rendezvous Sites

Denning sites in the northern Rocky Mountains are characteristically located on southerly aspects of moderately steep slopes in well-drained soils. The sites are usually within 0.25 miles of surface water and at an elevation overlooking surrounding low-lying areas.

Rendezvous sites consist of complexes of meadows and adjacent hillside timber with surface water nearby, bogs, abandoned/overgrown old beaver ponds and stream corridors. Rendezvous sites move during the summer as the pups grow. Both den and rendezvous sites may be used for several years.

Field reconnaissance did not reveal any denning or rendezvous sites within the analysis area.

Seclusion

Because gray wolf and grizzly bears respond to disturbance in a similar fashion, the current situation was analyzed using the same evaluation criteria used for grizzly bears. See the preceding *Grizzly Bear: Affected Environment* subsection within *this* section of this EIS for a complete discussion of wolverine seclusion habitat.

Canada Lynx: Affected Environment

(Threatened-Federal)

Past direction for lynx management on the CNF was found within the CNF Land and Resource Management Plan (Forest Plan) and the 25 August, 1995, memo titled "Analysis of Habitat Conditions for Lynx: Interim Guidelines for the Colville National Forest." The Forest Plan states that management for Franklin's grouse covers lynx foraging needs, and the distribution of pine marten and pileated woodpecker MRs and MA-1 (old growth) areas cover denning habitat. The 1995 interim guidelines suggest that adequate lynx denning and foraging habitat should be distributed across an area (approximately the size of a female lynx home range) with a minimum of 10% of the area in denning habitat and a maximum of 30% in non-lynx habitat. This guideline included the following as non-lynx habitat: openings caused by recent harvest units, burn areas where hares had not re-colonized, meadows, and roads.

In February 2000, the USFWS and USFS signed the Lynx Conservation Agreement to formalize the two agencies' decision to utilize The Lynx Science Team Report (Ecology and Conservation of Lynx in the United States) and The Lynx Conservation Assessment and Strategy (LCAS) to plan and analyze projects to ensure a comprehensive approach to conserving lynx.

Starting in late 1999, as guided by FS direction, the Colville National Forest refined the Washington Department of Fish and Wildlife primary lynx habitat map and redefined lynx analysis area (LAU) boundaries to better reflect areas that have the potential to support lynx habitat. The LAU borders were outlined using the best available information for plant associations or biophysical environments. The LAUs cover a large area, little of which had site-specific information. Because of this we took a cautious approach to ensure that we had included all potential lynx habitat, which caused us to include areas that would not support lynx habitat. During project planning we more closely examine the habitat within the LAU boundaries to remove from consideration those areas that will not support lynx habitat (non-lynx habitat). A variety of habitat factors were considered:

- Non-lynx habitat (permanent openings and dry habitat types that will not support lynx habitat)
- Connectivity habitat (habitat that allows lynx to move within and between LAUs)
- Unsuitable habitat (which could at some point support lynx habitat, but currently does not)
- Foraging habitat (habitat for snowshoe hare, red squirrel and other alternative prey),
- Denning habitat (moist sites with lots of down logs), and
- Human access (measured by road and trail densities)

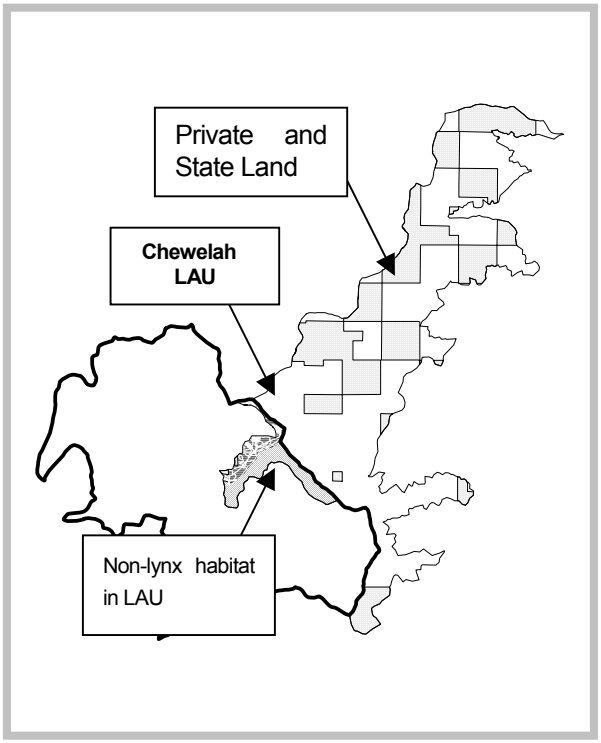
The Chewelah LAU is the southernmost LAU in a string of about 270 square miles of LAUs that extend from Canada to just south of Calispell Peak and the 49 Degrees North

ski resort. Like other areas of northeast Washington, the area supported more lynx in the 1960s and 1970s than it does currently. Habitat in this zone is naturally fragmented, and habitat alteration has been significant. The Chewelah LAU constitutes the project-level analysis area for lynx, and the chain constitutes the cumulative effects analysis area.

Lynx distribution in northeast Washington is determined by documenting winter tracks, sightings and reviewing trapping records. Within the Chewelah LAU there are no past records of lynx sightings. In 1999 the Washington State Department of Fish and Wildlife conducted snow track surveys in the LAU. Lynx tracks were not recorded with this survey.

Non-Lynx Habitat

Very little non-lynx habitat exists in the LAU. Most of the non-lynx habitat consists of small patches on dry, south-facing slopes near the top of a ridge. The Quartzite section of the Chewelah LAU contains the largest patch of the warm, dry Douglas-fir biophysical environment is considered non-lynx habitat. About 850 acres, or 60% of the Quartzite section of the LAU, consists of non-lynx habitat.



Connectivity Areas

In July 1995 the Washington Department of Natural Resources developed a map that shows major ridges, or areas that lynx might use as corridors for movement. The cover on these ridges was examined to determine effects to connectivity habitat.

No lynx travel corridors in the Quartzite portion of the lynx analysis unit have been eliminated due to past harvest because no harvest has occurred in this area. In the Quartzite watershed, a major potential corridor lies on the ridge between Betts Basin and Horseshoe Basin, and a few smaller potential corridors follow minor ridges toward Horseshoe Lake and Wessendorf Canyon. The Cottonwood Divide ridge top, which separates the Quartzite watershed from the rest of the LAU, forms another major corridor. NFS road 4342000 and the edge of the 49^0 North Ski Area lie in this corridor. The 4342000 road is a groomed snowmobile route that provides roughly 400 recreation visitor days per winter. The road receives moderate use by berry pickers, hunters and other recreationists in the summer and autumn.

In the portion of the LAU outside the Quartzite watershed, openings created by harvest in the late 1980s or early 1990s on private land bisect one of the main north-south corridors. The height and density of vegetation on this corridor is sufficient to provide cover in summer, but not in winter. The vegetation will grow tall enough to provide cover in winter within the next 5 to 10 years. The Flowery Trail road is the only main east-west road that bisects the main north-south corridor. Outside of the 49^0 North Ski Area, current levels of use are not high enough to negatively affect lynx movements.

Unsuitable Habitat

The total amount of unsuitable habitat and the amount created in the past decade lie below the 30% and 15% maximums recommended in the LCAS.

The Newport Ranger District activity database and 1998 digital orthophoto quad maps were used to determine the amount of unsuitable habitat within the LAU. In the Chewelah LAU, all unsuitable habitat created by past harvest lies outside the Quartzite watershed. About 18.5% of the LAU consists of unsuitable habitat, and about 4.5% of the unsuitable habitat was created during the past decade.

Foraging Habitat

The amount of forage habitat exceeds the minimum recommended in the LCAS.

Based on the definitions of forage habitat in the LCAS, the entire LAU, excluding the unsuitable and non-lynx habitat areas, provides some level of forage. Forage quality differs among the stand types: young stands provide good habitat for snowshoe hares, while older stands provide habitat for both hares and red squirrels (though hares occur at a lower density than in young stands).

Percent of forage habitat on National Forest System and non-NFS land in the Chewelah LAU

	NFS	Non-NFS	All Land
% young forage*	15%	38%	23%
% mature forage	72%	33%	59%
% total area in forage	87%	71%	81%

Denning Habitat

The total amount of denning habitat is above the amount recommended in the LCAS. However, about half of this consists of good denning habitat, and the other half of marginal denning habitat.

Few studies have focused on lynx denning habitat, but those that have, suggest that it consists of cool or cold habitats (rather than warmer habitats) and contains numerous down logs. Warm biophysical environments were excluded from consideration for lynx habitat. Structural stage 6 (old forest, multi-strata) was used to identify the best potential denning habitat, and structural stages 4 and 5 (multi-strata younger forests) to identify marginal denning habitat. Because of the history of harvest on non-NFS land, it was assumed that no denning habitat exists on those lands.

Denning habitat was identified from aerial photo interpretation and some ground checks. Within the Quartzite portion, heavy snow and winds during the winter of 1996-1997 created substantial blowdown, consequently, most of the cool, mesic habitat types in that area was labeled as potential denning habitat. Down log densities were not quantified for these areas, but some informal surveys were conducted. In other portions of the LAU, the downed trees felled during an ice storm killed by insect or disease created several hundred acres of future potential denning habitat. These areas currently do not have much of an overstory, and do not qualify as denning habitat.

A bit more than 9% of the LAU contains potentially good denning habitat, and another 10% contains marginal denning habitat. On the northern half of the LAU, interspersion of potential denning habitat is good, with nearly any point lying within a mile of potentially good denning habitat. Few of the stands on the southern half of the LAU support potentially good denning habitat, partly because of the drier habitat and partly due to past harvest on NFS and non-NFS land. The area within Quartzite supports about 400 acres of potential denning habitat.

Lynx Denning Habitat Within the Chewelah LAU.			
	Good	Marginal	Total
Acres of denning habitat	1960	2170	4130
% Denning habitat	9%	10 %	19%

In recent years, Douglas-fir bark beetle and other insects and diseases have killed portions of about 500 acres of stands of trees in various spots in the LAU. About half of these acres fall in cooler, moister habitats and the trees, if left unharvested, will contribute to future lynx denning habitat. The large infestation of Douglas-fir bark beetle in this area occurred at lower elevations, outside the LAU, on drier habitats that do not provide good lynx denning habitat.

Human Access: Roads and Winter Recreation

The existing road and snowmobile trail density on NFS land is below the levels of concern mentioned in the LCAS draft (the final LCAS does not indicate a road or trail density target). The 49 Degrees North ski area lies in the southwestern part of this LAU.

On NFS land, the open road density is about 1.7 miles of road per square mile of land. Another 2.1 miles/sq. mile of closed roads wind through the NFS land in the LAU. Within the Quartzite portion of the LAU, no roads exist, though a road does lie on the ridge that separates the Quartzite watershed from the rest of the LAU. Except for the county road, all roads are small, unpaved forest roads. The county road is in the process of being rebuilt and upgraded to specifications for a 35-mile-per-hour road. This road divides the southern 1/3 of the LAU from the northern 2/3.

Road densities on NFS land in the Chewelah LAU		
Jurisdiction	Open	Closed
County	0.1	0.0
FS	1.6	2.1
Total	1.7	2.1

The amount of road on non-NFS lands was not available, but both the county and the Forest Service maintain roads on non-NFS lands. These values establish the minimum road density on non-NFS land

Minimum road densities on non-NFS land in the Chewelah LAU		
Jurisdiction	Open	Closed
County	0.1	0.0
FS	1.1	0.2
Total	1.2	0.2

One major, groomed snowmobile route lies along the ridge between the Quartzite watershed and the remainder of the Chewelah LAU. This snowmobile route is part of the popular trail system that extends southwards from the Pend Oreille Lakes chain. The CNF, in cooperation with the State of Washington and local snowmobile clubs, grooms about 5.6 miles of snowmobile trails in the LAU. That area receives about 400 Recreational Visitor Days (1 RVD equals 12 hours of use) during the winter, which is considered low-to-moderate use and not a threat to lynx (LCAS).

The 49 Degrees North ski area lies along the western boundary of the LAU. It covers over 1.5 square miles of terrain, about 690 acres of which remain permanently open due to parking lots, building sites, and ski runs from which brush is removed annually. At present, the ski area is not used frequently during the summer.

Bull Trout: Affected Environment
(Threatened-Federal)

Even though bull trout may have been able to access the Colville River drainage, there is no historical record of occupation. They have either been extirpated from the drainage in the distant past, or they have never inhabited the drainage.

Wolverine: Affected Environment
(Sensitive-USFS R6)

The Forest Plan provides no specific Standards and Guidelines or management direction applicable to this species. Wolverine is rare in northeast Washington, but may be found throughout the Colville National Forest. Wolverines are most often associated with boreal woodlands, but may be found in almost any habitat type. Research indicates wolverine habitat use is based more on adequate year-round food supplies and large, sparsely inhabited wilderness areas than on particular topography or plant associations.

The wolverine is a solitary, highly mobile animal requiring large territories. Territory size and seasonal movements of wolverines are influenced by food availability, breeding activity, and habitat conditions, including availability of denning sites and seclusion. Wolverines are considered opportunistic scavengers, consuming a wide variety of plant and animal food, with carrion (especially big game animals) serving as the mainstay of the animal's winter diet. Surplus food is often cached for later use. Remote country with limited human activity appears essential to maintenance of viable wolverine populations. Radio-tracking studies indicate wolverines will separate themselves from human activities if areas with less human disturbance are available.

Biologists reported seeing a wolverine in the northern portion of the Quartzite Planning Area in 1984. Because of the occurrence of a sighting by biologists, the wolverine's large territorial requirements, and the presence of seclusion habitat, the analysis area is considered to provide suitable wolverine habitat.

Corridors

See the preceding *Forest Plan Management Indicator Species/Marten: Affected Environment* discussion for a description of travel corridor habitat within the analysis area.

Prey

The analysis area contains fawning areas and summer and winter range for deer, and thus provides prey for wolverine the entire year. See the section titled *Forest Plan Management Indicator Species/Big Game/Deer and Elk Affected Environment* in this EIS for a complete discussion of the current habitat condition of these wolverine prey species.

Seclusion Habitat

Because wolverine and grizzly bears respond to disturbance in a similar fashion, the current situation was analyzed using the same evaluation criteria used for grizzly bears. See the preceding *Grizzly Bear: Affected Environment* subsection within *this* section of this EIS for a complete discussion of wolverine seclusion habitat.

Denning Areas

Denning sites are an essential habitat component for wolverine. Dens found in Idaho were associated with high-elevation, snow-covered talus slopes. Wolverine respond to humans near the natal den sites, usually by moving the kits several miles to another talus slope. Later in the spring, mothers bring the kits to secondary den sites at lower elevations. High levels of down logs are preferred at the secondary den sites, and human disturbance is not a factor in the selection of secondary den sites.

Generally, the analysis area provides few natal denning sites. Two mid-elevation west-facing talus slopes occur in the area, but elevation and aspect limit snow cover. The area does contain suitable secondary denning sites.

Pacific Western Big-eared Bat: Affected Environment

(Sensitive-USFS R6)

The Forest Plan does not contain specific standards and guidelines or management direction pertaining to pacific western big-eared bats. Pacific western big-eared bat may occupy almost any type of habitat, from grasslands to mixed conifer forest. This bat roosts and hibernates in caves or mine shafts.

Analysis of pacific western big-eared bat habitat considers effects to sites that support hibernacula and maternal colonies (caves, mines, old buildings). A bat survey conducted in 1988 on the Three Rivers Ranger District documented three pacific western big-eared bat locations, all more than 25 miles from the planning area boundary. Two mine sites located within the analysis area were surveyed in 1988. No pacific western big- eared bats were detected.

No caves or mine shafts longer than 50 feet occur in the analysis area, so the planning area does not contain high-quality pacific western big-eared bat wintering habitat. Pacific western big-eared bats roost in specialized structures (natural or man-made cavities) and do not use talus slopes.

Fisher: Affected Environment

(Sensitive-USFS R6)

The Colville National Forest Plan does not contain specific standards and guidelines or management direction pertaining to the fisher. Fishers are solitary animals. Fishers prefer mature to old growth coniferous forests containing a diversity of habitat types and successional stages. The best habitats are multi-aged stands interspersed with openings and containing riparian habitats. Fishers prefer forested riparian areas for foraging, resting, and travel corridors. They prefer mature to old growth grand fir forests and utilize stands containing pacific yew with large diameter spruce and Douglas fir particularly in the summer. During the winter, fisher prefer "decadent-seral stands" of lodgepole pine consisting of larger diameter live and dead trees and logs with a pacific yew understory component. They avoid openings regardless of season. Home ranges vary between 0.61 and 15 square miles.

This species was added to the Region 6 (R-6) sensitive species list late in 2000. Fisher populations are extremely low in Washington. In 1994,a tagged fisher that had been released in Montana was found dead approximately 10 miles northeast of the analysis area. There are no other reports of fisher in Stevens County. There is no documented evidence of fishers inhabiting Quartzite analysis area.

The analysis area may provide some of the diverse habitat components fishers use, therefore, it is possible that fisher could use the analysis area.

Great Gray Owl: Affected Environment

(Sensitive-USFS R6)

The Forest Plan does not contain specific standards and guidelines or management direction pertaining to great gray owls. Nesting habitat, including a platform for nests in close proximity to good foraging, is probably the most important habitat component for this species. The vast majority of prey species are small rodents, so nesting opportunities adjacent to meadows, pastures, marshes, lakes, young clear-cuts or in open forests proves best. Great gray owls may nest in many types of forest habitat. These can be moist to dry and can be all coniferous, all deciduous or a mix of both. Western United States conifer types can include Douglas fir, grand fir, lodgepole pine, Ponderosa pine, western larch, Englemann spruce, or combinations. Nests have been reported in broken-top snags, in old raptor nests, on platforms formed by dwarf-mistletoe, and on artificial platforms.

In northeastern Oregon Great Gray Owl nests were found in all forest types, but the majority of nests were in over-mature or remnant stands of Douglas-fir and grand fir forest types on north-facing slopes. After leaving the nest, cover becomes important to fledglings as they escape predators.

This species was added to the Region 6 (R-6) sensitive species list late in 2000. Breeding almost certainly occurs in Washington, but the presence of great gray owl scantly undocumented. Great gray owl observations have been reported only a few times on the entire Colville National Forest and none of those reports are within the analysis area. Wildlife personnel have surveyed the Quartzite analysis area many times over several years, including night surveys for wolves and barred owl, but have never encountered this species.

Peregrine Falcon: Affected Environment

(Sensitive-USFS R6)

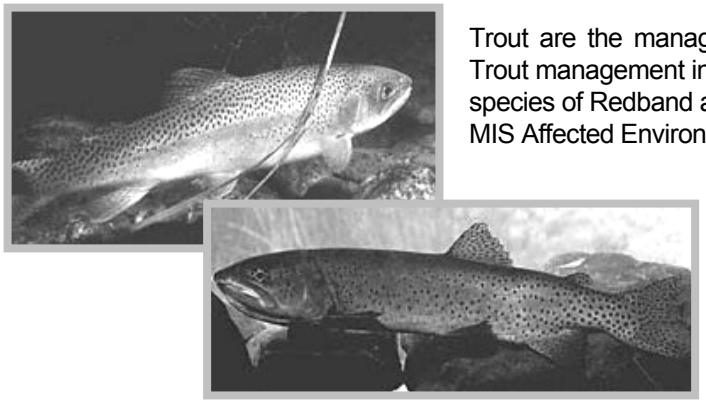
The Colville National Forest Land and Resource Management Plan provides direction to monitor nest sites for activity and to support recovery plan efforts. The Recovery Plan for Peregrine Falcon lists nesting habitat requirements as cliffs over 150 feet in height. A foraging area associated with the nesting territory usually includes wooded areas, grasslands, and marshes or open water.

Good nesting cliffs occur on the face of Quartzite Mountain. This area was considered as a "hacking" site in about 1990 and scientists concur with the site's suitability for nesting. The site has been observed over the years, but no nests (active or old) or birds have been seen. There are no historical records of peregrine falcon nesting on the eastern portion of the District.

Foraging habitat is good due to the adjacency to the open habitat in the Colville Valley. The Colville River flows through the valley and other creeks are found nearby. There are small wetlands in the valley and in other nearby valleys. Open fields also provide forage habitat.

Redband Trout & Westslope Cutthroat Trout: Affected Environment

(Sensitive-USFS R6)



Trout are the management indicator species for stream health. Trout management indicator species include the aquatic sensitive species of Redband and Westslope Cutthroat trout. The previous MIS Affected Environment section applies these native species.

To review this discussion, see the *Management Indicator Species/Riparian species/Trout: Affected Environment* sub-section of this EIS.

Focal Species

Several migratory bird species have been experiencing population declines and concern for this group is growing. Migratory birds are not Management Indicator Species for the Colville National Forest, but they were identified as a group of interest during the watershed analysis. Recently, several important actions related to migratory birds have occurred. The Neotropical Migratory Bird Conservation Act was signed into law on July 20, 2000. The USDA Forest Service Landbird Strategic Plan was issued in September 2000. The Forest Service and USDI Fish and Wildlife Service have developed a Memorandum of Understanding to strengthen migratory bird conservation (January 17, 2001). Multiple agencies have been involved in the development of general guidelines for land bird conservation in eastern Oregon and Washington. On January 10, 2001, The President signed an executive order outlining Federal agencies' responsibilities to protect migratory birds. The 125 land birds associated with breeding in habitats in the Northern Rocky Mountains in Oregon and Washington include many Neotropical migratory bird species.

Migratory Land Birds: Affected Environment

Migratory birds utilize a variety of habitats, including upland coniferous forests and riparian zones. Different species utilize different habitats for nesting. Many associate with deciduous trees and shrubs such as those found in riparian areas, but others nest in upland coniferous forests. Different species also use forest stands ranging from early successional to late successional stage. Some species are ground nesters using forest or meadow settings. Consequently, the entire analysis area offers nesting habitat to a variety of species.

Riparian areas provide nesting habitat for many migratory bird species. Some of the riparian vegetation in the analysis area has been reduced or eliminated, especially on other ownerships where pastures were created adjacent to streams. Within National Forest System lands, the Woodward Meadows riparian habitat was also converted to pasture, including the channelization of one branch of Cottonwood Creek. In addition to changing the location where water flowed to make a drier meadow, this channelization removed shrubs and other riparian vegetation. Other streams on National Forest System lands are located in upland settings where riparian zones are smaller and occur within a general forest matrix. The forests have greater canopy cover today than historically was present and conifer species composition is also changing. These changes are causing a shift in bird composition as well.

Lazuli Bunting

No surveys were conducted specifically for migratory land birds, but many species have been observed in portions of the Quartzite watershed. The relative abundances of different species has likely shifted over time due to past management such as homesteads, cattle grazing, and fire suppression. With fire suppression, encroachment of more shade tolerant species is occurring. Overall, the National Forest System lands in the analysis area have received relatively little commercial timber treatment. Most of the migratory land bird species that would use the area are expected to currently occur here, though their numbers are less than what would have occurred historically.

3.3.9 Wildlife and Habitat: Environmental Consequences

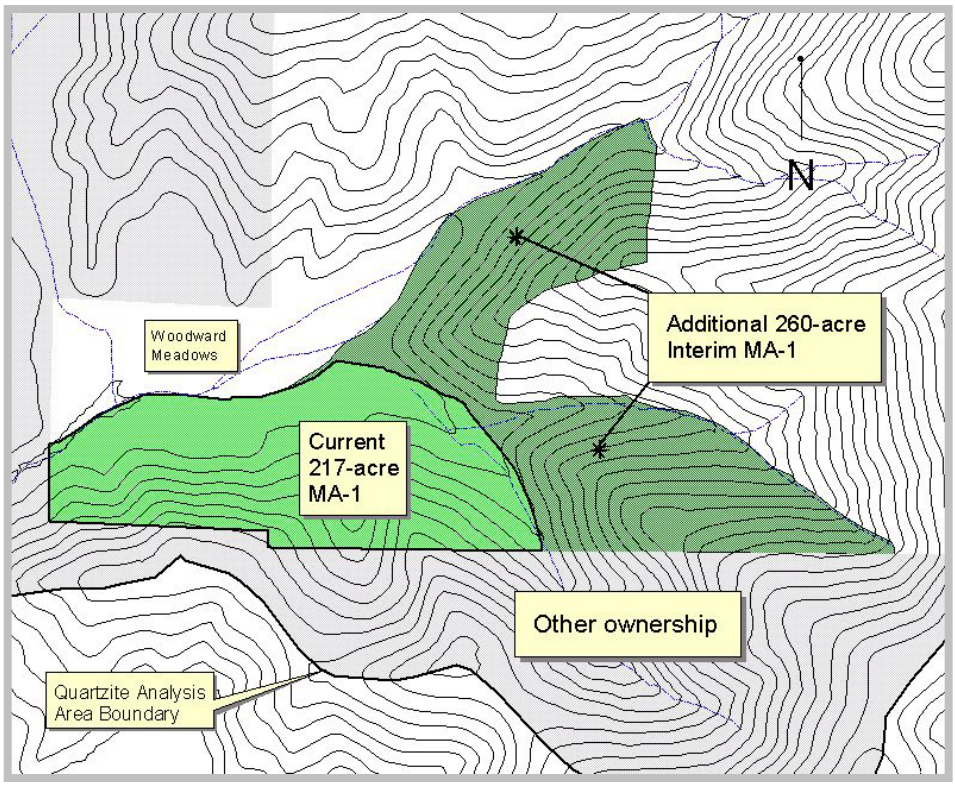
Forest Plan Management Indicator Species

Old Growth Dependent Species

Barred Owl: Environmental Consequences

MA-1 Areas

As noted in the previous *Barred Owl: Affected Environment* discussion, one MA-1 area exists in the Quartzite Planning Area. This MA-1 is 217 acres. Because of a land exchange in the 1990s, it is smaller than the requisite 300 core acres identified by the Forest Plan.



With all action alternatives, an additional 260 contiguous acres of the best habitat available would be managed as barred owl habitat, on an interim basis, until the Forest Plan revision[81] considers Forest-wide barred owl habitat strategies. This increase would insure that 477 acres would be managed as barred owl core habitat in the interim. Also, an additional 123 acres would be managed[82] as barred owl forage, thus insuring Forest Plan consistency. The No Action Alternative would maintain the current status of the MA-1.

Large Tree and Old Growth Habitat

No alternative proposes to harvest old growth. No alternative would harvest live trees larger than 21 inches in diameter (some dead trees >21" would be removed). No alternative proposes harvest in the pileated woodpecker habitat unit, the MA-1 core area, or the marten habitat units.

Harvest outside these old growth habitat reserves is designed to move stands toward late structure and, in the long-term, would benefit barred owl. Stands outside pileated woodpecker habitat units and the MA-1 are not essential to meet the Forest Plan habitat objectives for barred owls. However, the habitat quality within the reserve areas, across the Forest, is generally less than desirable, so stand conditions outside these areas remain important. Moving their condition toward late structure would provide long-term benefits to barred owl.

Cumulative Effects

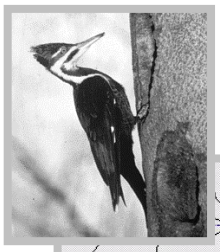
The incremental effects of the alternatives when added to other past present and reasonably foreseeable future actions were considered for barred owl and all the other species discussed in this analysis. Appendix C displays the list of associated actions.

Harvest on NFS Lands will not affect riparian areas because of INFISH guidelines. Harvest also will not affect trees greater than 21 inches DBH, although some dead trees greater than or equal to 21 inches DBH may be removed in pockets of Douglas fir beetle outbreaks that occur within planned units. Harvest will have little effect to potential nesting trees. State Forest Practices protect most riparian areas on other lands.

[81] The Forest Plan revision is scheduled to start in 2003.
[82] See Section 2.2.4 of this EIS: Wildlife Mitigation/Management Indicator Species/Marten-Barred Owl mitigation.

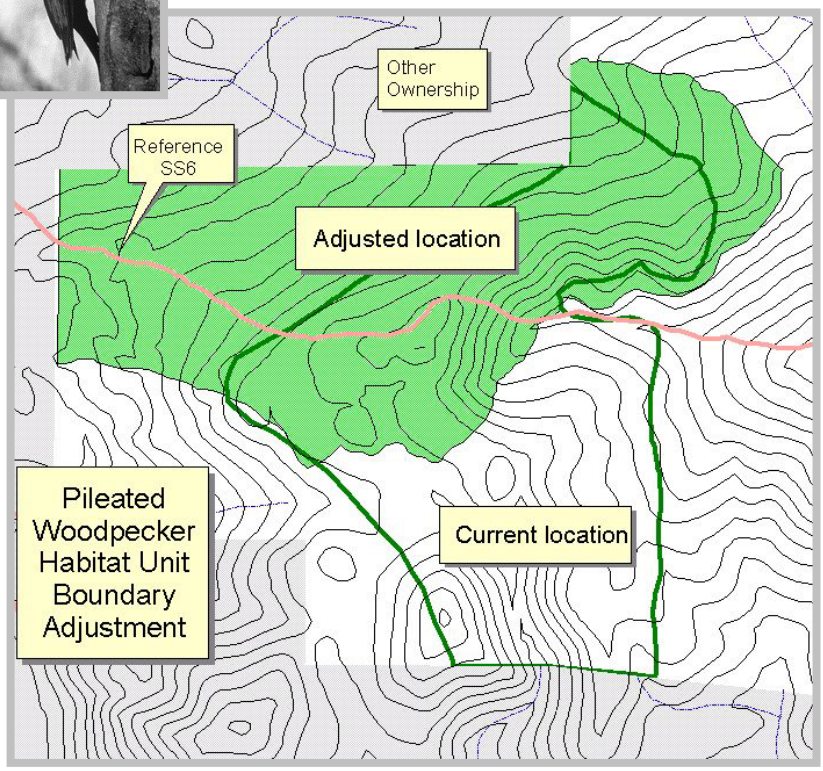
Because this action would improve long-term conditions, the cumulative effects of this and other past, present, and reasonably foreseeable future actions on barred owl habitat would be beneficial.

Pileated Woodpecker: Environmental Consequences



Pileated Woodpecker Habitat Unit

All action alternatives make boundary adjustments to the single existing pileated woodpecker habitat unit. These boundary adjustments were designed to increase the area that coincides with reference SS6 strongholds, where desired habitat features are more likely to be maintained over time. The action alternatives result in a 384-acre reproductive habitat unit, where no harvest or prescribed fire or non-commercial thinning would occur with any alternative. The Proposed Action Alternative (B), and the Upper Cottonwood Alternative (C) would construct 1,600 feet of new road through this habitat unit. The Vegetation Alternative (F) would construct 1,900 feet of new road through the unit. The No Action Alternative maintains the current boundaries.



All action alternatives propose treatment adjacent to the habitat unit. These units would be commercially thinned and are designed to move the stands toward structural stage 6 conditions. The Forest Plan requires leaving prescribed numbers of down logs for wildlife in harvest units. This requirement for down log retention insures sufficient pileated forage habitat within these harvest areas. There are untreated areas nearby that provide additional forage opportunities. Marten habitat units in the area also provide forage.

Douglas fir bark beetle activity occurs in the proposed pileated woodpecker habitat unit. While this activity causes a slight decline (<5%) in the quantity of habitat classified as high/moderate quality, it is not enough to threaten the ability of this unit to supply sufficient quality habitat. Some variability in habitat quality is expected.

Old Growth and MA-1 Areas

Only 60 acres of National Forest System Lands the meet NIZOG[83] criteria for old growth. None of these would be affected by the alternatives. See the preceding *Barred Owl: Environmental Consequences* subsection within *this* section of this EIS for a complete

[83] See Section 3.3.1 of this EIS (Forests: Affected Environment), for a discussion of North Idaho Zone Old Growth (NIZOG) definitions.

discussion of old-growth and MA-1 areas as they pertain to both barred owl, and pileated woodpecker.

Total Snag Habitat

Snags levels are rated adequate-to-high across NFS lands in the analysis area. However, all action alternatives would reduce the number of snags within harvest units. Snags are not targeted for harvest, but some are felled during logging to increase worker safety, especially in helicopter units. So, the more the area proposed by an alternative for commercial harvest, the more the alternative would reduce the number of existing snags.

To compensate for this potential loss in snags and to ensure population viability for this and other snag dependent species, timber sale contracts incorporate guidelines that retain a minimum of 4 large snags and 8 replacement trees per acre. All commercial harvest units would be marked to meet these guidelines. Consequently snag numbers would be consistent with the Forest Plan requirements[84].

Some stands have root rot, beetle-kill, and other pathogens that continue to add snags to the landscape.

Cumulative Effects

The incremental effects of the alternatives when added to other past present and reasonably foreseeable future actions were considered for pileated woodpecker and all the other species discussed in this analysis. Appendix C displays the list of associated actions.

Past activities (more than 10 years old) have had more negative effects on late structure and snag habitat than more recent and future projects, because retention standards for these habitat components were absent. Over the past 10 years these standards have improved habitat for pileated woodpecker. These standards may be modified with the approaching Forest Plan revision, however it is anticipated their objectives will persist and future management will incorporate pileated woodpecker habitat needs.

Marten: Environmental Consequences

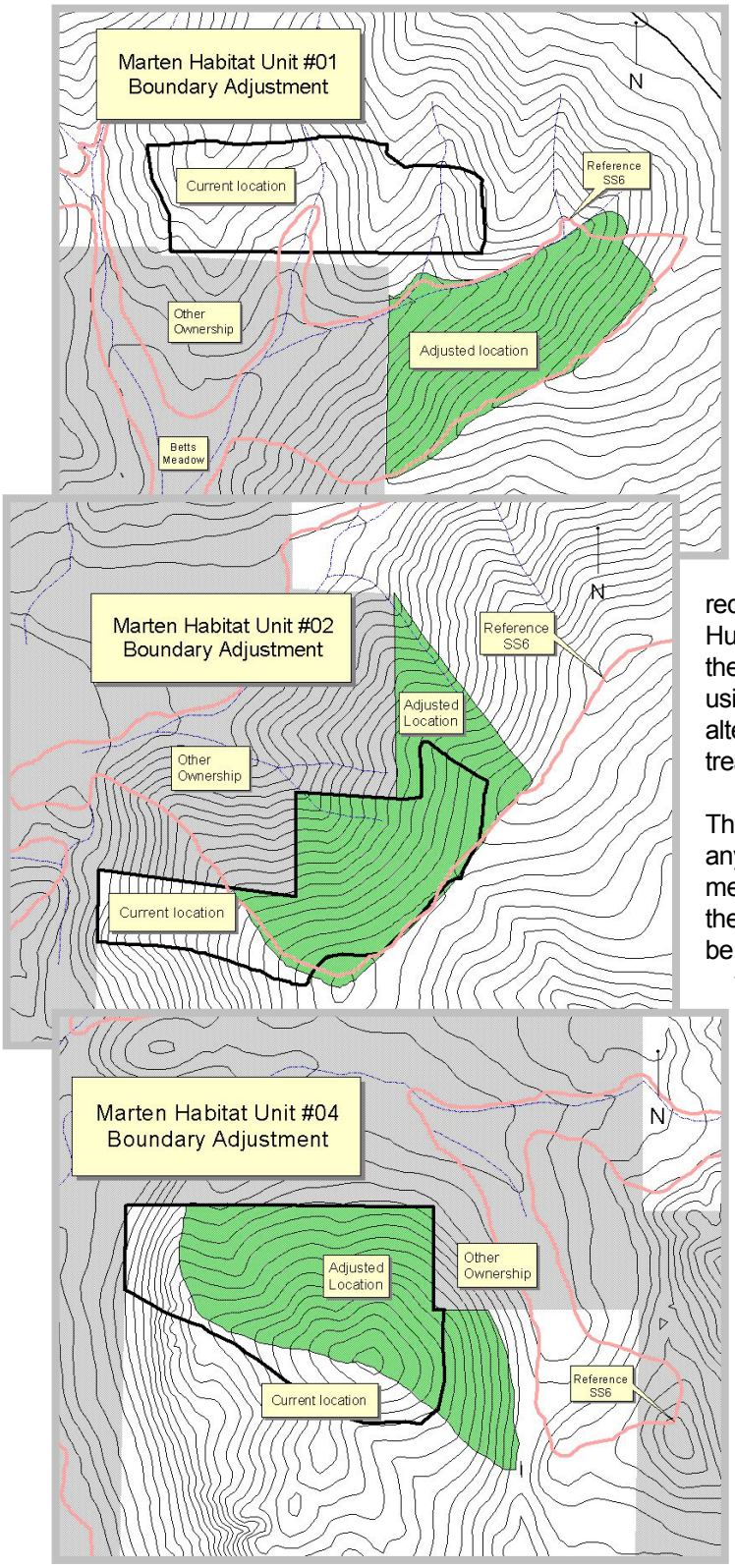
Mesic Large Tree Habitat

No alternative proposes to harvest old growth. No alternative would harvest live trees larger than 21 inches in diameter (some dead trees >21" would be removed). No alternative proposes harvest in the pileated woodpecker habitat unit, the MA-1 core area, or the marten habitat units. Mesic large tree habitat within these areas would not be affected by the action alternatives.

Harvest outside these old growth habitat reserves is designed to move stands toward late structure and, in the long-term, would benefit marten. Stands outside marten habitat units and the MA-1 are not essential to meet the Forest Plan habitat objectives for marten. However, the habitat quality within the reserve areas, across the Forest, is generally less than desirable, so stand conditions outside these areas remain important. Moving their condition toward late structure would provide long-term benefits to marten.

Some multi-stratum with large trees (SS6) stands located outside old growth habitat reserves would be affected by harvest units. Most occur on south and west facing sites

[84] Forest Plan Standards and Guidelines require two hard snags per acre more than 10-inches diameter in forage areas.



where this structure was historically uncommon because of frequent low intensity fire. Others occur in reference SS6 areas. As noted above, harvest in these stands would maintain all live trees over 21 inches in diameter. Stand structure would shift from a multi-stratum condition, to a simpler one or two story condition. This shift would reduce marten habitat quality in these areas. However, because these areas are located outside of marten habitat units, this reduction in habitat quality would not threaten marten viability.

Thinning overstocked stands can reduce the likelihood of catastrophic fire events that could negatively affect large areas of habitat. Still, there may be a short-term reduction in habitat quality after treatment. Human activity and machinery incumbent with the action alternatives would deter marten from using available habitat in the short-term. Those alternatives that propose more acreage for treatment would affect more disturbance.

The No Action Alternative does not propose any harvest. In the absence of a severe fire, mesic large tree habitat would remain intact in the short-term. This habitat would continue to be affected by the insect and pathogen agents that convert live trees to snags.

Marten and Pileated Woodpecker Habitat Units

No alternative proposes harvest in the pileated woodpecker habitat unit, the MA-1 core area, or the marten habitat units. Pileated woodpecker habitat units provide marten habitat. See the preceding *Pileated Woodpecker: Environmental Consequences* subsection within *this* section of this EIS for a complete discussion of pileated woodpecker habitat units as they pertain to both pileated woodpecker, and marten.

All action alternatives make boundary adjustments to three of the five marten habitat units. Where possible, these boundary adjustments are designed to increase the area that coincides with reference SS6 strongholds, where desired habitat features are more likely to be maintained over time. Unit #01 would increase to 165 acres; Unit #02 would increase to 173 acres; and Unit #04 would increase to 176 acres. The Vegetation Alternative (F) would construct

1,460 feet of new road through Unit #01. The No Action Alternative maintains the current boundaries.

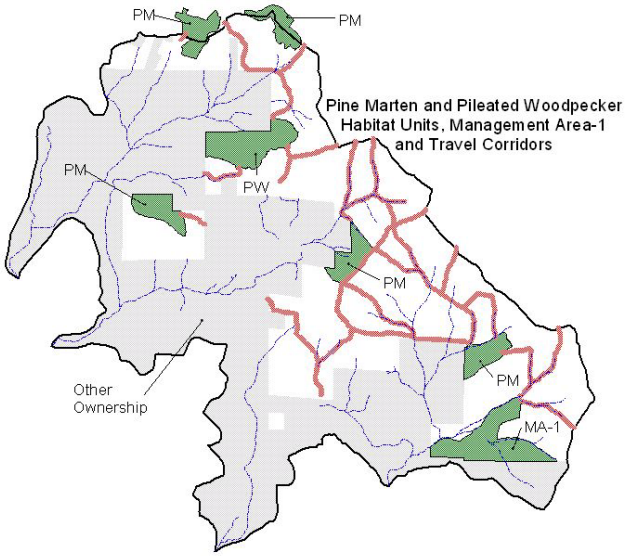
Douglas fir bark beetle activity occurs in the proposed pine marten and pileated woodpecker habitat units. While this activity causes a slight decline (<5%) in the quantity of habitat classified as high/moderate quality, it is not enough to threaten the ability of these units to supply sufficient quality habitat. Some variability in habitat quality is expected.

Large tree, multi-storied, closed-canopy cover types support good marten habitat. The three habitat units that would be adjusted by the action alternatives were evaluated and rated for these conditions.

Adjusted Marten and Pileated Woodpecker Habitat Units			
	High Quality	**Moderate Quality**	**Poor Quality**
Pine Marten Unit #01	32%	68%	0%
Pine Marten Unit #02	63%	37%	0%
Pine Marten Unit #04	16%	73%	1%

Treatment adjacent to these marten units would move stands toward desired marten habitat conditions.

Portions of two other marten units occur in the Quartzite Analysis Area. No road construction is proposed in either of these units. Underburning is proposed in all action alternatives within a small portion of one of these units. There would be little reduction in the quality of this marten unit as a result of this prescribed fire.



MA1 areas

MA-1 areas provide marten habitat. See the preceding *Barred Owl: Environmental Consequences* subsection within *this* section of this EIS for a complete discussion of MA-1 areas as they pertain to both barred owl, and marten.

Travel Corridors

The travel corridor network crosses existing roads in 20 places. A very small portion of corridor is affected by each crossing (0.3 acres). While road crossings do not preclude use, they do reduce the effectiveness of this habitat. The more crossings an alternative has, the more negative effects it imposes on the travel corridor network.

Because new road construction is not included with either alternative, the No Action Alternative (A) and the Existing Roads Alternative (K) add no new crossings. All other action alternatives propose new road crossings: the Wildland Alternative (E) and Wildland Fire Alternative (J) add 2 crossings; the Upper Cottonwood Alternative (C) proposes 3 new crossings; the Proposed Action Alternative (B) proposes 8 new crossings; and the Vegetation Alternative (F) proposes 16 new crossings.

Where corridors intersect timber sale units, silvicultural prescriptions would maintain the upper one-third of site potential canopy closure[85] and corridor integrity would be maintained. Alternate travel routes occur and the effect to animal movement would be small to non-existent.

Cumulative Effects

The incremental effects of the alternatives when added to other past present and reasonably foreseeable future actions were considered for marten and all the other species discussed in this analysis. Appendix C displays the list of associated actions.

Marten and pileated woodpecker habitat units were established across the District through photo interpretation and ground knowledge when the Forest Plan first became effective. Before then, older sales generally reduced the amount of structure that marten prefer. Old growth stands outside habitat units have been reduced.

Sales planned since the Forest Plan was amended (by "screens") are designed to maintain or improve late structure conditions and consequently improve the quality and quantity of marten habitat. Over time, this direction will improve marten habitat across the Colville National Forest. Habitat that forms travel-ways between MRs has been reduced, but riparian areas are being buffered by INFISH, so many of the stream buffer areas will allow marten movement.

White-headed Woodpecker: Environmental Consequences

Quantity of Nesting Habitat

White-headed woodpeckers use ponderosa pine (with which they are primarily associated) and mixed conifers for reproduction and feeding. They prefer mature (80 to 159 years) and old (160+ years) trees.

Action alternatives propose prescribed underburning. This action will help maintain or move stands to open park-like fire tolerant stands of ponderosa pine or larch. Burning would retard the conversion of these sites to Douglas fir. In general, underburning would improve white-headed woodpecker habitat. Accordingly, the more underburning an alternative proposes, the more positive effects it has on white-headed woodpecker habitat. All action alternatives propose a large number of acres to be underburned, so all would provide benefit to white-headed woodpeckers. In the absence of catastrophic wildfire, the No Action Alternative (A) would allow the continued growth of shrubs and shade-tolerant understory trees. This ingrowth would continue the decline of white-headed woodpecker habitat.

All six action alternatives propose commercial treatment in stands that have a large component of ponderosa pine. Silvicultural prescriptions in these stands and other sites historically occupied by ponderosa pine are designed to improve conditions for fire tolerant tree species like ponderosa pine. Correspondingly, the more an alternative improves conditions (the more commercial treatment it proposes), the more positive effects it has on white-headed woodpecker habitat. From greatest to least beneficial effect, these are: the Vegetation Alternative (F), the Proposed Action Alternative (B), the Existing Roads Alternative (K), the Upper Cottonwood Alternative (C), the Wildland Alternative (E), the Wildland Fire Alternative (J) and the No Action Alternative (A). Activities in potential

[85] See Chapter 2, Section 2.2.4: Pine Marten/Barred Owl mitigation.

habitat may impact unknown nests, but overall proposed activities will benefit white-headed woodpecker habitat.

Snag Habitat

Snags are a special habitat component used by the white-headed woodpecker. The Forest Plan requires that for all stands (other than lodgepole pine) snags greater than or equal to 21 inches DBH should be left when possible with snags down to 15 inches DBH being left when larger ones are not available. The proposed harvest activities are designed to meet these requirements and maintain snag habitat for all woodpeckers, including the white-headed woodpecker. Salvage would occur where the Douglas fir bark beetle outbreak has killed trees. Some dead trees greater than 21 inches DBH may be removed in these beetle-killed pockets. Their removal would have little effect on habitat. Also see the preceding *Pileated Woodpecker: Environmental Consequences* discussion for a description of the effects of the alternatives on total snag habitat within the analysis area.

Cumulative Effects

The incremental effects of the alternatives when added to other past present and reasonably foreseeable future actions were considered for white-headed woodpecker and all the other species discussed in this analysis. Appendix C displays the list of associated actions.

Sales planned since the Forest Plan was amended (by "screens") are designed to maintain or improve late structure conditions including, where appropriate, the SS7 open park-like conditions that are favorable to white-headed woodpeckers. Past harvest on dry forest sites targeted larger ponderosa pine. This coupled with the effects of the ingrowth of shade tolerant species has greatly reduced preferred habitat. The current Forest Plan direction that protects large snags and emphasizes the restoration of SS7 habitat will continue to improve conditions for this and other species.

Primary Excavators

Northern three-toed woodpecker: Environmental Consequences

All alternatives meet Forest Plan direction for old growth management, marten/pileated woodpecker habitat unit management, and snag habitat availability. Alternatives would meet northern three-toed woodpecker habitat capability objectives.

Marten Habitat Units

See the preceding *Marten: Environmental Consequences* subsections within *this* section of this EIS for a complete discussion of habitat units, as they pertain to both northern three-toed woodpecker and marten.

Snag Numbers

See the preceding *Pileated Woodpecker: Environmental Consequences* discussion for a description of the effects of the alternatives on total snag habitat within the analysis area.

Cumulative Effects

The incremental effects of the alternatives when added to other past present and reasonably foreseeable future actions were considered for northern three-toed

woodpecker and all the other species discussed in this analysis. Appendix C displays the list of associated actions.

Past timber sales, road building, and firewood gathering have reduced snags, especially large snags on many acres. The Quartzite area however has a high number of snags and some events (ice storm, beetles, etc.) are creating more. The proposed project would result in some reduction of the snag levels. Overall it is expected that Forest Plan snag requirements would be met. Many commercial units would be moved toward late structure, so should improve Northern three-toed woodpecker habitat in the subalpine fir biophysical and in those stands that have a large component of lodgepole.

Other Woodpeckers: Environmental Consequences

Throughout the Quartzite Watershed, snags have developed and continue to develop primarily through root rot diseases, insect outbreaks, and post-fire mortality. However, the proposed project would result in some reduction of the snag levels. The more timber harvest an alternative has, the more negative effects it imposes on the snag habitat. In harvest units that have sufficient snags and/or trees, marking would leave *at least* 4 large snags and 8 green trees. If the number of remaining snags is not sufficient, creating snags would mitigate the loss due to harvest.

The tree damage created during the winter storms of 1996/1997 created a great number of standing, broken, live trees. These trees will become extremely valuable as time passes because they will begin to decay and to attract insects, yet will remain standing. Additionally, because they are not considered snags under OSHA guidelines, many more of these can remain in a stand during logging activities. Mitigation restricts salvage prescriptions from removing more than 50% of the standing broken trees that are less than 40 feet tall. Consequently, harvest would have minor effects to woodpecker habitat.

Also see the preceding *Pileated Woodpecker: Environmental Consequences* discussion for a description of the effects of the alternatives on total snag habitat within the analysis area.

Cumulative Effects

The incremental effects of the alternatives when added to other past present and reasonably foreseeable future actions were considered for other woodpeckers and all the other species discussed in this analysis. Appendix C displays the list of associated actions.

Insect and pathogen activity across ownerships in the past and into the future has created and will continue to create snags. Many of these located on other ownerships will be removed. However harvest measures on NFS lands reserve snags and replacement snags. When these snags are added to snags located in areas where no harvest occurs, adequate snag habitat would be supplied, across the landscape.

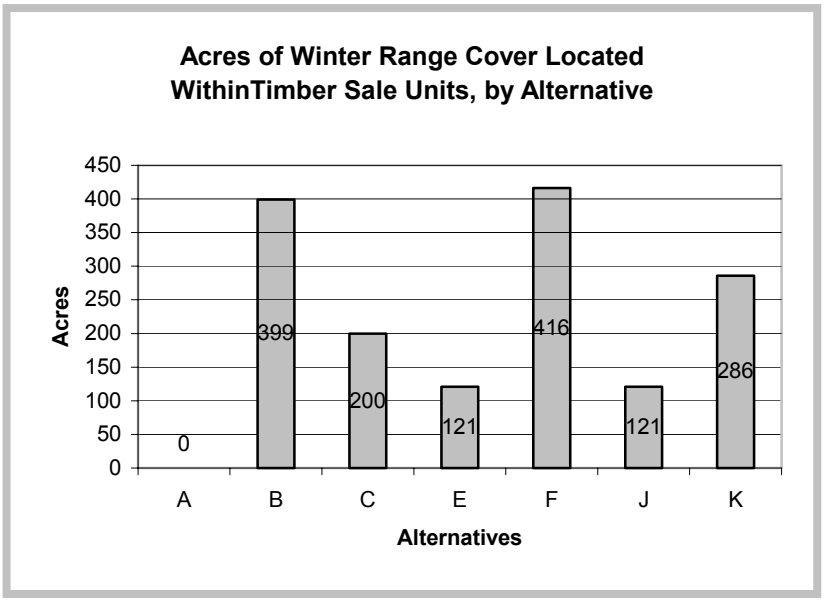
: Environmental Consequences

nge Cover Quantity and Quality

an allocated 37% of the analysis area (3,954 acres) for big game winter
d MA8). Fifteen percent of MA6 & MA8 qualifies as true cover (593 acres).

All action alternatives propose to harvest some winter range cover. All action alternatives also propose thinning in forested forage areas that include some cover. In some units, trees that contribute to thermal cover would be harvested. Harvest of these trees would improve future thermal cover by removing individuals that are stressed or that contain diseases or parasites. The short-term effect to cover would be slightly negative but the long-term effect would be more positive than if the stands were not managed. Cover quality is predicted to increase over time in units proposed for harvest because of the reduction of diseased trees.

Five winter range blocks occur in the analysis area: Woodward, Betts, Horseshoe, Quartzite, and Eagle. With the exception of the Woodward Block, all action alternatives propose harvest in cover-areas in some or all of these blocks. Harvest prescriptions would maintain the crown closure required for winter range cover (60%). There may be a few places in cover-areas where Douglas fir bark beetle or other insects have killed trees and reduced the crown closure below cover requirements. Prescriptions would not be able to meet cover requirements in those areas. However, harvest prescriptions are designed to produce a mosaic of covers within a unit, while protecting riparian areas where many cover patches are concentrated. Because of the prescription, many or most of these cover patches would remain.



The majority of the winter range occurs on low elevation southerly slopes. Prescriptions in drier sites will generally favor SS7 attributes so the quantity of cover may not increase in these areas over time. Overall, there is a negligible effect to cover from commercial treatment in the winter range in the Quartzite Watershed.

Prescribed fire has the potential to affect cover requirements in winter range. However, mitigation would maintain 60% crown closure where these activities coincide with areas mapped as winter-range cover. Underburning may stimulate some browse in cover areas that have lighter crown closures.

Winter Range Cover Distribution

All action alternatives propose treatments that affect the distribution, but activities would not alter the distribution greatly. The change in effective habitat is small. Forage distribution will remain nearly unchanged, and the quality and quantity should increase.

Condition of Winter Range Understory Vegetation

All stands proposed for harvest will show some increase in forage quantity and quality. The underburns and jackpot burns in the harvest units generally would increase the quantity and quality of forage over that of unburned stands.

Noxious weeds have become a problem since reference times. Maintaining an open habitat by thinning and underburning may benefit some species of noxious weeds.

Noxious weeds that encroach provide poorer forage quality than the native vegetation. Both harvest activities and prescribed fire provide opportunity for noxious weeds to encroach and displace forage for big game. Alternatives that propose greater numbers of acres either underburned or harvested have the potential to have greater negative effects from noxious weeds. However noxious weeds and competing vegetation mitigation emphasizes prevention, early-treatment and correction. This mitigation would effectively limit negative effects associated with noxious weeds, by first preventing encroachment, and correcting it if it does occur. Additionally, shrubs and forbs that respond with fast, lush growth would limit the potential effects from noxious weeds.

Roads in Winter Range

Roads cause negative direct and indirect effects to big game and big game habitat. Direct effects are the loss of habitat converted to roadway. The greatest indirect effects are the potential for noxious weeds to encroach, and for vehicle traffic to increase (noxious weed vector, poaching potential, and disturbance).

Direct effects from roads to *winter range* in all action alternatives range from minimal to moderate. Both the No Action and the Existing Roads alternatives construct no new roads. The other alternatives convert the varying amounts of acres from habitat to non-habitat. The Vegetation Alternative has the greatest short-term negative effects.

Road density would remain at current conditions with the No Action Alternative and would return to the current level after new roads are closed in the Vegetation Alternative, because neither of these alternatives proposes to close existing open roads in winter range. The other alternatives would reduce the winter range road density to below current conditions after new roads are closed and after existing road 4342.250 (at Woodward Meadows) is closed. Closing this road would close over 1.0 mile in winter range.

The table shows the short-term effects (5 years) for each alternative. All new road segments in winter range would be closed from December 1 through March 31 each year until sale activity is completed then must be closed permanently after that (see Big Game Mitigation in Chapter 2 of this EIS). Consequently, Forest Plan Standards would be met.

Alternative	Road Acres	Miles	Road Density Increase (m/m^2)	Road Density (m/m^2)
No Action (A)	0	0	0	0
Proposed Action (B)	16.1	4	0.6	1.8
Upper Cottonwood (C)	9.4	2.4	0.4	1.6
Wildland (E)	7.0	1.8	0.3	1.5
Vegetation (F)	23.1	5.8	0.9	2.1
Existing Roads (K)	0	0	0	0
Wildland Fire (J)	7	1.8	0.3	1.5

Indirect effects are potentially greatest in the alternative (Vegetation) that proposes the most road construction and descend in order as the number of road miles decline. Though new roads would be closed, their existence would increase access and noxious weed spread. However noxious weeds and competing vegetation mitigation emphasizes prevention, early-treatment and correction. This mitigation would effectively limit negative effects associated with noxious weeds, by first preventing encroachment, and correcting it if it does occur.

Big Game Cumulative Effects

The incremental effects of the alternatives when added to other past present and reasonably foreseeable future actions were considered for big game and all the other species discussed in this analysis. Appendix C displays the list of associated actions.

In all recent projects harvest units in winter range were designed to improve cover quality over the long-term by increasing growth rates and reducing diseases and parasites of remaining trees. Some units in older projects have affected cover quality by either reducing the crown closure to minimal levels or favoring larch (a tree species does not provide winter cover).

Past winter range burns have improved the quality of forage in several areas across the east side of the District. Some noxious weeds are present in winter range areas. Activities related to harvest or prescribed fire have the potential to expand the distribution of noxious weeds and decrease the abundance of forbs and grasses, thus decrease overall forage quality. However noxious weeds and competing vegetation mitigation emphasizes prevention, early-treatment and correction. This mitigation would effectively limit negative effects associated with noxious weeds, by first preventing encroachment, and correcting it if it does occur.

Avian Species

Large raptors and great blue heron: Environmental Consequences

Great blue heron habitat is negligible or non-existent within the analysis area; consequently, analysis for this MIS group is limited to large raptors.

Quantity of Nesting Habitat

Potential nesting habitat is scattered across the analysis area. Some of the best potential nesting areas are in “strongholds” areas because the habitat is more likely to be sustained over a longer period of time. Other areas outside “strongholds” on north slopes or along drainages also provide good potential nest sites. No live trees larger than 21” DBH will be harvested. Some beetle-killed trees that are 21” DBH or greater may be harvested in some units.

All action alternatives propose commercial harvest in stands that may provide potential goshawk (or other accipiters) nesting habitat. Cooper’s and sharp-shinned hawks prefer to nest in young overstocked stands. All action alternatives propose commercial thinning in some of these areas. Consequently, reducing stocking in these stands would negatively affect potential nesting habitat for Cooper’s and sharp-shinned hawks. However, adequate nesting habitat exists outside commercial thinning areas. Commercial harvest may also move the current SS6 to SS7 type stands on drier sites where the more open structure is better able to persist. By moving SS6 stands toward SS7, all action alternatives may reduce the amount of potentially highest quality goshawk nesting habitat, but those sites generally will still provide the mature tree habitat so will still provide goshawk nesting habitat.

In general, the more commercial harvest an alternative proposes, the more negative effects it imposes on accipiter nesting habitat. Conversely, not treating stands may leave them more susceptible to events such as wildfire and insect outbreaks, so there are also positive effects from commercial treatment. And the same relationship holds true: the more commercial harvest an alternative proposes, the more positive effects it realizes.

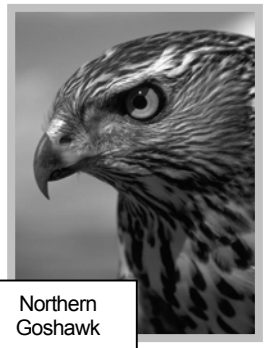
The tradeoffs are a reduction of current nesting habitat versus an increase in stand stability.

Underburning also could reduce the dense stocking that Cooper's and sharp-shinned hawks prefer to use for nesting. It may reduce ingrowth in some stands that goshawks use for nesting, but would not remove the mature trees that goshawks prefer. Generally, the potential effects to Cooper's and sharp-shinned hawks from underburning range from greatest to least by the alternatives that treat the most to those that treat the fewest acres. Underburning has little potential to decrease the amount of potential goshawk nesting habitat, though it may occasionally kill a larger tree and may thin ingrowth in some SS6 stands.

The 30 acres of habitat surrounding the 1997 goshawk nest will not be treated in any alternative. A nearby alternate nest was found in 2000 and 30 acres surrounding that nest is also buffered. No Douglas-fir beetle occurs in the alternate nest buffer. As with the first nest, there will be helicopter timing restrictions in the Betts Basin and the West Fork subwatersheds and additional, restrictions within ½ mile of the nest.[86]

Goshawk Post-Fledging Habitat

Project design incorporated a 400-acre post fledging area (PFA) for the goshawk nest(s) in the Betts drainage. Over half of this PFA is greater than 4,000 feet elevation. The majority of the stands in the PFA are classified as SS5 and SS6. Some studies recommend that goshawk PFA habitat should contain overstories with a canopy cover greater than 50% and with well-developed understories and habitat attributes (e.g., snags, nest trees, foods) that are important to goshawk prey species. PFAs should also contain high foliage volume and canopy cover in nest stands with more open foraging habitats.



Northern Goshawk

No treatment is proposed in the PFA in the No Action Alternative (A), the Upper Cottonwood Alternative (C), the Wildland Alternative (E) or the Wildland Fire Alternative (J). The Vegetation Alternative (F) proposes harvest in 329 PFA acres. The Proposed Action Alternative (B) proposes harvest on 201 PFA acres. The Existing Roads Alternative (K) proposes harvest on 92 PFA acres. Some of this harvest occurs in *reference* SS6 stronghold areas, the majority of which is currently classified as SS5. The harvest in these units is designed to meet the Forest Plan standards that retain SS6 & SS7 stands and move younger stands towards LOS condition. Silvicultural prescriptions would also maintain 50% canopy cover, with the cover clumped rather than uniformly distributed. This thinning could limit future goshawk nesting sites in the PFA. However, without thinning, the PFA would be more susceptible to insect outbreaks, wildfire and other events that can decrease or eliminate the ability of this area to function as a PFA.

Prescribed fire is proposed within the goshawk PFA in three of the alternatives. The Vegetation Alternative (F) proposes fire in 329 acres of the PFA. The Proposed Action Alternative (B) proposes fire in 323 acres of the PFA. The Existing Roads Alternative (K) proposes fire in 214 acres of the PFA. As noted above, underburning has little potential to decrease the amount of potential goshawk nesting habitat, though it may occasionally kill a larger tree and may thin ingrowth in some SS6 stands.

Currently, there are no roads in the PFA. Two new road segments are proposed within the PFA for both the Proposed Action Alternative (B) and the Vegetation Alternative (F). If

[86] See Section 2.2.4 Mitigation in this EIS.

built, 0.8 miles of one of these roads would be within the PFA. Six tenths of a mile of the other would be within the PFA.

Thinning, prescribed fire and road construction activities all have the potential to disturb goshawk-fledging activities. To minimize these negative effects, mitigation restricts these activities during critical times. From March 1 through September 30, each year, these activities would be prohibited.[87]

Evidence of goshawk use (prey remains) was found outside the PFA. Goshawk forage makes up the largest part of a goshawk home range, averaging 5400 acres in addition to those areas identified for the nest site and PFA. The Betts Basin area is about 3,420 acres, so it provides foraging opportunities for this goshawk nest. Betts Meadows is also a good foraging area. Other suitable goshawk nesting and PFA habitat does currently occur outside the PFA.

Cumulative Effects

The incremental effects of the alternatives when added to other past present and reasonably foreseeable future actions were considered for large raptors and all the other species discussed in this analysis. Appendix C displays the list of associated actions.

The Colville National Forest has been locating and protecting goshawk nests since 1992. The protection of nests minimizes impacts for these and future nests. Before 1992 it is assumed that nesting birds or nest sites were impacted by timber harvest, road construction and prescribed fire. The surveying and nest protection does minimize the overall negative effects to raptors. Current Forest Plan direction may impact potential sharp-shinned and Cooper's hawk nest habitat more than potential goshawk nest habitat because it emphasizes moving stands toward late structure.

Roads built into potential habitat will increase possibility of disturbance to nests we have found and unknown nests. Harvest activities and spring burning in potential habitat may also affect unknown nests.

Within the Quartzite Watershed, a relatively small portion of the National Forest System lands has been harvested in the last 30 years. These areas included the No See Um units near Flowery Trail Road, the Old Run units near Flowery Trail Road, the Eagle Mountain unit on Eagle Mountain, and some of the United Eagle units on the south side Eagle Mountain. Harvest has also occurred on other ownerships during this time period.

Blue grouse: Environmental Consequences

The No Action Alternative does not enter any blue grouse habitat so it would not affect the existing situation. All action alternatives have harvest and prescribed fire units that benefit blue grouse habitat by opening the understory, thus enhancing stands for blue grouse. Harvest prescriptions would maintain 8 mature limby Douglas fir or subalpine fir trees, where available. Beneficial effects from silvicultural treatment would be highest with the Vegetation Alternative (F), followed in descending order by the Proposed Action Alternative (B), the Existing Roads Alternative (K), the Upper Cottonwood Alternative (C), and the Wildland Alternative (E) and the Wildland Fire Alternative (J). With the exception of some beetle-killed trees,

[87] See Section 2.2.4 Mitigation in this EIS.

no trees larger than 21" DBH would be removed. Excluding the removal of these infrequent dead trees, larger roost and forage trees would not be affected.

There are potential negative effects associated with road construction. Removing larger trees would reduce roost habitat, and noxious weeds could decrease forage. Greatest negative effects from road construction are associated with the alternative that proposes the most new road construction - the Vegetation Alternative (F), followed by the Proposed Action Alternative (B), the Upper Cottonwood Alternative (C), both the Wildland Alternative (E) and the Wildland Fire Alternative (J), and lastly the Existing Roads Alternative (K).

Alternatives have mixed effects to blue grouse. Some alternatives provide more benefits as a result of vegetation management while including the negative effects associated with road construction. Other alternatives may provide less benefit from vegetation management, but may not convert as many acres from forest to roadway. However, because at least 8 roost trees per acre would be retained; springs and wetlands would be buffered; and loss of habitat due to noxious weed invasions would be minimized by mitigation that emphasizes prevention, early-treatment and correction, there would not be a great difference among alternatives in the total beneficial or negative effects to blue grouse or their habitat. All alternatives would met or exceed Forest Plan habitat requirements.

Cumulative Effects

The incremental effects of the alternatives when added to other past present and reasonably foreseeable future actions were considered for blue grouse and all the other species discussed in this analysis. Appendix C displays the list of associated actions.

Pre-Forest Plan regeneration harvest in all watersheds greatly reduced blue grouse habitat by removing large ponderosa pine or Douglas-fir, especially mistletoe-infested Douglas-fir, on open, dry, south-facing slopes. Roads built in blue grouse habitat could increase the amount of noxious weeds and consequently decrease forage for blue grouse. However, noxious weeds and competing vegetation mitigation emphasizes prevention, early-treatment and correction. This mitigation would effectively limit negative effects associated with noxious weeds, by first preventing encroachment, and correcting it if it does occur.

Franklin's grouse Environmental Consequences

Shelterwood or sanitation/shelterwood harvest prescriptions that regenerate lodgepole pine would have a positive effect on Franklin's grouse habitat. Because there are so few of these acres currently, and because even fewer of those acres would be treated, the net effect is very small. Commercial thinning would have a minimal effect. Non-commercial thinning on some acres could have a negative effect. However, retaining un-treated portions in these units would prevent foraging habitat loss.

Cumulative Effects

The incremental effects of the alternatives when added to other past present and reasonably foreseeable future actions were considered for Franklin's grouse and all the other species discussed in this analysis. Appendix C displays the list of associated actions.

Past fire suppression has contributed to the decline of larger expanses of young lodgepole pine. Franklin's grouse habitat is likely to decrease due to the recent trend away from

regeneration harvesting in lodgepole stands. Noncommercial thinning continues on the District, although the number of acres is declining. Though un-thinned patches are left in thinning units, noncommercial thinning in lodgepole pine decreases habitat quality for Franklin's grouse.

Riparian Species

Beaver: Environmental Consequences

None of the proposed timber harvest or prescribed fire activities would affect beaver habitat. The buffer zone around riparian areas is sufficient to insulate habitat from the effects of these activities. There are proposed road crossings for some creeks, but they are in steeper reaches that are not good beaver habitat. These crossings are planned and constructed so that beaver habitat is not negatively affected. Improving the Woodward riparian/wetland area by planting willow, aspen, or other deciduous vegetation and by restoring drainage patterns would improve beaver habitat.

Cumulative Effects

The incremental effects of the alternatives when added to other past present and reasonably foreseeable future actions were considered for beaver and all the other species discussed in this analysis. Appendix C displays the list of associated actions.

Some past projects on the District have proposed habitat improvement activities in riparian areas. Some of these wetlands/riparian projects have a slight, positive, effect on beaver habitat. Lack of disturbance may eventually eliminate beaver habitat. Much of the potential beaver habitat within Quartzite Watershed occurs on other ownership. A high proportion of that habitat has been converted to agricultural or other purposes so it no longer provides habitat.

Trout: Environmental Effects

The viability of trout species can be assessed by distribution and quality of their habitat. In outside NFS lands habitat conditions have been degraded by land management activities. These channels depend on woody debris for channel structure. The switch from timbered riparian habitat to pasture land negatively affected bank stability, consequently negatively impacting the native fisheries. No native populations of cutthroat and bull trout have been recorded within this area. Habitat conditions may have changed enough that these populations are no longer present at viable levels. A small rainbow trout population is present. The non-native fish population is strong. Brook trout out-competed the native fishes due to the degraded habitat.

No Action Alternative (A)

As stated in INFISH, the exclusion of timber harvesting in RHCAs would permit the natural succession of forest vegetation and would rely more heavily upon natural events, such as fire and insect and disease infestations, to influence or shape forest succession. Consequently, increases in tree mortality and the associated risk of fire, insects and disease would be expected.

The function of the riparian habitat (providing instream large wood, shade, detritus, bank stability and acting as a sediment filter) is expected to remain stable along most of the streams. Improvement of riparian function is expected as vegetation matures in past riparian harvest units and provides shade and wood recruitment over time.

Not implementing the Woodward Meadows riparian/wetland improvements and the road/stream crossing improvements would continue to degrade streams. Since this alternative does not restore the water table in Woodward Meadows, the brook trout population would continue to be the dominant fish species. However the portion of Cottonwood Creek going through Woodward Meadows provides only marginal trout habitat. For Woodward and Betts Meadows past and current management activities have negatively affected the functioning of the meadows and the vegetation. Restoration efforts are underway in Betts Meadows. In Woodward Meadows, the Reed canary grass infestation would continue as the water table drops.

The overall recruitment sources for large instream wood is expected to slightly improve as riparian vegetation is protected from most harvest and it matures throughout the watershed. Over time, the new instream wood debris is expected to increase the number of pools, available spawning, hiding, resting and feeding habitat for trout. It would also increase the amount of detritus and habitat available to macro invertebrates and slightly decrease water temperatures due to increased shading.

The habitat would continue to be dominated by a brook trout population. Redband and Cutthroat trout populations would most likely not return. The reasons for this are the lack of re-founding populations in the Colville watershed; degraded habitat within Cottonwood Creek and the Colville River (overall low habitat complexity, marginal summer water temperatures; limited winter rearing and spawning habitat); and competition with brook trout for the most favorable habitat in the Cottonwood Creek watershed.

One of the major landscape processes in this watershed is fire. Because of past fire suppression efforts, fuel loadings in the watershed are high. This increases the risk of catastrophic fire. Effects on riparian resources from a catastrophic fire in this analysis area are described in the hydrology section under the no action alternative. In summary sedimentation from streambank instability would cause fish habitat to decline as spawning gravels become embedded with fine sediments that decrease the intergravel dissolved oxygen. Riparian wildlife habitat would decline as beaver ponds fill in with sediment or if dams are breeched due to high flows. Stream temperatures would also increase due to increased sediment loads and the removal of vegetative shade. The fisheries population would decline due to degradation of habitat after the fire.

There would be no significant effects to fisheries with the No Action alternative, as long as a catastrophic fire does not occur. The status quo would be maintained. Sediment would not reach levels that will cause a detriment to fisheries. If a catastrophic fire occurs, there would be a temporary drop in the fish population till the stream heals as vegetation returns.

Action Alternatives

After reviewing all action alternatives the effects to fishes, their habitats, and INFISH RMOs are negligible in the Sherwood and Thomason Creek watersheds. There will be no cutting in riparian habitat conservation areas. Therefore there will be no reduction in LWD. Sedimentation from haul is not expected to reach fish bearing portions of these watersheds. The cumulative effect on the Colville River from these Watersheds is also negligible. Therefore these watersheds will not be further considered.

There are no significant effects to fisheries from harvest units for the Action alternatives. Because all of the harvest activities in the action alternatives stay out of the RHCAs, bare ground will not be exposed

Effects Common to All Action Alternatives

Vegetation Management
Harvest units are located outside of riparian areas. There will be no effect to trout or INFISH RMOs from harvest activities within individual unit boundaries, except that the risk of catastrophic fire is reduced.

For the action alternatives the degree to which fuel levels are reduced influence the risk of catastrophic fire. One of the major landscape processes in this watershed is fire. Because of past fire suppression efforts, fuel loadings in the watershed are high. This increases the risk of catastrophic fire. If a catastrophic fire occurred, sedimentation from streambank instability would cause fish habitat to decline as spawning gravels become embedded with fine sediments that decrease the intergravel dissolved oxygen, streams widen in response to the sediment loading, and mid channel bars develop. Riparian wildlife habitat would decline as beaver ponds fill in with sediment or if dams are breeched due to high flows. Stream temperatures would also increase due to increased sediment loads and the removal of vegetative shade. By reducing the risk of catastrophic fire, there is a beneficial effect to fisheries, INFISH RMOs, and fish habitat.

Prescribed burns would not be ignited in riparian areas. The vegetation would remain intact. The filtration capacity of the riparian forest floor would not decrease. For these reasons, it is unlikely that noticeable increases in sediment influxes to streams would be caused by the fuel treatments. However, the potential for prescribed fire to bare more soil than desired and to cause some increase in sediment production is recognized. With regard to water quality, the burning of slash and burning to restore open ponderosa pine-Douglas-fir forest stands would result in nutrient flushes into streams. This would support rather than damage the fishery, but in any event would probably be too minor to be a significant influence.

Riparian/Wetland Management
Restoration on Woodward Meadow would dramatically improve wetland function. However a temporary increase in sedimentation below in Cottonwood Creek may occur during for a few years after restoration work on Woodward Meadows. Small dams would divert water from the human-made channel, back into the wetland. No new channel would be dug. The water would be allowed to flow over the wetland. A channel may form as the water finds channels and headcuts back through the meadow. The headcutting would not be severe and would result in a favorable Rosgen E type channel. This is expected to stabilize as the stream channel forms. It is expected that the stream channel would go from a being six feet below the meadow to a foot below the meadow. Currently the stream is not connected to the meadow. Restoration allows flooding over the meadow improving filtration and moderating flows. A temporary loss of habitat would cause a short-term negative impact on the fisheries in the meadow reach as the channel adjusts to flows. All action alternatives implement restoration on Woodward Meadows. There are short-term effects to trout, trout habitat, and INFISH variables in the meadow reach, but over time there will be a beneficial impact to the entire stream ecosystem.

Restoration of the meadow also involves the closing of the road along the meadow. This closure will help prevent vehicles from accessing the meadow causing large areas of disturbance.

The Road/Stream Improvement projects would significantly reduce erosion and improve aquatic habitat. Culvert problems would be fixed. Road segments that are contributing the most sediment in the watershed would either be treated or closed. There are numerous aquatic enhancements proposed which will improve the fisheries habitat, such as the Woodward Meadows project. These projects would have a beneficial impact on trout, INFISH RMOs, and fish habitat. There would be a reduction in sediment, therefore pools depths would increase.

Road management
Road reconstruction and use for haul can cause negative effects. Short-term (1-2 years) sedimentation is produced from ditch cleaning, cutslope rejuvenation for curve widening, culvert replacement, and drainage dip construction, etc. However, these activities used in conjunction with mitigation would result in a moderate beneficial effect over the longer term, as sediment production from road templates decreases due to new armoring, drainage structure placement, and revegetation.

New road/stream crossings cause detrimental effects through fine sediment introduction to streams. New crossings have both long and short-term effects. Sediment is delivered from temporary and new roads, landings, and skid trails before they revegetate.

Road reconstruction and use for haul cause detrimental effects. Short-term (1-2 years) sedimentation is produced from ditch cleaning, cutslope rejuvenation for curve widening, culvert replacement, and drainage dip construction, etc. A number of mitigation measures are included that would result in a moderate beneficial effect over the longer term, as sediment production from road templates decreases due to new armoring, drainage structure placement, and revegetation. The use of County road 2888 and county road 2857 as main haul routes have the potential to negatively affect fisheries because portions of these roads lie within 200 feet of stream channels. However, the Road/Stream Improvement projects and other mitigation would significantly reduce erosion and negate adverse effects.

Alternative Specific Effects
There are no significant effects to fisheries from harvest units for the Action alternatives. Because all of the harvest activities in the action alternatives stay out of the RHCAs, bare ground will not be exposed.

Proposed Action Alternative (B)
Under this alternative, there is only one new crossing in the Cottonwood Watershed. The proposed crossing is located on Reach 2 of Tributary 2. This stream reach is a Class III whose riparian area has abundant to excessive large woody debris in and adjacent to the channel. It empties into the main tributary of this subwatershed approximately 4000' below the proposed crossing. Sediment produced at this crossing would be stored behind abundant instream organic debris and would move through the system in pulses during high spring flows. Because of the excellent condition of this tributary, the sediment would be adequately stored in the tributary and would not enter the mainstem in amounts that would be measurably different from current levels. The effects of this crossing would not negatively affect the fisheries or INFISH RMOs.

The detrimental effects of road reconstruction and use for haul are described as short-term (1-2 years). This includes sediment production from ditch cleaning, cutslope rejuvenation for curve widening, culvert replacement, and drainage dip construction, etc. Mitigation use, however, would result in a moderate beneficial effect over the longer term,

as sediment production from road templates decreases due to new armoring, drainage structure placement, and revegetation.

Sedimentation resulting from roads and harvest would not be enough to change existing down-stream habitat characteristics. There would be no change in spawning success, fish populations, and instream habitat.

This alternative implements the restoration on Woodward Meadow. There would be a dramatic improvement in wetland function and stream habitat after restoration work. However there would be a temporary increase in sedimentation in Cottonwood Creek during and for a few years after restoration work in Cottonwood Creek. The channel would also be adjusting over its floodplain affecting connectivity and fish habitat. This is expected to stabilize as the stream channel forms. It is expected that the stream channel would go from being six feet below the meadow to a foot below the meadow. Currently the stream is not connected to the meadow. Restoration would allow flooding over the meadow improving filtration and moderating flows.

Brook trout are the only trout species found in Cottonwood Creek on National Forest System lands. Brown trout are located in the Colville River. Habitat would be lost in Woodward Meadows, but it is not a significant spawning, rearing or over wintering area. It is currently marginal habitat. The loss of the habitat would not wipe out any trout population in Cottonwood Creek or the Colville River.

The road management activities, including haul and reconstruction, would follow BMPs and mitigation measures and therefore would have a very minimal impact on the species. Sedimentation increases may be expected to fall within the natural range of variation of sediment production within these watersheds, and would be undetectable using current sampling techniques. INFISH variables are not expected to change (except for Woodward Meadows) since sediment level would not be increased. There would be no stream in the Woodward Meadows, until a new one forms naturally. Approximately a quarter of a mile of marginal trout habitat would be lost. However 20 acres of wetland habitat would be improved. This would improve water quality downstream for trout species. The reduction in fire risk would benefit trout, since post-fire channels would not downcut and riparian integrity would be maintained. The trout populations and the INFISH RMOs in the analysis area and downstream of the analysis area would not be significantly negatively impacted.

This alternative is one of the more aggressive alternatives, proposing more acres of vegetation treatments than all alternatives beside alternative F. This alternative reduces the risk of catastrophic fire more than any other alternative with the exception of alternative F. Therefore this alternative reduces the risk to stream channels and fisheries more than the alternatives C, E, K, and J.

Upper Cottonwood Alternative (C)

There is no difference between the Proposed Action Alternative (B) and this alternative, except in Betts Basin. No activities are planned in the Betts Basin with this alternative. It would implement commercial harvest, non-commercial thinning and fire and it would build new roads. There are no crossings in the Cottonwood Watershed. Therefore the affects to the fishery are the same except in Betts Basin. Because there are no units in the Betts Basin, the risk of catastrophic fire is high. This could negatively affect fisheries in the Cottonwood Creek watershed should a catastrophic fire occur since fuel loadings remain high. The effects of catastrophic fire are described above.

Wildland Alternative (E)
This alternative is one of the least aggressive alternatives. Because there are no units in the unroaded area, including Betts Basin, the risk of catastrophic fire is high. This could negatively affect fisheries in the Cottonwood Creek watershed should a catastrophic fire occur since fuel loadings remain high.

Vegetation Alternative (F)
Implementation of this alternative would result in an increase in ten new road/stream crossings in the analysis area. Three of these are located in the Thomason Creek watershed, one in the Sherwood watershed, one in the West Fork Watershed, and five are located in the Betts subwatershed. The Betts subwatershed crossings have the potential to impact fisheries restoration efforts underway in Betts.

Because of the effects from the crossings on the Betts subwatershed, this alternative has the potential to negatively impact fisheries and INFISH RMOs.

Wildland Fire Alternative (J)
The effects of implementing this alternative are very nearly the same as for the Wildland Alternative (E). The additional prescribed fire activities included with this alternative would not have negative effects on fisheries.

Existing Roads Alternative (K)
The detrimental effects of road reconstruction and use for haul are described as short-term (1-2 years). This includes sediment production from ditch cleaning, cutslope rejuvenation for curve widening, culvert replacement, and drainage dip construction, etc. With the use of BMP and fisheries mitigation, results of implementation include in a moderate beneficial effect over the longer term, as sediment production from road templates decreases due to new armoring, drainage structure placement, and revegetation. Use of County road 2888 and county road 2857 as main haul routes could negatively affect fisheries. However, the Road/Stream Improvement projects and other mitigation would significantly reduce erosion and negate adverse effects. Because of BMPs, road reconstruction and haul would have a minimal effect on fisheries and INFISH RMOs.

This alternative implements the restoration on Woodward Meadow. There would be a dramatic improvement in wetland function and stream habitat after restoration work. However there would be a temporary increase in sedimentation in Cottonwood Creek during and for a few years after restoration work in Cottonwood Creek. The channel would also be adjusting over its floodplain affecting connectivity and fish habitat. This is expected to stabilize as the stream channel forms. It is expected that the stream channel would go from a being six feet below the meadow to a foot below the meadow. Currently the stream is not connected to the meadow. Restoration would allow flooding over the meadow improving filtration and moderating flows.

Conclusions

No Action Alternative (A)
Under the “No Action” alternative, the area is left at risk for catastrophic fire and Cottonwood Creek would continue to be degraded. As stated earlier, a catastrophic fire may cause excessive sedimentation and downcutting. Cottonwood Creek would remain a marginal brook trout fishery.

Action Alternatives (B, C, E, F, J & K)

From an aquatics perspective alternatives B and K are preferable because they reduce catastrophic fire impacts and do not have stream crossings that would negatively affect fisheries. Alternatives C and E do not have harvest units within the Betts Basin so this leaves that area prone to catastrophic fire and the associated aquatic impacts. Alternative F has harvest units in Betts Basin however the road system and associated road crossings would negatively impact fisheries.

Cumulative Effects

The area analyzed for cumulative effects includes the Colville River from the confluence of the Colville River to the confluence with Chewelah Creek. This is a class 1 fishery. All of the streams within the analysis area flow into the Colville River in this section.

There should be no noticeable change in the fishery or INFISH Riparian Management Objectives in the cumulative effects reach from the Quartzite project.

Noxious Weeds

The spread of noxious weeds has indirect negative effects on the water resources in the analysis area. Typical locations for noxious weed invasions across the analysis area include homestead meadows, road corridors, forested areas with low shade, and high disturbance areas. In the many riparian meadows in the analysis area, noxious weed invasion has replaced riparian plant communities. Riparian vegetation provides extensive streambank protection through root structure and/or woody material. Noxious weeds cannot provide the same root strength leading to streambank erosion where they dominate. In forested stream reaches however there are very few reaches across the forest that have been negatively affected by noxious weeds. Generally shading and healthy plant communities keep noxious weeds out in the forested reaches. Noxious weeds on road right of ways and new construction usually do not extend into forested riparian areas because of this. One exception is hawkweed. Hawkweed has been found on the Colville National Forest in shaded riparian conditions. This noxious weed is a priority for treatment.

New noxious weed populations resulting from planned projects would not create a negative effect to aquatic habitat. No riparian harvest or activities associated with the meadows is planned. Populations are expected to remain in the road corridor. New populations of hawkweed will be treated. There should be no change in riparian vegetation, INFISH RMOs, and fish populations because of noxious weeds introduced from this activity.

Private Land Uses

Private lands are used for farming and cattle grazing. These activities have opened up riparian areas and caused streambank erosion. This has caused a decline in the quality of the fish habitat in the cumulative effects reach. The Quartzite project will not add a significant amount of sediment to the cumulative effects reach to be noticeable (Hydrology Report).

Betts Meadow will continue to be improved through a conservation easement. Woodward Meadows would also be restored through this project. The restoration of these two large wetlands will improve water quality downstream and be a benefit to the fishery.

Dispersed Recreation

The Quartzite project would change recreation patterns and subsequently affect aquatic resources. The project closes roads thereby reducing access to some areas. New roads, except for crossings, and skid trails would not be within RHCAs. There should be no increased access to RHCAs from the project. This reduces the amount of sediment delivered to the cumulative effects reach.

Closing or reconstructing roads would improve conditions caused by traffic such as recreationists. As part of the analysis for closing the roads, consideration was given to closing roads in the RHCA where runoff or access causes sedimentation. When roads are closed in this area, the closure is generally effective and vegetation returns. As roads are reconstructed, they would be designed to reduce surface erosion. This would be achieved through proper drainage and surfacing in the RHCAs. The Quartzite Project would reduce the sedimentation from recreationists on the roads that would be closed or reconstructed. As shown in the Hydrology Report, for road reconstruction, the main sediment delivery would occur during the year of construction. Mitigation and BMPs will reduce sedimentation reaching the cumulative effects reach.

The project also uses the main roads adjacent to the majority of the dispersed sites. This may cause reduced pressure to dispersed sites within the analysis area and increased pressure to dispersed sites across the Colville National Forest. Since a majority of the haul would come out on these roads, noise, traffic, and dust may force recreationists to go to other areas. Since most of the increased use would be dispersed throughout the Colville National Forest, determining the amount of the effect is not possible. However increased use of dispersed recreation sites may cause more compaction in the RHCAs and reduce the amount of woody debris available for future recruitment. There may be a beneficial effect to fisheries and INFISH RMOs within the analysis area, and some negative effect outside of the analysis area.

Timber Management

The model to predict increased instream flows only predicted Alternative F to potentially result in channel damage (Hydrology Report, 2002). If alternative F is selected higher flows would mean that Cottowood Creek through Betts Meadow would adjust to the higher flows. The creek would widen or downcut depending on the channel control. It is unlikely that the sediment would make it to the cumulative effects reach since there is adequate storage in the form of beaver dams.

Past harvests have impacted streams across the analysis area and the Colville National Forest. A correlation between wood sizes and riparian harvest is seen across the Colville National Forest. A comparison of wood sizes in past harvested areas and unharvested areas the entire stream inventory database. The areas with past riparian harvest areas had 15% less medium and small pieces of wood than in the unharvested areas. Large wood was 30% less in the areas of past riparian harvest than in the unharvested areas. The entire Colville National Forest is in recovery from large-scale riparian harvests that occurred in the early to mid 1900s.

The Quartzite project is not proposing any harvest in the riparian areas. Therefore stands would not be improved to increase tree growth nor harvested which could reduce the amount of trees available for recruitment of wood to the creek. There should be no change in the INFISH Large Woody Debris status quo with the exception of Woodward Meadows. The proposed restoration of Woodward Meadows is designed to restore riparian vegetation and increase woody debris over the long-term (50 years). The

previously harvested stands are at the point of recovery to add medium wood recruitment at levels approximately equal to non-harvested areas.

Root diseases such as *Armillaria mellea* will continue to infect Douglas fir. This root disease also increases the susceptibility of Douglas fir to secondary attack by bark beetles. Insect attacks by the Douglas fir bark beetle, *Dendroctonus pseudotsugae,* will continue at existing or increasing levels over the next 3-5 years. This will result in patch mortality of mature trees in openings up to several acres in size. The Forest Service may respond to insect attacks with some form of management such as timber harvest. However INFISH limits the type and reason for harvest in riparian areas. All activities by the Forest Service would follow INFISH Standards and Guidelines. This project is designed to improve stand health and decrease the likelihood of insect and disease. Each stand was rated for the potential of insect and disease risk. The prescription for the stands was made to address this potential. Thinning and shelterwood would increase vigor making them more resistant to insect attack. Therefore the Quartzite Project would reduce the need for treatments to remove diseased or dying trees. This would reduce the amount of road use needed in the future reducing sedimentation. Overall there should be no additional negative cumulative aquatic impacts from the timber sale to impacts projected to occur from future harvests.

Fire Management

No changes are expected to Forest Service fire suppression policies in the next 3-5 years (i.e. no let-burn policy with regard to naturally occurring wildfires). The Quartzite Project's Purpose and Need is to reduce the risk of fire in the watershed. The project should reduce the risk of a large catastrophic fire and thereby reducing the fire suppression needs. This would result in a positive benefit to fisheries as described in the Indirect and direct effect section of this report.

Road Management

Sediment levels are affected more by roads than any other activity in the analysis area. Implementation of mitigation measures included in the Quartzite BMPs will adequately mitigate these impacts to water quality. Sediment levels may increase during the project, but would be adequately stored throughout the system and not reach the cumulative effects reach in levels harmful to fish and their habitat. Overall the project would not add detrimental impacts to fisheries or INFISH RMOs.

Summary

In summary, the Quartzite project would not add significant cumulative effects to existing and past activities for fisheries and the INFISH RMOs. No activities are planned which would increase noxious weed invasion to riparian areas. Past harvest units would not be modified under this project. Recreationists may leave the area during the project, this may allow some dispersed recreation sites to heal. The Quartzite Project proposes to reduce the risk of catastrophic fire and this would reduce the amount of disturbance from fire suppression activities. Even though sediment would enter the streams from road use from all the combined harvest activities including private lands, mitigation measures will keep the levels close to current amounts.

Threatened, Endangered and Sensitive Species

Bald Eagle: Environmental Consequences
(Threatened-Federal)

The No Action Alternative will not affect winter roost sites and thus will not affect bald eagles. Although the nearest important roosting habitat on the Colville River lies about 1½ miles away from any Quartzite harvest unit, all action alternatives may affect large trees and thus, **"may affect but are not likely to adversely affect"** bald eagle winter roost sites. Consequences of affecting a roost site in this area are low because if a site were harvested, few birds would be displaced. The risk of affecting a site is low because of the low potential of the area to support winter roost sites.

Cumulative Effects

The incremental effects of the alternatives when added to other past present and reasonably foreseeable future actions were considered for bald eagle and all the other species discussed in this analysis. Appendix C displays the list of associated actions.

All current or proposed sales could affect large trees that have the potential to serve as roost trees. However, most units remain fairly distant from potential roost trees. Bald eagles have not been observed roosting within the planning area. The No Action Alternative will have No Effect on bald eagles or their habitat. The Proposed Action, Upper Cottonwood, Wildland Vegetation Existing Roads and Wildland Prescribed Fire alternatives may proceed as planned, if concurrence occurs from informal consultation.

Grizzly Bear: Environmental Consequences
(Threatened-Federal)

The No Action Alternative would have no effect on grizzly bears. Because all action alternatives affect hiding cover, forage, travel corridors and/or seclusion habitat, they **"may affect but are not likely to adversely affect"** individual grizzly bears, grizzly bear habitat, or established recovery areas and their objectives. Because grizzly bears might occupy the planning area and the only sighting reports are unconfirmed, the Likelihood of adverse effects is rated as low for all action alternatives. The Consequence of adverse effects depends on evaluation criteria. Though the effects of each alternative vary by criterion, the combined effects of each alternative rank similarly: the consequence of adverse effects is rated as Moderate for all action alternatives.

Hiding Cover

The action alternatives vary in their effects to hiding cover. The prescriptions have a great deal of variability in how units are treated so this comparison displays only a relative ranking of alternatives rather than specific numbers of acres that might affect hiding cover. Although prescriptions vary a comparison is established by considering the combined acres of irregular shelterwood (iHSH) and of seed tree (HCR) treatments in each alternative. The actual change to hiding cover might be less than the total of the acres in these two treatment types. By comparing alternatives based on the acres iHSH or HCR treatments, the order of potential negative effects to hiding cover ranked from greatest to least are: the Vegetation Alternative (F), the Proposed Action Alternative (B), the Existing Roads Alternative (K), the Upper Cottonwood Alternative (C), and equally, the Wildland

Alternative (E) and the Wildland Fire Alternative (J). The difference in total acres of iHSH and HCR for the action alternatives ranges from 100 acres to more than 1000 acres. Because of the size of the area being treated with either iHSH or HCR, there is a potential to affect 10% to 30% of the hiding cover on NFS lands in the watershed, however, the actual effect will likely be much less.

Travel Corridors

The HCR (seed tree), iHSH (irregular shelterwood) and the regeneration portions of the HSL (uneven age management) treatments may remove enough cover to affect the function of those acres as travel corridors. In addition Douglas fir bark beetle outbreaks have created patches of dead trees. Some of these are proposed for treatment in the Quartzite Watershed project as HSV (salvage). The order of the alternatives for negative effects to travel corridors is the same as that for hiding cover. Corridors between late structure stands and specific management units (such as those for barred owls, pine marten, and pileated woodpeckers) were also considered. However, many different travel routes are possible, so this analysis considers all areas in Quartzite. Even though treatments may affect specific acres in terms of usefulness for travel, there are many other stands that would provide potential movement corridors.

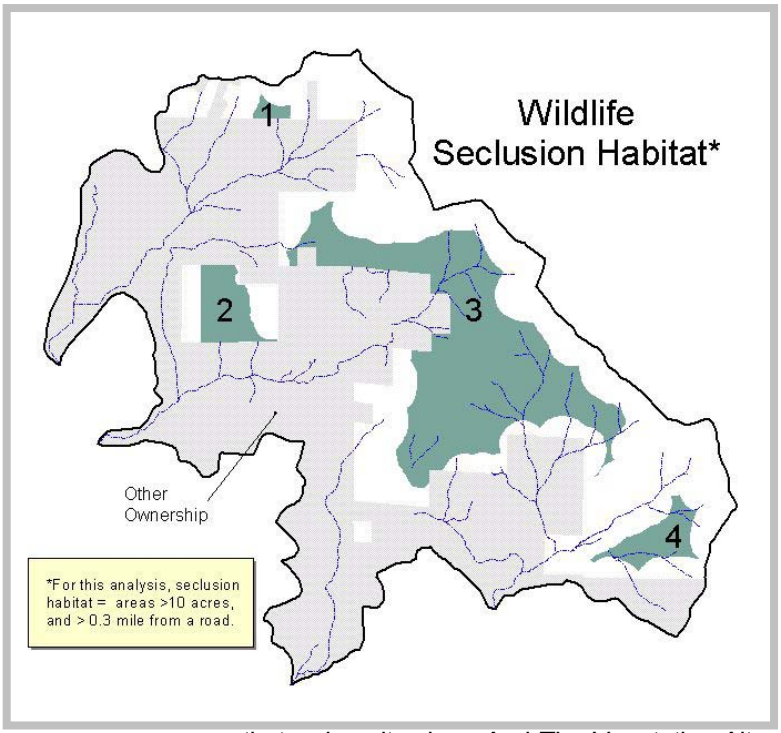
Forage

No units were designed to improve forage for bears, though all harvests would stimulate forage. Alternatives that propose the greatest acreage for harvest will have the highest increase in forage. The ranking of alternatives from the most beneficial effects to the least is: Vegetation Alternative (F), the Proposed Action Alternative (B), the Existing Roads Alternative (K), the Upper Cottonwood Alternative (C), and equally, the Wildland Alternative (E) and the Wildland Fire Alternative (J).

Seclusion

Harvest units or roads can affect seclusion habitat. The effects of units relate to the duration of activities and to harvest intensity. Roads affect seclusion habitat both directly and indirectly. Direct effects of roads relate to length of time the road remains open, the level of traffic on the road, and habitat loss to the road prism. Indirect effects relate to the potential loss of prey habitat due to noxious weed encroachment and future disturbance by humans.

Units proposed for commercial thinning would affect seclusion habitat only during the period that harvest and post-harvest activities take place. These effects are negligible because sight distance would be fairly short. The effects to seclusion habitat from units proposed for seed tree, irregular shelterwood, regeneration portions of the group selection in commercial free thinning and salvage harvest would be greater and would last for several years because sight distance in a stand would be lengthened (some animals avoid these more open habitats). The potential effects from these treatments are similar to those discussed in the hiding cover section above.

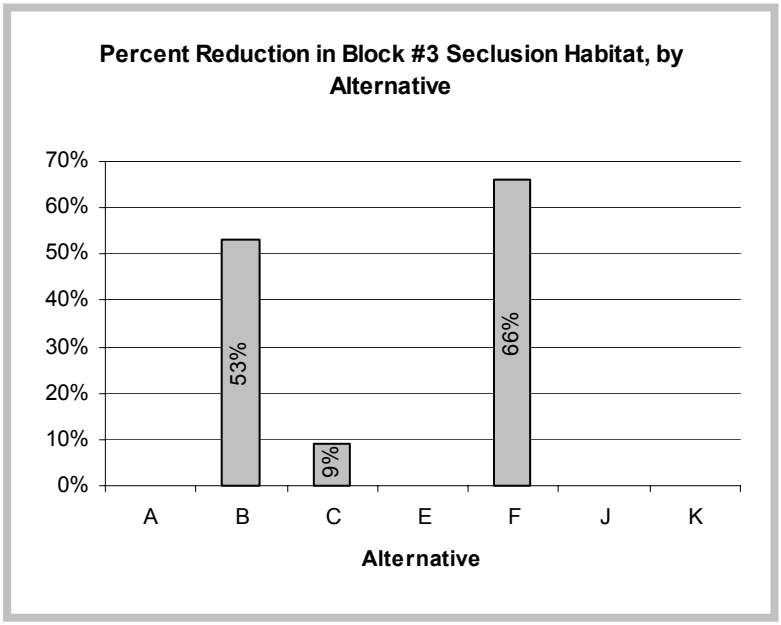


For this analysis, seclusion habitat is any area on NFS land, more than ten acres in size, and more than 0.3 of a mile from a road. Currently four blocks of land meet this criterion.

Those alternatives with the least amount of roads would have the least direct and indirect effects to this habitat. No alternative proposes new road construction that affects Block #2 or Block #4. All the alternatives that propose road new construction equally affect Block #1. The largest disparity in effects caused by these road-building alternatives becomes evident when Block #3 is considered.

The Upper Cottonwood Alternative (C) proposes to construct two new roads that reduce the size of Block #3. The Proposed Action Alternative (B) proposes to construct four new roads that reduce its size. And The Vegetation Alternative (F) proposes to construct nine new roads that reduce its size.

Loss of habitat due to noxious weed invasions would be minimized by mitigation that emphasizes prevention, early-treatment and correction. This mitigation would effectively limit negative effects associated with noxious weeds, by first preventing encroachment, and correcting it if it does occur.



The Forest Plan directs that all new roads be closed following completion of harvest activities. However, some illegal motorized use could occur. The amount and type of traffic and season of use contribute to impacts on seclusion habitat. Non-motorized recreational use (berry picking, cross country skiing, hiking and mountain bike riding) currently occurs at low to moderate levels in the Quartzite watershed. There is a groomed snowmobile route along Cottonwood Divide (Forest road 4342) and ATV use is increasing. Quartzite Watershed also is moderately to heavily hunted for species such as big game, forest grouse and turkey. The road closure

mitigation measures listed in Chapter 2 will decrease the effects of road construction on habitat.

Because mitigation closes new roads, most negative effects would be short term and limited to the time the roads remain open. Although closed roads restrict some vehicles, they still allow access by humans riding ATVs, so nearly all closed roads have some effect to seclusion habitat until the road becomes too grown-over to pass. The No Action Alternative is expected to have No Effect to grizzly bears. The Proposed Action, Upper Cottonwood, Wildland, Vegetation, Existing Roads and Wildland Prescribed Fire alternatives all vary in the amount of roads, harvest and prescribed fire proposed, so they vary in degree of effect. One alternative may have greater effect from roads than from harvest while another may have more effect from prescribed fire than from road construction so the following is a generalized rating. Overall, the effect is greatest from the Vegetation Alternative, followed, in descending order by the Proposed Action, Upper Cottonwood, Existing Roads, Wildland Prescribed Fire and Wildland alternatives. All action alternatives may affect, but are not likely to adversely affect grizzly bears or their habitat. Even though the effects vary between alternatives, each action alternative may proceed as planned.

Cumulative Effects

The incremental effects of the alternatives when added to other past present and reasonably foreseeable future actions were considered for grizzly bear and all the other species discussed in this analysis. Appendix C displays the list of associated actions.

Historically, the grizzly bear ranged over much of what is now the Colville National Forest. As part of the overall grizzly bear recovery effort, specific "grizzly bear ecosystems" have been identified. Recovery areas have been delineated within those ecosystems and classified into "Management Situations," based on the needs of the bears and the capabilities of the areas to supply those needs. The only Recovery Area on the Colville National Forest is located 25 miles east of the analysis area, on the east side of the Pend Oreille River. Grizzly bears are protected outside of the recovery areas, but they are not specifically managed for or encouraged there. The analysis area falls within Management Situation #5 under Interagency Grizzly Bear Guidelines (Interagency Grizzly Bear Committee 1986). Management Situation #5 states:

- Grizzlies do not occur, or occur only rarely in the area. Habitat may be unsuitable, unavailable, or suitable and available but unoccupied. The area lacks survival and recovery values for the species or said values are unknown. Major Federal activities and programs probably will not affect species conservation and recovery

- Consideration for grizzly bears and their habitat in other resource related decisions is not directed. Maintenance of grizzly habitat is an option. Any grizzly involved in a grizzly-human conflict will be controlled.

Road Density and Seclusion Habitat

This and other projects reduce seclusion habitat, and consequently decrease habitat suitability for grizzly bears. Current and future projects that construct, reconstruct or reopen roads reduce seclusion habitat. A large proportion of the Quartzite analysis area does not have roads, so it provides some seclusion habitat. Other areas throughout the eastern part of the Three Rivers Ranger District also provide seclusion habitat. One of the

largest is a parcel designated as Management Area 11[88], located in the northern part of the District. In addition to the treatments proposed by this project, sales in other watersheds temporarily reduce seclusion habitat because of new roads and reconstruction of existing, impassable roads. Some sales from the Addy-Chewelah analysis are still active and are relatively close to the Quartzite area. Two existing roads that are currently open in the Quartzite Watershed are proposed for closure in most action alternatives. Closure of both of these roads would increase seclusion habitat.

Gray Wolf: Environmental Consequences

(Threatened-Federal)

The effects of the alternatives on potential wolf habitat are considered here, even though this area is not within a wolf recovery area. Wolves have been reported nearby and transient wolves may pass through the area. The USFS makes provisions to protect individual animals and/or essential habitats, such as denning or rendezvous sites, outside recovery zones in timber contract clause CT6.25, *Protection of Habitat of Endangered, Threatened and Sensitive Species*, a part of all timber sale contracts on the CNF. This clause calls for protection of any essential habitat components discovered during construction and harvest activities related to this project.

Effects to Ungulate Prey Base

Effects to big game are described above in the section titled *Deer and Elk Environmental Consequences*. Please refer to this section for detailed effects to gray wolf ungulate prey base.

Summary

In all alternatives, proposed harvest would not have a substantial negative effect to winter range. Harvest in existing poor cover would improve long-term winter cover for deer, thus benefiting gray wolf. Post-harvest prescribed fire would improve forage in these areas.

Road construction and reconstruction, skidding trees, and other activities involved with log haul disturb soil and provide habitat for noxious weeds. Noxious weeds displace native and desired non-native forage species, thus reduce an area's capacity to support prey for wolves. However, loss of habitat due to noxious weed invasions would be minimized by mitigation that emphasizes prevention, early-treatment and correction. This mitigation would effectively limit negative effects associated with noxious weeds, by first preventing encroachment, and correcting it if it does occur.

Effects to Denning and Rendezvous Sites

Denning sites are often located on southerly aspects of moderately steep slopes in well-drained soils. The sites are usually within 0.25 miles of surface water and at an elevation overlooking surrounding low-lying areas. No denning or rendezvous sites were found during field reconnaissance. Wolves den in a variety of habitats. This project could affect areas that have denning and rendezvous habitat attributes.

Effects to Seclusion Habitat

Wolves and grizzly bears respond to disturbance in a similar fashion. Effects to grizzly bear seclusion habitat are described in the section titled *Grizzly Bear Environmental*

[88] The Forest Plan management goal for MA-11 is to manage these areas to protect the existing unroaded character and to provide opportunities of dispersed, non-motorized recreation.

Consequences. Please refer to this section for detailed effects to gray wolf seclusion habitat.

Cumulative Effects

The incremental effects of the alternatives when added to other past present and reasonably foreseeable future actions were considered for gray wolf and all the other species discussed in this analysis. Appendix C displays the list of associated actions.

No confirmed sightings of gray wolf have been documented on the eastern portion of the Three Rivers Ranger District. However the catalogue of unconfirmed reports of wolf-like animals infer that individuals may move through the area.

Recent harvest and post-harvest activity in the United Eagle portion of the Quartzite Watershed has improved big game winter range in that area. Other vegetation management that benefits ungulate forage has occurred on the District. The Forest Service has conducted prescribed underburns at Woodward and Wessendorf/Cottonwood in Quartzite Watershed and at many other locations across the District. Additional future winter range prescribed burns will be proposed in the Quartzite and other watersheds. These projects will benefit big game, thus gray wolves.

Noxious weeds could encroach into areas where harvest and post-harvest activities disturb soil, thus will reduce site productivity for forage. However, loss of habitat due to noxious weed invasions would be minimized on NFS Land by mitigation that emphasizes prevention, early-treatment and correction. This mitigation would effectively limit negative effects associated with noxious weeds, by first preventing encroachment, and correcting it if it does occur.

Reductions in seclusion habitat decrease habitat suitability for gray wolves. All current projects construct, reconstruct or reopen roads and reduce seclusion habitat. See discussion of the cumulative effects to seclusion habitat within the *Grizzly Bear Environmental Consequences* section.

Effects Conclusions

The No Action Alternative (A) will have no effect on wolves, habitat, or recovery areas. All action alternatives propose harvest and prescribed fire/noncommercial thinning. These treatments may improve forage for ungulates, especially in Biophysical Environment 2[89] areas. All action alternatives, except the Existing Roads Alternative (K), propose roads that affect seclusion habitat. The Wildland Alternative (E) and the Wildland Fire Alternatives (J) only affect a small block of this habitat. The Vegetation Alternative (F), the Proposed Action Alternative (B) and the Upper Cottonwood Alternative (C) affect the largest amount of seclusion habitat. New roads would be closed after harvest, post treatment and possibly one season for firewood collection. However, closing the roads does not fully eliminate the effects.

Provisions in timber sale contracts would protect known denning and rendezvous sites and protect against any accidental "taking" (as defined in FSM 2670.5) of a wolf during harvest-related activities.

[89] For a description of Biophysical Environment 2, see the section of this EIS titled Forests*: Affected Environment.*

The No Action Alternative will have **"no effect"** on wolves or their habitat; all action alternatives may proceed as planned after informal consultation is completed and concurrence is obtained.

Canada Lynx: Environmental Consequences

(Threatened-Federal)

Non-lynx habitat

Many regeneration and non-regeneration harvest units and prescribed fire units have been proposed within the non-lynx habitat in the Quartzite section of the LAU. Portions or all of harvest units 43, 45, 46, 49, 50, 51, 52, 54, 55, 83, 84, 85, 104 contain areas of warm, dry habitat and are thus considered non-lynx habitat. Because these units lie in non-lynx habitat within the LAU, the harvest and prescribed fire will not affect lynx.

Connectivity areas (travel habitats and corridor routes)

Prescriptions for harvest and fire will be implemented to maintain connectivity, thus no corridors or connectivity areas will be negatively affected by harvest in any alternative. The Vegetation Alternative (Alt. F) proposes a road on the ridgetop, which does negatively affect connectivity habitat. It is possible to mitigate the long-term effects of this road, and to reduce, but not eliminate, the short-term effects.

All action alternatives propose regeneration harvest near ridgetops. The harvest prescriptions will be written to maintain cover on the ridgetops in order to maintain their effectiveness as corridors, whether the area is or is not in lynx habitat. Harvest in the Vegetation Alternative (Alt. F) proposes harvest directly on the ridgetop.

Harvest will not occur near streams, so these important corridors will remain virtually intact. All alternatives retain dearth of good foraging cover that existed before harvest.

Prescribed fire is also proposed either adjacent to or in a corridor. The fires will not negatively affect lynx habitat because they would occur in warmer, drier habitat types considered to be non-lynx habitat.

The Vegetation Alternative (Alt. F) proposes a road directly on the ridgetop. This road will negatively affect the corridor along the top of that ridge. Putting the road to bed after use and replanting it with trees can mitigate the long-term effects of the road. It is not possible to mitigate the short-term impacts of the road, but it is possible to limit the length of disturbance by not building the road until absolutely necessary, and then preventing non-harvest-related traffic on the road.

Unsuitable habitat

The amount of created unsuitable habitat will not negatively affect lynx habitat, and the overall amount of unsuitable habitat remains below the maximum recommended in the LCAS. The no-action alternative will not create any unsuitable habitat.

The amount of unsuitable habitat will not exceed 30% in any action alternative. We determined the maximum amount of unsuitable habitat to be created by assuming that in those units whose harvest prescription is iHSH, HCR or HSV, the entire unit will become

non-cover. Because patches within the stands will remain as cover, this heaviest-harvest assumption overestimates the amount of unsuitable habitat that will be created.

Maximum amount of unsuitable habitat to be created				
	Acres of LAU to be harvested that will be unsuitable	% of LAU to be harvested that will be unsuitable	% of NFS land that will be unsuitable	% of total LAU that will be unsuitable
No Action	N/A	N/A	N/A	N/A
Proposed Action	60	0.3%	14%	19%
Upper Cottonwood	60	0.3%	13%	19%
Wildland	0	0.0%	13%	19%
Vegetation	180	0.8%	14%	19%
Existing Roads	65	0.3%	14%	19%
Wildland Fire	0	0.0%	13%	19%

Except for units in the Upper Cottonwood alternative (Alt. C), most of the units in the other action alternatives lay in warm, dry, Douglas-fir biophysical environments that we consider non-lynx habitat. Many of the units on the southeast side of the Jay Gould ridge propose harvest in areas hard hit by bark beetle or root rot. With or without treatment, their quality as corridors or any sort of cover will decrease.

All road building will create near-permanent unsuitable habitat at the rate of about 4 acres of non-cover per mile of road, which equates to about 9.4 acres for the Proposed Action (Alt. B) and 10.4 for the Vegetation Alternative (Alt. F). The No Action alternative and the other action alternatives (Upper Cottonwood (Alt. C), Wildland (Alt. E), Existing Roads (Alt. K) and Wildland Prescribed Fire (Alt. J)) do not propose any road building in the LAU. The amount of created unsuitable habitat will not negatively affect lynx habitat, and the overall amount of unsuitable habitat remains below the maximum suggested in the LCAS.

Foraging Habitat

No alternative proposes activity that will negatively affect good forage habitat. The Vegetation Alternative (Alt. F) will create the most future foraging habitat by regenerating some stands.

We do not propose any noncommercial thinning in the LAU so high-quality, young forage stands will not be affected.

We do not propose harvest in any high-quality, young-aged forage habitat.

We propose harvest in more closed-canopy stands in the cool, mesic Douglas-fir/grand fir biophysical environment that could support alternative prey, especially squirrels. The regeneration harvests will provide future foraging habitat.

We propose regeneration harvest in older stands in warm, dry, Douglas-fir biophysical environments in order to move the stands to a more park-like condition that occurred historically. The biophysical environment in which these stands occur is considered non-lynx habitat and thus does not provide foraging habitat.

We propose a small amount of fire for the purpose of beginning to restore park-like, open stands in warm, dry Douglas-fir biophysical environments. The biophysical environment in

which these stands occur is considered non-lynx habitat and thus does not provide foraging habitat.

The areas proposed for regeneration harvest will produce future forage. The Vegetation Alternative (Alt. F) will create the most future forage (180 acres). Alternatives B, C and K will create about 60 acres, and Alternatives E and J will not produce any future foraging habitat.

Denning Habitat

No alternative will affect potential denning habitat. However, the Vegetation Alternative (Alt. F) proposes the greatest disturbance to areas around denning habitat.

We field-examined all proposed harvest units that we identified, based on aerial photos, as having the potential to provide denning habitat (portions of units 20, 37, 40 and 41 in Alternatives B, C, F and K, and units 110, 119 and 120 in Alternative F). The units did not support denning habitat because: they were too dry or had too open an overstory. None of the areas had many down logs and all of the units lay on 45-60% slopes, which indicates that they would not provide denning habitat.

Human Access: Roads and Winter Recreation

The proposed Action (Alt. B) and Vegetation Alternative (Alt. F) will result in a temporary increase in vehicle traffic because both propose new road construction in the LAU, but the open road density will not exceed 2.0 miles/square mile in the LAU. The proposed road will not affect ridge tops or other corridors and lies in non-lynx habitat within the LAU. The road will have minimal negative effects to lynx movements. The other alternatives will have no effect on winter recreation or road density.

The proposed Action (Alt. B) and Vegetation Alternative (Alt. F) propose a new road along the mid slope of the upper Cottonwood Creek sub-basin, on the drier, southeast-facing aspect that we consider non-lynx habitat. The road will connect to the 4342 road (Upper Cottonwood Divide Road). No roads currently enter this sub-basin from the 4342 road.

The Vegetation Alternative (Alt. F) also proposes a short section of road on the ridge top upslope from the road described in the previous paragraph. This road lies adjacent some potential denning habitat and negatively affects the corridor that lies on this ridge top.

We expect that some of the snowmobilers that sled the 4342 road will travel out on the new roads. To mitigate effects of the lower road, we will pile slash on a section of the road and close it with a series of earthen berms. The road will be open for 4 or 5 years. To mitigate the effects of the upper road, it will not be built until necessary, and will be put back to bed after management activities are completed.

During the period that the roads remain open, they probably will receive some use, mostly in the autumn during woodcutting and hunting seasons, and again during the winter snowmobile season. This disturbance might have a temporary, negative effect to lynx movement within the LAU. Because the lower road lies at mid slope rather than on the ridge top or other corridor, and lies in dry habitats that we consider to be non-lynx habitat, it will have minimal effects to lynx movement. This negative effect is within the range of acceptable disturbance on forest roads and trails. The upper road lies on a ridge top, in lynx habitat, and could affect lynx movement unless mitigated by the activities listed

above. However, considering the lack of records of lynx occupying the LAU, the probability is very low.

Cumulative Effects

The incremental effects of the alternatives when added to other past present and reasonably foreseeable future actions were considered for Canada lynx and all the other species discussed in this analysis. Appendix C displays the list of associated actions.

The cumulative effects analysis area is the string of LAUs that run south from Canada, with the Chewelah LAU lying on the south end. Federal land constitutes about 81% of the area. Most of the non-federal land lies grouped near the southern 1/3 of the LAU string and consists mainly of private industrial forestland.

We examined all current and foreseeable projects on NFS land during Forest consultation that we conducted after the USFWS listed the lynx as a threatened species. Our analysis for each project considered past and current harvest on both federal and non-federal land. (Planned projects include Backlakes, Addy-Chewelah (various sales), M. F. Mill, Millstream, Twigs, Dominion, Hudson, Stoney, United Eagle, 49 Degrees North and Rocky and completed projects in Aladdin Blowdown, Bestrom, Butte Creek Riparian, Divine, Flowery Trail, Frater, Hande Creek, Holford, Hosmer, Hound, Longshot, Master Deluxe, Meadows, Middleport, MF Mill Cr. Riparian, Mitchell Meadows, No Smacks, Quark, Riddy Salvage, Rocky Creek Riparian, and Six Bits. The next planning area for the eastern (Colville) portion of the District is South Deep. The Colville National Forest will initiate a Forest-wide vegetation management project in 2003 that is designed to improve defensible fire space around structures near National Forest System Lands. National Forest Systems lands within two miles of known structures will be considered. Proposed activities include thinning, brush disposal and prescribed fire. There are also treatments on other ownerships within the Forest boundary.)

We modified all projects using the LCAS and on September 8, 2000, received USFWS concurrence that all existing and ongoing projects were not likely to adversely affect lynx.. We will plan all future projects that lie in lynx range using information outlined in the LCAS. The Little Pend Oreille National Wildlife Refuge manages the only other Federal land in the area. They, too, are required to use the LCAS when planning projects within an LAU. Therefore, this project, when added to current and foreseeable future federal projects, cumulatively may affect but is not likely to adversely affect lynx.

Connectivity areas (travel habitats and corridor routes)

Much of the industrial timberland has been heavily harvested in the past decade. Connectivity through some of these areas has been disrupted because regeneration harvests lap over corridors on ridges and saddles. Because the current project will not eliminate any corridors, this project will not add to the cumulative negative effects to corridors.

Unsuitable habitat

The total amount of unsuitable habitat within the cumulative effects analysis area lies below the 30% maximum in the LCAS. The current project will create, at most, another 180 acres of unsuitable habitat. The cumulative impact of this addition is consistent with information in the LCAS that indicates the activities will not negatively affect lynx.

Foraging Habitat

This project will not impact good forage habitat, so will not add to the cumulative effects.

Denning habitat

Little of the non-federal lands, especially the industrial timberlands, contain denning habitat because of past harvest. However, because the current project will not affect denning habitat, the addition of this project will not further negatively affect lynx denning habitat.

Human access: roads and winter recreation

If the mitigation measures are followed, the current project will not add to human access over the long-term. This project will increase human impacts for about 5 years, until harvest activity has been completed.

Risk Assessment

All action alternatives **"may affect but are not likely to adversely affect"** lynx.

Alternative F, the Vegetation alternative, will have the least positive effect to lynx. In the short-term, Alternative F creates the greatest amount of open area and proposes construction of a new road along the ridge top, which affects a travel corridor. In the long-term, the regeneration harvest would improve forage habitat. However, the loss of habitat and negative effect on the corridor due to the new road offsets the improved forage conditions.

The effects of the other alternatives are similar. Alternatives B, C and K all propose about 60 acres of regeneration harvest, which will grow into foraging habitat, and Alternatives E and K don't propose any. The difference between the two amounts is negligible. Only Alternative F negatively affects a corridor. None of the alternatives affect denning habitat.

The Likelihood of Adverse Effects for Alternatives B, C, E, J and K is "Low" because little unsuitable habitat will be created, harvest and fire will not affect good foraging habitat, roads will not affect corridors, and harvest and fire will not affect denning habitat.

The Likelihood of Adverse Effects for Alternative F is "Moderate" because proposed roads will affect a corridor. With mitigation listed in Chapter 2, the Likelihood will be "Low."

The Consequence of Adverse Effects is "Moderate" for all action alternatives because lynx may occupy the Quartzite Watershed Management Project planning area. Lack of records and poor habitat quality in the southern portion of the LAU make it unlikely that lynx occupy the area.

Bull Trout: Environmental Consequences

(Threatened-Federal)

Even though Bull trout may have been able to access the Colville Watershed, there is no historical written record of the species in the Colville Watershed. They are assumed to be either have been extirpated from the watershed or have never existed in the watershed. There will be **"no Effect"** to bull trout or bull trout habitat.

Wolverine: Environmental Consequences
(Sensitive-USFS R6)

Successional Stages

Proposed harvest activities are designed to allow trees in stands to grow to larger sizes (both SS6 multi-story and SS7 single stratum) to move blocks of habitat toward the historical ranges of structural stages and stand conditions. This would benefit wolverine by providing a variety of habitat types and amounts more similar to historical conditions.

Corridors

Wildlife corridors connecting late structure stands, MRs and the MA-1 for the Quartzite Planning Area were delineated according to guidelines in the Forest Plan. Flowery Trail Highway, Cottonwood Divide, Upper Cottonwood and other roads in the analysis area break corridor continuity. Sometimes logging and pastures affect connectivity, especially with Structural Stage 6 habitat in the Colville Valley. Since the corridors were delineated, locations have been mapped for patches of dead trees in Quartzite Watershed. These dead trees are caused by an outbreak of Douglas fir beetle. Some of these pockets of dead trees occur in delineated corridors. Where these dead trees occur in corridors, canopy cover has been reduced. In most instances, those patches of beetle-killed trees will still function as corridors (canopy closure will usually remain within the top one-third of site potential) even though there are dead trees.

Corridors will not be narrowed to less than 400 feet with the possible exception of locations where Douglas fir beetles may have killed enough trees to reduce the canopy closure of a specific site to below the top one-third of site potential. In instances where Douglas fir beetle outbreaks might reduce canopy closure in sections of corridors to less than the amount needed for corridor function, unit prescriptions in adjacent areas would maintain canopy closure suitable for alternate corridor use. Wolverine movement might be affected by corridor widths, but this should not preclude wolverine from using a corridor.

Currently there are other potential passageways that are not mapped, but that would meet corridor criteria. Existing live tree densities over most of the area provide sufficient cover to serve as corridors during winter when vegetative cover is least. Additionally, most riparian areas support more dense understories than the surrounding upland.

Prey

Effects to big game are described above in the section titled Deer and Elk Environmental Consequences. Please refer to this section for detailed effects to wolverine ungulate prey base.

In all alternatives, proposed harvest would not have a negative effect to winter range. Harvest in existing poor cover would improve long-term winter cover for deer, thus benefit wolverine. Post-harvest prescribed fire would improve forage in these areas.

Road construction and reconstruction, skidding trees, and other activities involved with log haul disturb soil and provide habitat for noxious weeds. Noxious weeds displace native and desired non-native forage species, thus reduce an area's capacity to support prey for wolves. However, loss of habitat due to noxious weed invasions would be minimized by

mitigation that emphasizes prevention, early-treatment and correction. This mitigation would effectively limit negative effects associated with noxious weeds, by first preventing encroachment, and correcting it if it does occur.

Seclusion Habitat

Wolverines and grizzly bears respond to disturbance in a similar fashion. Effects to grizzly bear seclusion habitat are described in the section titled *Grizzly Bear Environmental Consequences*. Please refer to this section for detailed effects to wolverine seclusion habitat.

In addition the mitigation measures listed Chapter 2 would decrease the effects road construction and harvest have on seclusion habitat.

Denning Areas

One moderately high talus west-facing slope in Quartzite does not maintain snow levels preferred for denning. One group of talus area on the north side of Jay Gould Ridge does have the characteristics preferred for denning, although it is only moderately high in elevation (about 3600 feet). There are also talus areas on the south side of Jay Gould Ridge. The ridge extends up to 5000 feet. There are other high areas in Quartzite, but some of these are susceptible to human disturbance. Chewelah Mountain is the highest point in Quartzite and reaches 5700 feet. The ski area, 49^{o} North, is located on the north side of Chewelah Mountain, just outside of the watershed. Much of the eastern side of Quartzite Watershed along Cottonwood Divide road ranges around the 5000-foot elevation. This is a snowmobile route. There are other higher elevation areas that currently receive little human disturbance. The ridge between Horseshoe Basin and Betts Basin ranges from 4600 through 5200 feet. Smaller ridges come off the ridge where Cottonwood Divide road runs reach up to that 5000-foot level. Although these areas do not contain all of the attributes preferred for wolverine denning, alternatives may affect potential (but lesser quality) natal denning areas in those high elevation habitats.

In the unlikely event that an active wolverine den is located, the area will be protected using timber sale clause CT6.25 and the Forest Plan standard that provides protection of unique habitats. Provisions in timber sale contracts would protect known denning sites and protect against any accidental "taking" (as defined in FSM 2670.5) of a wolverine during harvest-related activities.

Cumulative Effects

The incremental effects of the alternatives when added to other past present and reasonably foreseeable future actions were considered for wolverine and all the other species discussed in this analysis. Appendix C displays the list of associated actions.

All recent sales were planned using the concept of managing towards historical ranges of variability for different structural stages, which would maintain successional patterns and processes similar to those with which wolverine evolved. Continued management under this scenario should benefit wolverine.

The only recent timber activity on Forest Service land within Quartzite Watershed is the portion of the United Eagle project on the north side of the Quartzite Watershed. Some underburning is also planned within the United Eagle part of Quartzite. The harvest and underburning should improve big game winter. We have also conducted wildlife

underburns in the southern part of Quartzite (Woodward, Wessendorf/Cottonwood) that have improved ungulate forage. Action alternatives would improve the cover: forage ratio and propose underburning that would improve forage. These projects would benefit big game, and thus wolverine.

Noxious weeds could encroach into areas where harvest and post-harvest activities disturb soil, thus will reduce site productivity for forage. The level of forage reduction and consequent reduction in big game populations is not known. However, loss of habitat due to noxious weed invasions would be minimized by mitigation that emphasizes prevention, early-treatment and correction on NFS Lands. This mitigation would effectively limit negative effects associated with noxious weeds, by first preventing encroachment, and correcting it if it does occur.

Wolverine and grizzly bears respond to disturbance in a similar fashion, so we used the same evaluation criteria for both. (See discussion of the cumulative effects to Seclusion Habitat within the Grizzly Bear section.) The mitigation measures listed Chapter 2 would decrease the effects of road construction and harvest have on seclusion habitat.

Risk Assessment

The No Action Alternative (A) is expected to have "no impact" on wolverine as it would not change the structural stage distribution within any biophysical environment and will not affect any seclusion habitat.

The Proposed Action Alternative (B), the Upper Cottonwood Alternative (C), the Wildland Alternative (E), the Vegetation Alternative (F), The Existing Roads Alternative (K) and the Wildland Fire Alternative (J) propose harvests or road construction that would affect structural stage distribution, habitat for prey base and/or seclusion habitat. These activities may modify use of the area by wolverine, but are not expected to substantially negatively affect wolverine. However, impacts would be cumulative. The action alternatives **"may impact individuals but are not likely to result in a trend toward Federal listing or loss of viability."** Even though the effects vary between alternatives, each action alternative may proceed as planned following informal consultation.

Pacific Western Big-eared Bat: Environmental Consequences

(Sensitive-USFS R6)

No known roost or hibernacula occupancy sites have been documented in the watershed. The No Action Alternative will not affect any mines. All action alternatives locate the pileated woodpecker area where one of the surveyed mines is located. No treatment activity occurs in that area. The other surveyed mine is within a no-treatment exclusion area of a unit in the Proposed Action Alternative (B), the Upper Cottonwood Alternative (C), the Vegetation Alternative (F), and the Existing Roads Alternative (K) and the Proposed Action, Upper Cottonwood, Vegetation, and Existing Roads alternatives. This area is not in the Wildland Alternative (E) or the Wildland Fire Alternative (J). None of the alternatives would affect hibernacula or maternal colonies of Townsend's big-eared bats.

Cumulative Effects

The incremental effects of the alternatives when added to other past present and reasonably foreseeable future actions were considered for pacific western bit-ear bat and all the other species discussed in this analysis. Appendix C displays the list of associated actions.

Ongoing recreational mining activity will continue. One mineral-operating plan allows work outside of adits where a single Townsend's big-eared bat was found in 1995. Later visits in 1995 did not reveal any bats. The permit holder has not been active at this site. No other work has been proposed that would affect mines, caves or old buildings where Townsend's big-eared bat are known to occur. No cumulative effects from this project exist to either hibernacula or maternal colonies.

Risk Assessment

The No Action Alternative (A) is expected to have "no impact" on Townsend's big-eared bats. Although unlikely, Townsend's big-eared bats might occupy an unknown site in the analysis area that could be impacted by activities proposed by this project. The Proposed Action Alternative (B), the Upper Cottonwood Alternative (C), the Wildland Alternative (E), the Vegetation Alternative (F), The Existing Roads Alternative (K) and the Wildland Fire Alternative (J) **"may affect individual Townsend's big-eared bats, but the proposed alternatives are "not likely to result in a trend toward Federal listing or loss of viability"**.

Fisher: Environmental Consequences

(Sensitive-USFS R6)

Areas meeting fisher habitat definitions are present in the Quartzite Watershed Planning Area. Important features to consider include prey base habitat, winter habitat, and the amount of mature/late habitat. This analysis considers the effects to these features.

The No Action Alternative (A) would not alter the existing conditions. Dense stands with ingrowth would not be thinned and roads would not be constructed. Over the short-term, this alternative would have the least impact, because existing stands would not be harvested. The density of overhead cover and the occurrence of older stands would not be altered. But there is an increased risk from wildfire because many stands are overstocked and the ecosystem is not capable of maintaining those conditions over a long period of time.

All action alternatives could affect fisher habitat. Any action alternative could cause the loss of potential or unknown denning trees, but establishing MA-1, pileated woodpecker MRs, pine marten MRs, and riparian buffers; and implementing snag marking guidelines would provide adequate denning habitat. Fisher and pine marten use similar habitats. They both prey on small mammals and spend most of their time in mature and older forests. Both require denning sites sheltered from harsh weather conditions and safe from predators with an adequate prey base nearby. All action alternatives propose establishing the same areas for marten, pileated woodpecker and barred owls and so they would maintain the same amount and array of land base that is set aside for these and associated species. However, there are variations in the amount of treatment (both timber harvest and underburning) and the amount of roads that are proposed in the planning area outside these MRs and the MA-1.

The Vegetation Alternative (F) proposes the greatest amount of activities that could reduce habitat, followed by the Propose Action Alternative (B), the Upper Cottonwood Alternative (C), the Existing Roads Alternative (K), the Wildland Fire Alternative (J), and the Wildland Alternative (E). Reducing the density of overhead cover by thinning or creating openings may reduce the potential for fisher use, but conversely, much of the area now has a greater stocking level than was historically present. If a catastrophic fire occurs, the habitat could become even less suitable for potential fisher use. Older forest conditions would continue, but many of the stands would be moved toward single-stratum drier site condition. Harvest may improve the habitat conditions for some prey species, but it may also reduce the habitat conditions for others. Because winter range habitat would be improved, there is a potential for more winter carrion.

Although new construction roads would be closed after use, there would be a period in which more of the area is more easily accessible to trappers. The roads would be closed, but not obliterated, so use by anything less than a full-sized vehicle could occur after the road is closed. There is an increased, but minimal, potential for increased trapping mortality both during operation and after the roads are closed. Increased roading contributes to habitat fragmentation. This fragmentation can be detrimental to fisher. Action alternatives propose year-round closure of one existing road that is within winter range and another existing road that is outside winter range. One of the roads is used as a snowmobile route and the analysis area is adjacent to the 49° North Ski area. It is possible, but not highly likely, that unknown individuals may be impacted if an alternative is implemented. However if a den is discovered, it will be protected.

Cumulative Effects

The incremental effects of the alternatives when added to other past present and reasonably foreseeable future actions were considered for fisher and all the other species discussed in this analysis. Appendix C displays the list of associated actions.

Establishing and limiting activities in MA-1s, pine marten MRs and pileated woodpecker MRs would reduce cumulative effects to this species. Continued fire suppression maintains or increases the amount of mature timber. But it also can contribute to unnaturally dense stands and increased fuel build-up thus increasing the likelihood for stand replacing fire and possibly the loss of mature stands or riparian areas.

Risk Assessment

The No Action Alternative would to have "no impact" directly, though events such as wildfire are possible. The Proposed Action Alternative (B), the Upper Cottonwood Alternative (C), the Wildland Alternative (E), the Vegetation Alternative (F), The Existing Roads Alternative (K) and the Wildland Fire Alternative (J) **"may impact individual fisher or habitat, but are not likely to result in a trend toward Federal listing or loss of viability for the population or species"**. There are no, or questionable adverse effects on habitat or population and the activity is controllable.

Great Gray Owl: Environmental Consequences

(Sensitive-USFS R6)

The proximity of stands containing broken-top trees or snags or nests of other large birds (corvids, raptors) to openings, is one indication of potential nesting habitat, so this analysis focuses on those areas. Areas meeting that broad description are present in the Quartzite Watershed Planning Area. This analysis considers the effects to potential nest sites

having these characteristics. Some of the meadows also have aspen and/or cottonwood trees that also provide nesting opportunities. Habitat use in other seasons is less restrictive. No known nests have been documented in the Quartzite Planning Area.

The No Action Alternative (A) would not affect potential nest sites. All action alternatives have the potential to affect unknown nests. Analysis was limited to stands within 0.3 miles of large openings. Analysis concentrated on National Forest System timber stands with a high canopy cover regardless of tree type.

Betts Meadows is private ownership, but is near Forest Service ownership. None of the action alternatives propose timber harvest within 0.3 miles of this meadow. Another major meadow is Woodward Meadows. Two units are proposed within 0.3 miles of this meadow for all action alternatives, except the Vegetation Alternative (F), which proposes three. Consequently, the Vegetation Alternative (F) would have the greatest effect near Woodward Meadows. All other action alternatives would have equal effects. The Woodward Meadows area has been surveyed for barred owls and has had numerous visits from wildlife personnel. No great gray owls have been documented in this area.

Another large meadow occurs southeast of Quartzite Mountain on private ownership. Only a small portion of one unit, common to all action alternatives, is within 0.3 miles of this meadow. Long Valley is on private ownership at the base of Quartzite Mountain on the west side. One unit common to all action alternatives may affect nesting habitat. There is a relatively large, dry opening on the south side of Eagle Mountain that may include foraging opportunities. All action alternatives propose the same units near this meadow. Another unit in the southeastern part of the planning area is common to all action alternatives and is within 0.3 miles of a more recent harvest opening on other ownership. A smaller opening that may also provide limited forage opportunity occurs in the southwestern part of Quartzite. Only parts of two units in the Vegetation Alternative (F) are near this opening.

One final area to consider is the goshawk post-fledgling area[90]. The alternate goshawk nest that was active in 2000 is within 0.3 miles of an opening on private ownership so may be a potential for great gray owl nest use. There are other openings, including dry south slopes and timber units that may be open enough to provide some foraging habitat. Suitable nesting habitat may also occur near these areas.

The relative amount of harvest proposed by the alternatives relates to the relative potential for nest habitat impacts. The Vegetation Alternative (F) proposes the greatest amount of harvest followed by the Propose Action Alternative (B), the Upper Cottonwood Alternative (C), the Existing Roads Alternative (K) and the Wildland Alternative (E) and Wildland Fire Alternative (J). It is possible, but not highly likely, that unknown individuals or nests might be impacted. Additionally, in the event that a great gray owl nest is found, the nest will be protected.

Some studies also indicate that great gray owl foraging occurs in stands with less canopy cover. Some logging may enhance forage opportunities by opening up dense stands, but the type, extent and timing of the activity can make it either beneficial or detrimental. Long-term threats to the persistence of this species may be great if ingrowth continues in those sites that are more suited for the open, park-like Structural Stage 7 type habitat. Most studies focus on actual openings as the primary locations for foraging near nest

[90] See the goshawk post fledging area discussion in the section titled *Large Raptors and Great Blue Heron: Environmental Consequences* in this EIS.

stands, so these benefits from silvicultural treatment are not discussed in detail. However, forest management that maintains a mix of successional stages and maintains well-distributed LOS stands would be compatible with management for this species.

Cumulative Effects

The incremental effects of the alternatives when added to other past present and reasonably foreseeable future actions were considered for great gray owl and all the other species discussed in this analysis. Appendix C displays the list of associated actions.

Cumulative effects for this species generally relate to impacts to unknown nests or nest habitat. No nests have been documented on the District. However, treatment has occurred in stands that have characteristics that could have provided nesting habitat, so some past impact may be inferred. Potential future impacts also exist. Emphasis on snag retention, protection of goshawk nests, and limiting activities in MA-1s, pine marten MRs and pileated woodpecker MRs will help reduce potential effects to this species.

Risk Assessment

The No Action Alternative (A) is expected to have "no impact". All action alternatives (the Proposed Action Alternative (B), the Upper Cottonwood Alternative (C), the Wildland Alternative (E), the Vegetation Alternative (F), The Existing Roads Alternative (K) and the Wildland Fire Alternative (J)) **"may impact individual great gray owls or their habitat, but are not likely to result in a trend toward Federal listing or loss of viability"**. The project may proceed as planned.

Peregrine Falcon: Environmental Consequences

(Sensitive-USFS R6)

No alternatives will affect peregrine falcon because they are not nesting in this location. Existing provisions allow protection of a nest in the event that one is found. Harvest and burning is proposed around the cliffs on Quartzite Mountain as well as in other areas throughout the watershed.

Cumulative Effects

The incremental effects of the alternatives when added to other past present and reasonably foreseeable future actions were considered for peregrine falcon and all the other species discussed in this analysis. Appendix C displays the list of associated actions.

Records indicate that peregrine falcons do not nest on or near the District. There are sighting reports, usually during migration, from various locations on the Colville National Forest.

Risk Assessment

The No Action Alternative is expected to have "no impact". All action alternatives (the Proposed Action Alternative (B), the Upper Cottonwood Alternative (C), the Wildland Alternative (E), the Vegetation Alternative (F), The Existing Roads Alternative (K) and the Wildland Fire Alternative (J)) also would have **"no impact"** and the project may proceed as planned.

Redband Trout & Westslope Cutthroat Trout: Environmental Consequences

(Sensitive-USFS R6)

No pure strains of either of these species have been found in the watershed. However *habitat* does exist for both of the species. Habitat will be lost in Woodward Meadows, but it is not a significant spawning area, or does not contain redband or cutthroat. It is currently marginal habitat. The loss of the habitat will not affect the overall population in Cottonwood Creek or the Colville River. The road management activities, including haul and reconstruction, will follow BMPs and mitigation measures and therefore will have a very minimal impact on the species. Sedimentation increases may be expected to fall within the natural range of variation of sediment production within these watersheds, and will be undetectable using current sampling techniques.

Cumulative Effects

The incremental effects of the alternatives when added to other past present and reasonably foreseeable future actions were considered for redband and westslope cutthroat trout and all the other species discussed in this analysis. Appendix C displays the list of associated actions.

See Section 3.3.9, subsection: *Riparian Species/Trout: Environmental Consequences* of this EIS, for a discussion of the cumulative effects on redband and westslope cutthroat trout.

Risk Assessment

This proposal "**May impact individuals and their habitat but is not likely to lead in a trend towards federal listing".**

Focal Species

Migratory Land Birds: Environmental Consequences

Nesting Habitat

Changes in the amount of nesting habitat due to project implementation are difficult to quantify. For some species there may be an increase in nesting habitat, but for others there may be a decrease.

Lazuli Bunting

The percentage of change (either increase or decrease) that results from implementation of any of the proposed alternatives for the Quartzite Watershed Management Project is likely to be negligible when considered over the entire species' range. In order, from greatest to least potential change (increase or decrease of potential habitat) the alternatives are the Vegetation Alternative (F), the Proposed Action Alternative (B), the Upper Cottonwood Alternative (C), the Wildland Fire Alternative (J), the Wildland Alternative (E), the Existing Roads Alternative (K) and the No Action Alternative (A). This is based on the overall amount of acres proposed for

commercial harvest treatment and for underburning. In general, the benefit to species requiring open, single stratum habitat from management activities (thinning, underburning, etc.) will outweigh the (often short-term) negative effects to other migratory birds.

Cumulative Effects

The incremental effects of the alternatives when added to other past present and reasonably foreseeable future actions were considered for migratory land birds and all the other species discussed in this analysis. Appendix C displays the list of associated actions.

For the past several years, most winter range underburning and riparian habitat enhancement projects have been associated with larger projects rather than individual projects that were analyzed separately. Other small projects (for example, trail reconstruction/relocation or repairing ORV damage) that may impact individual nests also occur. Because of mixed ownerships, there are also treatments on other ownerships within the Forest boundary. All these areas have nesting and foraging habitat for some of the species of migratory land birds. The effects may be proportionally greater in those portions of these projects that contain shrub-fields, riparian habitat, overstocked stands or stands converting from single stratum types than in the general coniferous forest environment. For many species, the effects are transitory and limited to the season in which the disturbance occurs. However, even when the effect is of short duration, there will be some impacts to some individuals. Some projects may also reduce the habitat quality for some migratory land bird species.

A large factor affecting migratory land birds is the alteration of habitats these species use outside of the nesting season, in distant winter migration habitat. This may have an even greater affect on abundances and species composition for Quartzite Watershed than changes in the watershed habitat, but this consideration is beyond the scope of this analysis.

Section 3.4 – The Human Environment

Section 3.4 depicts the affected environment and the effects alternative implementation would have on the roads, scenery, recreation, economics and heritage resources. It will track analysis methodology and the logic path used to determine effects. Where relevant, it will discuss the relationships these specific resources have with other resources and their synergistic effects on ecosystem functions and processes.

Reference Uses

Indigenous people's culture and spirituality was linked to their environment through ceremonies, customs and social responsibility. How they managed their environment was dependent on these multidimensional connections.

The oral history of indigenous people indicates the area lying between the Colville River valley and the Calispell Divide was not occupied when Kalispel peoples looking for a place to settle first viewed it. This area has also been identified as the northern part of the range of the Spokane Indians, and the territory of the Chewelah Indians. All of these groups were part of the Plateau cultural tradition and the Salishan language grouping. As such, their resource-based economy included a seasonal round of harvesting and trading for the various materials and foodstuffs required for life in the Plateau culture. A principle reason for traveling through the analysis area would have been to access the fishery at Kettle Falls where salmon was harvested and dried. The river valleys and lowland areas were generally used to gather camas, one of the very important staples of the Plateau diet, as well as waterfowl and waterfowl eggs. Upland areas were generally used to gather a variety of berries (mostly huckleberry), and for hunting game.

Peeled cedar trees near the Chewelah Trail indicate indigenous people used parts of the analysis area for gathering huckleberries. These small tree scars indicate the construction of small gathering baskets or platters or serving vessels. No other substantial Native American sites have been identified within the project area. We can assume however, that parts of the project area were used as short-term habitation sites and that there were trails passing through the area.

The only practice that would have significantly affected the ecosystem within the planning area was the use of fire to enhance resource habitat. There is ethnographic evidence of Native Americans setting fires to enhance habitat for huckleberries and forage for deer in the period around the 1850's. There is no data available indicating how early this practice may have been used or in what specific areas. The "Report to the Colville National Forest on the Results of the Quartzite planning area Fire History Research" notes that the earliest fire discovered was in the year 1384, and that the mean fire frequency interval was 8.3 years. At this point however, only speculation and conjecture can establish a relationship between this report and the use of fire by Native Americans.

Present-Day Uses

Today, 5.8% of Stevens County's 39,000 people are Native American. People of European decent and others comprise the remaining 94.2%. Fur-trappers and miners led the way for the in-migration of Europeans and others in the early to mid-1800s. Homestead settlement between 1890 and 1930 brought Stevens County's population to more than 18,000. This influx initiated the transition from reference landscape conditions to current conditions, when prospects for mining, timber, livestock grazing and crops lured people into the analysis area.

Today, these subsistence activities continue, however as leisure time increases so does the use of the area for recreation. Auto-touring, firewood gathering, berry picking, snowmobiling, cross-country-skiing, bicycling, hiking, camping, off-road vehicle riding, horseback riding, and hunting make up most recreation pursuits. Other human-uses in the area include domestic water use, scenery and solitude.

Timber harvest on NFS Lands has been limited to the Thomason and Woodward drainages. The Betts, Wessendorf and Sherwood drainages have not incurred any logging activity on Forest Service land. Logging has occurred within all watersheds outside National Forest System Lands. Forest Service timber sale contracts typically limit ground-based (tractor) logging systems to slopes of 35% or less, with cable-based systems specified on slopes greater than 35%. Logging practices outside National Forest System Lands typically use ground-based systems without slope limitations. Silvicultural prescriptions on NFS cutting units have included a wide range of prescriptions including clear cutting, broadcast burning, and artificial regeneration (planting). Logging prescriptions outside National Forest System Lands usually removes 50-70% of the basal area at each entry. There are approximately 140 miles of roads within the analysis area. The highest road densities are located outside National Forest System Lands at the lower elevations.

Most human-uses are compatible however some compete for area resources, and conflicts between users exist. Northern Stevens County is the home of several sawmill operations, and support for the timber industry is strong and relatively unopposed by any locally organized environmental groups. Two environmental groups have organized in neighboring counties, one of which opposes any logging on NFS Lands. Both of these groups focus their efforts on preserving unroaded areas. The Betts Meadows Wetland Preserve[91] members want to preserve the drainage above Betts Meadows. Chewelah is less timber dependent than northern Stevens County communities because of its distance from large sawmills and because its proximity to Spokane has allowed it to attract retirees and others to its scenery, recreation, and medical services. Many area residents however, commute to sawmills for work, or depend on local timber felling, skidding and hauling jobs.

3.4.1 Scenery: Affected Environment

Of all the resources analyzed, scenery proves to be the most subjective, and regardless of predictions or models, “the eye of the beholder” ultimately gauges the effects to scenery.

Complicating analysis is the time scale involved with an observer’s perceptions. The unbroken forested landscape viewed now, is much different from the fire dominated patchy forests of one hundred years ago. The gradual scenic conversion that has taken place in the absence of fire, results from decades of subtle forest in-growth, most of which has gone undetected. Only old photographic images can show us what once was. And after eighty years that landscape now seems out of place.

The analysis attempts to overcome these subjective and temporal issues by detecting the landscape character that people collectively value the most.

[91] See the subsection titled Hydrology: Affected Environment within Section 3.2-of this chapter.

Current Scenic Character

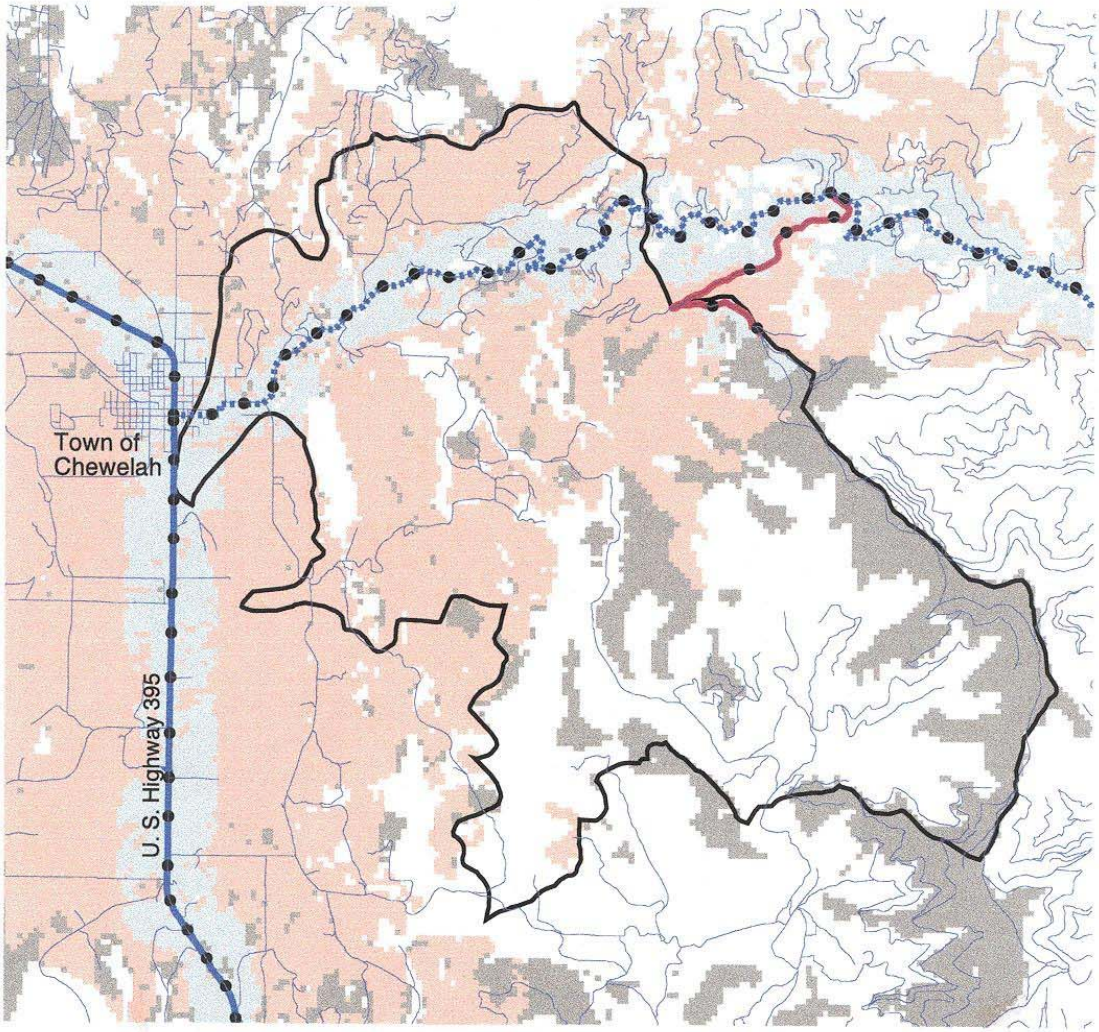
Scenic integrity indicates the degree of intactness and wholeness of the landscape character. It is affected by human activities such as road construction, timber harvesting, or activity debris. It is evaluated by measuring "the degree of alteration in line, form, color, and texture from the natural or natural-appearing landscape character or from the established landscape character accepted over time by the general public".

The overall appearance of the planning area is of natural appearing forestlands, including broad undisturbed areas that are considered an important scenic feature of the landscape. The Quartzite Planning Area contains one site mapped as having distinctive scenic qualities, Quartzite Mountain, and the remaining portion is mapped as typical of the Okanogan Highlands character type. The rocky face of Quartzite Mountain is a focal point within this portion of the Colville River valley.

The dominant human processes that affect the visual quality of the landscape are suppression of fire, road building, and natural resource based industries (agriculture, timber harvesting, and mining). Fire suppression for approximately 80 years has altered the vegetative structure of the landscape by modifying species diversity and stocking levels. Stands on north facing slopes tend to be dense with continuous canopy while south facing slopes tend to be more open with occasional breaks in the canopy.

The main transportation system that provides access to the planning area is Washington State Highway 395, which is the major travel route from Spokane to Canada. Stevens County Road 2902 (Flowery Trail Road) leads east away from Highway 395 and bisects the project area. The Flowery Trail Road accesses the Chewelah Mountain area and leads east to the towns of Usk and Cusick, Washington. 49 Degrees North Ski Area is accessed from this route. The road is currently paved from Highway 395 to the Stevens and Pend Oreille County boundary, a distance of approximately 14 miles. Stevens County Road 2888 (Upper Cottonwood Road) provides access to the southwestern portions of the planning area and is predominately gravel surface. Forest Development Roads in the project area provide access for a variety of uses.

LANDSCAPE VISIBILITY ANALYSIS



FOREGROUND - 0 to 1/2 Mile, Individual forms are dominant.

MIDDLEGROUND - 1/2 to 4 Miles, Viewer is able to see human activities.

BACKGROUND - 4 Miles to Horizon, Large patterns are distinguishable.

DISTANCE ZONES
Foreground
Middleground
Background
Unseen

TRAVELWAYS
U S Highway 395 - Concern Level 1
Flowery Trail Road - Concern Level 1
Road 4342 - Concern Level 2

Computer Generated Viewpoints
Quartzite Planning Area

Washington State Highway 395 Scenery Corridor

When traveling along this highway, approximately 45 miles north of the City of Spokane Washington, the traveler moves into the Colville River Valley, which is broad, flat, and bound by the Huckleberry and Selkirk Mountain Ranges. The Highway runs north south following the line of the valley. Rolling hill landforms are prevalent in the landscape, and many are tree covered broken by rock outcrops. Vegetation along the valley ranges from agricultural openings to small wooded sections along the Colville River as it meanders through the length of the valley. The valley is mostly rural in appearance with farms, ranches, homes, a light industrial center, and casino located along the road corridor. The Highway passes directly through the small town of Chewelah.

A small segment of Chewelah Mountain is visible when driving south on Washington State Highway 395 and is more prominent in the winter due to snow cover. The prominent rock outcrop on the west side of the 3701 foot Quartzite Mountain can be seen for long durations while traveling along the Highway 395 corridor and through the town of Chewelah. Its contrast with surrounding forest cover makes it stand out as a prominent landscape feature. Private residents and developers of subdivisions orient homes to view this local landmark. It is especially attractive when lit by the long light rays of sunset.

The upland elevations of the project area have rolling hills and mountains with a coarse texture as tree canopy is broken by natural rock openings. The top of Wessendorf Canyon can be seen from this corridor and the eye is attracted to it's contrasting light colored rock and dark tree cover. Quartzite Mountain, Parker Mountain, and a series of rolling hills partially screen background views to the higher elevations. Roundtop Mountain has a pointed, conical shape, which stands out from the other hills. Snow cover in the winter highlights recent high-elevation harvest units located outside National Forest Lands. The snow enhances the changes in texture, which is less prominent in summer months.

The mixed ownership visible from this corridor provides a range of scenic integrity rated from very low (heavily altered) to very high (appears unaltered). National Forest System Lands are visible from middleground to background viewing distances, with the average viewing duration from the highway being fairly short due to driving speeds (55 mph). The south aspect of Jay Gould Ridge and the southwest aspect of Chewelah Mountain can be seen from WA State Highway 395 and from private residences. Roads are not evident as part of the landscape character attributed to National Forest Lands.

One man-made feature that visually affects the Quartzite area is the short segment of power transmission line that can be seen from Washington State Highway 395, where the opening forms a linear intrusion along the lower slope of Jay Gould ridge.

Flowery Trail Road Scenery Corridor

The Flowery Trail Road starts in Chewelah and travels east through a rural setting, with the foreground dominated by agricultural fields and private residences. The forest

boundary is approximately 4 miles east of Chewelah, where the road takes on a tunnel-like appearance created by the densely stocked trees that line the road. The road was constructed in the 1930's by the Civilian Conservation Corps, and may have been used as a trail by Native Americans and settlers, before that. The road receives heavy traffic from skiers accessing 49 Degrees North Ski Area. The resort is primarily a day use area, which results in heavy traffic in the morning and afternoons during the winter.

The south slope of Eagle Mountain is occasionally visible from the Flowery Trail Road, through a screen of vegetation. This slope is naturally appearing, with scattered openings fringed by Ponderosa pine. Timber harvesting on low elevation non-federal lands and higher up on National Forest System Lands is visible from the roadway. An old ski run is also visible, however, trees and shrubs growing in the run reduce the contrast with the surrounding landscape. Viewing duration for any one feature along the route is reduced by the many curves in the road, as it snakes it's way up the mountain.

The scenic integrity along the Flowery Trail Road varies from natural appearing, to slightly altered. The scenic integrity appears natural within the immediate foreground of the road Stand texture is fine due to densely stocked trees with short viewing distance. Outside of the project area, two harvest units from the No See Um sale are visible and have a slightly altered appearance

Cottonwood Divide Road:

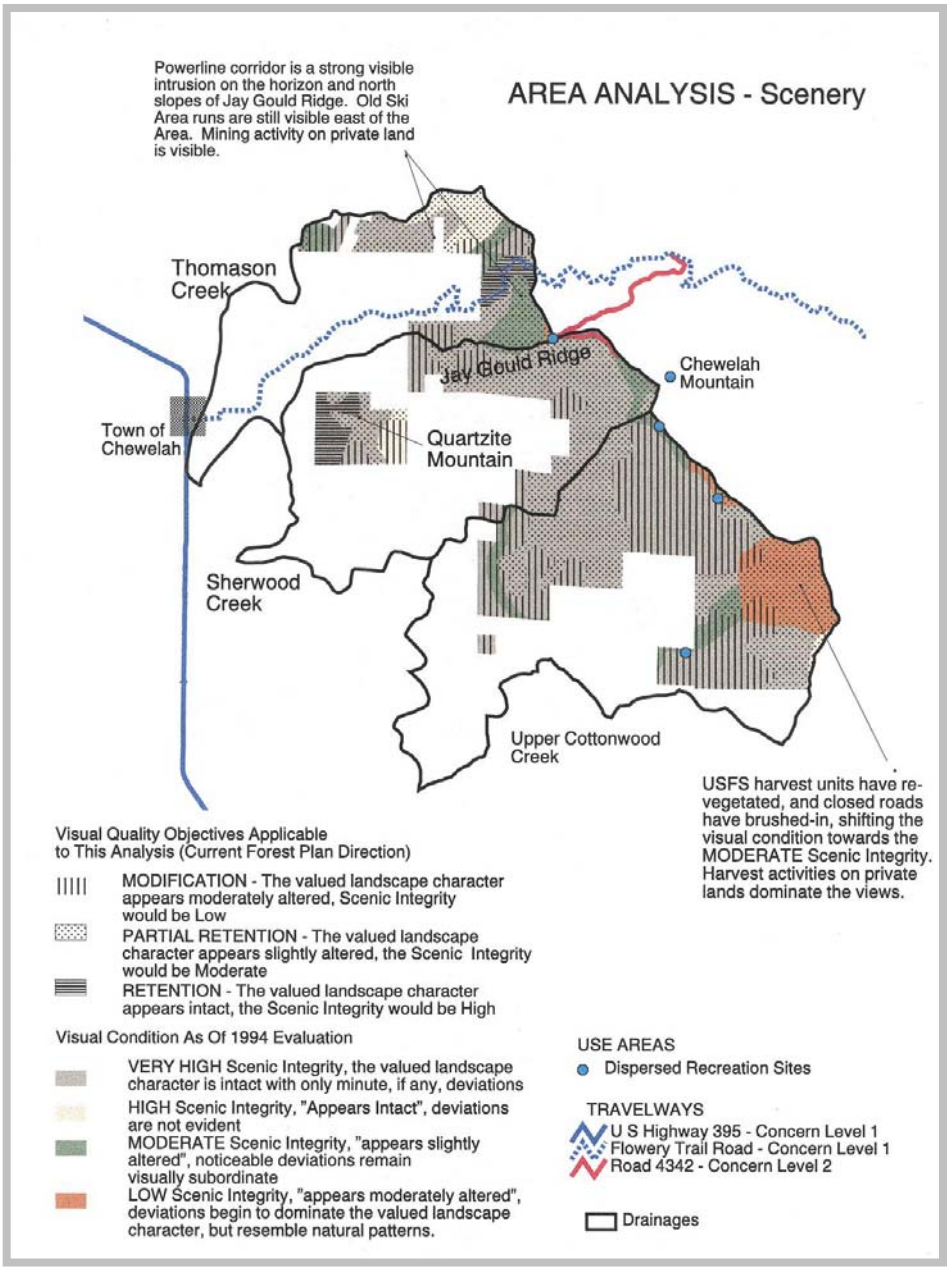
This route not only provides access to the Chewelah Mountain area, but also accesses a ridgeline dividing drainage patterns between the Pend Oreille River valley to the east, and the Colville River valley to the west. The forest road along this ridgeline is known as the Cottonwood Divide Road. A winter-recreation snow park is located on Washington Department of Natural Resources land adjacent to the junction of the Flowery Trail Road and Cottonwood Divide Road. This creates an almost year round use of the area, and access to broad views of the valley.

Long distance views along the route include vistas down into the Colville River Valley. The town of Chewelah and Highway 395 can be seen in the background, with natural appearing ridges in between. The scenic integrity varies from natural appearing in foreground and middleground views, to heavily altered in background views. The top of Chewelah Mountain previously had a fire lookout tower, which provided views down into the drainages. The tower is no longer there and the site is primarily used for utility towers and ski resort facilities.

3.4.2 Scenery: Environmental Consequences

The Colville National Forest manages visual resources according to Visual Quality Objectives developed through the Visual Management System (USDA Forest Service 1974), and further specified in the Colville Land and Resource Management Plan (1988), which allocates management areas that guide resource management activities on National Forest System Lands. The Visual Management System has recently been updated by Landscape Aesthetics, A Handbook for Scenery Management (USDA Forest Service 1995), otherwise known as the Scenery Management System (SMS). The Colville National Forest utilizes the concepts within the SMS process during area analysis.

Scenic Analysis Methodology



Visual quality objectives were used in the Forest Plan to describe a desired level of scenic quality, and diversity of natural features, based on physical and sociological characteristics of a specific Management Area. The objective for each Management Area refers to the degree of acceptable alteration of its characteristic landscape. The five categories of Visual Quality Objectives are Preservation, Retention, Partial Retention, Modification, and Maximum Modification.

The Visual Quality Objectives relating to proposed activities within the Quartzite planning area are defined as follows:

- Retention – Human activities are not evident to the casual Forest visitor. Activities may only repeat the forms, lines, color, and textures, which are frequently found in the characteristic landscape.

- Partial Retention – Human activity may be evident, but must remain visually subordinate to the characteristic landscape.

- Modification – Human activity may dominate the characteristic landscape but must, at the same time, utilize naturally established form, line, color, and texture. It should appear as a natural occurrence when viewed in middleground or background.

Viewing distance also determines the sensitivity of the landscape and is described as; Immediate Foreground (0 to 500 feet from observer), Foreground (500 feet to ½ mile from observer), Middleground (1/2 mile to 4 miles from observer), and Background (from 4 miles to horizon from observer).

Viewing distance also determines the sensitivity of the landscape and is described as; Immediate Foreground (0 to 500 feet from observer), Foreground (500 feet to ½ mile from observer), Middleground (1/2 mile to 4 miles from observer), and Background (from 4 miles to horizon from observer).

Concern levels are a measure of the degree of public importance placed on landscapes viewed from travelways and use areas. The travelways and use areas affecting this analysis, and documented through Forest Planning, are as follows:

- Washington State Highway 395 Corridor: This travel route is designated as a level one primary travelway due to the high public interest in scenery, and the regional importance as a state highway. The National Forest Lands of primary concern are those acres seen at a middleground distance from the Highway.

- Flowery Trail Road Corridor: This travel route is designated as a Level One Primary Travelway due to the regional importance as a forest land access route, and the access route to 49 Degree North Ski Area, which is also classified as a Level One. The route also accesses permanent and summer homes, and has strong potential as a scenic drive upon completion of the current reconstruction efforts. There is a high interest in scenery by the public using the route, which includes not only the small communities located at either end of the route, but visitors from the City of Spokane as well. The National Forest Lands of primary concern are those seen at either a foreground or a middleground distance.

- Chewelah Peak Road: The route to Chewelah Mountain, along Road 4342 from the Flowery Trail Road and then along the Chewelah Peak Road (4342600) to the lookout, carried a visual sensitivity rating of a Level Two or Secondary Travelway. The lookout tower on Chewelah Mountain has been removed and the 4342600 Road is now gated and closed to traffic. There is still interest in accessing the ridgeline near Chewelah Mountain and the National Forest Lands of primary concern are those seen at either a foreground or a middleground distance.

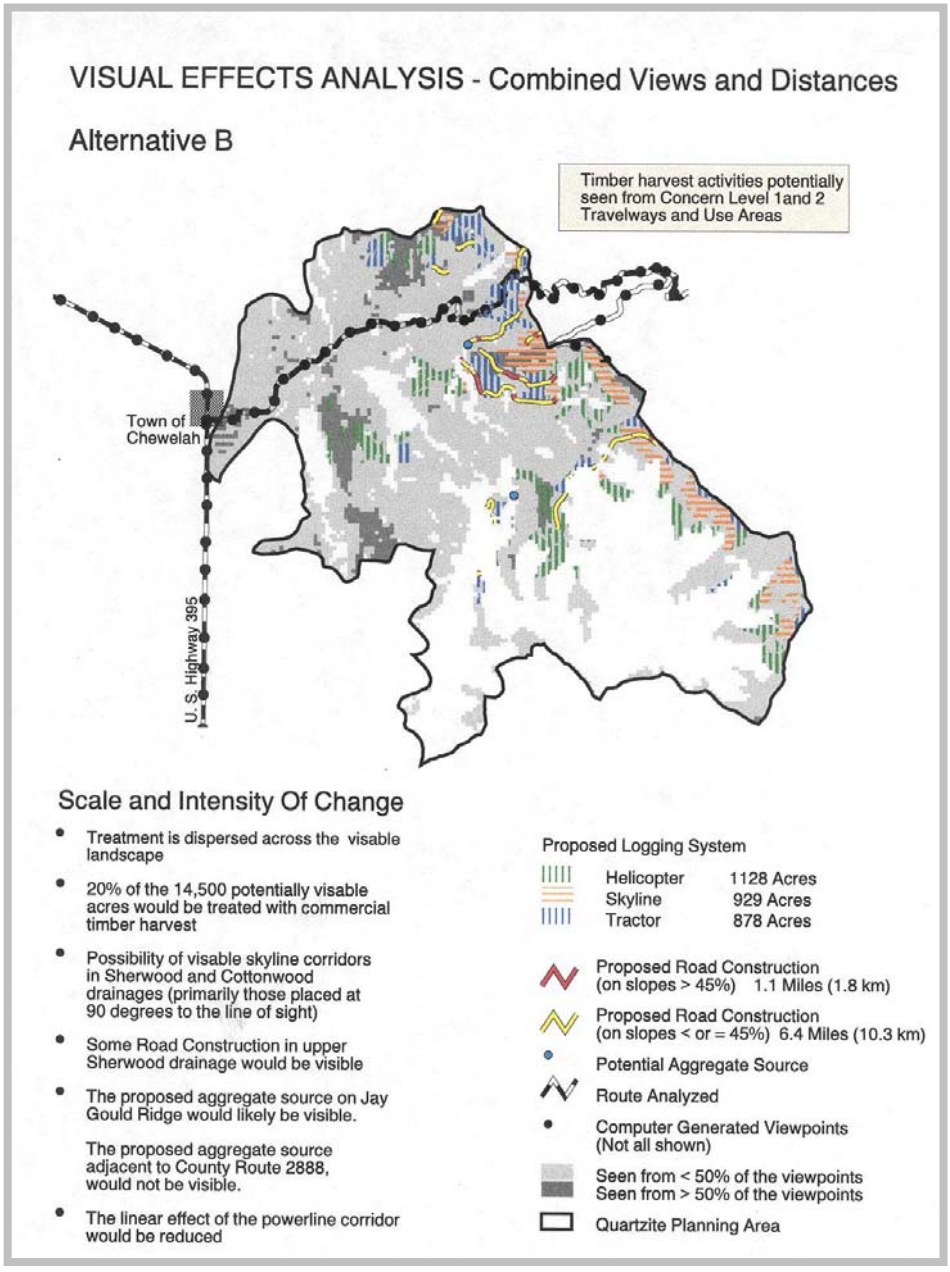
Analysis of the projected effects to these viewsheds focuses on those proposed activities that could alter the landscape character valued by the public today. Road construction, timber harvesting, prescribed fire, and the debris they leave behind all have the potential to change the scenic landscape.

Effects of the No Action Alternative

In general, no immediate change would occur to the quality of scenic resources. No activities would occur with this alternative, and consequently changes in landscape appearance would continue at its present pace. However, this highly valued scenic backdrop may not be sustainable. As noted at the beginning of this discussion, the relatively unbroken forested landscape viewed now, is much different from the fire dominated patchy forests of one hundred years ago. The gradual scenic conversion that has taken place in the absence of fire, results from decades of subtle forest in-growth. And it is just this in-growth that threatens the current viewsheds.

Eight decades of fuel accumulation make fire control difficult, at best. So far, control measures have limited wildfires to small areas. As fuel continues to accumulate, the risk of large wildfires increases. When a large wildfire occurs, radical alterations to the valued landscape character can be expected.

Effects of The Action Alternatives



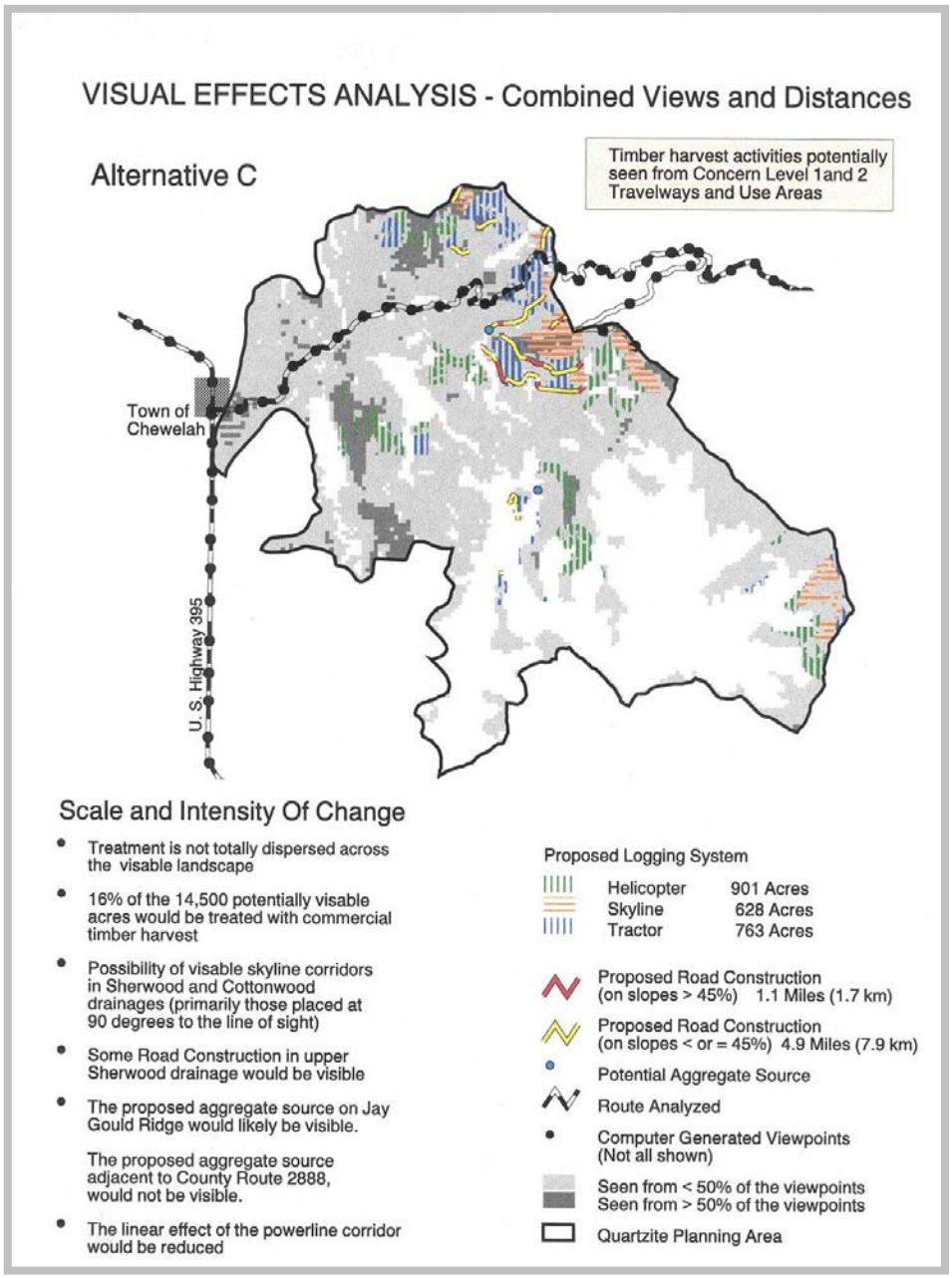
Road Construction

Proposed roads, that access the upper slopes of Thomason Creek drainage, have the potential to be seen in background from Highway 395, in foreground and middleground from the Flowery Trail Road, and in middleground from the northern section of Cottonwood Divide Road. Reconstruction of the Flowery Trail Road[92] may open new views of these slopes. Under all action alternatives except K, new roads are proposed in areas designated as partial retention under the Forest Plan. Road cuts may be visible in the short-term, until vegetation becomes re-established. After these roads are closed, most of the area would exhibit a high scenic integrity. However, the existing power line that crosses Flowery Trail Road, and the impending Flowery Trail Road re-construction, will more likely meet a moderate to low scenic integrity.

Alternatives that propose road construction in the upper slopes of Sherwood drainage (Alternatives B, C, and F) threaten the natural appearing landscape character due to the un-natural linear feature imposed on those slopes. The roads would cross an area managed as partial retention and would be visible in the background from a distance of

[92] Stage 3 of the on-going Flowery Trail Road re-construction is scheduled for 2002 and 2003.

five miles from viewpoints located along the Highway 395 travel corridor. Site-specific mitigation[93] for Alternatives B & C, however, would effectively screen these roads from these viewpoints and the natural appearing characteristics of landscape would be maintained and accordingly would meet Forest Plan direction for the area. The contrasting elements of color and line associated with the un-mitigated roads proposed by Alternative F would not be subordinate to the natural appearing landscape and therefore would not meet Forest Plan direction for the area.



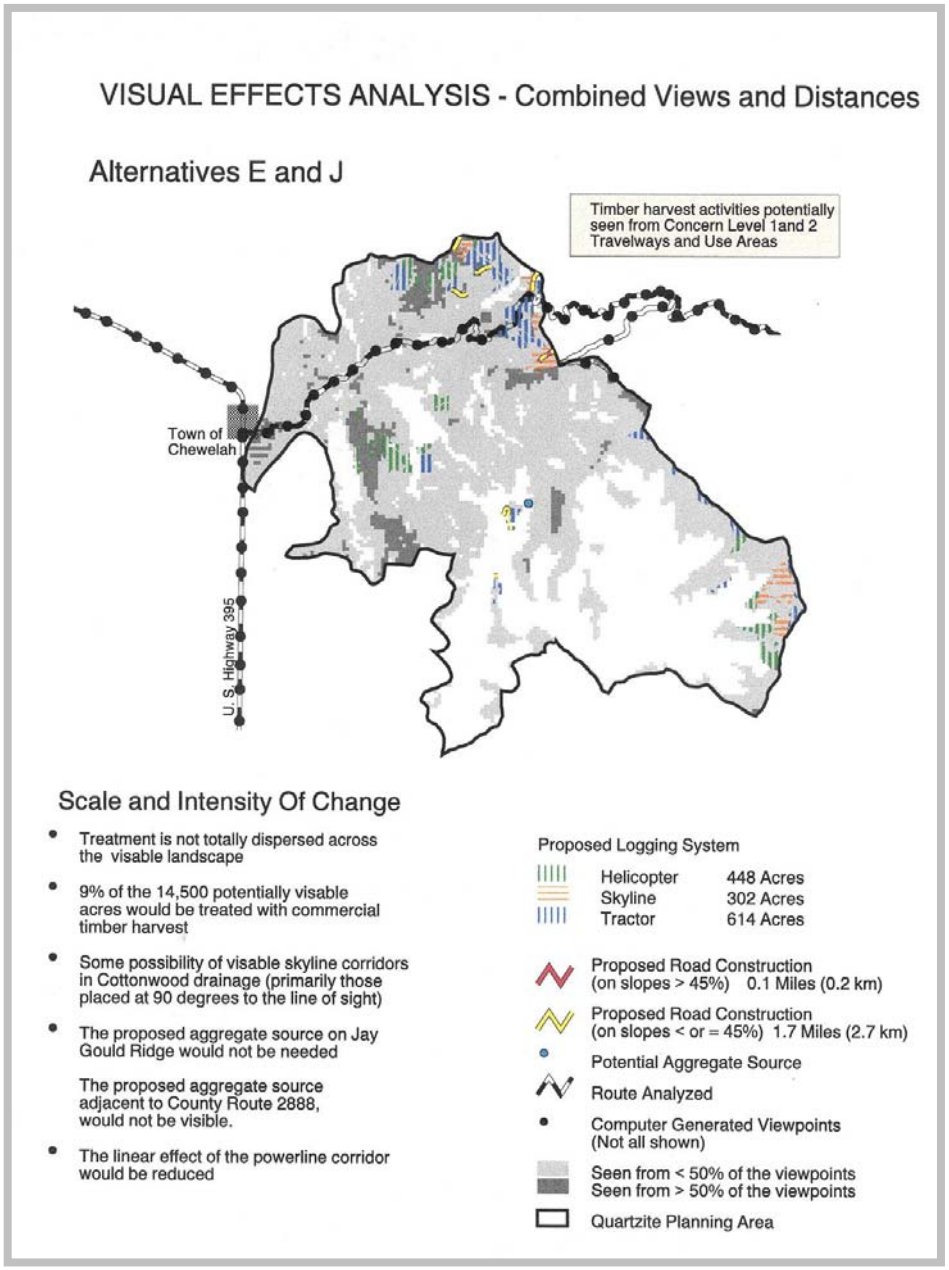
Alternative F also proposes road construction to access the slopes along the eastern side of Cottonwood Creek drainage. The steep side slopes create a situation where the proposed road will impose visible line and color change on the otherwise natural appearing landscape. This will not meet the Forest Plan visual quality objective where it crosses MA 5 on slopes over 45 percent. This occurs at the beginning portion of the proposed road, which would be visible in background from Highway 395. The remaining portion of Road 12 would cross MA 7 with a visual quality objective of modification.

Timber Sale

Due to the tremendous in-growth of Douglas-fir within the timber stands of the Quartzite Planning Area, the stands have become homogenous and the texture of the view has become more fine than coarse. Building patchiness into these stands is critical to

[93] Road locations would avoid natural openings. Trees would be used to screen roads elsewhere. See Scenery Mitigation in chapter 2 of this EIS.

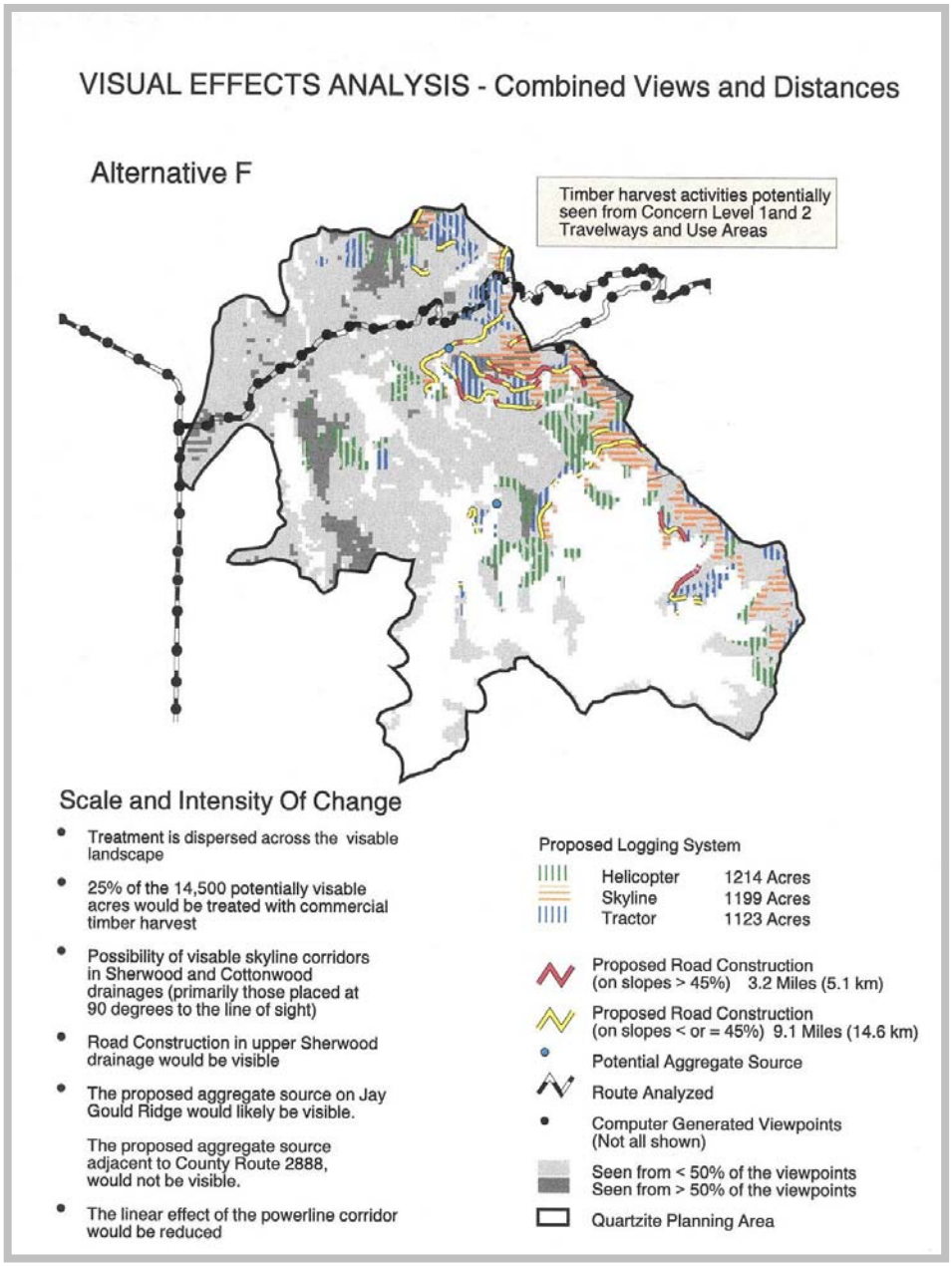
providing a more sustainable landscape character. Proposed activities will promote a combination of open single-storied stands and multi-storied stands, emphasizing and maintaining the large tree component.



Under Alternatives B, F, and K, and to a lesser extent Alternative C, much of the harvest activity done by skyline logging systems occurs along the Cottonwood Divide Ridgeline. These units would be visible in background from various locations along the Highway 395 corridor, foreground or middleground from the northern section of Cottonwood Divide Road, and some would be seen in middleground from the Flowery Trail road. Where skyline corridors are aligned at, or near 90 degrees to the line of sight, and stands are fairly uniform, there is a possible long-term effect due to the introduction of the unnatural vertical lines and color contrast from soil exposure and vegetation removal. This effect is especially visible in the winter months when snow creates a strong visible contrast to the adjacent vegetation. These alternatives, however, propose to treat at the landscape scale rather than isolated sections, which allows for greater flexibility in location of skyline corridors. Alternative C does this in the most visually sensitive areas, except a portion along the northeastern slopes of Cottonwood drainage, where the slopes are seen primarily in background from Highway 395, and the visual quality objective is modification.

Proposed harvesting in the upper slopes of Thomason Creek drainage, along the existing power line corridor, would help to soften the edges of that corridor. The existing roads may become more visible as a result of reconstruction of the Flowery Trail Road, and reconstruction of those roads for use under this sale. It is difficult to predict how impacting this will be until Road 2902 is reconstructed. The Flowery Trail Corridor will be heavily affected for several years as a result of reconstruction of the Flowery Trail Road. It is

anticipated that treatment of the vegetation seen in foreground and middleground from the road will have a positive affect in serving to promote species diversity and vigor. The long-term effect will be to increase the scenic and recreational value of this landscape. These effects will meet the long-term visual management objectives of the Colville National Forest Land and Resource Management Plan.



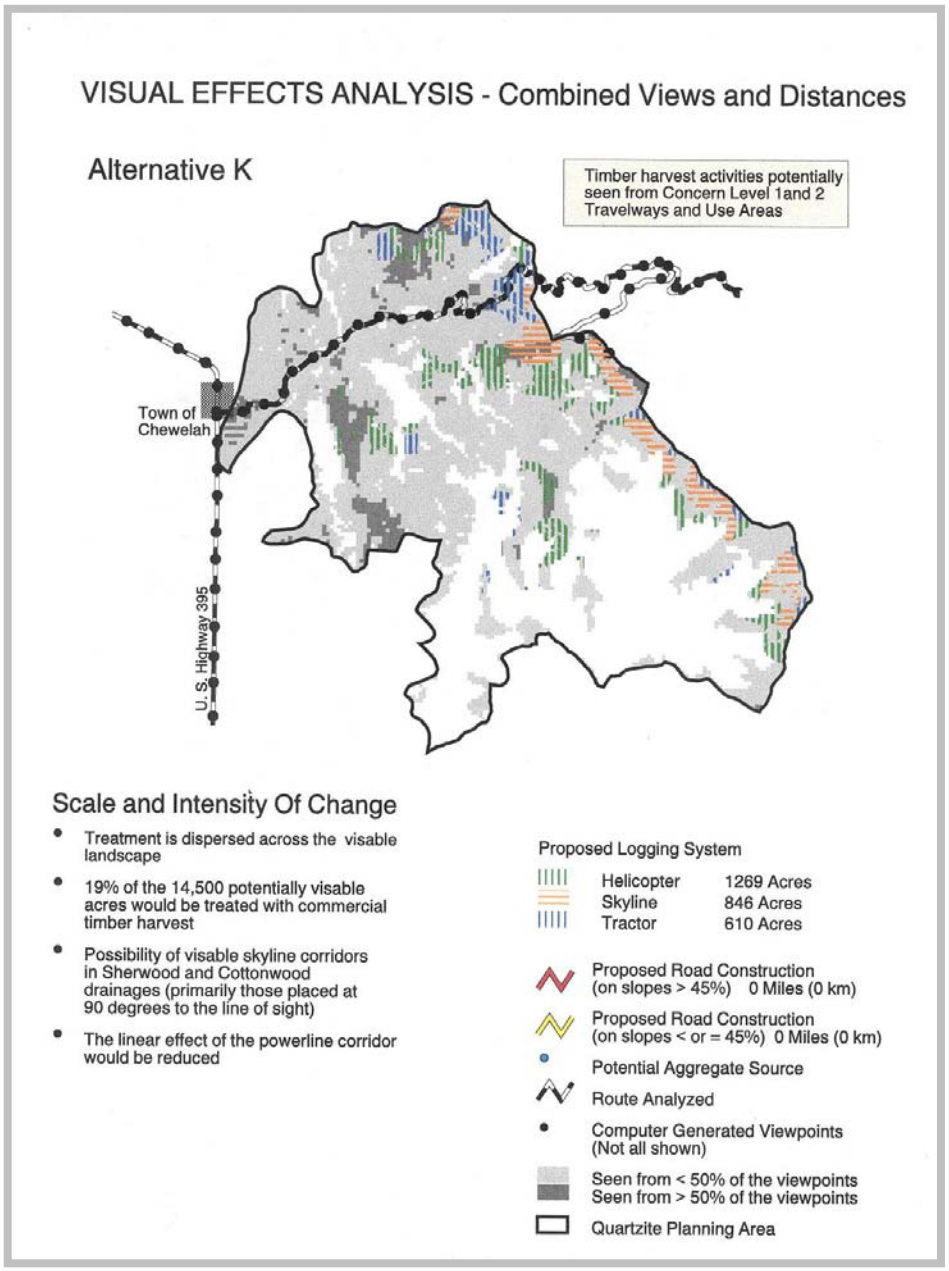
Prescribed Fire

Forest Plan visual quality objectives that were developed for forest management activities are not well suited to the temporary effects of under-burning. In addition, fire is a natural process regardless of whether ignition is by human intervention or natural causes. The goal of the Visual Management System has been to strive to maintain a natural-appearing landscape. Since it is a natural occurrence, fire, even prescribed under-burning in moderation, is consistent with a natural-appearing landscape. On the other hand, the heavily burned-over landscape that results from catastrophic wildfire is generally considered unattractive even though it may be natural appearing. The moderate use of jackpot or under-burning proposed by these alternatives may help to diminish the risk of wildfire and the resulting negative visual impacts.

Post stand treatment, through the use of jackpot or under-burning, will be used as necessary to reduce activity debris and the risk of wildfire. There will be short-term noticeable changes in foreground zones along the Flowery Trail road however, the long-term appearance will be of a healthier, more open, and natural appearing landscape.

Conclusions

The risk of large intense wildfire increases with the No Action Alternative (A). When a large wildfire occurs, radical alterations to the valued landscape character can be expected, the result being Forest Plan visual standard violations. Until then, changes in landscape appearance would continue at its present pace.



The Proposed Action alternative (B) and the Upper Cottonwood alternative (C) propose to build two new roads on the upper slopes of the Sherwood drainage. These roads have the potential to impose un-natural linear features that could be visible in the background from viewpoints located along the Highway 395 travel corridor. However, mitigation that uses vegetation to screen these roads would diffuse negative linear elements and maintain the natural appearing characteristics of the landscape. Accordingly, these alternatives would meet Forest Plan visual standards. Landscape scale stand treatments would affect a subtle shift in texture, as thinning and small openings would cause the landscape to appear slightly coarser.

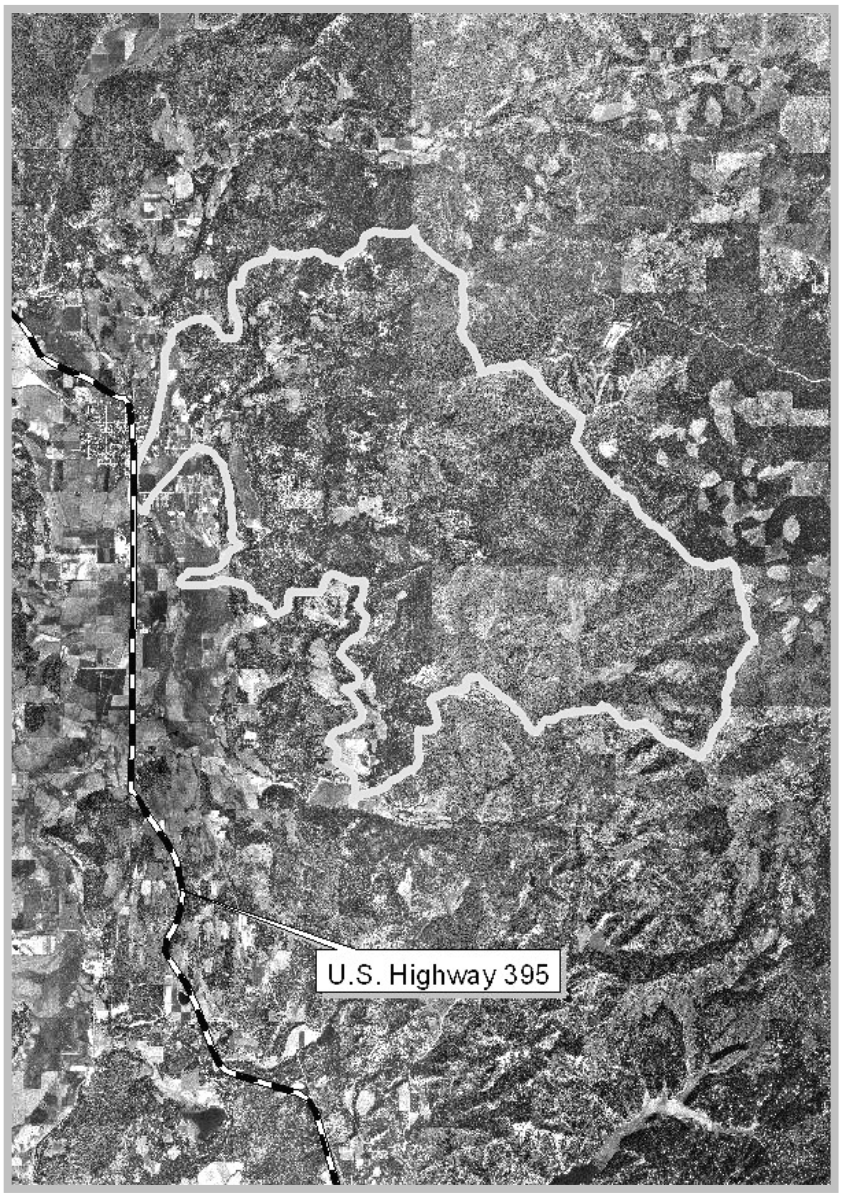
The Wildland alternative (E) and the Wildland Fire alternative (J) limit the scope of stand treatments and, like the No Action Alternative A, the valued landscape character may not be sustainable. These alternatives would treat the stands along the visible power line corridor and adjacent to the visible harvest units on private land southeast of the Planning Area. This would likely soften the visual effects of these activities.

The Vegetation alternative (F) would have the strongest impact to the existing landscape character because of the horizontal lines, and color contrast new roads would impose on

slopes seen from the Flowery Trail road and Highway 395. Under this alternative, these new road effects would not be consistent with the Forest Plan objective of Partial Retention, and consequently, scenic integrity would be reduced. If selected, the Vegetation Alternative would require an amendment to the Forest Plan.

The Existing Roads alternative (K) retains the scenic integrity of the area and sustains the valued landscape character through broad scale treatment of the vegetation without introducing the negative visual elements associated with new roads. This alternative would be consistent with the Forest Plan objective of Partial Retention.

Cumulative Effects



The Quartzite area comprises only a portion of the landscape visible from the Highway 395 travel corridor. Forested lands of other ownership lie south of the area, and west, across the Colville River valley. Less than half the acres within the analysis area are National Forest System Lands. In the 1990s, as federal timber supply declined, a corresponding increase in timber value caused a widespread harvest of timber on private holdings. Unlike earlier harvest that used clear-cutting, harvest in the 1990's emphasized partial cutting and thinning; the scenic result being a coarse and sometimes patchy appearing forested landscape.

The contrast between these lands and the un-harvested National Forest System Lands located within the analysis area is most evident just south of the analysis area. Elsewhere, the difference between the coarse forested landscape of harvested land and other lands is less evident.

The scenic character of the landscape viewed from the Highway 395 travel corridor is formed by an assemblage of landowners. The changes to this landscape that are proposed by the action alternatives would tend to increase scenic uniformity. That is, the partial harvest and prescribed fire proposed by the alternatives would simulate the coarse forested appearance of neighboring lands: Alternatives B, C, F & K more so, and Alternatives E & J, to a lesser degree. New road

construction associated with the Vegetation Alternative (F) would introduce un-natural features and could dominate the landscape character of background views. Discounting a major wildfire, the No Action Alternative would not contribute change to the cumulative scenic landscape.

Activities on private land, which use clear-cutting and open mining techniques, will continue to draw the attention of travelers in the area. Power line corridors will still be a visible feature throughout the landscape, while efforts to thin stands will soften the 'notch" effect along the skyline.

Reconstruction of the Flowery Trail Road will be the primary change to the character of the landscape along this route. This will take approximately 5 years to complete and the long-term effects to area users, as well as increased demand for access to areas off of the Flowery Trail Road, are uncertain. It is probable that the road improvements will bring more users to the area, and an increased public interest in the overall landscape.

3.4.3 Recreation: Affected Environment

No recreation sites or trails have been developed within the project area. However, a variety of dispersed recreational pursuits occur, ranging from solitude-seeking hikes in the deep woods, to adrenalin pumping snowmobile tours on the ridge tops.

Sense of Place

Sense of place is the meaning or attachment that people have for a landscape. Many residents living in Chewelah and the surrounding areas are descendants of first settlers of the area and are likely to have strong values regarding the land. Many local residents regard the area as an extended backyard. Recreation visitors develop an attachment to places based on past experiences. Families may visit the same area for a number of years and often many generations seek the same type of recreation experiences and activities.

Subsistence occupied the lifestyle of early residents with limited time available for recreational pursuits. Hunting, fishing, and berry picking were more likely for subsistence rather than recreation. Recreation pursuits may have included hiking, skiing, sled riding, camping, picnicking, and horseback riding. Personal interviews have revealed that people would travel to the lookout then located on Chewelah Mountain, and camp out while picking huckleberries for a weekend outing. The lookout has since been removed. In the past, a number of residents would snowshoe up Flowery Trail to the mountaintops, and pack down trails to create skiing areas. Other winter activities included building and camping in snow caves, and skiing from Chewelah east to the town of Usk. In the summer people sought relief from the heat of the valley by traveling to higher elevations to cool off.

Through time, lifestyles were changed from subsistence to a more diverse economy based on mining, agriculture, and timber harvesting. Increased leisure time led to more varied recreation uses and new forms of recreation evolved as a result of changes in transportation. The advent of the automobile provided more access to remote areas, which increased as road systems were developed and driving for pleasure became a common recreational activity. Today mountain bicycles, snowmobiles and off road vehicles are increasing access into previously unused areas.

Hunters and berry pickers seeking a more remote experience use the high elevation ridge that separates the Cottonwood and Sherwood Creek drainages. Avoiding the steeper side slopes, hunters and berry pickers typically hike out the rounded ridge top to seek their quarry. This ridge provides an opportunity not found elsewhere in the area.

A profile of recreation visitors to the analysis area indicates most are from Spokane, and the tri-county area of Stevens, Pend Oreille, and Ferry counties. Ski area visitors increasingly originate from other neighboring states including Idaho and Oregon. Trends in recreation uses indicate a growing interest in dispersed camping, hunting, off road vehicle riding, and snowmobile riding. There is also an increasing demand for huckleberries and other forest products.

The 49° Degrees North Ski Area attracts visitors to the area that often stop in Chewelah for dinner and other amenities. The ski area is currently a day use area and has potential to become a destination area for multiple day visits as the site is enlarged. The City of Chewelah, with its proximity to the Ski Area and Spokane, is becoming a destination for retirees, this trend influences recreation use in the Quartzite area.

Natural resources continue to be perceived as a commodity as the local economy is heavily dependent on these resources. An appreciation for the value of natural scenery will continue among residents and visitors.

Dispersed Recreation

In 1903 the population of Chewelah was 823 people, by the 1930's the population had grown to 1,100, and currently the town's population is 2,418. Many residents in the area are descendants of the first settlers and for generations have participated in natural resource industries (agriculture, ranching, logging, and mining). The Quartzite area is approximately 45 miles north of city of Spokane, which has a population of 400,000. This area is the first access point to Colville National Forest available to Spokane area residents, which comprises a large percentage of the visitors.

Quartzite Mountain is becoming a popular destination among local residents since it provides a panoramic view of Chewelah and the Colville River Valley. A number of user-built foot trails that lead to the top of Quartzite Mountain exist but are not maintained as system trails. Other uses of this area include picnicking and camping. Although it has the appearance of a good climbing area the rock is not suitable for this use.

The existing Forest Service managed roads do not represent the main access routes used by the public in the Planning Area. Forest Service roads within the area are not maintained for passenger cars, and many are managed to close naturally over time depending on use. Some get seasonal dispersed use by high clearance vehicles, but the primary roads offering public access to the area are county roads, typically single lane with turnouts and minimal surfacing.

The area receives year-round recreation use including: firewood gathering, berry picking, snowmobiling, bicycling, hiking, camping, off road vehicle riding, horseback riding, snow shoeing, cross country skiing, and hunting. Driving for pleasure is another major use of forest and county roads within the planning area. Holidays, hunting season, ski season and berry picking season draw significant numbers of visitors to the forest. There are no system trails or developed recreation facilities located on National Forest System Lands within the planning area.

Hunting, and the gathering of forest products, are considered by many locals as both recreation and subsistence. The northeast portion of Washington State is recognized as a premier hunting area for white-tailed deer, as it has the largest population in the state. Hunters come to this area from across Washington State as well as surrounding states. The Quartzite Planning Area provides an opportunity to hunt along ridgelines and steep slopes. Huckleberry picking has changed from subsistence activity to a commercial enterprise for some individuals. Other special forest products that may be gathered from the area are mushrooms, firewood, Christmas trees, tree boughs, floral greens, fence posts, and seedlings.

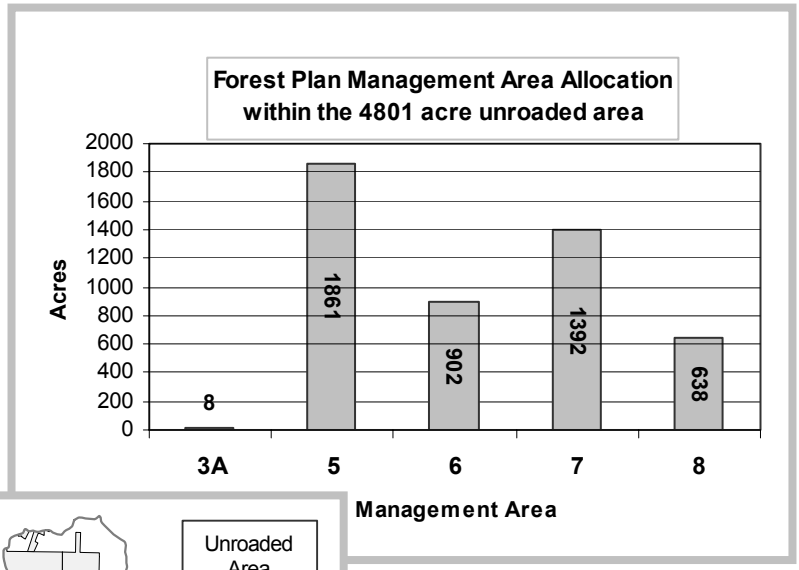
Several dispersed campsites are located within the project planning area. These sites are located along ridgelines accessed by roads and in meadows or clearings with open, grassy areas near water. People are drawn to dispersed sites to experience a less structured environment. Dispersed areas can provide the opportunity to experience solitude, as these areas are generally more remote. Heavy use in some of these areas can lead to impacts to riparian zones through compaction of soils, waste disposal, and trampling of vegetation. Woodward Meadows is a large meadow that receives moderate dispersed recreation use within the Quartzite planning area, including unauthorized vehicle use that is causing resource damage.

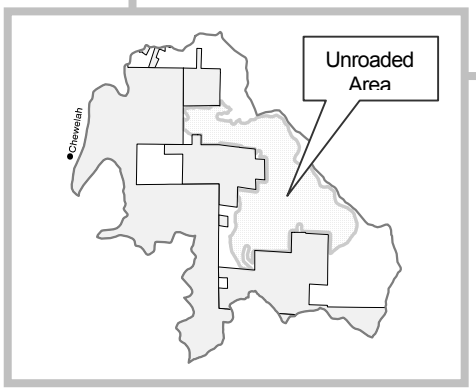
The Cottonwood Divide Road is also part of the Chewelah Mountain/Power Peak groomed snowmobile route that follows Forest Service roads, with trailheads at Flowery Trail Road, Middle Fork Calispell Creek, and west of Woodward Meadows. The route is located on both the Three Rivers and Newport Ranger Districts. It is groomed by the 49 Degrees North Ski Area personnel and has an estimated 5,000 visitors annually. Cross-country skiers also use one section of the Cottonwood Divide Road. The parking areas west of Woodward Meadows and along Calispell Creek are small, and not located at constructed snowparks. The route is groomed from November to March or as snow conditions allow.

Located just east of the Quartzite Project Area, 49° North Ski Area operates on National Forest System Lands under a special use permit. It provides opportunities for downhill, telemarking, snowboarding, and cross-country skiing. An estimated 50,000 people visit this ski hill annually with occasional summer mountain bicycle events, which draw approximately 300 people per event. This developed recreation site attracts the highest recreation use on the Colville National Forest. Skiing has a long history in this area, and a special use permit was first issued to the Chewelah Ski Club in 1940. In 1972 the 49° North Ski Resort opened for public use on Chewelah Mountain at its present location.

Remote Recreation

The Quartzite area did not qualify for analysis for potential wilderness designation during Roadless Area Review and Evaluation (RARE II)[94]. Appendix L of the Forest Plan[95] notes, "*The area near Betts meadows does not meet the roadless area criteria (larger than 5,000 acres).*"





Public scoping for the Quartzite project, however, exposed concern for the effects the proposed action could have on the portion of the analysis area that is without roads[96]. Many are concerned about the possible loss of a variety of attributes, including the area's natural integrity, its apparent naturalness, the opportunity for solitude, and any primitive recreation opportunities-and-unique features it may include.

To analyze effects the alternatives could have on unroaded land, large tracts of unroaded, undisturbed areas were mapped within the analysis area. Mapping criteria considered all lands within the Colville National Forest Administrative Boundary that are within or adjacent to the project area. For this analysis, any contiguous area greater than 1,000 acres in size and greater than 100 meters from any existing road or past harvest activity was considered unroaded.

No Designated Roadless Areas, no RARE II areas, no Wilderness Areas, and no unroaded areas over 5,000 acres on other federal lands exist within or adjacent to the planning area. However, one un-inventoried, unroaded area (4,801 acres in size) was identified within the project area. Forest Plan management direction for the area allows both timber harvest and road construction.

Recreation-Opportunity-Spectrum

Preserving the character of the recreating experience, and the benefits provided by a natural appearing landscape are objectives of the Forest Plan. These ends are met by using an analytical system (the Recreation-Opportunity-Spectrum) that identifies and analyzes broad categories of recreation opportunity on Forest lands.

[94] Wilderness areas were provided for in the Wilderness Act of 1964 (Pub. L. No. 88-577), which established the National Wilderness Preservation System. The Wilderness Act directed review of FS-designated primitive areas and other larger roadless areas to consider their suitability for inclusion in the national wilderness system. This review was carried out and expanded (with respect to the national forests) in the Roadless Area Review and Evaluation or "RARE" studies. Roadless areas inventoried either as part of the RARE studies or as part of subsequent reviews during the NFMA planning process are referred to as "inventoried" roadless areas.

[95] Appendix L, page L 3-19, Colville National Forest Land and Resource Management Plan.

[96] See Section 2.1 of this EIS: Public Involvement.

The Recreation-Opportunity-Spectrum system involves a Forestwide recreation analysis of the physical setting (remoteness, size, and evidence of humans), social setting (user density and character), and managerial setting (management regime and its evidence) on the Forest. It is designed to provide an indication of the kind of experience users are likely to find in an area.

The Forest Plan Record of Decision, signed in 1988, established Recreation-Opportunity-Spectrum settings for the thirteen Management Areas[97] it created. These settings are used across the Forest to guide recreation development within the Management Areas.

The 4801-acre unroaded area identified for this analysis is comprised of five different Forest Plan Management Areas, each with their own Recreation-Opportunity-Spectrum setting(s).

Management Area	Recreation-Opportunity-Spectrum Setting
3A	**Roaded Natural:** Motorized and non-motorized activity occurs. The area is roaded, and roads may be paved. Extensive interaction with other Forest visitors and management activities is the norm.
5	**Roaded Natural:** See *Roaded Natural* above. **Semi-primitive, motorized**: Motorized and non-motorized activity occurs on and off roads. The area may or may not be roaded depending on the overall recreation and wildlife management objectives. Dispersed use sites are well used. Opportunity for interaction with other Forest visitors is moderate.
6	**Roaded Natural:** See *Roaded Natural*, above. **Semi-primitive motorized:** See Semi-primitive, motorized, above.
7	**Roaded Modified:** Motorized and non-motorized activity occurs. The area is roaded, and roads may be paved. Extensive interaction with other Forest visitors and management activities is the norm.
8	**Roaded Modified:** See *Roaded Modified*, above.

Project-level Unroaded Analysis

For the Quartzite Project, recreation and wilderness attributes were used to depict the existing character of the unroaded area. Five descriptors were used to determine the Recreational-Opportunity-Spectrum rating: *access, remoteness, social encounters, visitor management and on site development*. Four criteria were used to describe wilderness attributes: *natural integrity, apparent naturalness, opportunity for solitude and primitive recreation opportunities and unique features.*

Recreational-Opportunity-Spectrum Descriptors

- *Access* – On its east side, the Cottonwood Divide road provides access from above, along the ridgeline that forms the hydrologic divide between the Colville River and the Pend Oreille River. Less than 2 miles to the west, lower elevation access is gained from the Upper Cottonwood road, where the area can be entered from County, private, and National Forest roads.

- *Remoteness* - Most of the area is within one mile of existing roads, but topography, and the presence of running water in local streams, can limit the sights and sounds associated with these roads and other Colville River Valley impositions.

[97] See Chapter 1, Section 2 of this EIS for a description of these Forest Plan Management Areas.

- *Social Encounters* – A short distance away from access roads, there is almost no likelihood of encountering another party while using the area.

- *Visitor Management* - There are no controls or information facilities within the area.

- *On site development* – There is no recreation or any other type of development located within the area.

Wilderness Attributes

- *Natural Integrity* - The primary alteration to the natural integrity of the area is from the roads located along the divide and along the lower slopes, as well as the visible cutting units adjacent to the area on private land. That and the several dispersed campsites along the ridge adjacent to the divide road are the only on site alterations to the natural integrity of the area. The effects of the dispersed sites are only apparent in the area immediately adjacent to the road and do not affect the majority of the unroaded area. Fire suppression has delayed the start of a large fire, but without vegetation management, the area will in all likelihood be subject to a large fire in the future. There is scattered, isolated evidence of past logging where individual trees were removed along the edges of the area. Evidence of these activities is obscured by vegetation and time, and do not detract from the natural integrity.

- *Apparent Naturalness* - The area appears natural when viewed from outside and from within the area.

- *Opportunity for Solitude* - The majority of the area faces south and west with some exposure to Washington State Highway 395. As noted above, most of the area is within one mile of existing roads, but in some locations, topography, and the sound of running water in local streams, can limit the sights and sounds associated with these roads and other Colville River Valley impositions.

- *Primitive Recreation Opportunities and Unique Features* - Primitive recreation opportunities are limited by the size of the area and the ease of access to existing roads. Even considering the steepness of the terrain, the entire area can be reached within two hours. There are no unique features within the unroaded area. Quartzite Mountain is a unique feature within the Quartzite Planning Area, but is located outside the unroaded area.

3.4.4 Recreation: Environmental Consequences

The activities associated with vegetation management would affect recreation more than the riparian/wetland management or the road management activities. Because of their scope, timber sale activities and prescribed fire activities would affect short-term and long-term dispersed recreation and unroaded recreation.

Dispersed Recreation

As is typical when a timber sale is active, dispersed recreation use would be disrupted in the short-term while the sale is active. The chance of meeting a loaded log truck on a narrow gravel road has a way of discouraging casual recreation use. During the winter, groomed snowmobile routes would be altered to avoid log-haul routes. When it is not active, dispersed recreation opportunities would increase for those alternatives that develop new roads. These alternatives close newly constructed roads after use, however, new road corridors would provide hikers and hunters new access for up to five years or more, until vegetation obstructs passage. The alternatives that construct more new road have more effect.

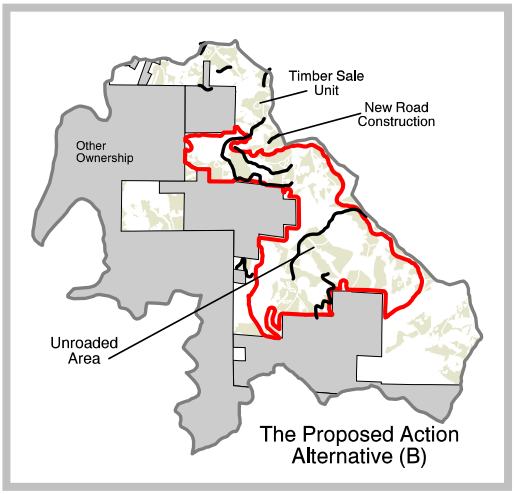
While prescribed fire activities also discourage use, they tend to be less disruptive than timber sale activities. Burning activities usually occur only one day at a time. However, weather conditions make their timing less predictable, and because of limited windows of opportunity and because of the large size of the area proposed for prescribed fire, sporadic early spring (and less likely fall) disruptions to recreation would occur over a 3-5 year period.

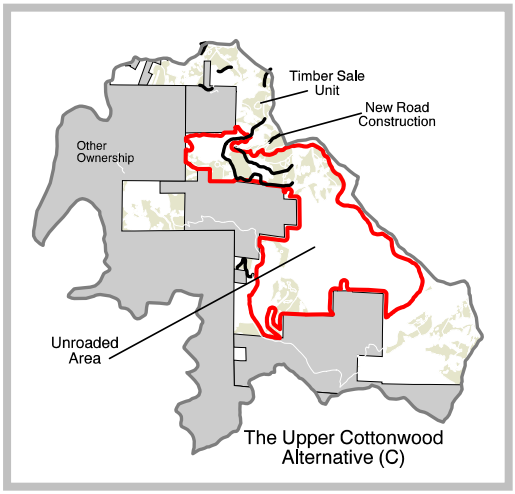
Riparian/wetland management activities in the Woodward Meadows area would have little to no effect on dispersed recreation.

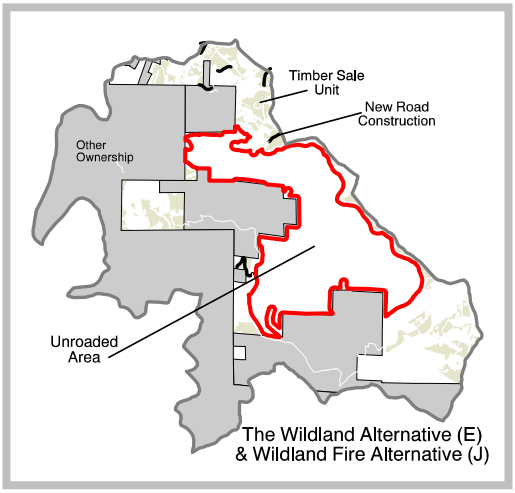
Firewood gathering and four-wheel driving would be limited by those alternatives that propose to close two roads (Alternatives B, C, E, J & K). The Jay Gould road closure, while limiting four-wheel drive opportunities, also increases user safety. Existing dispersed campsites located within 500 feet of the beginning of this road would remain accessible. The Woodward Meadows road closure would not create a significant loss of quality dispersed recreation sites. Access to the area will not be denied; however, the location of some dispersed campsites would be changed.

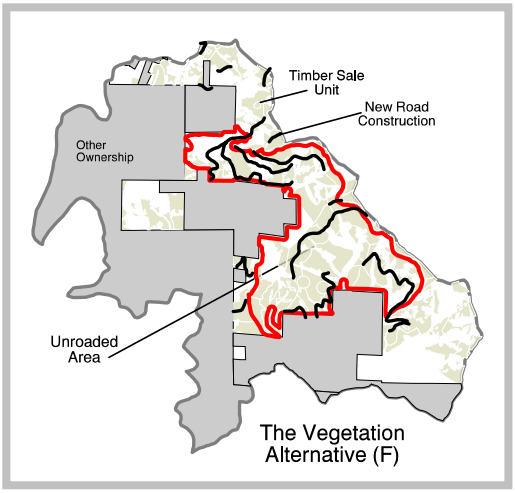
Remote Recreation

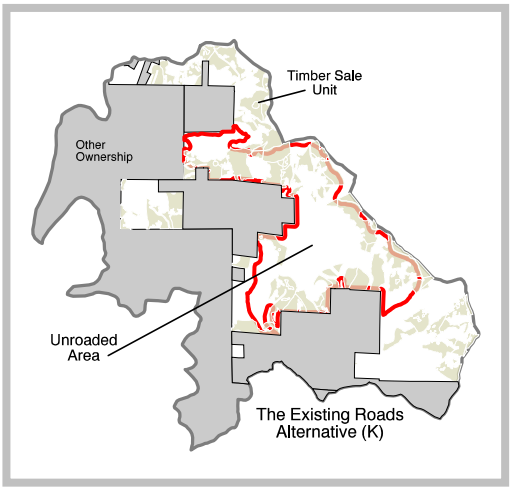
As the maps show, the seven alternatives provide a range of effects on unroaded recreation. Three would have little or no effect. The No Action Alternative (A) and the









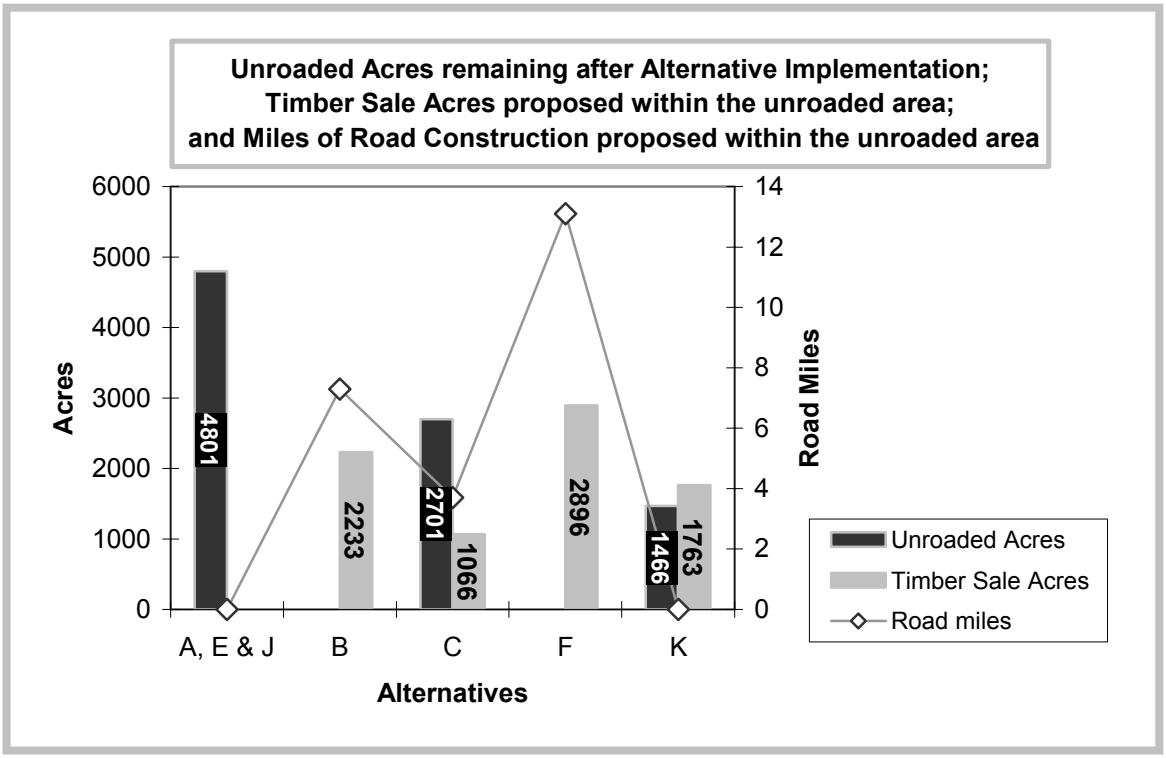


Wildland Alternative (E) do not propose any activity within the unroaded area, and the Wildland Fire Alternative (J) only proposes prescribed maintenance-fire within the area. If the Proposed Action Alternative (B) were implemented, no area would meet the unroaded criteria[98]. Two thousand seven hundred and one acres would meet the criteria, if the Upper Cottonwood Alternative (C) were implemented. No area would meet the criteria if the Vegetation Alternative (F) were implemented, and 1,466 acres would meet the criteria if the Existing Roads

[98] For this analysis an unroaded area is defined as any contiguous area greater than 1000 acres in size and greater than 100 meters from any existing road or past harvest activity.

Alternative (K) were implemented.

More difficult to analyze are the effects the alternatives have on wilderness attributes. Natural integrity, apparent naturalness, opportunity for solitude, and primitive recreation opportunities and unique features all have the potential to be affected by any of the seven alternatives.



Even the three alternatives that propose no timber sale or road construction within the unroaded area (A, E, & J) could reduce the opportunity for solitude. The incumbent risk of large, intense wildfire that is associated with these alternatives includes the risk that views and sounds from outside the area would increase after such a fire.

Those alternatives that propose a timber sale and road construction however, would more effectively reduce the opportunity for unroaded recreation. Although the Existing Roads Alternative (K) proposes no road construction, the apparent naturalness of the area would be affected by the presence of stumps for many years to come. The opportunity for unroaded recreation would essentially be limited to the headwaters area of Cottonwood Creek if the Upper Cottonwood Alternative (C) were implemented.

The apparent naturalness and opportunity for solitude now associated with the unroaded area would be reduced across the area, if the Proposed Action Alternative (B), and the Vegetation Alternative (F) were implemented. The timber sale and road construction proposed by these alternatives would reduce the risk of large, intense wildfire, but the evidence of human activity would persist for decades. The loss of the opportunity for solitude however, would be more short term. As noted above, dispersed recreation opportunities would increase for those alternatives that develop new roads. These alternatives close newly constructed roads after use, however, new road corridors would provide hikers and hunters new access for up to five years or more, until vegetation obstructs passage. During this time, the opportunity for solitude would decrease.

Cumulative Effects

The area of consideration needed to assess the cumulative effects the alternatives would have on recreation, depends upon the recreational pursuit. The opportunity for most *dispersed* recreation activities such as firewood gathering, huckleberry picking, hunting, mountain biking, hiking and driving for pleasure exists on most public lands, consequently the area of consideration can be limited to the Quartzite analysis area, and lands immediately adjacent to it. *Unroaded* recreation opportunities however, occur on a larger scale that extends across the Colville National Forest, and beyond.

Dispersed Recreation

Like the timber sale, prescribed fire, and road construction activities proposed by the action alternatives, similar activities proposed adjacent to and outside the project area have little potential to affect most dispersed recreation opportunities or general sense of place attachments. Past resource management projects both outside and within National Forest System Lands have generally increased the opportunity to gather firewood, gather huckleberries, hunt, mountain bike, hike and drive for pleasure. This increase is directly attributable to the access provided by associated road construction. No large timber sale projects are planned within or adjacent to the project area on National Forest System Lands for the next ten years. The timber sale, prescribed fire, and road construction activities proposed by the action alternatives, combined with those occurring outside National Forest System Lands in the future, would not reduce most dispersed recreation opportunities.

Remote Recreation

Remote recreation opportunities occur across the Colville National Forest and across the inland northwest region. Some of these opportunities occur within designated wilderness areas, others can be found in areas without wilderness designation. The rugged topography of the inland northwest has made road construction expensive, and consequently limited construction in many areas. Several areas within a day's drive of Chewelah provide remote recreation opportunities, including sites in Idaho, Montana, and British Columbia, Canada.

The Washington State Wilderness Act of 1984 designated the Salmo-Priest Wilderness Area that is located in the northeast corner of the Colville National Forest. With the passage of this act, Congress stated that the Forest Service was not required to review the wilderness option for the remaining Roadless Area Review and Evaluation (RARE II) areas. The Colville National Forest contains 18 of these areas (175,000 acres or 16% of the Forest) that are located within a 50-mile radius of Chewelah. And even though timber production is the Forest Plan management emphasis for many of these areas, roads or timber sales have affected fewer than 5% of these lands since the Forest Plan was signed in 1988. Future incursions into these areas could occur, however the trends of the past 15 years are expected to continue.

As noted above, lands within the Quartzite area did not qualify for analysis for potential wilderness designation during Roadless Area Review and Evaluation (RARE II). And while the unroaded area located within the Quartzite Project Area has some of the attributes required for remote recreation (natural integrity, and apparent naturalness), other attributes (opportunity for solitude, and primitive recreation opportunities and unique features) are diminished or lacking. Alternatives that degrade the natural integrity and the apparent naturalness of the area (B, C, F & K), would force users to seek other areas, but

they would not appreciably reduce the inventory of available areas across the Colville National Forest, and the inland northwest region.

3.4.5 Social and Economic Resources: Affected Environment

The oral history of indigenous people indicates the area lying between the Colville River valley and the Calispell Divide was not occupied when Kalispel peoples looking for a place to settle first viewed it.

Today, 5.8% of Stevens County's 39,000 people are Native American. People of European decent and others comprise the remaining 94.2%. Fur-trappers and miners led the way for the in-migration of Europeans and others in the early to mid-1800s. Homestead settlement between 1890 and 1930 brought Stevens County's population to more than 18,000. This influx initiated the transition from reference landscape conditions to current conditions, when prospects for mining, timber, livestock grazing and crops lured people into the analysis area.

Most human-uses today, are compatible however some compete for area resources, and conflicts between users exist. Northern Stevens County is the home of several sawmill operations, and support for the timber industry is strong and relatively unopposed by any locally organized environmental groups. Regional environmental groups are primarily interested in preserving unroaded areas on National Forest System Lands.

Chewelah is less timber dependent than northern Stevens County communities because of its distance from large sawmills and because its proximity to Spokane has allowed it to attract retirees and others to its scenery, recreation, and medical services. Many area residents however, commute to sawmills for work, or depend on timber felling, skidding and hauling jobs.

Environmental Justice

Executive Order 12898, issued in 1994, ordered federal agencies to identify and address the issue of environmental justice[99]. To date, questions of environmental justice have typically dealt with pollution or waste being discharged or dumped in minority or poor neighborhoods. However, the Executive Order specifically directs agencies to consider patterns of subsistence hunting and fishing when an agency action may affect fish or wildlife.

Hunting, firewood gathering, and huckleberry picking constitute the primary subsistence activities in the area. While a discreet population is difficult to identify, it is assumed that low-income people in the area use National Forest System Lands to augment their income either from the direct sale of forest products, or by offsetting food and fuel bills.

Costs and Revenues

This subsection identifies the costs and revenues (if any) that are associated with proposals included with the alternatives. Most of the proposals associated with vegetation management, riparian/wetland management, and road management incur costs. The

[99] Environmental Justice issues consider the adverse human health and environmental effects of agency programs that would disproportionately affect minority and low-income populations.

sale of logs that is included in vegetation management proposals is the only activity that would provide revenue to the National Treasury.

No revenue is currently being generated from the project area. Tangible costs incurred by the Forest Service within the project area result primarily from road maintenance and fire protection. Fire-protection equipment, staffing, and training costs are roughly $1.80 per acre per year. Road maintenance costs for the 31 miles of road maintained by the Forest Service average $228 per mile per year.

The 10,587 acres of National Forest System Lands within the project area hold roughly 300 million board feet of timber. The current market value for this amount of timber is $118 million dollars.

3.4.6 Social and Economic Resources: Environmental Consequences

Environmental Justice

The Quartzite Alternatives were analyzed for their effects on low-income people who use the area for subsistence activities.

Hunting, firewood gathering, and huckleberry picking constitute the primary subsistence activities in the area. The action alternatives are expected to increase browse for game species, consequently, subsistence hunting would improve. A slight increase in firewood gathering opportunity is expected in the short term. Huckleberries generally respond to decreased competition for sunlight. Accordingly, subsistence huckleberry gathering is expected to benefit from the action alternatives.

Alternatives would impose no disproportionate adverse human health or environmental effects on minority and low-income populations.

Costs and Revenues

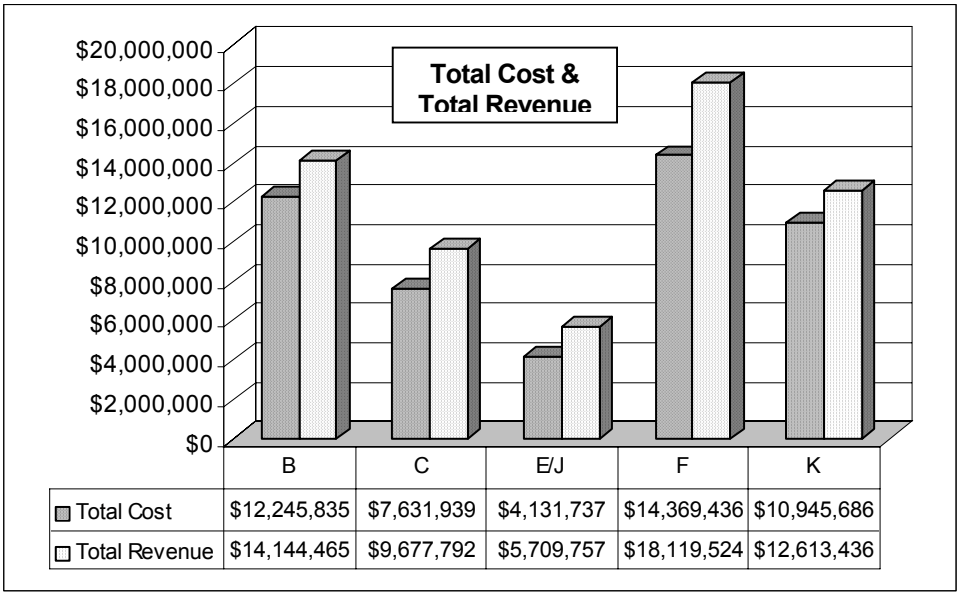
As noted above, most of the proposals associated with vegetation management, riparian/wetland management, and road management incur costs. The sale of logs that is included in vegetation management proposals is the only activity that would provide revenue to the National Treasury.

Vegetation Management

Vegetation management proposals associated with the alternatives fall into two categories: Timber Sale, and Prescribed Fire and Non-Commercial Thinning.

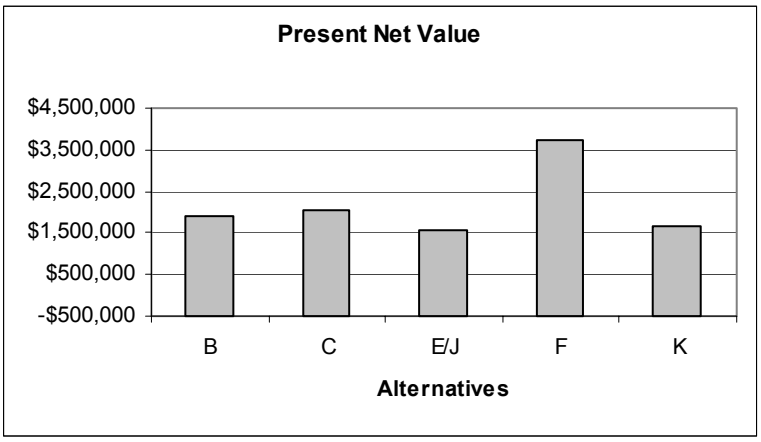
Timber Sale Cost-Revenue Analysis

To determine the viability of the timber sale proposed by the action alternatives, the value of the timber proposed for harvest will be compared to the costs associated with harvest. The log values used for analysis are an average of the current prices paid by local sawmills for logs delivered to their log yards. Assuming log delivery would occur in 2004, present values were calculated by using an annual discount rate of 4%. The present net value of logs delivered to local log yards that would result from Alternative B, is $14.1 million. This figure is $9.7 million for Alternative C; $5.7 million for Alternatives E & J; $18.1 million for Alternative F, and $12.6 million for Alternative K.



	B	C	E/J	F	K
Total Cost	$12,245,835	$7,631,939	$4,131,737	$14,369,436	$10,945,686
Total Revenue	$14,144,465	$9,677,792	$5,709,757	$18,119,524	$12,613,436

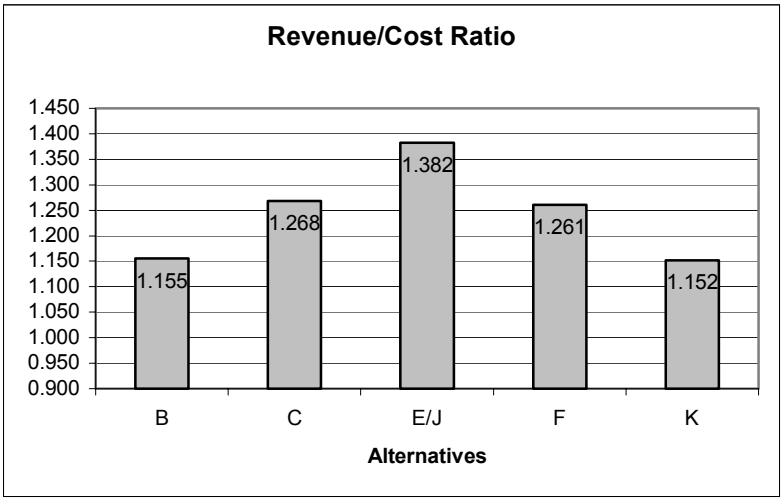
The costs associated with harvest are also based on current rates. They include the Forest Service costs for preparing the timber sale and for administering the contract after the sale. Other costs include erosion control, road construction, logging slash disposal, road maintenance, log yarding, log hauling, and reforestation and mitigation implementation. For a review of mitigation measures associated with the action alternatives refer to Section 2.2 of this EIS. It should be noted that because the Timber Sale Area Improvements listed in Section 2.2.3 would not be used to mitigate the effects of the alternatives, they are not included as costs for this analysis. Activities incurring costs would occur from one to five years from 2002. As with log values, present net costs were calculated by using an annual discount rate of 4%. The present net cost of delivering the volume of logs associated Alternative B is $12.2 million. The present net cost for Alternative C is $7.6 million, $4.1 million for Alternatives E and J, 14.4 million for Alternative F and $10.9 million for Alternative K.



The present net value (PNV) of the timber sales associated with the action alternatives is determined by subtracting the present net costs from the present net values. A positive, PNV indicates that values exceed costs and that Federal Treasury funds would not be used to implement the alternative. A measure of economic efficiency results from comparing the PNV to the number of acres proposed for harvest, or comparing the PNV to the log volume, or comparing values to costs.

All the action alternatives propose a positive PNV. Revenue exceeds cost. As a result, the timber sale proposed by the action alternatives would be economically viable and deposits would be made to the Federal Treasury.

Economic efficiency, however, varies by alternative. Alternatives E & J rank as the most efficient action alternative with a Value/Cost ratio of 1.38. As the chart shows, Alternatives C and F would be somewhat less efficient, and Alternatives B and K rank as the least efficient alternatives.



Alternative A (the no action alternative) would not generate revenue. Timber would not be sold and logging costs would not be incurred. Existing road maintenance and fire protection costs would continue.

Cumulative Effects

The volume of timber that would be harvested in the proposed timber sale is within the range of previous timber programs on the Colville National Forests, and is therefore not expected to have an unusual impact on the local timber market, including not causing a decrease in the timber prices that other landowners might receive for their timber.

Prescribed Fire and Non-Commercial Thinning Costs

As noted in Chapter 1 of this EIS, Prescribed fire that is designed to maintain current desired conditions would occur outside commercial vegetation management areas. Existing fuel loads in these areas are low enough to conduct a burn that reduces these fuels, while maintaining desired vegetation conditions.

Restoration thinning and other prescribed fire proposals occur in areas where existing fuel loads are outside historic fuel loads. In most instances, they follow commercial vegetation management, and are designed to restore fuel conditions consistent with fire ecology.

Where appropriate, the cost of a portion of these activities was included in the timber sale revenue-cost analysis; the remaining costs are dependent on other funding. As the area of treatment varies by alternative, the total cost of these remaining activities varies, however, the cost per acre only ranges from $80 (Alternative F) to $84 (Alternative E).

Alternative	Cost	Acres	Cost per Acre
A	$0	0	0
B	$348,014	4259	$82
C	$282,212	3482	$81
E	$175,586	2114	$84
F	$339,722	4241	$80
J	$210,394	2572	$82
K	$310,488	3804	$82

Riparian/Wetland Management Costs

Riparian/wetland management proposals are located on National Forest System Lands, in the Woodward Meadows riparian area. They are designed to improve riparian vegetation diversity and wetland habitat in this lower elevation wetland that was previously modified for livestock grazing. Management activities include improving the stream channel, and planting native riparian plant species.

Like the costs associated with Prescribed Fire and Non-Commercial thinning, these Woodward Meadows riparian improvement costs are dependent on other funding. With the exception of the No Action Alternative (A), which incurs no costs, these costs do not vary between alternatives.

Alternative	Excavator Cost	Planting Cost	Total Cost
No-Action	$0	$0	$0
Action Alternatives	$2,500	$500	$3,000

Road/Stream Crossing Improvement Costs

Six locations are proposed for improvement, where roads cross streams. Proposals are designed to reduce the amount of road-generated sediment that reaches streams, by modifying road and ditch drainage structures such that water is directed away from streams. Applications of crushed rock to the road surface in these areas would also reduce the amount of sediment that moves off roads during storms and spring runoff.

Like other costs not associated with a timber sale, these road/stream crossing improvement costs are dependent on other funding. With the exception of the No Action Alternative (A), which incurs no new costs, these costs do not vary between alternatives.

Alternative	Total Road Length	Total Cost
No-Action	0 miles	$0
Action Alternatives	0.98 miles	$21,293

3.4.7 Heritage Resources: Affected Environment

Heritage resources are the physical remains of sites, structures, or objects used by humans in the past. They may be historic, prehistoric, archaeological, or architectural. Prehistoric refers to anything that predates written history. Historic refers to that period for which written records exist.

Very few prehistoric sites have been located within the Colville National Forest, but research indicates prehistoric use of uplands. Small hunting camps, tool manufacturing areas, rock shelters, graves, pictographs, trails, vegetable processing sites, and religious sites may exist within the Forest. The most common *historic* sites are homesteaders' log cabins. These numerous sites make up the bulk of the heritage sites on the Forest. Other historic sites include

mines, mining camps, logging camps, wagon roads, splash dams, Civilian Conservation Corps camps, and early Forest Service Administrative sites, including abandoned fire lookout towers and old Forest Service trails.

Pursuant to the National Historic Preservation Act of 1966, as amended, the Colville National Forest conducts a program designed to identify, evaluate, preserve and protect cultural resources. As a result of this effort, 14 heritage sites have been identified within the Quartzite Project Area. Of these 14 heritage sites, seven sites could be affected by the alternatives. These unevaluated sites are potentially eligible for inclusion in the National Register of Historic Places. Sites that have not gone through a formal Determination of Eligibility to the National Register must be managed as though they are eligible until the formal evaluation can be completed.

3.4.8 Heritage Resources: Environmental Consequences

The heritage mitigation listed in Chapter 2 of this EIS, uses a buffer zone to avoid the seven sites that could be affected by the alternatives. Mitigation also insures that where avoidance is not possible, heritage information would be gathered and a National Register of Historic Places eligibility evaluation would occur, before activities commence. Because of these measures, these sites area designated "Historic Properties, but No Effect." Sites of this type are reported quarterly to the State Historic Preservation Officer, and require no response.

3.4.9 Other Social Effects

Consumers, Civil Rights, Minorities, Women and Native Americans

The proposed project is expected to have no adverse effects on consumers, civil rights, minorities, or women.

No effects are anticipated to the American Indian Religious Freedom Act. No impacts on American Indian social, economic or subsistence rights are anticipated.

Public Health and Safety

Public health and safety are slightly affected by the proposed actions. Safety concerns concerning logging and log haul within heavily used recreation areas have been mitigated through timing of proposed activities. An improvement in public safety would result with the action alternatives due to closure of the hazardous section of Forest Service Road #4300.300.

Range Resources

Allotment and Pasture Boundaries

Activities such as road construction, timber harvest, and fire can affect range allotment and pasture boundaries. However, the Cottonwood allotment that is within the Quartzite project area is vacant, and there are no near future plans to re-activate this allotment. Therefore, a detailed analysis of the effect of the various alternatives on the allotment and

individual pastures was not considered in detail. If the Cottonwood allotment was to be re-activated in the distant future, there could be a residual effect on allotment and its pastures due to the loss of natural barriers by harvest, road construction, or fire due to activities proposed in the various action alternatives of this project. Before the Cottonwood allotment could be reactivated, an environmental analysis would be done that would included the affects of past and future activities upon the allotment.

Range Vegetation

Activities such as timber harvest and fire can also affect range vegetation. Small amounts of transitory range will be generated to varying degrees by the action alternatives of this ecosystem project. This is unlikely to affect the available forage for livestock if the Cottonwood Allotment were ever reactivated.

Mineral Administration

Mining Claims and Patents

Patented mining claims in the northwest corner of the Quartzite Ecosystem Project will not be affected by the proposed activities of the Quartzite Ecosystem Project because the patents are currently inactive. If during the life of the proposed Quartzite Ecosystem Project, activity at patent claims changes to active exploration or mining, some conflict could arise from use of National Forest road 017 and other mine access roads. This would only occur if heavy equipment was being moved into or out of the patented mining claims or hauling of mine material became heavy. The likelihood of this happening is very low. This effect would be the same for all action alternatives (B, C, E, F, J, and K). There would be no affect from alternative A (no action).

Current activity at located lode and placer mining claims could be affected by the proposed activities such as road construction, timber harvest (both commercial and non-commercial), and prescribed fire. Impacts are most likely to be from the removal of trees that are being used for claim corners and monuments. Conflicts could arise if one or more of the located mining claims were to become active during implementation of the Quartzite Ecosystem Project. Conflicts would then most likely be over road use and location of mining activities within a timber sale or burn unit. The likelihood of an increase in located mining claim activity beyond claim corner and monument establishment or maintenance is low. This effect would be the same for action alternatives B, C, F, and K. Alternatives E and J have a slightly lower chance of effect due to fewer proposed activities in section 9. There would be no affect from alternative A (no action).

All mining corners or monuments (including discovery monuments), and active workings within the Quartzite Ecosystem Project are to be left undisturbed by any of the proposed activities. There is a chance that corners or monuments from new claims may also be encountered during implementation of the Quartzite Ecosystem Project. The chance of encountering mining claim corners or monuments is most likely to occur in alternative F, and the chances decrease in alternatives B, K, and C. The lowest chance of encountering claim corners and monuments occurs in alternatives E and J.

Mitigation for all action alternatives protects existing or new claim corners or monuments, discovery monuments, or active workings during road construction, harvest, fuel reduction, site preparation, and prescribed fire.

Section 3.5 – Disclosures

Section 102 of the National Environmental Policy Act of 1969, mandates all agencies of the Federal Government to consider and display any unavoidable effects caused by the proposed action. This section does that and includes any irreversible and irretrievable commitments of resources and discusses the relationship between short-term uses and long-term productivity.

3.5.1 Adverse Effects Which Cannot be Avoided

Physical Environment

Soil

Unavoidable effects are those adverse environmental impacts that cannot be avoided. Some soil would be compacted during timber harvesting in all action alternatives. Regional and Forest guidelines specify that no more than 20 percent of an activity area will be compacted, puddled, or displaced, including roads and landings. Mitigation measures are designed so that activities meet these guidelines.

An analysis was completed to determine the total amount of disturbed soil for each action alternative. All alternatives propose activities that would produce soil disturbance of 12% or less in the activity area. Calculations and soil descriptions can be found in the Quartzite Project Soils Analysis, located in the Analysis File.

For all action alternatives, other unavoidable effects include exposure of soils to erosion during road reconstruction and maintenance; and minor nutrient loss as a result of burning.

Water

Road building included with the action alternatives (except the Existing Roads Alternative K) would create sediment that would reach some stream systems, but Best Management Practice mitigation and use of buffers around streams would reduce the effects to a minimal level. The risk of sedimentation above Forest Plan standards and guidelines is highest with the No-Action Alternative; however, this risk is associated with unpredictable fire events.

Air Quality

The prescribed burning of slash, and prescribed fires would cause a temporary deterioration in air quality, but would still meet State requirements.

Biological Environment

Vegetation

Atypical forest stocking levels would be perpetuated by the No-Action alternative. In addition, the single-stratum-with-large-trees forest structural stage that dominated pre-suppression times would continue to decline. Large diameter ponderosa pine and western larch would decrease in numbers, as the effects of fire suppression continue to change forest species composition to more shade-tolerant Douglas-fir and grand fir.

Fuels & Fire Disturbance

Under the No Action alternative, the prolonged buildup of fuel may lead to fire that is more catastrophic and destructive to the site than typically occurred in the native forest. The combination of more fine fuels such as grasses and shrubs regenerating in openings, new understory trees serving as ladder fuels, and continuing accumulation of heavy fuels from down logs and snags all contribute to changes in fuels and towards more severe fire behavior, which in turn threaten future fire control and place neighboring forest ecosystems at risk. The fuel conditions that enable a fast moving wildfire of higher than normal intensity could persist for several decades.

Noxious Weeds

Any activity has a risk of introducing and spreading weeds. Vehicle use and travel associated with timber harvesting, road construction and other actions will increase the risk of spread. Mitigation measures such as washing vehicles and closure of temporary roads will help reduce but not eliminate the risk of weed spread due to proposed activities.

Species and Habitats

The road construction that is associated with some of the action alternatives would increase the opportunity for foot travel and some mechanized travel, thereby, increasing the vulnerability of some species to hunting and trapping. This would last until the roads become re-vegetated (5-10 years).

The removal of merchantable dead trees would reduce the amount of trees and snags available to some wildlife species; however, snag habitat left within timber sale units would meet Forest Plan Standards and Guidelines. These snags in conjunction with the numerous snags located outside timber sale units would mitigate this adverse effect.

Some wildlife species would be displaced/disturbed during periods of human activity in action alternatives. The harvesting of trees would result in a direct loss of reproduction of some nesting birds.

Human Environment

Scenery and Recreation

New road construction associated with the Vegetation Alternative (F) would introduce un-natural features and could dominate the landscape character of background views.

Action alternatives would cause a temporary disruption of recreation uses while harvest activity is taking place.[100]

3.5.2 Short Term Uses Versus Long Term Productivity

Short-term uses are those that determine the present quality of life for the public. Timber harvest, recreation, livestock grazing, and some mineral extraction are considered short-term uses. Long-term productivity of the land refers to the capability of the land to provide resources such as forage, timber, wildlife habitat and high quality water. Maintaining soil productivity and water quality will assure maintenance of long-term productivity.

Physical Environment

Soil

Action alternatives that propose new road construction would reduce long-term soil productivity, where roads and rock pits are built. While this affect would not be permanent, it would be long-term.

The relative ranking of the action alternatives in this context, from the most favorable to the least favorable is: K, E, J, B and F.

The risk of erosion associated with a large high intensity fire is highest with the No Action Alternative (A).

Water

As a result of road/stream crossing improvement activities, there would be a slight increase of sediment during the activity but the project would reduce long-term sediment to area streams. By reducing the total potential volumes of sediment entering the stream channels and this long-term benefit would improve channel morphology.

The risk of sedimentation associated with a large high intensity fire is highest with the No Action Alternative (A).

Action alternatives propose two activities that would benefit the long-term productivity of Woodward Meadows wetlands. The Woodward Meadows Road closure would reduce ongoing vehicular damage to the meadows, while the Woodward Meadows Riparian/Wetland Management Activities would begin the process of restoring historic wetland conditions.

Considered independently or in concert both activities would improve long-term productivity.

Air Quality

The potential for air quality degradation and reduced visibility increases with the No Action Alternative (A). Existing and increased tree mortality increases the intensity of wildfire. A

[100] Additional discussions about the adverse environmental effects that cannot be avoided when timber is harvested is found on pages IV-147 to 148 in the FEIS for the Forest Plan.

wildfire under normal summer conditions could prove difficult to control. 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 the fire's size and intensity.

Under the action alternatives, the Forest Service would voluntarily cease burning activities to comply with State air quality standards. Burning of fuels under prescription would occur primarily in early spring when demand for airspace has been historically low. Activities such as agricultural field burning, other forest residue burning on private lands, residential wood stove use, motor vehicle exhaust, and dust input from the Palouse and Columbia basin are competing uses of the monitored airspace.

Drilling, blasting, crushing, screening and material handling at the proposed rock pit(s) can be significant sources of particulate matter and emissions of particulates less than 10 microns in diameter if uncontrolled. However, the Washington State Department of Ecology monitors emissions from all crushed stone processing activities to assure air quality compliance. Consequently, air quality resulting from rock pit activities would comply with State standards. (Alternatives B, C, and F propose two pits; Alternatives E, J and K propose one.

Biological Environment

Vegetation

The capability of the land to produce forage, timber and high quality water would not be impaired by the action alternatives. Examining more than 140 fire scars in the area revealed evidence of the historic balance between biomass production and frequent low-intensity fire[101]. All action alternatives approximate these fires to one degree or another. Accordingly, these alternatives would start the process of restoring balance to long-term productivity. The vegetation resilience to disturbances such as fire, insects and disease would be increased.

Fuels & Fire Disturbance

Timber harvest under the Action Alternatives can significantly affect both short and long-term fuel quantities. Timber harvest moves unavailable aerial fuels (tops, stems, limbs, needles) into available surface fuels. Thus the risk of a crown fire may be reduced while moving fuel to the ground could increase the short-term risk of surface fires. An increased fire hazard and risk of ignition from ground activities such as recreation camping, vehicles, recreational hiking, and machinery used in timber harvest may result.

However, the post-harvest prescribed fire included with all action alternatives would ameliorate this short-term condition, and in the end, reduce long-term fuel loads and fire hazard. The combination of timber harvest and prescribed fire would improve the chances of controlling future wildfire.

[101] See "Report to the Colville National Forest on the Results of the Quartzite planning area Fire History Research," located in the analysis file.

Species and Habitats

Studies show that native wildlife adapted to fire and the resulting range of habitat patterns over the past thousands of years. A long history of ecological studies indicates the strong association between disturbance processes and species survival.

The short-term vegetation management included with the action alternatives approximates historical disturbance events, the outcome of which could be to restore native species habitat, and historic productivity.

3.5.3 Irreversible effects and Irretrievable Commitments of Resources

The Forest Service Environmental Policy and Procedures Handbook (1909.15) defines irreversible as *a loss of future options. It applies primarily to the effects of the use of nonrenewable resources, such as minerals or cultural resources, or to those factors, such as soil productivity that are renewable only over long periods of time.*

Irretrievable is defined as *the loss of production, harvest, or use of natural resources. For example, some or all of the timber production from an area is lost irretrievably while an area is serving as a winter sports site. The production lost is irretrievable, but the action is not irreversible. If the use changes, it is possible to resume timber production.*

Physical Environment

Soil

Road building and rock pits were identified as an *irreversible* commitment of the land base since roads and rock pits can only be restored after a long period of time or after ripping and revegetating. No other irreversible commitments of resources were identified in any of the alternatives.

Biological Environment

Vegetation

The loss of production, harvest or use of natural resources can be considered an *irretrievable* loss. In all action alternatives, there will be some timber volume growth and yield reductions because, in these alternatives, the optimal silvicultural prescription was not always selected.

The risk of a loss of timber production and wildlife habitat resulting from a large high intensity fire is highest with the No Action Alternative (A).

3.5.4 Other Disclosures

During analysis of the proposed project, no unique areas such as parklands were found. There is no Wild and Scenic river within or adjacent to the project area. There are no Wilderness areas within or adjacent to the project area. There are no Research Natural Areas within or adjacent to the project area.

In review of the effects listed in Chapter 3, there are no known effects on the human environment that are highly uncertain or involve unique or unknown risks. Although public concerns have been raised over certain aspects of the proposed actions, the effects upon the human environment are not likely to be highly controversial.

The actions do not threaten a violation of Federal, State, or Local law, or requirements imposed for the protection of the environment.

The decision made to implement the proposed action or an alternative action would not set a precedent for other projects.

Wetlands and Floodplains

The FEIS for the Colville National Forest Management Plan defines wetlands as "Areas that are inundated by surface or ground water with a frequency sufficient to support a prevalence of vegetation or aquatic life that requires saturated or seasonally saturated sloughs, potholes, wet meadows, river overflows, mud flats, and natural ponds." The analysis area contains areas that meet this definition. These areas have been identified and are discussed under Riparian Management Indicator Species. The proposed project would not affect these areas. None of the wetlands identified within the Project Area would be converted to other uses. Floodplains associated with all identified riparian areas are limited to the identified Riparian Habitat Conservation Areas and will follow Washington State Streamside Management Guidelines in the Washington Forest Practices Rules and Regulations Handbook.

Chapter 4 List of Preparers

Several members of the Colville National Forest Staff provided guidance and oversight to the project interdisciplinary team, throughout the process. Their primary function served to insure that project objectives were consistent with Forest Service objectives. They conceived the project, established project goals, and provided the initial letter of direction to the interdisciplinary team. This, coupled with their diligent oversight helped the interdisciplinary team maintain their focus on ecosystem management objectives.

Name	Title	Home Office
Dan Len	(former) District Planning Assistant	(former) Colville RD
Tom Pawley	District Planning Assistant	Three Rivers RD, Kettle Falls Office
Nora Rasure	Forest Supervisor	Colville NF, Supervisor's Office
Sherri Schwenke	District Ranger	Three Rivers RD, Kettle Falls Office
Connie Smith	(former) Forest Environmental Coordinator	Colville NF, Supervisor's Office
Robert Vaught	(former) Forest Supervisor	Colville NF, Supervisor's Office
Meredith Webster	(former) District Ranger	(former) Colville RD

Interdisciplinary team members were responsible for developing the proposed action, identifying issues, designing alternatives, and analyzing the effects the alternatives have on area resources. Both District and Forest specialists comprise the team.

Team Member	Title	Qualifications	Team Role	Home Office
Kathy Ahlenslager	Forest Botanist	M.A. Botany; USDA FS 15 years	Sensitive Plants	CNF SO
Mike Almas	Assistant Fire Management Officer	B.S. Forestry Resource Mgt.; USDA FS, 14 years	Fire and Fuels	Three Rivers RD, Kettle Falls Office
Jann Bodie	Assistant Recreation Staff/Forest Landscape Architect	B.S. Landscape Architecture, USDA FS 22 years	Recreation and Scenery	CNF SO
Joe Coates	Hydrologist	B.S. Forest Management & 1 1/2 years Watershed Mgt. post graduate study; USDA FS, 21 years	Hydrology	Three Rivers RD, Colville Office
Bob Holt	Civil Engineering Technician	A.S. Biology; USDA FS, 22 years	Transportation	CNF SO
Karen Honeycutt	Fisheries Biologist	B.S. Forestry & Wildlife, emphasis Fisheries Mgt.; USDA FS, 11 years	Fisheries	CNF SO
Stephen F. Kramer	Forest Archaeologist	B.S. & M.A.I.S. Anthropology; USDA FS, 4 years	Heritage Resources	CNF SO
Kirk Larson	Botany Technician	B.A. Biology; USDA FS, 12 years	Sensitive Plants	Three Rivers RD, Kettle Falls Office
Chris Loggers	Wildlife Biologist	B.S. & M.S. Wildlife Biology; USDA FS, USDI FWS, Minnesota DNR, & Moroccan DWF, 22 years	Canada Lynx Habitat	Three Rivers RD, Kettle Falls Office

Team Member	Title	Qualifications	Team Role	Home Office
Sandy Mosconi	Wildlife Biologist	B.A. Environmental Biology & 2 years Wildlife Biology post graduate study; USDA FS, 16 years	Wildlife Habitat	Three Rivers RD, Colville Office
Gary Nielsen	Forestry Technician	USDA FS, 32 years	Timber Sale Feasibility	Three Rivers RD, Colville Office
Ellen Jeanne Picard	Rangeland Management Specialist	B.S. Range Ecology; USDA FS, 17 years	Range, Noxious Weeds, Minerals	Three Rivers RD, Kettle Falls Office
Michelle Satterfield	Silviculturist	B.S. Forest Science, R6 Certified Silviculturist; USDA FS, 20 years	Forest Vegetation and Silviculture	Three Rivers RD, Colville Office
Ed Shaw	Planning Forester	B.S. Forestry; USDA FS, 20 years	Project Team Leader, Writer-Editor	Three Rivers RD, Colville Office
Kevin Wolfe	GIS Specialist	B.S. Forestry; USDA FS, 17 years	GIS Support; Roads Analysis	Three Rivers RD, Colville Office

Chapter 5 List of Agencies, Organizations, and Persons to Whom Copies of the Statement Are Sent

The following agencies, organizations, businesses and individuals were sent Final EIS, maps and the Record of Decision (ROD). Individuals listed below received the document either in a hard copy format or electronic format via CD Rom. Others accessed the document on the Internet. All Participants have been given the opportunity to receive the Final EIS and ROD.

Government Agencies	
Western Office of Review Advisory Council on Historic Preservation Lakewood, CO	USDA Deputy Director, TDP, EAD Animal & Plant Health Inspection Service Riverdale, MD
USDA National Resource Conservation Service Environmental Coordinator of Ecological Sciences Division Washington, D.C.	USDA OPA Publication Stockroom Washington, D.C.
USDA Policy and Planning Division Office of Civil Rights Washington, D.C.	USDA, National Agricultural Library Head, Acquisitions and Serials Branch Beltsville, MD
USDA-Forest Service Washington Office Washington D.C.	U.S. Army Engineers Division North Pacific, CENPDP Portland, OR
Director, Office of Environmental Compliance U.S. Department of Energy Washington, D.C.	EIS Review Coordinator Environmental Protection Agency Seattle, WA
Northwest Region Office of the Regional Administrator Federal Aviation Administration Renton, WA	Advisor on Environmental Quality Federal Energy Regulatory Commission Washington, D.C.
Federal Highway Administration Western Resources Center San Francisco, CA	General Services Administration Washington, D.C.
U.S. Department of Housing & Urban Development Seattle, WA	Director, Office of Environmental Policy and Compliance U. S. Department of the Interior Washington, D.C.
Surface Transportation Board Chief, Energy and Environment Washington, D.C.	Northwest Power Planning Council Portland, OR

Government Agencies	
USDA-Forest Service Pacific Northwest Region Portland, OR	EPA Washington D.C.
Stevens Co Commissioners Colville, WA	

Businesses and Organizations		
Chewelah Basin Ski Corp Chewelah, WA	Stevens County Federal Lands Advisory Committee Chewelah WA	Kettle Range Conservation Group Republic, WA
Backcountry Horsemen Deer Park, WA	The Lands Council Spokane, Wa	Vaagen Bros. Lumber, Inc Colville, WA
Williamson Consulting Colville, Wa		

Individuals		
Ed Schultz Colfax, WA	Mr. James C Berry Spokane, Wa	Michael Irving Valley, WA
Pat Graham Chewelah, WA	Gary Garrison Kettle Falls, WA	Jim Cronin Spokane, WA
William P & Mary Lou A Safranek Spokane, WA	Mary and Brian Jokela Deer Park, WA	Bill Osebold Spokane, WA
Bob Playfair Chewelah, WA	Eugene Kiver Cheney, WA	EDMUND P HARSHMAN Chewelah, WA
Tim Durnell Rice, WA	Nicholas & Rebecca Oltean Chewelah, WA	Gary Hemingway Loon Lake, WA
Edwin Jansen Chewelah, WA	Richard Artley Grangeville, ID	Erika Beachley Spokane, WA
Marty Bergoffen Asheville NC	Sue Coleman Republic, WA	Glenn A Cosby Spokane, WA
Brian Culler Chewelah, WA	Susan Davis Malo, WA	Kathy Dellwo Spokane, WA
Deanna S Devaul Malo, WA	Carol Ellis Spokane, WA	Bob Faller Republic, WA
Steve and Betty Goetz Chewelah, WA	David Govedare Chewelah, WA	Susan Griepp Chewelah, WA
Danial C Harshman Chewelah, WA	Marian Hennings Spokane, WA	Viola Garrison Colbert WA
Derrick Knowles Cheney, WA	Jeff Lambert Spokane, WA	Michael Buffalo Mazetti Tonasket WA
Nancy McCambridge Republic, WA	Jill McGrath Seattle, WA	Bonnie E Miller Seattle, WA
Robin Moyer Chewelah, WA	Mike Oehler Bonners Ferry ID	Virginia Petersen Republic, WA
Ewen Picken Spokane, WA	Owen Pullen Chewelah, WA	Megan Schmall Cheney, WA
Debbie Rowe Spokane, WA	Hal Rowe Spokane, WA	Gunthild Sondhi Valley, WA

Individuals		
Tommy Walen Kettle Falls, WA	Michelle Wasco Chewelah, WA	Curtis G Wasco Chewelah, WA
BERVELY McLAUGHLIN Colville, WA	S & D Anthes Malo, WA	

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