CHAPTER 3 –AFFECTED ENVIRONMENT AND ENVIRONMENTAL EFFECTS
NSA MANAGEMENT PLAN CONSISTENCY FINDINGS

3.0 – INTRODUCTION

This chapter addresses the potential environmental impacts that could result with the implementation of each alternative. Direct, indirect and cumulative effects are described. Cumulative effects occur because of a combination of past, current, and reasonably foreseeable future actions. Evaluation of these effects help the decision maker select an alternative.

Mitigation measures associated with each, or common to all alternatives, are also identified in this chapter if needed by resource area to be consistent with the NSA Management Plan or other requirements. These mitigations were incorporated into the respective alternative and are part of the design of the alternative and listed as special implementation requirements in Chapter 2. The natural resource mitigation plan required by the CRGNSA Management Plan is also a part of the special implementation requirements. The following tables of known previous and foreseeable future actions within the planning area will be used in the development of the cumulative effect analyses for each resource. The actions relevant to a particular resource will be applied and the cumulative effects evaluated in the cumulative effects sections in this chapter.

Table of Previous Projects and Known Actions within the Planning Area

PROJECT NAME/ TYPE	ACTIONS	LOCATION/DATE
Burdoin I Small diameter Thin	Thinning, slash pile burning	2003 Burdoin Sub-area Complete
Volunteer Fire Dept. Firehouse	Small amount of tree removal, brushing, installation of building and utilities.	2002 Burdoin Sub-area Complete
Courtney Road widening	Tree removal and paving	2005 Burdoin Sub-area Complete
Allen Property thinning and structure removal	Small diameter thinning and structure removal	2003-5 Catherine sub-area On-going
BPA road widening	Road widening	Just North County Rd. 1230-complete
Invasive Plant treatments	Herbicide or Mechanical Treatment	Hand pulling-Rd. 1230 Herbicides-Just east of Coyote Wall. On-going
Catherine Creek Trail	Paved accessible trail	Adjacent but outside planning area-complete
Land acquisitions	Purchase SMA lands	After 1986-present
Historic Forest Practices	Historic Harvests large oak, pine, Douglas-fir	Planning area/ circa 1860-1920

Table of Reasonably Foreseeable Future Projects or Actions within the Planning Area

PROJECT NAME/ TYPE	ACTIONS	LOCATION/DATE
Burdoin II Thin from Below	Thinning, slash pile burning, road maintenance, soil de-compaction	2007 Burdoin Sub-area
Coyote wall FS trails	Designated trails and decommissioning unwanted trails	After 2007
Land aquisitions	Purchase SMA lands	Unknown
Invasive Plant treatments	Herbicide or Mechanical Treatment	On-going
State/Private SMA forest practices	Forest Practices consistent with NSA guidelines	Unknown

3.1 - EFFECTS TO FIRE RESILIENCE AND AIR QUALITY

FIRE RESILIENCE

Introduction

Fire resilience can be summarized as an ecosystem's ability recover from or adjust easily to the disturbance of fire. Fire is an important element of many ecosystems and is necessary for some species to complete their life cycles. In a review of 90 ecosystem management projects in the United States, Yaffee et al. (1996) found that in 34% of the projects, disruption of the natural fire regime was an important human-caused stress on the ecosystem.

Analysis Methods and Measurements

Fire Regime Condition Class

Hardy and other scientists from the USDA Forest Service provided the research to develop condition class attributes. This group of researchers developed a spatial database of historic natural fire regimes for the eleven western states. The base-layer spatial data they used was a 159-class Land Cover Classification database derived from seasonal profiles from the USGS EROS Data Center. In order to assign fire regimes to Land Cover Characterization databases they added in biophysical data, Kuchler's unit data (4th code), and the ecological sub-regions based on Bailey's sections.

Fire regimes describe the historic frequency and severity of wildland fires. Under the natural fire regime in Catherine, fires occurred at a frequency (0-35 years) repetitive enough to kill younger trees and brush. This repetitive burning reduced the fuel loading (including ladder fuels) for the next fire. Thus, under the natural fire regime, fires tended to burn at the ground surface rather than in the tree crowns. Fire suppression and the resulting exclusion altered this regime by removing an important pattern of disturbance and renewal.

Condition class is an expression of the difference between the current condition of vegetation types and the condition during the historic fire regime. It is used as a proxy for the probability of severe fire effects. Condition class is useful as an index of ecosystem risks attributable to an occurrence of wildland fire under the current regime of fire suppression.

Fire regimes and condition classes are listed in the USDA Forest Service General Technical Report RMRS-GTR-87.2002 as cited in the Healthy Forest Restoration Act (HFRA) to describe existing stands in fire-dependent landscapes as to the degree of alteration from the historic fire regime and the relative risk of fire-caused losses of key components of the forest ecosystem.

Surface Fuel models

Surface Fuel models (FM) are used to help describe and quantify surface fuel situations and estimate fire behavior. Fuel Models are selected based on the fact that fire burns through fuels that are best conditioned to support sustained combustion (smallest, least compact, continuous, driest, etc). Criteria for choosing a fuel models involves assessing the fuel layers that will support a fire as it spreads and generates heat intensity. Where fuel beds are relatively continuous with similar fuel characteristics, one model can provide a realistic representation of expected fire behavior. On the other hand, situations occur where one fuel model represents the rate of spread most accurately and another best depicts fire intensity. In other situations, two fuel conditions may exist, so the spread of fire across the area must be weighted by the fraction of the area occupied by each fuel type.

The publication, Aids to Determining Fuel Models for Estimating Fire Behavior (Anderson, 1982) was used to identify fuel models within the project area. Fuel loadings for naturally occurring forest debris were calculated using the Photo Series For Quantifying Natural Forest Residues in Common Vegetation Types of the Pacific Northwest (1980), Stereo Photo Series for Quantifying Natural Fuels Volume I: Mixed Conifer with Mortality, Western Juniper, Sagebrush, and Grassland Types in the Interior Pacific Northwest (1998), and Volume VII of the National Wildfire Coordinating Group Stereo Photo Series for Quantifying Natural Fuels (Maxwell & Ward, 2004).

Ladder and Crown Fuels

The density and continuity of tree canopies as well as the canopy base height provide ladder fuels. More simply stated, ladder fuels are any shrubs, limbs or branches, either living or dead, which can provide a surface fire with a route into the tree crown.

Existing Conditions

Weather

The Columbia River Gorge provides the only east-west sea-level break in the Cascade Mountain Range--connecting the Columbia Basin with the Pacific coastline. As a result, strong winds are common year round. In the spring and summer, wind direction is predominately from the west as the cooler west side air near the Pacific Ocean pushes through the gorge to replace the warmer rising air of the desert interior. In the fall, this pattern begins to fluctuate and gives rise to significant episodic east wind events that last throughout the winter.

There are no remote weather stations located within the project area. However, wind readings recorded at an air quality monitoring station in Wishram, Washington during the summer of 2000 show an average wind speed for June through August of 18.4 MPH, that the wind was out of the west 88 % of the time, and the maximum wind speed was 47.5 MPH.

Additionally, the average wind speeds listed below were measured in Dallesport Washington from May through November during the years indicated. Approximately 75% of the time these winds were out of the west.

Years	Average wind speed (MPH)	Average gusts
1996-1998	10.50	24.89
1999-2001	11.24	26.48
2002-2004	10.77	28.41

The Cascade Mountain Range serves as an effective moisture barrier causing weather systems to dump the majority of their moisture west of the peaks leaving the project area in a "rain shadow." Rainfall totals are collected and averaged at weather stations managed by the Oregon Climate Service (OCS) throughout the gorge. From 1961-1990 the Hood River weather station averaged 31.05 inches of rain per year. Only 19 miles east and during the same time period the OCS weather station in The Dalles recorded an average 13.97 inches of rain per year. The project area is some six miles east and two miles north of the Hood River OCS weather station. Extrapolating this weather data, the estimated average annual precipitation within the project area is 23-26 inches. The majority of this precipitation reaches the ground as rain.

Temperature readings measured in The Dalles, Oregon from 1975 through 1995 indicate that the east end of the gorge spends an average of 42.6 days above 90˚ F. The average number of days with temperatures between 90˚-100˚ F. was 34 and an average of nine days are experienced with temperatures exceeding 100˚ F.

In early September east wind conditions develop and the directional pattern throughout the gorge begins to fluctuate. Under certain atmospheric conditions the gorge acts like a chimney and carries the arid east wind directly through the west end of the gorge. Early settlers referred to the east wind as the "Devil Wind" for the fire problems it created. Extreme fire behavior associated with the 'Devil Wind" has been observed in the Columbia River Gorge since 1902 when the Yacolt Fire burned over 200,000 acres in less than 36 hours.

Topography

Topography influences fire behavior at different special scales. The rate at which a fire spreads doubles from 0 to 30 percent slope and doubles again from 30 to 60 percent slope. Ridges, drainages, and other topographic features work with and against the wind to create localized turbulence that affects both the rate at which a fire spreads as well as the amount of energy released. Such topographical influences combine with general wind direction to dictate the rate and direction of a fire's spread as well as the effects a fire has over the landscape.

Volcanism; lava flows, glaciations and erosion are the key forces that formed the Columbia Gorge landscape. The project area is fractured by Catherine and Major Creek drainages which flow southeasterly. While the predominant aspect of the project area is southerly, these drainages offer significant and steep east and west aspects. The remainder of the area presents gentle to moderately steep slopes. Elevations within the project area range from 80 to 2500 feet above sea level.

Fire Suppression and Protection

There are some 94 adjacent land owners and an estimated 55 homes within or adjacent to the project area. Adjacent land parcels and in-holdings vary in size as well as uses and management objectives. Some are as small as five acres and have primary residences. Others are hundreds of acres and are currently being managed for timber values.

Wildland fire threatens structures and adjacent property in three primary ways; direct exposure from flames, radiant heat and airborne firebrands. The proposed treatment is intended, in part, to decrease the probability of wildland fire damaging structures and private property by reducing these primary threats.

Defensible space refers to the reduction of vegetation between a structure and an oncoming fire to reduce fire intensity and provide fire fighters with the opportunity to safely and effectively defend the structure. Fuels can be treated in a relatively small area immediately surrounding a structure to reduce exposure to radiant heat and direct flame impingement. Fuel reduction within 40 meters of a structure can substantially reduce ignitions from direct exposure to flames and their radiant heat (Cohen 1995 and Alexander et al 1998).

With the exception of the Burdoin Mtn. fire station, (located on USFS systems land under a special use permit) all of the structures at risk in the project area are on private property. Some landowners have created defensible space around their structures and more are in the process. Reducing the fuel loading, fuel continuity and the availability of ladder fuels decreases fire intensity and firebrands which increases the ability to control fires. Reducing the threat of ignition from firebrands requires reducing the vegetation both near and at some distance from private property. Ignitions may result from firebrands originating as far away as 1 kilometer or more (Cohen, 2000). Anecdotal evidence suggests that viable firebrands may travel as far as 1 ½ miles.

Four Volunteer Fire Departments (VFD's), The Washington Department of Natural Resources (WDNR) and USDA, Forest Service (USFS) share fire protection responsibilities within or directly adjacent to the project area. The VFD's include Bingen, Lyle, Cherry Heights and Appleton and they respond to both structure and wildland fires within their respective district boundaries. The WDNR assumes wildland fire protection responsibilities on both state and private land within and adjacent to the project area and the USFS assumes wildland protection responsibilities for those lands administered by the Forest Service. This fire community is universally concerned about the existing fuel loads, stand structure and fuel continuity fuels within the project area.

Risk
Fire risk is defined as the chance of a fire starting from any ignition source. This is determined by using the frequency of past fire starts. Since 1997 there have been numerous fires within and immediately adjacent to the project area. Ignition sources include virtually the full spectrum of human causes and include lightning. Human causes include power lines, fireworks, vehicle and equipment exhaust, debris burning, and arson.

Fire Hazard
Fire hazard for any given forest or landscape is the potential magnitude of fire behavior and effects as a function of fuel conditions (Peterson et al. 2004). Fire hazard most commonly refers to the predicted difficulty of controlling a potential wildfire. Fire behavior characteristics such as rate-of-spread, intensity, torching, crowning, spotting, persistence, or resistance to control are generally used to determine and describe fire hazard. Fire severity can also be considered an element of fire hazard (Brown et al. 2003).

Wildfires burn quickly and can consume hundreds and even thousands of acres in a single day. Under average summer weather conditions, at the lower elevations of the project area, fires have repeatedly consumed hundreds of acres in a matter of hours. Fire suppression resources confine 95% of all starts to less than 10 acres. Those that exceed 10 acres are typically ignitions that occur when atmospheric conditions allow for extreme fire behavior, are initiated in areas of high contiguous fuel loads, are not quickly accessible, or do not allow suppression resources to work in close proximity to the fire, or some combination of the above.

Fire behavior and severity depend on the properties of various fuel strata and the continuity thereof. Such fuel strata have been classified into the following layers:

- Tree canopy
- Shrubs and small trees
- Woody fuels
- Moss, lichens and litter
- Ground fuels or duff (Graham et al. 2004).

The influences of fine fuels such as litter, duff, grasses and small woody vegetation (less than 3 inches in diameter) have the most effect on a fire's intensity and rate-of-spread. Such fuels are used in the fire behavior models developed for predicting the behavior of an initiating fire (Rothermel 1983). Coarse woody debris 3 inches in diameter and larger have little influence on spread rates and intensity of an initiating fire. However, they do contribute to the development high fire severity and large scale fires. Fire persistence, resistance-to-control and residence time are significantly influenced by fuel loading and size and the decay state of large woody fuel. Torching, spotting and crowning contribute to large fire growth and are greater where large woody fuels have accumulated under a forest canopy. Large woody fuel with significant decay are the preferred fuel bed for firebrands and can hold can hold fire for extended periods of time (Brown et al. 2003). Spot fires can also be started in rot pockets of standing snags.

Crown fires are considered the primary hazard to life, property, and ecological function. Crown fires occur when surface fires create enough energy to preheat and combust the fuels

well above the surface (Agee 2002). Crown fires present the greatest hazard to public and fire fighter safety due to long range spotting. Such hazards prompt fire fighters to use indirect fire suppression strategies which increase both the area burned and the fire severity over the landscape.

Fuel conditions within the project area and their representative hazards are the result of fire exclusion, timber management practices and livestock grazing. This has led to an increase in understory vegetation and surface fuels, a change in species composition, and an increase in the continuity of vertical and horizontal stand structure. As a result, the potential for crown and severe fires has increased. Historically, stand structure played an important role in maintaining fire resilient ecosystems (Graham, et al. 2004).

Fire Regime Condition Class

The Catherine area was determined to be a high priority because of its location near development, its location in the transitional rain shadow zone east of the Cascades. Past land management activities, including fire exclusion, left this fire dependent ecosystem with high stem densities that make it susceptible to wildfires of a greater severity than is typical of the natural fire regime.

Fire regimes describe the historic frequency and severity of wildland fires. Under the natural fire regime in Catherine, fires occurred at a frequency (0-35 years) repetitive enough to kill younger trees and brush. This repetitive burning reduced the fuel loading (including ladder fuels) for the next fire. Thus, under the natural fire regime, fires tended to burn at the ground surface rather than in the tree crowns. Fire exclusion and altered this regime by removing an important pattern of disturbance and renewal.

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Within the project area, departures from the natural fire regime were caused by fire exclusion, timber harvesting, livestock grazing, introduction and establishment of exotic plant species, introduced insects or disease, or other management activities.
Most of the stands in the Catherine area were considered to be in Condition Classes 3. Condition Class 3 is a significantly altered fire regime, at high risk for losing key ecosystem components, dramatic change to pattern, size, frequency, or severity of fires where vegetation attributes have been significantly altered from their historical range.

Additional information on condition classes may be found in Protecting People and Sustaining Resources in Fire-Adapted Ecosystems–A Cohesive Strategy, published by the National Wildfire Coordinating Group.

The Condition Class 3 determination for the project is based on the following research used as reference conditions and juxtaposed with existing site conditions in the project area:

1. **Reference Condition-Fire Frequency**
   Historically, Oregon white oak was subjected to a fire regime of low-severity surface fires every 7.5 to 13.3 years (Stuart, John D. 1987. Madrono 34(2):128-141).

   Existing Condition
   Fire has been largely excluded from the project area for nearly 80 years.

2. **Reference Condition-Oregon Oak Sprout Behavior**
   In the absence of fire, Oregon white oak sprout clumps form dense, even-aged stands. Most Oregon white oak woodlands of today are of this type due to fire suppression. (Habeck, J. R. 1962. Proceedings of the Montana Academy of Sciences. 21:7-17).

   Existing Condition
   This is the condition of much of the Oregon white oak seen within project area; it has evolved from dense sprout clumps and tends to be even-aged.

3. **Reference Condition- Oak Savannas**
   Frequent fire in Oregon white oak habitat resulted in the open savannas (Sugihara, Neil G.; Reed, Lois J.; Lenihan, James M. 1987. Madrono. 34(3): 193-208).

   Existing Condition
   Due to encroachment by less fire tolerant species and oak sprout density there are few remnants of these open savannas within the project area.

4. **Reference Condition- Pondersoa Pine Forests**
   Fire is an integral part of the ecology of ponderosa pine. Prior to 1900, most stands experienced low-severity surface fires at intervals ranging from 1 to 30 years. (Arno, Stephen F. 1988. Fire ecology and its management implications in ponderosa pine forests. In: Baumgartner, David M.; Lotan, James E., compilers. Ponderosa pine: The species and its management: Symposium proceedings; 1987 September 29 - October 1; Spokane, WA. Pullman, WA: Washington State University, Cooperative Extension: 133-139.)

   Existing Condition
   Fire has been largely excluded from the project area for some 80 years.

5. **Reference Condition-Composition Ponderosa Pine Forests**
   Fire also shapes the composition of ponderosa pine stands. In the late 1800's stands exhibited open park-like appearances with well-stocked overstories and relatively few understory trees. Over the last 100 years of fire suppression, seral ponderosa pine stands have been replaced by shade-tolerant climax stands. (Habeck, James R. 1990. Northwest Environmental Journal 6(2): 271-292.)

   Existing Condition
   Within the project area there are few open park-like areas and understory trees tend to be dense enough to make foot travel difficult.

6. **Reference Condition –Frequent Fire Containment of Douglas-Fir In-growth**

Douglas-fir is successional to ponderosa pine in the absence of fire. Fire suppression favors increased Douglas-fir because it is less fire resistant and slower growing than ponderosa pine when juvenile.

Existing Condition

Within the project area, though heavier and more pronounced at higher elevations, Douglas-fir encroachment is evident within all stand types in the project area. The highly altered composition and structure of the vegetation predisposes each stand and the transition zone ecosystem to disturbance events well outside the range of historic variability-- potentially producing changed environments never before measured.

The above photo is a good example of how reference conditions for Pine-oak forests change due to fire exclusion. Note the establishment of the Douglas-fir saplings on the far left and background of the photo.

As a result of the comparison of reference conditions with existing conditions, it was determined that most stands in the project area were Condition Class 3 and that such stands may require thinning followed by prescribed under-burning in order to reduce the severity of wildland fires and the risk of losing ecosystem components for species that evolved under the natural fire regime.

Surface Fuels

Within the project area six fuel models were identified (FM 1, 2, 3, 5, 8, 9, & 10). Of these six fuel models, four were identified as covering the majority of the project area. A brief description of the majority fuel model characteristics located within the project area and their representation follows:

Fire Behavior Fuel Model 1

Fire spread is governed by the fine, very porous, and continuous herbaceous fuels that have cured or are nearly cured. Fire runs rapidly through the cured grass and associated material. Very little shrub or timber is present. Grasslands and savannahs are represented.

Fire Behavior Fuel Model 2

Fire spread through this fuel model is primarily through fine herbaceous fuels, either curing or dead, and litter. These are generally surface fires where the herbaceous material, in addition to litter and dead-down stemwood from the open shrub or timber overstory, contributes to the fire intensity. Open shrub, oak and pine stands found within the project area generally fit this model. Many of these stands include concentrations of dead and down material that could generate higher intensity flames and may produce firebrands.

Fire Behavior Fuel Model 9

Fire in this fuel model tends to actively burn through the surface litter. Both long-needle conifer and hardwood stands such as oak typically represent this fuel model. Closed stands of long-needle pine such as ponderosa are included in this model where concentrations of dead-down woody material will contribute to possible torching, spotting and crowning.

Fire Behavior Fuel Model 10

Due to the heavier fuels in this model, fires burn with greater fire intensity than in the previous fuel models. This fuel model includes nearly any forest type with a larger dead-down component of fuel at the surface. Such moderate loading is gained through insect and disease damage and mortality and wind throw as well as natural mortality. High heat intensity with longer flame lengths are experienced under these fuel conditions and as a result, higher rates of torching, crowning and spotting may be expected during wildfire events; resistance to control is high. Some 45% of the project area falls within the definition of FM 10.

Within the project area many stands identified as fuel model 2 have a component of fuel model 10. This is due to stand density, or density induced mortality. An estimated 16% of the area is in a fuel model 2/10.

Duff levels over the project area vary greatly with less accumulation in the pure oak stands and higher levels in the mixed conifer stands. Ponderosa pine bark constantly flakes off and accumulates within the first few feet of the bole of the tree. The exclusion of fire over the past century has allowed these bark flakes to reach depths of up to 12” under some of the larger ponderosa pine. When these duff mounds burn completely, under low moisture conditions, a high level of stress can be placed on the tree, often causing mortality.

Fuel Model Percent across project area:

Fuel Model	Percent of Project Area
1	18%
2	21%
2/10	16%
9/10	45%

Existing Fuel Loadings by Fuel Model:

Size Class	Loading for Areas Identified as FM 1	Loading for Areas Identified as FM 2	Loading for Areas Identified as FM 2/10	Loading for Areas Identified as FM 9/10
0” – 0.25”	0.18 Tons per Acre	.13 Tons per Acre	1.9 Tons per Acre	0.6 Tons per Acre
0.26” – 1”	0.30 Tons per Acre	0.9 Tons per Acre	0.9 Tons per Acre	1.4 Tons per Acre
1.1” – 3”	0.60 Tons per Acre	.7 Tons per Acre	1.5 Tons per Acre	2.2 Tons per Acre
3” +	2.4 Tons per Acre	3.7 Tons per Acre	17 Tons per Acre	35 Tons per Acre
Litter	0 Tons per Acre	1.4 Tons per Acre	1.5 Tons per Acre	1.3 Tons per Acre
Herbaceous	0.5 Tons per Acre	0.5 Tons per Acre	0.9 Tons per Acre	0.2 Tons per Acre
Shrubs	2.5 Tons per Acre	1.9 Tons per Acre	1.4 Tons per Acre	0.4 Tons per Acre
Foliage	0 Tons per Acre	3.0 Tons per Acre	4.5 Tons per Acre	3.0 Tons per Acre
Branch	0 Tons per Acre	0.4 Tons per Acre	.5 Tons per Acre	1.5 Tons per Acre
Duff	2.5 Tons per Acre	3.7 Tons per Acre	17 Tons per Acre	40 Tons per Acre
Total	**8.98** Tons per Acre	**16.3** Tons per Acre	**47.1** Tons per Acre	**106** Tons per Acre

Ladder and Crown Fuels
As discussed under fire risk above, crown fires are generally considered the primary threat to life, property, and ecological function. Crown fires develop when surface fires create enough energy to preheat and combust fuels well above the surface (Agee, 2002). Crown fires typically move faster than surface fires, are more difficult to suppress and pose the greatest threat to fire fighter safety. This threat comes from increased fire line intensity and long range spotting. Such hazards often mandate an indirect suppression strategy, which increases the acres burned as well as the fire severity on the landscape. This results in higher tree mortality and smoke production.

The density and continuity of tree canopies as well as the canopy base height provide ladder fuels. More simply stated, ladder fuels are any shrubs, limbs or branches, either living or dead, which can provide a surface fire with a route into the tree crown. These characteristics in combination with numerous weather factors as well as topography provide the conditions for a rapidly moving crown fire. Canopy bulk density, canopy base height and canopy continuity are the key characteristics of forest structure that affect the initiation and propagation of crown fires. Reducing canopy bulk density by thinning is a means to minimize crown fire potential. As surface fire intensity increases, or canopy base height decreases, it takes less wind to cause a surface fire to jump into the crowns. As a stand becomes denser, active crowning occurs at lower wind speeds and the stand is more vulnerable to crown fire.

Expected Fire Behavior
Fire behavior within the project area is anticipated to be consistent with the aforementioned fuel characteristics. Fires burning in light fuels and pushed by typical gorge winds will spread rapidly. Recent examples of this include both of the Major Creek Fires (July, 1999; and August, 1999) which burned through a portion of the project area consuming one residence and some 700 acres. The challenge for fire fighters in light fuels is not found in the fire's resistance to control, it is found in the rate at which the fire spreads.

As outlined above, fires burning in heavier fuels can be anticipated to exhibit extreme fire behavior characterized by torching, spotting, and crowning. For a recent example of this we need only look eight miles south of the project area. On July 23, 2002 a lightning strike ignited a fire on Sheldon Ridge; typical gorge winds and heavy fuels prompted extreme fire behavior including torching, spotting, and crowning. By July 25 the Sheldon Ridge fire had consumed some 15,000 acres. While this fire burned in Oregon; the fuels, elevation and topography are nearly identical to those found in the project area.
Under existing conditions episodic smoke production is unpredictable and may be experienced in high volumes and for long duration, posing significant impacts to human health, safety, and societal values.

Considering the Fire Regime Condition Class, localized steep topography, current fuel loading and predominant weather patterns, a wildfire within the project area could represent a significant threat to the lives and safety of residents and firefighters, the ecosystem, and human improvements such as homes and infrastructure.

The photos above show good examples of ladder fuels. The Catherine planning area contains many stands that look like these.

Regulatory Framework
The regulatory framework governing fire resilience includes:

The Management Plan for the Columbia River Gorge National Scenic Area, approved in 1992 (revised 2004)

Land & Resource Management Plan, Gifford Pinchot National Forest, approved in 1990

The Record of Decision amended the Gifford Pinchot National Forests' Land & Resource Management Plans in 1994 within the Range of the Northern Spotted Owl. The Record of Decision is also referred to as the Northwest Forest Plan.

The Fire Management Plan for the Columbia River Gorge National Scenic Area

The Fire Management Plan (FMP), using federal fire policy as its guide, tiers to local land & resource management plans to provide clear direction for fire management activities. It describes the Scenic Area's program to manage wildland and prescribed fire as defined by direction in the Columbia River Gorge National Scenic Area Plan, the Gifford Pinchot National Forest Land and Resource Management Plan, and the Northwest Forest Plan.

Other documents used to develop the Fire Management Plan include:

- Federal Wildland and Prescribed Fire Management Policy, Implementation Procedures and Reference Guide, August 1998
- Review and update of the 1995 Federal Wildland Fire Management Policy, January 2001
- USDA Forest Service Manual (FSM) 5100
- USDA Forest Service Handbook (FSH) 5109

The FMP provides the operational parameters needed to implement the Land Management and Resource Management Plans. It is a detailed program of action, on how to carry out fire management policies that will help achieve resource management objectives as defined in the Columbia River Gorge National Scenic Area Plan.
Applicable direction from the Land and Resource Management Plans for Fire Management Activities includes:

- All fire management activities shall comply with area management direction. FW-248
- All wildfires shall receive an "appropriate suppression response" (Regional Guide for Pacific Northwest Region, 1984). FW-256
- Dead, down woody material loading levels shall be managed to provide for multiple resource objectives (Regional Guide for Pacific Northwest Region, 1984).
- The role and potential of fire as an integral part of the forest and rangeland environment shall be considered in obtaining multiple-use forest management objectives. FW-048
- Prescribed burning should be considered for use in meeting management objectives in areas where ecological studies show that natural fire has played a significant role in ecosystem development (Regional Guide for Pacific Northwest Region, 1984). FW-049

- Prescribed burning may be used when analysis indicates that it will be effective and feasible. Analysis shall include consideration of measures to mitigate impacts on air quality. FW-050, FW-051

The 2001 Federal Wildland Fire Management Policy directs Federal agencies to achieve a range of acceptable practices from full response to fire use to protect life, property, resources, and maintain healthy ecosystems. The policy provides nine guiding principles that are fundamental to the success of the Federal wildland fire management program:

- Fire Management Plans will be developed for every burnable acre of Federal Land.
- Firefighter and public safety is the first priority in every fire management action.
- The role of wildland fire as an essential ecological process and natural change agent will be incorporated into the planning process.
- Fire management plans, programs, and activities will support land and resources management and their implementation.
- Sound risk management is a basis for all fire management activities.
- Fire management plans and activities incorporate public health and environmental quality considerations.
- Federal, state, tribal, local, interagency coordination and cooperation are essential for implementing broad-scale fire management activities.
- Incorporate standardization of policy and procedures among federal agencies.

AIR QUALITY

Introduction

Air and by extension, air quality, is an integral part of the forest environment. Its character directly affects plant, animal and human habitat, as well as many of the scenic and recreational opportunities within the Columbia River Gorge National Scenic Area.

Analysis Methods and Measurements

Visibility and air quality are being monitored by the Forest Service and Washington dept. of Ecology in the Columbia River Gorge. The Federal Environmental Protection Agency has developed and promulgated National Ambient Air Quality Standards (NAAQS) for six pollutants: carbon monoxide, nitrogen dioxide, sulfur, dioxin, lead, ozone, and particulate matter. The standards were established to protect public health and welfare. States are responsible for developing and implementing programs to assure that the NAAQS and any other standards (visibility) are met. Washington and Oregon Smoke Management Plans are now part of the State Implementation Plans for both states. They detail the procedures and lines of authority for land management burning in the two states. Numerous areas in the Region are classified "designated areas" in the Smoke Management Plan. Designated areas are typically the larger population centers. A "smoke-sensitive area" is an area that would be negatively affected by smoke, but is not necessarily a designated area.

Existing Conditions

"It was warm work, all the way, and the last fortnight of it was suffocatingly smoky, for in Oregon and along the Columbia the forest fires were raging." (Mark Twain, Following the Equator, 1897)

For centuries, the Pacific Northwest has had periods of poor air quality due to natural and human-caused forest fires. Diaries of early explorers and newspaper accounts of the last two centuries have commented on the problems of smoke from wildfire, burning of land clearing and logging slash, and the burning of woodstoves for home heating. Early twentieth century (1910-1920) legislation required the burning of logging slash. This practice became well established on private, state and federal lands. Early on, the accepted practice was to delay most slash burning until the fall season. With an enormous amount of logging slash burned in a very short time period; smoke pollution episodes were not uncommon. In the later part of the 1960's the states of Washington and Oregon developed and implemented Smoke Management Programs (SMP) and fall slash burning continued until the early 1970s. Air quality began to improve once SMP's moved both industry and natural resource agencies away from fall burning and towards spring and summer burning. This change provided for better climatic conditions for improved dispersion of pollutants. Pollutant-carrying smoke from summer and early fall burning can be trapped by temperature inversions, which aggravate the problem. A temperature inversion forms when the air in upper levels is warmer than the air that is closer to the ground. The warmer air keeps the cooler ground-level air from rising and dispersing its pollutant load.

Increased concern for air quality in the 1960s led to passage of the Amended Clean Air Act of 1970. The provisions of this Act were written to reduce the emissions of major pollutants, including small suspended particles called particulates. The Clean Air Act of 1963 (as amended) has designated that all areas of the country be placed into one of the following classifications: Class I: areas where anything but the smallest degradation of air quality would be unacceptable; Class II: areas where moderate degradation of air quality would be acceptable; Class III: areas where a considerable degradation of air quality would be acceptable. The Columbia River Gorge National Scenic Area is a Class II air shed.

As previously stated, the Columbia River Gorge provides both an effective moisture barrier and the only east/west sea level passage through the Cascade Mountain range. This results in dryer eastside conditions and year round vigorous winds. In the spring and summer, wind direction is predominately from the west as the cooler west side air near the Pacific Ocean pushes through the gorge to replace the warmer rising air of the desert interior. In the fall this pattern begins to fluctuate and gives rise to significant episodic east wind events that last throughout the winter.

In early September east wind conditions develop and the directional pattern throughout the gorge begins to fluctuate. Under the right atmospheric conditions the gorge acts like a chimney and carries the arid east wind directly through the west end of the gorge. Early settlers referred to the east wind as the "Devil Wind" for the fire problems it created. Extreme fire behavior associated with the 'Devil Wind" has been observed in the Columbia River Gorge since 1902 when the Yacolt Fire burned over 200,000 acres in less than 36 hours.

The prevailing wind conditions in the gorge have advantages and disadvantages. The primary advantage is the ability to plan prescribed fire activity when transport winds will disperse and carry smoke out of the area. The disadvantages are that under west wind conditions industrial, urban and suburban pollutants from the Portland/Vancouver area migrate into and through the gorge. Under east wind conditions industrial pollutants from large feedlot operations and coal fired power plants migrate through the gorge.
Particulate is a term used to describe dispersed airborne solid and liquid particles, which will remain in atmospheric suspension from a few seconds to several months. Particulates that remain suspended in the atmosphere are efficient light scatterers and therefore contribute to visibility impairment. Very small particles can travel great distances and contribute to regional haze problems. Regional haze can result from prescribed burning over multiple days and/or multiple owners utilizing the airshed over too short a period of time. Cumulative particulate load may be the result of prescribed burning only, or urban and industrial sources only, or it may be a combination of the two. The causes of regional haze are often difficult to identify. Total suspended particulates (TSP) include all suspended particulates, no matter the size. Particulate matter less than 2.5 microns in diameter (PM 2.5), or less than 10 microns in diameter (PM 10) describes particles small enough to enter the human respiratory system.

National Ambient Air Quality Standards (NAAQS) for PM 2.5 and PM 10 have been established to protect human health. The annual PM 2.5 standard is 15 micrograms per cubic meter and the 24-hour standard is 65 micrograms per cubic meter. The annual PM 10 standard is 50 micrograms per cubic meter and the 24-hour standard is 150 micrograms per cubic meter. This means that the average PM 2.5 or PM 10 concentration in a given area over the stated period of time cannot be exceeded. State air agencies mandate air quality standards, many which are stricter than federal standards. PM 2.5 and PM 10 are used for comparison to health based NAAQS and TSP is used for tracking impact on Prevention of Significant Deterioration (PSD) increments.

Regulatory Framework
The CRGNSA Revised Management Plan states that:

- Air quality shall be protected and enhanced, consistent with the purposes of the Scenic Area Act. The States of Oregon and Washington and the U.S. Forest Service shall: (1) continue to monitor air pollution and visibility levels in the Gorge; (2) conduct an analysis of monitoring and emissions data to identify all sources, both inside and outside the Scenic Area, that significantly contribute to air pollution. Based on this analysis, the States shall develop and implement a regional air quality strategy to carry out the purposes of the Scenic Area Act, with the U.S. Forest Service, the Southwest Air Pollution Control Authority and in consultation with affected stakeholders.

- The States and the Forest Service shall together provide annual reports to the Commission on progress made regarding implementation of this policy. The first report shall include a work plan and timeline for gathering/analyzing data and developing and implementing the strategy. The work plan and strategy shall be submitted to the Commission for approval.

Environmental Consequences
DIRECT AND INDIRECT EFFECTS ALTERNATIVE 1-NO ACTION

Fire Hazard
The no action alternative would not reduce fuels through thinning, mechanical surface treatment, or prescribed fire. The effect of no action would see the continued increase and expansion in tree stocking levels, canopy bulk density, lower canopy base heights and surface fuel loading. This would translate to increased potential for extreme fire behavior and severity and ever greater threats to neighboring property and life. The no action alternative would result in increasing potential for stand replacing fires would also be experienced in areas of large Oregon white oak, ponderosa pine and Douglas-fir.

Under the no action alternative, large ponderosa pines would continue to be vulnerable to mortality from wildfires due to the aforementioned ladder fuels and deep accumulations of duff that have built up around the boles. High stand densities would increase and spread under this option and continue to migrate into areas of mature oak. Sites that were historically dominated by large widely spaced Oregon white oak and ponderosa pine would continue towards a climax community of Douglas-fir. This would result in the loss the oak and pine/oak ecosystems as well as the loss of the dry meadow component. The native shrub and herbaceous layers in the project area are adapted to low severity fire and the absence of this disturbance has had adverse effects on these communities through shading and direct surface competition. When wildfires occur fire severity will be greater with this alternative, likely killing plants that would have been able to re-sprout following a low severity fire.

Surface, Ladder and Crown Fuels
With no action surface fuels would continue to increase contributing to the potential for stand replacing fires. Fir, and as a result, fuel model 10 would continue to spread and it is estimated that in 50 years some 60-75% of the project area would be in this condition. Fires would burn with higher intensities and torching, crowning, and spotting would be expected during wildfire events.

Stand density would continue to increase and tree vigor would continue to decrease. With this, the resiliency of stands within the project area to survive natural disturbance; be that fire or insect and disease, would decrease and late seral species would continue to increase within mixed species stands. The continuity of ladder and crown fuels under these conditions would provide for sustained crowning runs through the timber.

In short, avoiding action within the project area will have the following effects:

- Continued change from relatively low damage, stand-maintenance fires to more severe high damage, stand-replacement fires.
- Conversion from fire-resistant species to fire-intolerant species having less resilience to fire disturbances.
- Less controllable and more costly wildland fires.
- Increasing danger to the public and firefighters.
- Growing threat to wildland/urban interface values.
- Increasing potential for higher particulate matter emissions as fuel loads and understory biomass increase.

Fire Regime Condition Class
As previously stated, Fire Regime 1 represents the ponderosa pine, Douglas-fir and Oregon white oak plant association and includes nearly all of the of the project area. A fire burning under the existing condition would not burn as a low severity surface fire but would be of mixed severity and/or stand replacing. This would have detrimental effects to a broad range of natural resources not adapted to high severity fires.

The no action alternative would see continued deterioration of the overall condition of the vegetation as well as continued departure from the natural fire regime. Stand densities would continue to increase and tree species would continue to migrate towards higher proportions of shade tolerant fire and more fire susceptible fir. At the same time, there would be a continued decline in fire tolerant oak and ponderosa pine due to shading and density induced mortality. Under these conditions the Fire Regime Condition Class within the project area would continue to rise showing an ever greater departure form the natural fire regime.

Air Quality
The no action alternative would have the least immediate impact on air quality in the short-term. However, under the no action alternative biomass would continue to accumulate and remain available for consumption by wildfires. This increases the potential for large amounts of smoke during the summer and early fall months. Because wildfires occur at the driest time of the year, fuels are more completely consumed which nets about twice as much particulate matter in the 10 micron range (Huff and Ottmar et al. 1995). There is potential during a wildfire for as much as 440 pounds per acre of PM 2.5 emissions. Such smoke concentrations have high particulate levels that can cause health problems. Depending on the prevailing weather pattern during and after any wildfire event many residences and communities throughout the gorge may be impacted.

Wildfires are not planned--so there is little opportunity to mitigate air quality issues except to suppress the fire as quickly as possible. The smoke generated will be directed and concentrated according to prevailing winds and atmospheric stability. Wildfire does have one advantage over prescribed fire: it might not happen in our lifetime. The air quality trade off is less smoke from prescribed fire over a period of years or gambling that a catastrophic wildfire, with its large amounts of heavily concentrated smoke, will not occur.

Air quality monitoring in the CRGNSA by the Forest Service began using photographic data collected at Vista House on Crown Point in Oregon. Among the 17 camera locations in the Pacific Northwest, Vista House ranked near the bottom, 16th, 17th and 13th with respect to poor, medium and good visibility categories. In January 1993 an IMPROVE-protocol visibility monitoring station was installed near Wishram, Washington. The primary purpose of air quality monitoring is to assess the impact of pollution on the visual resource, as mandated by the Columbia River Gorge National Scenic Area Management Plan. Some baseline data exists to quantify scenic quality in the west end of the CRGNSA, and data from future monitoring will add sufficient detail to determine if the scenic resource is improving, degrading or not changing.

Ozone data from the Wishram site shows concentrations at or above the injury threshold for sensitive lichens. This is a concern because several popular recreational sites in the Gorge owe their appearance and visual attraction to lichens. An example is Oneonta Gorge, where

lichens color the sheer cliffs a peculiar shade of vibrant chartreuse. High ozone readings from the air quality stations support the initial results of a Forest Service study, which suggests a change in lichen distribution is a result of air pollution. Forest Service lichen specialist Linda Geiser is in the process of analyzing lichen data from the Gorge. Her preliminary findings indicate the Columbia River Gorge has clearly elevated levels of all three pollutants (sulfur, nitrogen and toxic metals) compared to all other National Forests measured between 1993-1995 (e.g. Siskiyou, Willamette, Mt. Hood, Gifford Pinchot and Deschutes National Forests). Air quality appears to be generally degraded at low elevations in the Gorge (Geiser 1998: personal communication).

Medical studies have shown a relationship between increases in particulate concentrations and rises in the number of clinic and hospital visits for upper respiratory infections, cardiac diseases, bronchitis, asthma, pneumonia, and emphysema. Deaths of elderly persons afflicted with respiratory diseases and cardiac conditions also show an increase during periods when the concentration of particulate matter is unusually high for several days.

Sulfur Dioxide

Sulfur dioxide (SO2) is emitted primarily from combustion of fuel containing sulfur; generally either coal or oil.

Most forest fuels contain less than 0.2 percent sulfur so sulfur oxides could be produced only in negligible quantities during wildfires.

Carbon Monoxide

Carbon monoxide (CO) is produced by automobile exhaust and other incomplete combustion sources. Carbon monoxide is a poisonous inhalant that deprives the body tissues of necessary oxygen. Extreme exposure (>750 ppm) can cause death. Impaired time-interval discrimination can occur when humans are exposed to concentrations as low as 10 to 15 ppm for 8 hours.

Large quantities of carbon monoxide are emitted from wildfire s. Carbon monoxide exposure from these sources can be detrimental to fireline workers but CO dilutes very rapidly in the atmosphere and is not likely a concern for urban and rural areas even a short distance downwind. One study measured CO concentrations as high as 200 ppm close to flames but observed that the concentration was reduced to less than 10 ppm just 100 feet from the fire.

Ozone

Ozone is a secondary pollutant formed from the reaction of volatile organic compounds with oxides of nitrogen in the presence of sunlight. Volatile organic compounds originate from industrial processes, solvent use, and transportation. Wildfires emit volatile organic compounds that can react with urban sources of nitrogen to form ozone. Elevated ozone levels have been measured at the top of smoke plumes. How this relates to ground level concentrations of ozone is uncertain.

Ozone effects on vegetation have long been recognized. Ozone can cause visible injury, reduced photosynthetic capacity, increased respiration, premature leaf senescence, and reduced growth. Other effects include alteration of carbon allocation, greater susceptibility

to environmental stress, changes in plant community composition, and loss of sensitive genotypes from a population. Sensitivity to ozone differs within and among species because of differences in uptake and genetic factors. Vegetation may begin to experience effects from ozone at concentrations as low as 0.06 ppm (7-hour growing season mean). Little research has been completed on lichen sensitivity to ozone but sensitive species may be impacted by concentrations as low as 0.02 ppm.

Nitrogen Dioxide

Oxides of nitrogen are formed during combustion when nitrogen in the air or in fuel combines with oxygen at elevated temperatures. Nitrogen dioxide acts as an acute irritant.

Formations of oxides of nitrogen occur at temperatures not normally found in prescribed fires. Some oxides of nitrogen may be formed at lower temperatures in the presence of free radicals and nitrogenous compounds in forest fuels are another possible source. Generally, wildland fire is considered an insignificant contributor of these emissions.

Lead

The principal source of lead emissions is the combustion of gasoline containing lead alkyl additives. Since use of leaded gasoline is dramatically decreasing, lead air pollution is rarely a problem anymore. Lead particles that have been deposited on vegetation over decades can become re-emitted if the vegetation is burned. This phenomenon was documented during chaparral burning which took place east of the Los Angeles basin.

CUMULATIVE EFFECTS ALTERNATIVE 1

CUMULATIVE EFFECTS DETERMINATION					
Past, Current or Reasonably Foreseeable ACTIVITY or PROJECT	**Potential Effects**	**OVERLAP in TIME or SPACE**		**Measurable?**	**Extent**
		Time	**Space**		
Burdoin I and II Forest Restoration Project Thinning, Pile Burning	Smoke	No	No	No	There will be no measurable effects
	Fire Behavior	Yes	No	No	No measurable effect

DIRECT AND INDIRECT EFFECTS ALTERNATIVE 2 – Proposed Action
This alternative seeks to mimic the stand and overall vegetation conditions that would be expected had low intensity, high frequency fire been historically allowed to burn through the project area. The proposed action would reduce fuel loading within the project area by reducing the amount of both live and dead vegetation in the three fuels layers: Crown and ladder fuels would be reduced through thinning stands from below according to the prescriptions described in Chapter 2. Surface fuel would be reduced through piling (both by hand and machine) and pile burning. Once thinned, these stands would be maintained through the scheduled application of prescribed broadcast burn followed by scheduled under burning.

The proposed action addresses Goal 3 as identified in the Klickitat and Skamania County Community Wildfire Protection Plan. Goal 3 is described as, Decrease the Risk of Catastrophic Fire in the Wildland Urban Interface (WUI). The proposed action specifically addresses Goal 3, Actions 3.1.2 and 3.1.3. This proposal reduces fuel loadings thereby addressing the risk factors and improving fire suppression effectiveness and safety.

In general, fuel reduction would be accomplished through thinning the smaller diameter trees and retaining the larger trees at variable spacing. There would be some species conversion from fire sensitive fir to more fire resilient species such as oak and pine through selective thinning. Mechanical treatments and thinning of small diameter trees would remove ladder fuels and canopy continuity that carry fire into the crowns.

Fire Hazard
The proposed action would reduce canopy, ladder and surface fuels and thereby improve stand resiliency to fire and wildland fire suppression effectiveness. It would also improve fire fighter and public safety while reducing the threat to neighboring property, structures and natural resources. Treatments included in this alternative will have a direct effect on and decrease surface fuels, increase canopy base height and reduce crown bulk density. As a result, fuel continuity will be broken up reducing, under most climate conditions, the chance of wholesale ecosystem loss within the project area due to catastrophic fire.

Surface Fuels
Under this alternative existing surface fuels and created slash will be treated through a variety of methods. Whole tree yarding for utilization or disposal by burning is one method. In areas where whole tree yarding is impractical, tops and limbs will be left in the stand where they, along with the existing fuels, will be hand or machine piled and burned. Within the units that are identified helicopter yarding, limbs and tops will be separated from the bole and left in the stand. Due to the steepness of the slope in these areas, the slash will be piled primarily by hand, but some grapple piling may occur where slope allows. The target for hand pile burning is not less than one year and not more three years after a pile is created. The target for burning machine piles is not less than one year and not more than five years after the pile is created. Other treatments include thinning and piling by hand and burning piles and the application of understory prescribed fire. A prescribed burning program will need to be implemented to maintain the desired surface fuel levels and limit new growth from becoming a ladder and stand density concern in the future.
Reduction in fuel loads decreases subsequent fire behavior, increases fire control possibilities and decreases fire suppression costs (Van Wagtendonk 1996). And, under

reduced fuel loads, resistance to control decreases and fireline construction rates increase (Agee et al. 2000).

The beneficial effects of prescribed fire on altering fuel structure and wildfire behavior and effects have long been observed and reported. Prescribed fire alters potential fire behavior by influencing many fuel bed characteristics:

- It reduces the amount of fine fuels, duff, large woody fuels, decadent material, shrubs and other live surface fuels, which when coupled with compactness and continuity change the stored energy and potential intensity and spread rate.
- It reduces the horizontal continuity which disrupts growth of surface fires and reduces spot fire ignition probability.
- It increases compactness of surface fuel components which slow combustion rates (Graham et al. 2004).

The primary stand attributes that dictate fire behavior are surface fuel condition, crown bulk density, and crown base height (Graham, 1999). Prescribed fire consumes much of the lowest ladder fuel and often scorches the lowest tree branches, which raises the live crown above the surface. As a result, prescribed burning can reduce fire intensity and severity from wildfires (Omi, Martinson 2002, Pollet, Omi, 1999). In a study of the effects of low intensity fire on ponderosa pine stands in Zion National Park, the needle and litter fuel load layer was reduced by 54 percent, duff loading was reduced by 35 percent and pole sized trees were reduced by 18 percent (Bastian, 2001). With such reductions in ladder fuels there would be a reduced probability of a surface fire moving into the crowns of the trees.

Expected Surface Fuel Reductions

The prescribed burning proposed in this alternative is all within fire regime 1. It is proposed on all acres within the project area. Some areas require thinning before underburning. The objective for surface fuels is to reduce loadings to desirable levels. Given the range of existing loadings within the project area, this could be as little as a 15 percent reduction in the lighter loaded oak stands and as much a 60 percent reduction in the more heavily loaded pine/oak/Douglas-fir stands. Burning in existing meadows, fields and other open areas would be intended to maintain those openings and prevent encroachment. Mortality of small diameter trees is not only acceptable it is desirable. Mortality of larger diameter trees would be minimized as described in the project design. Weather and fuel moisture prescription coupled with ignition patterns will be employed to best meet the surface fuel reduction target with limited large tree mortality and soil exposure. Burning would be conducted as to avoid a decrease in ground cover below that identified in the LRMP standards, so erosion would be insignificant.

Average flame lengths would be expected to increase in those areas within the project boundary that convert from FM 2/10 to a FM 2. This is due to increased exposure to the wind and more fine fuels, such as grass. While increased flame-length is not desirable under extreme fire-weather conditions, the combination of modified surface, ladder and canopy fuels suggests improved fire fighting capability even under difficult weather conditions as fire severity and resource impacts are reduced. These anticipated outcomes are the result of reduced crown fire potential and lower overall intensity.

Ladder and Crown Fuels
When mechanical thinning emphasizes smaller diameter trees it is effective in reducing the vertical fuel continuity that contributes to crown fire initiation. By removing ladder fuels, surface fires burning through treated stands are less likely to spread to overstory fuels (Graham et al. 2004). Not only is thinning effective at reducing the probability of crown-fire spread but it is precise in that specific species and size classes are targeted for removal from the fuel bed. Under this alternative tree removal would be accomplished by thinning from below, cutting the smaller diameter trees and retaining the larger diameter trees.

Some concern has been raised that the removal of canopy level tree can increase fire risk. Under some conditions the removal of trees from the understory and canopy could increase surface wind movement, thereby facilitating the drying of live and dead fuels (Peterson, 2004). However, the proposed alternative addresses this issue by reducing the fuel load. Sufficient fuel treatment after thinning provides for an overall reduction in expected fire behavior and severity that typically outweighs the changes in wind speed and fuel moisture (Agee, 2005).

With this alternative surface, crown, and ladder fuels, and fuel continuity would be reduced. Treatments in dense stands would reduce the ladder fuels and help break up canopy continuity and increase the average distance between ground and the crown of the trees. Mechanical treatments followed by prescribed fire (including pile burning) have been shown to have the greatest effect on mitigating fire severity (Cram, 2006). Specifically, as mean tree diameter increases, fire severity decreases.

Canopy base height, canopy bulk density and canopy continuity are the key forest structure characteristics that affect the initiation and propagation of crown fires. Reducing canopy bulk density and raising the crown base height through improved tree spacing and small diameter thinning is a means to minimize crown fire hazard.

By reducing fuel loadings, fuel continuity and the availability of ladder fuels the proposed alternative will help keep fire confined to the surface and reduce the occurrence of firebrands. This increases the ability to control fires. In the WUI, reducing the threat from fire brands requires fuels reductions both near and at some distance from structures, infrastructure and private property. The proposed treatments reduce the likelihood of firebrands being lofted from fires onto private land and structures which improves fire fighter's ability to protect life and property.

Additional benefits of this alternative would include improved vigor in residual trees through less moisture and nutrient competition. This makes for healthier stands that are less susceptible to mortality due to insect, disease, and draught.

Fire Regime Condition Class
Fire regime 1, a low severity high frequency regime comprises the vast majority of the project area. The proposed alternative would change vegetation characteristics including stand density, species composition, structural stage, fuel composition and potential fire severity as related to the reference condition. After completion of the mechanical treatment and prescribed burning, stands slated for such treatments would be changed from condition class 3 to condition class 2. In preceding years, continued applications of prescribed fire would move these stands from condition class 2 to condition class 1. Elsewhere in the

project area, stands scheduled strictly for prescribed fire will be maintained in condition class 1.

Under this alternative untreated acres will remain in their existing FRCC and will depart further from the reference condition.

Increased growth of the remaining trees associated with thinning would promote the development of old forest structural stages, allowing thinned stands to grow into larger size classes sooner.

Air Quality

Based on current fuel loadings and thinning prescriptions of the proposed alternative total smoke emissions from activity created pile burning and underburning would range from 12 to 29 tons per acre. This is less than half of predicted emissions under wildfire conditions.

Pile and prescribed burning affects air quality in ways similar to wildfires, however, prescribed burning offers many advantages over wildfire. The effects of prescribed fire can be manipulated to reduce adverse effects to air quality. Smoke mitigation techniques include consideration of atmospheric conditions, season of burn, fuel and duff moisture, diurnal wind shifts, appropriate ignition techniques and rapid mop-up.

Particulate matter, alone or in combination with other pollutants, can constitute a health hazard. Particulates enter the body mainly via the respiratory system. Particulate matter may exert a toxic effect in one or more of the following ways:

1. The particle may be intrinsically toxic because of its chemical and/or physical characteristics.
2. The particle may interfere with one or more of the mechanisms that normally clear the respiratory tract.
3. The particle may act as a carrier of an absorbed toxic substance.

Medical studies have shown a relationship between increases in particulate concentrations and rises in the number of clinic and hospital visits for upper respiratory infections, cardiac diseases, bronchitis, asthma, pneumonia, and emphysema. Deaths of elderly persons afflicted with respiratory diseases and cardiac conditions also show an increase during periods when the concentration of particulate matter is unusually high for several days.

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Large quantities of carbon monoxide are emitted from wildfire and prescribed fires. Carbon monoxide exposure from these sources can be detrimental to fireline workers but CO dilutes very rapidly in the atmosphere and is not likely a concern for urban and rural areas even a short distance downwind. One study measured CO concentrations as high as 200 ppm close to flames but observed that the concentration was reduced to less than 10 ppm just 100 feet from the fire.

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Lead

The principal source of lead emissions is the combustion of gasoline containing lead alkyl additives. Since use of leaded gasoline is dramatically decreasing, lead air pollution is rarely a problem anymore. Lead particles that have been deposited on vegetation over decades can become re-emitted if the vegetation is burned. This phenomenon was documented during chaparral burning which took place east of the Los Angeles basin.

Short-Term Adverse Health Effects of Slash Burning
Slash burning presents the combined hazards of fire and smoke to ground crews at the site. Effects on workers may include eye irritation, coughing, and shortness of breath in moderate-to heavy smoke concentrations. Workers trapped in an area of heavy smoke could be asphyxiated. Heavy smoke may also endanger members of the public in adjacent areas. Visibility may also be affected during the duration of the slash burn.

The following mitigation measures would lessen the negative effects of Alternative 2:

- Minimize the amount of material burned by making it available for other uses such as post and poles and habitat restoration projects where feasible.
- Where possible, burn material when weather conditions minimize impacts from smoke. These include: burning on cloudy days when residual smoke cannot be seen; burn during low visitor time periods; and burning during periods of atmospheric instability for better smoke dispersal and transport.

Long-term Effects
Lower levels of smoke from slash burns may have a local, transitory effect on air quality and visibility. Sensitive members of the public may experience eye, throat, or lung irritation from these exposures. There is some risk that chronic, low-level exposure of workers or the public to smoke may lead to such health effects and emphysema, lung cancer, or chronic respiratory disease.

Toxicity of Smoke Constituents
The various components of forest fire smoke are fairly well known, but the quantities produced vary considerably, depending on fuel moisture and fire temperature. The hazards include particulate matter, gases (carbon monoxide, carbon dioxide, and oxides of nitrogen), and chemicals that may enter the lungs on the surface of particulate matter.

There are few studies that evaluate the toxicity of forest fire smoke. Almost all investigations of the toxicity of smoke particulate matter in human populations have been conducted with particulates associated with burning coal or fossil fuels where sulfur oxides and sulfates are the important constituents. However, these chemicals are not generated in a noteworthy quantity by vegetation fires.

Some components of smoke, such as many polycyclic aromatic hydrocarbons (PAH), are carcinogenic. Probably the most carcinogenic is benzo-a-pyrene (BaP), which has been demonstrated to increase in potency when mixed with carbon particulates. Other components, such as the aldehydes, are acute irritants. These are most likely to affect forest workers who receive high exposures at the burn site.

CUMULATIVE EFFECTS ALTERNATIVE 2

CUMULATIVE EFFECTS DETERMINATION					
Past, Current or Reasonably Foreseeable ACTIVITY or PROJECT	**Potential Effects**	**OVERLAP in TIME or SPACE**		**Measurable?**	**Extent**
		Time	**Space**		
Burdoin I and II Forest Restoration Project Thinning, Pile Burning	Smoke	No	Yes	No	There will be no measurable effects as units from Catherine and Burdoin I and II will not be burned concurrently
	Fire Behavior	Yes	No	No	No measurable effect due to prevailing winds & natural barriers

3.2 – EFFECTS TO FOREST ECOSYSTEM COMPONENTS

Introduction

Forest ecosystem components include the structure, species composition, and landscape pattern of the forested system as well as the diversity of the wildlife and flora that use the forested system as their habitat. There is inherent overlap with the sections on fish, wildlife, and plants because of the importance of discussing the ecosystem components as linked to all wildlife and plant habitats. Habitats depend not only on the physical nature of the environment (topography, climate, etc), but on vegetation components such as tree densities, tree ages and sizes, tree species composition, tree canopy cover, the configuration of overstory and understory tree layers, the composition of the herbaceous layer, and the size and pattern of openings within the forest.

Fire Dependent Transition Zone Ecosystem

Ecosystem components are shaped by the natural processes endemic to the area. As has been discussed throughout this document, fire (Agee, 1993) and European colonization are the most important processes influencing this project area. Fire thinned the pine/oak/Douglas-fir communities creating the open oak woodlands and forests containing widely spaced large trees and rich herbaceous layer that were once predominant throughout this area. European colonization changed the physical components as well as the processes that shaped them.

Analysis Methods and Measurements
The approach taken here to analyze the forested ecosystem components is to identify the major disturbance factors that influence these forested communities. As mentioned throughout this document, the natural fire regime is the most important process that is no longer operational due to fire exclusion efforts since the early 1900s, followed in importance by the historic harvest of the largest pines, oaks, and firs. These components were present for centuries prior to the early 1800's. Next, the analysis identifies how the components change as a result of fire exclusion: The most important of these are increased fuels, increased tree densities and canopy cover, fewer large trees, more complex under-stories, and a reduction in forest openings and the herbaceous layer.

The biodiversity of an ecosystem evolves and adapts to the native forest communities (habitats) which in turn evolved with the natural disturbance regimes. Therefore, deviations indicate likely reasons for decreasing population trends of species. Changes in the forest structural and compositional components are the measurements used for identifying disruptions and changes in the disturbance regimes that would affect the forest ecosystem.

Existing Conditions
The Catherine Creek planning area is a mosaic of grassland, oak savannah, oak-pine woodlands, and mixed oak/pine/Douglas-fir vegetation communities. Typically the drier areas of grasslands and oak savannahs are at lower elevations or southern exposed slopes, while the oak-pine woodlands and mixed oak-pine-Douglas-fir are found in moister areas at higher elevations and on north and east aspects.

Over the past 10,000 years this area has been under important influence of Native Americans. It has been well documented that they often burned the oak woodlands causing frequent, low intensity fires to become the most important disturbance regime. To further supports this premise, today one can find evidence of large savannah oaks, which clearly developed in more open, frequently burned conditions, being over-topped by young Douglas firs dating back to the start of fire exclusion in early 1900s.

The stand structure of the oak-pine and mixed-conifer communities has changed as a result of fire exclusion. Prior to fire exclusion, frequent fires thinned the woodlands creating spaces and soil profiles for individual trees to grow large. Thus the woodlands were dominated by old, large diameter trees that could withstand low intensity ground fires and which produced a large mast crop. Today, these older trees have been harvested or died due to competition and drought and have been replaced by dense stands of younger trees increasingly encroached by Douglas-fir.

Historically, frequent but low-intensity fires stabilized the ecosystem keeping stand densities low, eliminating Douglas-fir encroachment, regenerating the grass and herbaceous layers, and keeping fuel accumulations low. Today the stability of the ecosystem has declined because of increased fuel loads and the risk of catastrophic fires has been increasing with each year. Today a catastrophic fire would destroy the structural components of these communities and, although the diversity may re-generate fairly quickly after a fire, the structural components will take decades, if not centuries to re-generate.

The grasslands today are dominated with non-native grasses with a poor herbaceous component and little plant diversity. These grasslands have been dramatically changed due to heavy cattle and sheep grazing in the mid 1800's. The native bunch grass/herbaceous communities, which were once rich and diverse, have virtually been eliminated throughout the project area except for remnants scattered in areas where the cattle or sheep did not congregate. The subsequent invasion of non-native annual grasses from Europe then made it more difficult for the native grasses to become re-established. The loss of the native bunch grasses and the rich herbaceous components has dramatically changed the structure and diversity of the grasslands.

Example of late encroachment where an older oak approx. 200 yrs old is over-topped and dying as a result of encroaching Douglas-fir which are less than 100 yrs old.

Regulatory Framework
Applicable Standards and Guidelines

The following applicable standards and guidelines were used to form the criteria for this effects analysis:

Columbia River Gorge National Scenic Area Management Plan

- Maintain, protect, and enhance the integrity and function of priority habitats (including oak woodlands, old-growth forests, talus, and others).
- Silvicultural prescriptions shall maintain the desired natural forest stand structures, created forest openings, and snag and down wood as given in the Desired Forest Structure and Pattern Table in the Management Plan.

Environmental Consequences
DIRECT AND INDIRECT EFFECTS ALTERNATIVE 1-NO ACTION

The direct effect of this alternative is the continued change in forest composition and structure as a result of not re-establishing the primary disturbance processes, fire, in this forested ecosystem. Douglas-fir would continue to encroach upon the oak/pine woodland communities changing the structural components from the simple, old-growth oak/pine forest (a Management Plan priority habitat) to a more complex, younger, multi-layered forest community. This change will result in higher fuel loading and higher risks to catastrophic fires. The habitat types present in the historic forest conditions of older, larger, well-spaced oaks and pines would continue to be lost to more dense stands of younger oak/pine/Douglas-fir and with this change the species composition will continue to show slow shifts as indicated in the wildlife and plant section.

Indirect effect of taking no action, is the increased potential for a catastrophic fire. Loss of over-story trees and shrubs would effectively eliminate large portions of an already diminishing set of forest communities and it would likely take several hundred years before they would become re-established. A high-intensity fire and resultant soil damage would retard re-colonization of the area, especially by native vegetation. Initial colonization by aggressive, early-seral, and non-native species, such as cheatgrass, thistle, knapweed, and scotch broom would further retard habitat recovery for native species dependent on oak woodland habitat.

Cumulative Effects of Alternatives 1 – No Action
The cumulative effects of no action would continue the present change in structure of the forested ecosystem and the increased risk of catastrophic fire. Both of these result in continued change in ecosystem components and in the continued deviation from the historic range of natural conditions. Linked to these changes are the negative impacts to the many floral and faunal species, including the listed species and important game wildlife, dependent on oak woodlands. The continued failure to re-establish the processes that keep the forested ecosystem components healthy and resilient will continue to place all aspects of the ecosystem at higher risk to future problems. Furthermore, as fire risk increases the cumulative impacts increase because of the temporal factor inherent in the extended time frames to re-establish the structural components of the pine/oak communities.

CUMULATIVE EFFECTS DETERMINATION					
Past, Current or Reasonably Foreseeable ACTIVITY or PROJECT	**Potential Effects**	**OVERLAP IN**		**Measurable Cumulative Effects?**	**Extent Detectable?**
		TIME	**SPACE**		
Burdoin I	Short term disturbance and possible loss to individuals. Long term beneficial effects on habitats.	No	Yes	Yes	Burdoin I project thinning has helped delay fuel loading, but is not sufficient to prevent catastrophic fires and loss of ecosystem components.
Road work on BPA easement	Effects on riparian habitats. Road was built within riparian area	No	Yes	No	Minor.
firehouse	Loss of habitat – increase disturbance	No	Yes	Yes	Loss of forest to permanent development is cumulatively detrimental.
Courtney Rd widening	Temporary disturbance. Long term - increase numbers of recreationists	No	No	No	
Allen Property thinning and structure removal	Short term disturbance and possible loss to individuals. Long term beneficial effects on habitats.	No	Yes	Yes	This project thinning has helped delay fuel loading, but is not sufficient to prevent catastrophic fires and loss of ecosystem components.
Weed treatments	Short term disturbance.	Maybe	Yes	No	Minor
Paved accessible trail at Catherine Creek	Short term disturbance. Long term attraction for more people , more disturbance.	No	No	No	Minor
Burdoin II Thin from Below	Short term disturbance and possible loss to individuals. Long term beneficial effects on habitats	Maybe	Yes	Yes	This project thinning has helped delay fuel loading, but is not sufficient to prevent catastrophic fires and loss of ecosystem components.
Coyote wall FS trails	Increased disturbance from recreation	Maybe	Yes	No	Minor
Land acquisitions	Reduces chronic disturbance. Encourages recreation, protects more habitat.	Maybe	Yes	Yes	Increasing land base enhances the ecosystem components in that more land becomes part of the ecosystem.
Historic Tree Harvest	Removed Large Trees	No	Yes	Yes	Fewer large trees Now more valuable to save
Future State/Private Forest Practices	Thinnings for ecosystem purposes In Open Space, to SMA guidelines in Forest/Agriculture	Maybe	Yes	Not now	Must meet SMA guidelines Slightly reduces the negative effects of no action

DIRECT AND IDIRECT EFFECTS ALTERNATIVE 2-PROPOSED ACTION

The short-term direct impacts of this alternative would be the impacts associated with the thinning operation. This would include the disruption of the ground cover and the temporary disruption and change of the existing composition and structure. Both of these are short term impacts which ultimately will be replaced by long-term benefits to stability and ecosystem long-term viability.

Priority Habitats

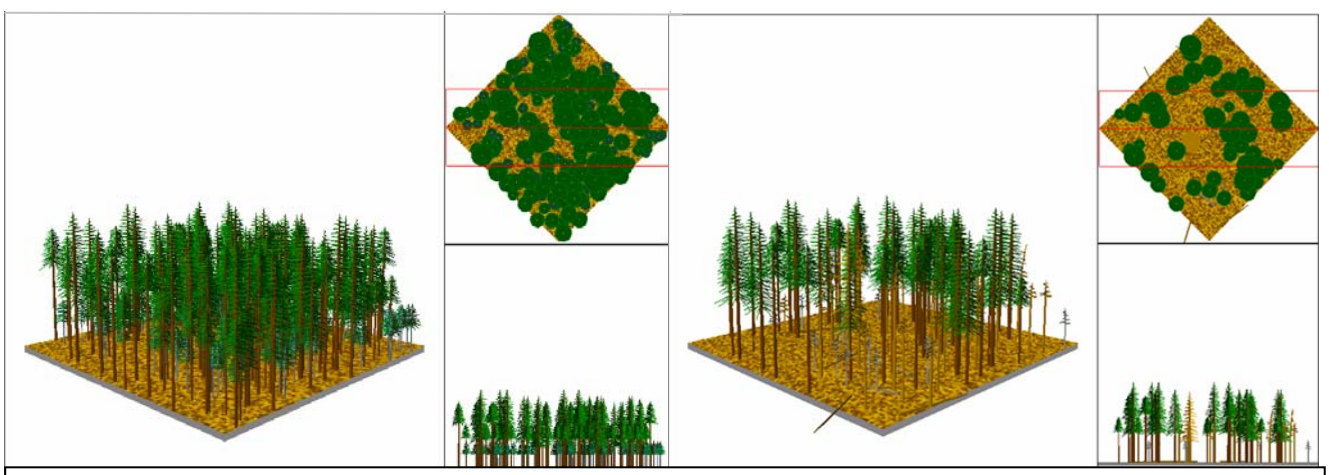
Priority habitats (such as talus slopes, cliffs and caves) are given protection in the prescriptions:

- Preserve clumps 100' feet away from the base of cliffs, caves, or talus slopes with the following:
    - Leave untreated clumps of 6-10 oaks spaced 50-150 feet apart (vary).
    - Treated areas within the 100' buffer are thinned from below in a manner that maintains the existing canopy cover.

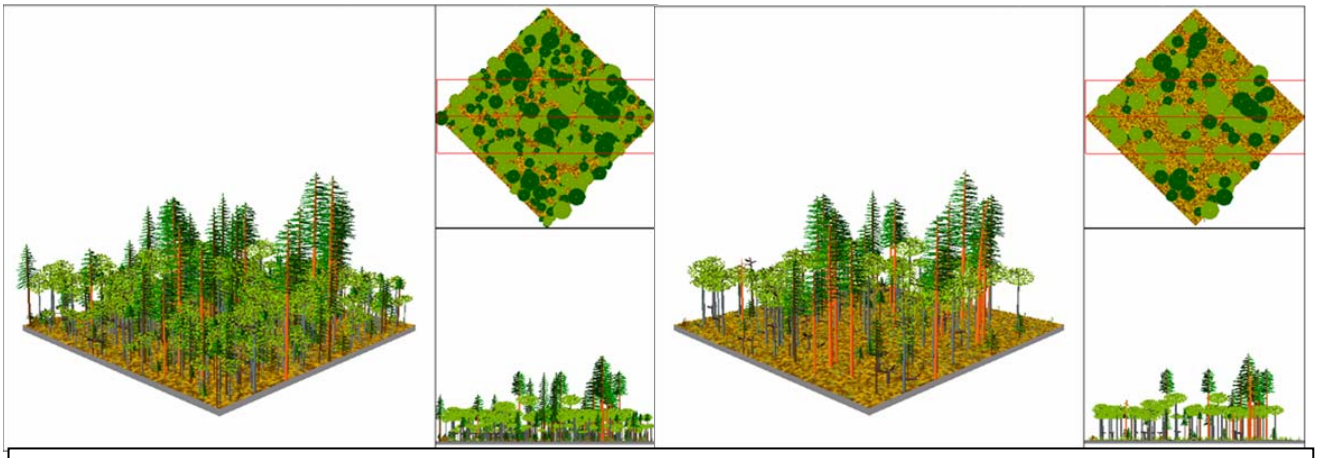
The overall objective of this restoration project is to enhance the long-term function of the area's habitats which includes the function of priority habitats such as oak-pine woodlands.

The indirect impacts of the proposed action would be to begin to re-establish the natural processes (low intensity and frequent fires) that were historically so critical to this ecosystem. Thinning of the oak/pine/mixed conifer followed by prescribed fire would create, in the long term, a more resilient and stable structural condition with larger and older trees well spaced out. The increased spacing will permit more light and more diversity in the under-story. This condition would reduce management costs (frequent prescribed fire is more cost effective than mechanical fuel reduction) and enhance the wildlife and plants endemic to this transitional zone.

As described in the proposed action alternative in Chapter 2, the computer models below indicate the expected range of structural changes for each stand type example:

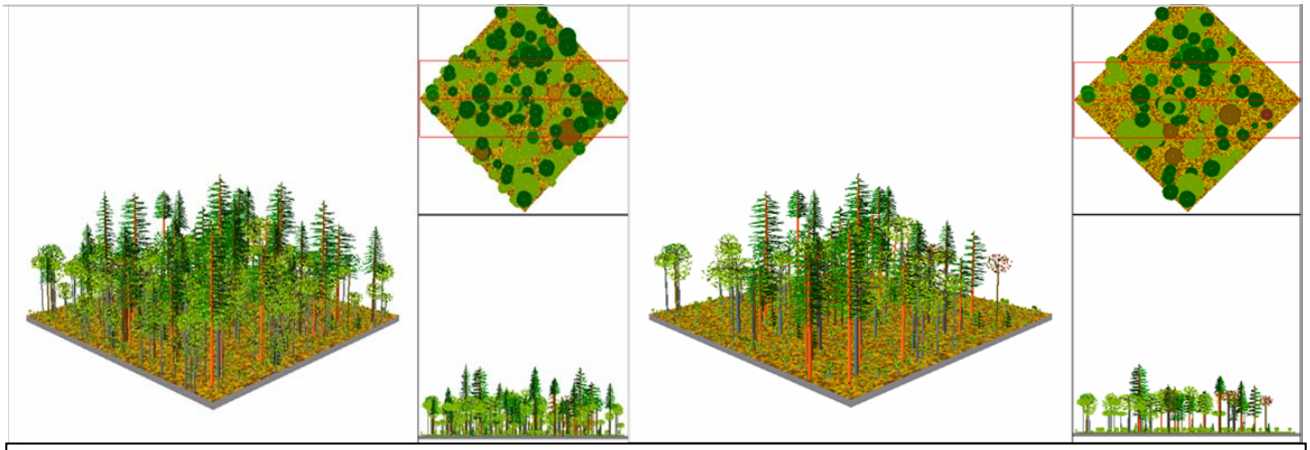


BEFORE THINNING CANOPY 82% AFTER THINNING CANOPY 60%
Forest Vegetation Simulator Model Example for Northern East Conifer



BEFORE THINNING CANOPY 84% AFTER THINNING CANOPY 59%
Forest Vegetation Simulator Model Example for Pine-Oak-Douglas Fir

This photo shows how an oak woodland may have looked with frequent low intensity fires and with some oak thinning as a result of the fires.



BEFORE THINNING CANOPY 72% AFTER THINNING CANOPY 58%
Forest Vegetation Simulator Model Example for Oak-Pine Woodlands

Desired Forest Structure and Pattern Table
Silvicultural prescriptions were designed to meet all guidelines given in the Desired Forest Structure and Pattern Table. The Management Plan defines a created opening as an opening with "…less than 40 percent average canopy closure of overstory trees and less than 60 percent average canopy closure of understory trees averaging less than 5 inches diameter at breast height for coniferous forests and less than 25 percent total canopy cover for oak woodlands. This definition does not include agricultural fields".

Landings will be located in existing openings and may need to be enlarged for worker safety. The size of the additional clearing will not exceed the Management Requirement in the structure and pattern table of less than one acre (including the size of the original opening).

Prescriptions for the east conifer types (including pine-oak-Douglas fir) require an average canopy from 45-60% and the pine/oak vegetation type requires average canopy closure of 50% percent which falls within the desired limits required by the Management Plan as indicated below with an excerpt from the Desired Forest Structure and Pattern Table:

Vegetation Type	**Forest Structure** (Average % total canopy closure (cc)) *
East Conifer (Ponderosa Pine/Douglas fir)	40-80% canopy closure Understory layer less than 25% of total cc
Ponderosa Pine/ Oregon Oak	25-60% canopy closure Understory layer greater than 25% of total cc.

Cumulative Effects of Alternative 2 – Proposed Action
The cumulative effects of this alternative would foremost be the cumulative benefits to long-term stability and fire resiliency brought to the area as a result of this action which adds to the benefits provided by previous actions at Burdoin I and II and the Allen property as summarized in the table below. The long term objective is to piece together, through land acquisition, a contiguous area of functional habitat in which ecological processes are re-established to maintain the habitat's viability over the long term. The most important component of this is to re-establish the ecosystem components, as described above, such that the area becomes fire resilient and functionally more stable.

As illustrated in the table below, the potentially negative cumulative effects of short-term disturbance is not a problem because there is little overlap in time of the activities and projects. Thus the effects of disturbance from one project to another are not cumulative.

CUMULATIVE EFFECTS DETERMINATION					
Past, Current or Reasonably Foreseeable ACTIVITY OR PROJECT	**Potential Effects**	**OVERLAP IN**		**Measurable Cumulative Effects?**	**Extent Detectable?**
		TIME	**SPACE**		
Burdoin I Small diameter Thinning	Short term disturbance and possible loss to individuals. Long term beneficial effects on habitats.	No	Yes	Yes	Burdoin I project thinning will increase the overall area thinned to meet fire resiliency thus reducing the risk of catastrophic fires and the loss of pine-oak ecosystem components.
Road work on BPA easement	Effects on riparian habitats. Road was built within riparian area	No	Yes	No	Minor
Firehouse	Loss of habitat – increase disturbance	No	Yes	No	Loss of forest to permanent development is cumulatively detrimental.
Courtney Rd widening	Temporary disturbance. Long term - increase numbers of recreationists	No	No	No	Minor
Allen Property thinning and structure removal	Short term disturbance and possible loss to individuals. Long term beneficial effects on habitats.	No	Yes	Yes	This project thinning was the first step in thinning portions of the CC project area. This project is a cumulatively beneficial effect towards fire resiliency and enhancing ecosystem components.
Weed treatments	Short term disturbance.	Maybe	Yes	No	Minor
Paved accessible trail at Catherine Creek	Short term disturbance. Long term attraction for more people, more disturbance.	No	No	No	Minor
Burdoin II Thin from Below	Short term disturbance and possible loss to individuals. Long term beneficial effects on habitats	Maybe	Yes	Yes	This project thinning is cumulatively beneficial in that it increases the overall area meeting fire resiliency and enhancement of ecosystem components.
Coyote wall FS trails	Increased disturbance from recreation	Maybe	Yes	No	Minor
Land aquisitions	Reduces chronic disturbance. Encourages recreation, protects more habitat.	Maybe	Yes	No	Increased land base enhances ecosystem components by blocking up larger tracts of land. Cumulatively this is a beneficial effect.
Historic Tree Harvest	Removed Large Trees	No	Yes	Yes	Fewer large trees Now more valuable to save
Future State/Private Forest Practices	Must meet SMA guidelines	Maybe	Yes	Not now	Must meet SMA guidelines

3.3 - EFFECTS TO SCENIC RESOURCES

Introduction and Analysis Methods and Measurements
This section evaluates the existing scenic condition, visibility, and effects of the alternatives on scenic resources. The analysis is based on the requirements of the Revised Columbia River Gorge National Scenic Area Management Plan (Management Plan) as adopted by the Gorge Commission, GIS data, digital photos, and several site visits during 2006 and early 2007. This analysis is invalid if photo copied or printed in black and white.

The measurement for the effect to scenic resources is the degree to which the project activities are predicted to meet Management Plan scenic resource guidelines in the required timeframes from Key Viewing Areas. The project activities relevant to scenic resources analyzed for the proposed action are: road maintenance and reconstruction, landings, thinning, slash piling, fire line, scheduled prescribed underburns, and proposed implementation requirements.

Land Use Designations and Landscape Settings
The project is located on Burdoin Mtn. and on National Forest System lands just east of Burdoin Mtn. in the Catherine and Major Creek drainages. The most visible portions of the landscape facing KVAs are the grasslands proposed for prescribed underburning.
The NSA land use designations are SMA Open Space for the Catherine and Major Creek sub-areas and SMA Forest or Agriculture for the Burdoin Mtn. sub-area. The landscape settings are Oak Woodlands on Burdoin Mtn. and Gorge Walls/Canyonlands/Wildlands for the rest of the planning area.

BURDOIN MOUNTAIN SUB-AREA
FROM THE HISTORIC COLUMBIA RIVER HIGHWAY AT MOSIER

Key Viewing Areas
The portions of the site visible from Key Viewing Areas (KVAs) were obtained from the KVA GIS layer developed by the Forest Service and Gorge Commission based on a 10-meter digital elevation model.

The factors that influence potential visual impact of a proposed development listed in the Management Plan are the following:

- The amount of area of the building site exposed to Key Viewing Areas.
- The degree of existing vegetation providing screening.
- The distance of the building site to the key viewing areas from which it is visible.
- The number of key viewing areas from which it is visible.
- The linear distance along the key viewing areas from which the building site is visible.

Visibility Analysis
The planning area is topographically visible (considering landform only, not vegetative screening) from the viewpoints listed below.

- Foreground Distance Zone (0-1/2 mile): SR-14, County Rd. 1230
- Middleground Distance Zone (1/2-3 miles): I-84, Historic Columbia River Highway (HCRH), Rowena Plateau, and the Columbia River.
- Background Distance Zone (3 miles or more): I-84, Historic Columbia River Highway (HCRH), Dog Mountain, Pacific Crest Trail, and the Columbia River.

Amount of Exposure to Key Viewing Areas (KVAs) and Existing Vegetative Screening
The KVAs of most concern for this project are the Middleground viewpoints. These viewpoints will provide a panorama of the project area while the view from all of the other distance zones will be largely unaffected by the project activities.

County Road 1230
Distance Zone-Foreground ¼ mile or less and Middle-ground 1 to 2 miles is superior to the viewer's position. Grasslands of the project area meet the road and the forested section of the project area appear above the viewer.

SR-14
Distance Zone-Foreground ¼ mile or less and Middle-ground 1 to 2 miles is superior to the viewer's position.

Duration of View-Relatively short because Coyote Wall blocks views from Westbound traffic until Locke Lake, because there are technically no viewing areas from the Bingen Urban Area to the west, and because landforms block views.

I-84 and Columbia River
Distance Zone- Middleground from .7 to 2 miles

Duration of View-Long open view going both Westbound and Eastbound

Historic Columbia River Highway and Rowena Plateau
Distance Zone-Middle-ground from 1 to 3 miles

Duration of View - Short duration on the Highway itself. Views are glimpse. At overlooks and turnouts, the duration can be very long.

Existing Scenic Condition
The Burdoin Mtn. sub-area is located within the Oak Woodlands landscape setting described by the Columbia River Gorge NSA Management Plan below:

Overview and Land Use
This visually complex setting represents the climatic transition area between the lush forests of the western Gorge-and the semi-arid grasslands of the eastern Gorge. Dry oak-pine woods, Savannah areas (predominantly grassy openings with scattered trees), and grassy prairies are interspersed with scattered rural development. Such development includes

residences, roads, fences, etc. In some portions of this setting, orchards and cultivated areas lend a pastoral flavor to this generally natural-appearing landscape. Most parcels are over 20 acres in size, and are frequently between 40 and 160 acres.

Landform
Most of this setting is found on gently rolling to hilly terrain. Pastures and small farm uses are interspersed in the gentler portions of this setting. Some very steep slopes and deeply incised side canyons are contained in the least developed portions of this setting.

Vegetation
This setting contains perhaps the most varied vegetative communities in the Gorge, adding to its visual richness. Mixed stands of Oregon white oak and ponderosa pine typify this setting. In the western portions, highest elevations, and north slopes, this community transitions into woodland vegetation patterns, with increasing numbers of Douglas-fir occurring. Drier portions of this setting and areas with poor, thin soils are often treeless prairies. "Biscuit scablands," or patterned ground areas with little vegetation and hummocky rock outcrops, also occur. This special landscape, created by scouring of great floods, is also found in some portions of the Grassland setting.

The escarpment at Coyote Wall is an exceptional landscape feature and draws the eye from key viewing areas to the south and southwest.

The vegetation on Burdoin Mountain has undergone changes over the last 100 years that are not apparent to the casual visitor. Stands that were once open and park-like are now generally more densely stocked with small trees, and are in most cases less than one-half to one-third as many large trees in the over-story than in the past.

The Catherine and Major sub-areas are located within the Gorge Walls/Canyonlands/ Wildlands landscape setting described by the Columbia River Gorge NSA Management Plan below:

Overview and Land Use
This setting represents the bluffs, cliffs and steep slopes that form the walls of the Gorge and the deeply incised canyons of the Columbia River's major tributaries. Because of extreme steepness, and in some cases inaccessibility and instability, these areas are largely undeveloped...Prevailing land use in these areas is undeveloped vacant land, although low-intensity recreation use and some silviculture occur in a few limited areas.

Landform
The landform component of this setting is a much greater determinant of its character than is true for any other setting. Steep wooded slopes, canyon walls, and sheer rock faces characterize this setting. In the side canyons, small ribbons of riparian floodplain areas also occur.

Vegetation
The steepest portions of this setting are rocky cliffs devoid of much vegetation or loose talus slopes with limited vegetation (although such slopes often include large, old fir, pine, and maple trees). Other portions of this setting include stands of large fir and pine trees, some of which appear to be the (remnants of) original forest cover.

Existing Scenic Quality Level
Currently, the planning area appears highly scenic from the middleground and background views from key viewing areas. It currently meets Not Visually Evident from all the previously mentioned key viewing areas because most private development is screened from view, not visible from KVAs, or is a naturalized landscape feature such as a pasture. However, the vegetation in the Catherine and Major Creek area has also undergone changes over the last 100 years that are not apparent to the casual visitor. Stands that were once open and park-like are now generally more densely stocked with small trees, and are in most cases stocked with less than one-half to one-third fewer large trees in the over-story than in the past. Douglas-fir is a more dominant landscape component than it was historically. It does not appear natural from the foreground due to the lack of large character trees.

The scenic desired future condition for the planning area is to decrease tree density and increase the average diameter of the remaining trees. In the long term, this would be more dramatic and therefore more scenic from foreground and close middleground views.

VISIBILITY FROM KVAs SUMMARY TABLE

KVA VIEWPOINT	VISIBILITY	DURATION OF VIEW	TOPOGRAPHIC OR VEG ETATION SCREENING	DISTANCE FROM KVA	EXISTING VISUAL QUALITY LEVEL
SR-14 and Rd. 1230 FOREGROUND	LOW	LOW	HIGH	LOW	NOT EVIDENT[1]
COLUMBIA RIVER MIDDLEGROUND	MED	HIGH	LOW	MED	NOT EVIDENT
ALL OTHERS	MED	MED	HIGH EXCEPT AT VIEWPOINTS	HIGH	NOT EVIDENT

Regulatory Framework
The Management Plan, Part I, Chapter 1, Scenic Resources, SMA guidelines, states:

- Forest practices shall meet the design guidelines and scenic standards for the applicable landscape setting and zone.

- The required SMA scenic standards for all development and uses are summarized in the following table:

(The following standards are applicable to the land use designations and landscape settings in the project area:)

REQUIRED SMA SCENIC STANDARDS		
LANDSCAPE SETTING	**LAND USE DESIGNATION**	**SCENIC STANDARD**
Gorge Walls, Canyonlands, Wildlands, Oak-Pine Woodland	Forest (National Forest Lands), Open Space	Not Visually Evident
Oak-Pine Woodland	Agriculture	Visually Subordinate

Visually Subordinate from Key Viewing Areas is defined in the Management Plan as:

Visually subordinate: Visually subordinate forest practices in the SMA shall repeat form, line, color, or texture common to the natural landscape, while changes in their qualities of size, amount, intensity, direction, pattern, etc., shall not dominate the natural landscape setting.

Not Visually Evident from Key Viewing Areas is defined in the Management Plan as:

Not visually evident (SMA): A visual quality standard that provides for development or uses that are not visually noticeable to the casual visitor. Developments or uses shall only repeat form, line, color, and texture that are frequently found in the natural landscape, while changes in their qualities of size, amount, intensity, direction, pattern, etc., shall not be noticeable.

The following are the scenic resource guidelines required by the Management Plan for forest practices:

- Created forest openings visible at one time shall be within the desired range for the vegetation type as set forth in the forest practice Natural Resources guidelines
- Size, shape, and dispersal of created forest openings shall maintain the desired natural patterns in the landscape as set forth in the forest practice Natural Resources guidelines
- The maximum size of any created forest opening is set forth by the "Desired" vegetation type in the Forest Structure and Pattern Table.
- Created forest openings shall not create a break or opening in the vegetation in the skyline as viewed from a key viewing area.

Oak Woodland landscape setting.

- Use of plant species native to the landscape setting shall be encouraged. Where non-native plants are used, they shall have native-appearing characteristics.

Gorge Walls, Canyonlands, and Wildlands landscape setting

- New developments and land uses shall retain the overall visual character of the natural-appearing landscape.
- Temporary roads shall be promptly closed and revegetated.
- Use of plant species non-native to the Columbia River Gorge shall not be allowed.

Environmental Consequences

DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE 1-NO ACTION

Partial Retention or Not Visually Evident from Key Viewing Areas -The No Action Alternative would meet the required scenic standards unless a large, catastrophic fire revealed existing development and caused an unnatural amount of tree mortality. In the natural fire regime, most fires would burn frequently and would stay in the understory. A large amount of crown death would not be a natural occurrence and thus would not meet the scenic standards as defined by the Management Plan.

Structural, Species and Age Diversity - There is currently a lack of structural diversity in the current stand structures. Over time there will be fewer and fewer large diameter trees. Stagnant stands will increase the risk of a depauperate under-story and a reduction of desirable wildflower species.

Form, Line, Color, or Texture Common to the Natural Landscape

LANDSCAPE ELEMENT From KVA'S	NATURAL	EXISTING	AFTER TREATMENT	DEGREE CHANGE (From Natural)
LANDSCAPE PATTERN (Form/Line)	MOSAIC	MOSAIC (fewer openings)	NO TREATMENT PROPOSED	MINIMAL : Will appear natural unless large fire occurs
LANDSCAPE STRUCTURE (Form, Line, Color)	Large Trees Park-like or Cathedral-like Orange bark visible on large pines.	Smaller Trees Not park-like Except at very low elevation. Not Cathedral-like Few visible large pines	NO TREATMENT PROPOSED	Short Term: MEDIUM : Large oaks and pine continue to die Unless large fire occurs Long Term: HIGH Eventual loss of pine-oak transition zone Ecosystem.
GROUND PLANE (Color, Texture)	Grasses Wildflowers Short Shrubs	Many areas grass and wildflower layer shaded out. Shrubs overgrown.	NO TREATMENT PROPOSED	Short Term: MEDIUM Long Term: HIGH Concern for Foregrounds only

Existing Created Openings

The Management Plan defines a created opening as an opening with "…less than 40 percent average canopy closure of overstory trees and less than 60 percent average canopy closure of understory trees averaging less than 5 inches diameter at breast height for coniferous forests and less than 25 percent total canopy cover for oak woodlands. This definition does not include agricultural fields." Created Forest Openings are human-made and will likely continue at the rate allowed in the Management Plan for private and state forested lands. Under this alternative, they would not increase in the planning area.

Below is an excerpt from the Management Plan Desired Forest Structure and Pattern table:

Vegetation Type	**Forest Structure** (Average % total canopy closure (cc)) *
East Conifer (Ponderosa Pine/Douglas fir)	40-80% canopy closure Understory layer less than 25% of total cc
Ponderosa Pine/ Oregon Oak	25-60% canopy closure Understory layer greater than 25% of total cc.

Large portions of the planning area would not meet the desired structure as defined above because stands exams have shown that that total canopies exceed desired and that understory layers exceed the above percentages of total canopy. See discussion starting on page 75.

CUMMULATIVE EFFECTS OF ALTERNATIVE 1-NO ACTION

The foreseeable cumulative effects of Alternative 1 would be the continued growth of small diameter trees competing for water and light with the existing trees. This competition will lead to the accumulation of fuels and the mortality of existing larger diameter trees. This effect will also occur in other similar landscapes throughout the Gorge, creating risk of a large fire which would reveal existing houses and cause negative effects to the scenic resource. The cumulative effects of the risk of wildfire throughout the Gorge may reduce scenic quality. If a large stand-replacing fire does not occur, the tree stands will slowly lose scenic quality. Large oaks and large diameter ponderosa pine trees will continue to die without being replaced. Note: The table below contains an assumption of continued in-growth of Douglas-fir.

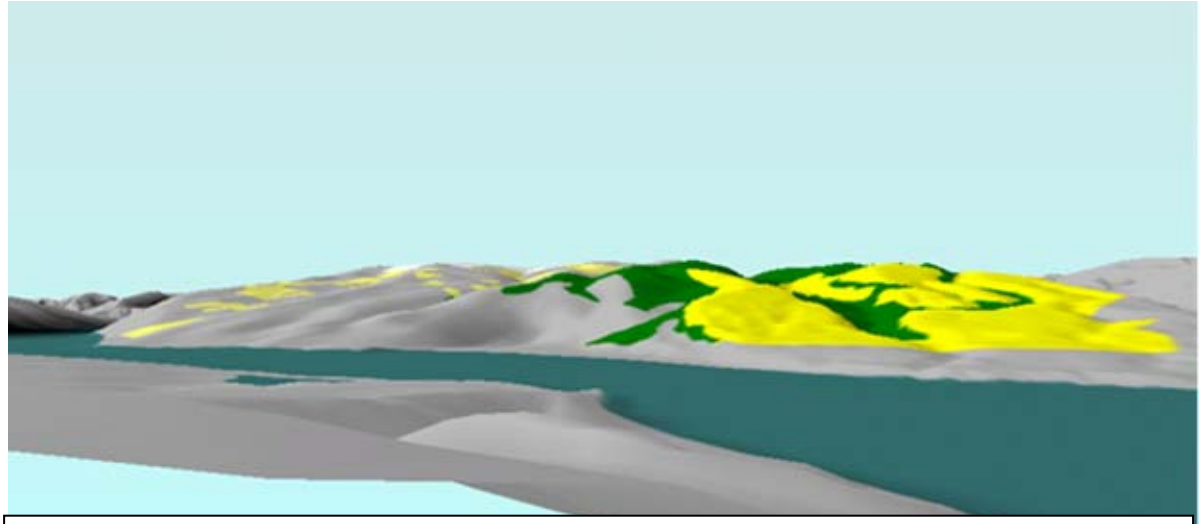
CUMULATIVE EFFECTS DETERMINATION					
Past, Current or Foreseeable **PROJECT**	**Potential Effects**	**OVERLAP IN: TIME**	**or SPACE**	**Measurable?**	**Extent**
Burdoin I	Foreground SR-14 Stumps, slash piles	No	Yes	No	No effects from Burdoin I are currently evident from KVAs, including SR-14.
Firehouse	Not visible KVAs	No	Yes	No	Not evident
Courtney Rd. widening	Not visible KVAs	No	Yes	No	Not evident
Allen property thinning and structure removal	Not visible KVAs	No	Yes	No	Not evident
Invasive Plant treatments past or future	Temporary Dead Plants Future-improve natives	Maybe	Yes	No	None evident—small input to cumulative scenic effects.
Paved accessible trail at Catherine Creek	Trail visible, Not very evident	No	Yes	No	Not very evident. Small input to cumulative scenic effects.
Burdoin II Thin from below	Middleground Not evident	Maybe	Yes	No	Fewer numbers of trees in viewsheds from Middleground distance but small visual deviation from the natural patterns.
Coyote wall FS trails	Not evident	Maybe	Yes	No	Not evident
Past/Future Land acquisitions	Less development-positive	Maybe	Yes	Yes	Measureably less development in SMA purchased by FS. Reduces cumulative negative effects.
Historic Tree Harvest	Removed Large Trees	No	Yes	Yes	Fewer large trees (due to past harvests) in viewsheds from Middleground distance but small visual deviation from the natural patterns.
Future State/Private Forest Practices	Must meet SMA guidelines	Maybe	Yes	Yes	Fewer numbers of trees in viewsheds from Middleground distance but small visual deviations from natural patterns.

DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE 2-PROPOSED ACTION

Scenic Standards from Key Viewing Areas

Middle-ground views -Most of the treatment area will be seen from the Middle-ground distance zone where the change will be a difference in the density of the under-story layers. This will meet the definition for scenic standards above. The large tall pines visible from key viewing areas may be more visible. The over-all natural appearance of the landscape will not be modified.

Effects from prescribed burning in the grasslands may be more visible and there will be short term effects such as visible smoke. These effects meet the definition of "line, color, or texture common to the natural landscape" as defined by the Management Plan.



Computer analysis of visible terrain of Catherine Alternative 2 from Memoloose Overlook.
YELLOW-PRESCRIBED BURNING ONLY
GREEN-AREAS PROPOSED FOR THINNING
(Riparian no-thinning areas are also shown green).

Foreground views -Prescribed burns will be visible in the foreground of County Road 1230 and will produce natural effects on the landscape and therefore retain the scenic standard as defined. A temporary road re-alignment of the road 1230020 intersection will the only evident temporary effect. The transportation plan calls for the following :

- *Post haul, remove rock, re-contour graded area and reset fence*

Short term negative scenic effects such as stumps, slash, and ground disturbance in the thinning units will not be visible in the foreground of any KVAs.

Almost all of the project activities are in the middleground or background distance zone from the above KVAs. No foreground KVAs are affected by thinning activities. A temporary road re alignment and a small area of the Burdoin and Catherine prescribed fire areas will be visible from SR-14 in the foreground. The project activities meet the requirement that management activities appear natural because the change in canopy closure will appear natural from the middle ground distance zone, fire is a natural disturbance, and the temporary road changes will not be visible within the required time frame to meet scenic standards (they will be removed).

The project will also exceed scenic requirement due to the following mitigations at non-KVA viewpoints:

- No permanent leave tree marking shall be used except the marking of boundary trees near the base of each tree.
- Stumps >10" dbh shall be flush cut in the immediate foreground (within 50 ft.) of Snowden Road.
- The landing at Snowden Road shall retain screening from existing trees as seen from Snowden Road wherever safety concerns permit.

Structure, Species and Age Diversity - The reduction of canopy in layer 2 and 3 will decrease structural diversity until the growth of larger diameter oak and pine in the thinned stands increases structural diversity. Age diversity will decrease until natural regeneration recurs. Species diversity will decrease because this project plans to minimize the encroachment of Douglas-fir seedlings and Douglas-fir trees less than 8 inches dbh into areas where this species was limited by frequent fire.

The current level of species diversity is out of the range of natural conditions. The prescriptions call for clumps of untreated or minimally treated vegetation within the treatment areas that will help offset any negative effects on species and age diversity.

The project is designed to meet scenic resources from Key Viewing Areas and will meet the scenic standards as summarized in the table below:

Form, Line, Color, or Texture Common to the Natural Landscape

LANDSCAPE ELEMENT From KVA'S	NATURAL	EXISTING	AFTER TREATMENT	DEGREE CHANGE (From Natural)
LANDSCAPE PATTERN (Form/Line)	MOSAIC	MOSAIC (fewer openings)	MOSAIC (no change from existing although some existing openings may be more visible)	MINIMAL (due to existing conditions rather than treatments)
LANDSCAPE STRUCTURE (Form, Line, Color)	Large Trees Park-like or Cathedral-like Orange bark visible on large pines.	Smaller Trees Not park-like Except at very low elevation. Not Cathedral-like Few visible large pines	Larger Trees more visible but not big enough for Cathedral-like Park-like possible More large pine may be visible. Fewer trees visible over oaks. Short-term effects from prescribed fire-- red needles, etc. are common to the natural landscape.	Short Term: MEDIUM (but caused by existing condition more than by treatment) Long Term: MINIMAL, Prescribed fire would help create park-like, cathedral conditions.
GROUND PLANE (Color, Texture)	Grasses Wildflowers Short Shrubs	Many areas grass and wildflower layer shaded out. Shrubs overgrown.	Short Term: Disturbed ground, stumps, slash, spindly trees, boundary marks, Long-term: Improved layer of grasses, Wildflowers, Short shrubs	Short Term: MEDIUM Long Term: MINIMAL Concern for Foregrounds only

Created Openings and Breaking the Skyline

The Management Plan defines a created opening as an opening with "…less than 40 percent average canopy closure of overstory trees and less than 60 percent average canopy closure of understory trees averaging less than 5 inches diameter at breast height for coniferous forests and less than 25 percent total canopy cover for oak woodlands. This definition does not include agricultural fields."

Landings will be located in existing openings and may need to be enlarged for worker safety. The size of the additional clearing will not exceed the Management Requirement in the structure and pattern table of less than one acre (including the size of the original opening). No openings are located on a ridge-top or are of a size that would break the skyline.

Prescriptions for the east conifer types (including pine-oak-Douglas fir) require an average canopy from 45-60% and the pine/oak vegetation type requires average canopy closure of 50% percent which falls within the desired limits required by the Management Plan as indicated below with an excerpt from the Desired Forest Structure and Pattern Table:

Vegetation Type	**Forest Structure** (Average % total canopy closure (cc)) *
East Conifer (Ponderosa Pine/Douglas fir)	40-80% canopy closure Understory layer less than 25% of total cc
Ponderosa Pine/ Oregon Oak	25-60% canopy closure Understory layer greater than 25% of total cc.

Temporary Roads
The only temporary road planned is a short spur off of Snowden Road (See description in Chapter 2). This road will be removed and the area re-planted with native plants as per the Management Plan requirement for the Gorge Walls, Canyonlands, and Wildlands landscape setting that temporary roads shall be promptly closed and revegetated.

Native Plants
The Natural Resources Mitigation plan in Chapter 2 calls for the use of native plants for all revegetation needs in the planning area.

CUMULATIVE EFFECTS OF ALTERNATIVE 2-PROPOSED ACTION

Cumulative effects from existing development and other forest practices along with the proposals in Alternative 2 will have a small effect on viewsheds because most of the effects of thinning prescriptions are found in the Foreground distance zone. Almost all of the project area is in the middle-ground or background distance zone from KVAs. The table below summarizes these cumulative effects.

The foreseeable future cumulative effects of Alternative 2 would be that the private or state landowners would implement similar thinning projects in the future or other visible projects in the planning area and these require implementation requirements or approval conditions under the Management Plan to forestall short-term or long-term negative scenic effects with regard to impacting viewsheds. The scenic protections in the Management Plan were meant to protect the resource from these effects. This should prevent cumulative negative effects to scenic resources. The cumulative positive effects of these thinnings would be to reduce the overall fire risk in the Gorge and to increase over time the development of very large trees and more prevalent wildflower under-stories. The table below summarizes these effects:

CUMULATIVE EFFECTS DETERMINATION					
Past, Current or Foreseeable **PROJECT**	**Potential Effects**	**OVERLAP IN: TIME or SPACE**		**Measurable?**	**Extent**
Burdoin I	Foreground SR-14 Stumps, slash piles	No	Yes	No	No effects from Burdoin I are currently evident from KVAs, including SR-14.
Firehouse	Not visible KVAs	No	Yes	No	Not evident
Courtney Rd. widening	Not visible KVAs	No	Yes	No	Not evident
Allen property thinning and structure removal	Not visible KVAs	No	Yes	No	Not evident
Invasive Plant treatments past or future	Temporary Dead Plants Future-improve natives	No	Yes	No	None evident—small input to cumulative scenic effects.
Paved accessible trail at Catherine Creek	Trail visible, Not very evident	No	Yes	No	Not very evident. Small input to cumulative scenic effects.
Burdoin II Thin from below	Middleground Not evident	Maybe	Yes	No	Fewer numbers of trees in viewsheds from Middleground distance but small visual deviation from the natural patterns.
Coyote wall FS trails	Not Evident	Maybe	Yes	No	Not evident
Past /Future Land acquisitions	Less development-positive	Maybe	Yes	Yes	Measureably less development in SMA purchased by FS. Reduces cumulative negative effects.
Historic Tree Harvest	Removed Large Trees	No	Yes	No	Fewer large trees in viewsheds from past harvest in Middleground distance but small visual deviation from the natural patterns.
Future State/Private Forest Practices	Must meet SMA guidelines	Maybe	Yes	No	Fewer numbers of trees in viewsheds from Middleground distance but small visual deviation from the natural patterns.

Summary

The following table summarizes the scenic effects of the alternatives:

VISUAL DISTURBANCE SUMMARY		ALT 1-No Action	ALT 2-Proposed Action
Foreground SR-14/County Rd 1230	KVA Visible Acres Treated	FG-0 Unless wildfire	135 Underburn
Middlegrounds/ Backgrounds		MG/BG-0 Unless wildfire	2055 Thin 1300 Underburn
% Visually Disturbed	% Negatively Affected Viewshed	0-Unless wildfire	Less 1%-Rd 1230 Temp realignment

3.4 - EFFECTS TO CULTURAL RESOURCES

Introduction
A comprehensive review of the history and prehistory of the project area was presented by Hess and Stump (1995) and will not be repeated here. McDaniel (2002) compiled the background research for the Burdoin Mountain portion of the project area. In summary, the Burdoin Mountain, Major Creek and Catherine Creek drainages show a long history of human occupation. While no documented Indian villages have been found within the project area there is evidence of extensive Indian use of the White Salmon River and Klickitat River drainages. Catherine and Major Creeks occur west of the Klickitat River and east of the White Salmon River. Talus rock feature site, 45KL327, is a complex rock feature site and is listed on the National Register of Historic Places. In addition, lithic debris and pictographs have also been recorded in previous surveys.

European-American settlement began in the nineteenth century. General Land Office (GLO) maps from the 1860-1870s show few structures, fields or roads within the project area. By the early twentieth century (1913) a significant number of land patents covered the project area. A review of the land patent records on the BLM website showed 38 different landowners had filed patents within the project area between 1883 and 1918. Seventy-six percent of the patents were filed in the nine years between 1904 and 1912. The earliest patents were filed in the southwest corner of the project area. The later patents occurred near the confluence of Major Creek and the Columbia River. Logging of the Catherine Creek and Major Creek drainages occurred throughout the first half of the twentieth century.

Analysis Methods and Measurements
The entire area of potential effect (APE) includes 4,177-acres of national forest lands in Klickitat County. Over the past 14-years several cultural resource surveys have been conducted within the area of potential effect for this project. In the mid-1990s a large cultural resource survey was conducted under contract by Hess and Stump (1995). They surveyed nearly 2700-acres of lands north of Rowland Lake. Two-thousand thirty-one acres of those areas occur within the current APE. Also in 1994, 38-acres of the Bonneville Power Administration transmission line were surveyed through the current project area (Luttrell 1994). Three more surveys were conducted in the Burdoin Mountain vicinity in the early 2000s (McDaniel 2002, Dryden 2004 and Dryden 2005). The McDaniel survey covered 422 acres Dryden (2004) covered 125-acres, and Dryden (2005) covered 86-acres.

1994 Charles Luttrell, archaeologist for Archaeological and Historical Services Eastern Washington University surveyed along the Ross-Franklin power transmission line in the southern portion of the project area (Luttrell 1994). The survey project was confined to 125-foot-400-foot corridor following the transmission rights-of-way. Transects were 30-meters apart. Area specific topographic maps of the survey area were not included in the final report so I was not able to determine the exact width of the area surveyed. The conservative corridor width of 125-feet (38-meters) has been arbitrarily attributed to this section of the 29-mile long survey that was conducted. No less than 38-acres were surveyed within the current project area. One historic habitation site was recorded along this section of the power transmission line.

1995 Sean Hess and Sheila Stump, archaeologists for Boas, Inc., surveyed 2653-acres for the Columbia River Gorge National Scenic Area and recorded 35 sites (Hess and Stump 1995) during the spring of 1994. Most of that survey (2,032-acres) falls within the Catherine Forest Restoration Project. While the inventory report and site forms were sent to the State Historic Preservation Office, the area surveyed map was not submitted using 7.5-min. topographic maps and the surveyed areas do not appear on the electronic Department of Archaeology and Historic Preservation (DAHP) GIS survey database.

Many of the sites recorded by Hess and Stump were assigned Smithsonian Trinomial numbers in 1997. Later, in 2002, there was a mix-up and two of the sites were given additional trinomial numbers. Site 45KL648 was also assigned 45KL882 and 45KL649 was also assigned 45KL887. Subsequent to the Hess and Stump survey, two additional pictograph sites were discovered by Michael Boynton and by Rich Davis (ranger at Horsethief Lake State Park) in 1996 (45KL658 and 45KL657)

2002 Sarah McDaniel, archaeologist for the Gifford Pinchot National Forest, conducted a cultural resource survey of 386-acres for the Burdoin Mountain Fuel Treatment Project (McDaniel 2002). Five cultural resources sites were observed. The areas surveyed by McDaniel appear on the GIS survey database.

2004 Charlene Schmid, archaeological technician for the Columbia River Gorge National Scenic Area, conducted a cultural resource survey of 165-acres for the Catherine Creek – Allen Tract Small Fir Removal and Prescribed Burn Project (Dryden 2004). One new cultural resource site and one isolated find were observed. The areas surveyed for this project appear on the DAHP GIS survey database.

2005 Eric Gleason and Jacqueline Cheung, consulting archaeologists, conducted a cultural resource survey of 100-acres for the Burdoin II Vegetation Management Project (Dryden 2005). No new cultural resource sites were observed. The areas surveyed for this project appear on the DAHP GIS survey database.

All five surveys were composed of linear transects averaging 30-meters or less in width and followed acceptable survey standards. The areas surveyed within this proposed project area were examined for evidence of surface and subsurface cultural artifacts. Visibility was variable, but generally poor and hampered by poison oak and vegetation thickets. Lineal transects were augmented by examination of areas of exposed mineral soil. Exposures were found where there was thin vegetation, native surface road beds, cut banks and rodent burrows.

In assessing the needs of the Catherine Forest Restoration Project, the probability map (Boynton 2002) was consulted. The project area encompasses 4177 acres. Of that 741 acres (18%) is high probability and 3,436-acres (82%) are low probability. The areas that had been previously surveyed were compared to the probability map to assess the distribution of the areas that had been covered.

One-hundred-seventy-four (174) acres (7% of the surveyed areas) were surveyed on more than one occasion between 1994 and 2005 with the following distribution:

Twelve-acres of low probability and 16-acres of high probability were surveyed by Lutrell and Hess and Stump in 1994.
McDaniel (2002) resurveyed 126-acres of Hess.
The 2005 (Dryden) resurveyed 20-acres of Hess.

Five of Boynton's high probability zones are present within the Catherine project area. "Surface sites within the H1 classification east of Hood River are normally defined by the presence of structural features, including but not limited to dwelling remains, occupational deposit (midden), ground and flaked stone tools, fire-cracked rock, bone and shell, burials, cairns, and petroglyphs/pictographs.

"Sites within the H2 classification, which are anticipated on benches on slopes in excess of 30 percent, tend to include secondary residential, primary seasonal, specific-task, burial and cairn sites. The presence of a nearby stream or spring will tend to weight the use of the area towards complexity.

"H4 classifications include the distinctive physiographic features of ridge crests, intersects, and saddles. ..Interestingly, prehistoric and historic activities within the H4 designation tend to be similar. They are associated with transportation (trails, roads), temporary occupation sites, and resource procurement and processing.

"H6 designated areas are the summits of peaks, bluffs, and hill tops. Prehistoric resource expectations for this zone include cairns and spirit quest sites. Historic uses include Indian and non-Indian cemeteries and burials, cremation disposals, lookouts, recreation/trail destinations, and monumented survey points.

"H7 areas consist of talus slopes, cobble and boulder fields, and the margins of these areas. …Prehistoric sites that will be encountered within talus slopes will consist of spirit quest features (cairns, pits, walls, sinuous features, single rock stacks) within the slopes. (Boynton 2002:64-67)."

Just over 221-acres of high and approximately 51-acres of low probability areas were selected for coverage. Seven acres of high probability and five acres of low probability that had previously been surveyed by Hess and Stump were resurveyed in 2006. Ten acres of high probability that had been surveyed in 2004 (Dryden) was also resurveyed. Of the 272-acres selected for survey, 22-acres were resurveyed acres and 250-acres were to be new acres surveyed. Twelve of those acres were not accessible and a final total of 238-acres of new acres surveyed were accomplished.

Michael Dryden, archaeologist for the Mt. Hood National Forest and Margaret Dryden, Heritage Program Manager for the National Scenic Area, conducted the cultural resource survey of 260-acres for the Catherine Forest Restoration Project. Eight new historic cultural resources sites and one prehistoric lithic isolated find were documented.

Existing Conditions
The project area has a large number of archaeological resources. Reconnaissance surveys conducted from 1994-2006 have located 36 historic properties within the area of potential effect. Eighteen of the sites have been evaluated for eligibility to the National Register of

Historic Places (NRHP). One prehistoric site is listed on the NRHP; six prehistoric sites and three historic sites have been found "eligible" to the NRHP, but are not listed; and five historic sites and four prehistoric sites have been evaluated as "not eligible" to the NRHP. The remaining 17 sites, 11 historic and five prehistoric, remain unevaluated.

All sites that are listed, eligible or unevaluated must be protected from the adverse effects of the project proposal. Many of these properties include artifacts that are combustible such as wood or that could be damaged by fire such as glass, leather, and some metals.

Regulatory Framework
Gifford Pinchot National Forest LRMP Forest-wide standards and guidelines and the Columbia River Gorge National Scenic Area Management Plan

NSA policy for cultural resources in the special management area (SMA) is:

- New developments or land uses shall not adversely affect significant cultural resources;
- NSA guidelines for cultural resources in the special management area (SMA) are:
- Professional expertise is required to conduct cultural resources surveys, evaluations, assessments and mitigation plans
- Federal undertaking shall complete consultation responsibilities under Section 106 of the Historic Preservation Act of 1966.
- A "new discovery" shall require immediate notification of the Forest service if cultural resources are discovered during construction. Specific notification requirements are triggered if human bone or burials are discovered.
- The following steps must be followed in assessing potential effects to cultural resources:
    - Literature Review and Consultation
    - Field Inventory
    - Evaluation of Significance
    - Assessment of Effect
    - Mitigation

Environmental Consequences
DIRECT AND INDIRECT EFFECTS ALTERNATIVE 1-NO ACTION

This alternative proposes no fuel treatment. Effects related to cultural resources are described below.

The No-Action alternative (without the foreseeable event of a catastrophic fire) would have the least risk of adverse effect on cultural resources because disturbance or any other adverse effect would be lower if there were no activity in the area.

The No-Action alternative (with the foreseeable event of a catastrophic fire) would have a greater risk of adverse effects on cultural resources because of disturbance of the fire and fire suppression actions.

Uncontrolled fires and suppression of wildfires have the potential to adversely affect cultural resources. Sites that have combustible artifacts and features, such as milled lumber or log walls can be damaged by fire. Suppression of wildfires can necessitate the use of equipment

such as shovels, fire hoses, retardant drops, water bucket drops from helicopters, and mechanically constructed firelines. The construction of dozer fire breaks has the potential to adversely affect historic structure remains, such as cabins and logging camps and to cause subsurface disturbance of archaeological sites. Some sites may not be damaged by wild fires but are still susceptible to the adverse effects cause by suppression actions. It is unlikely that even a catastrophic wildfire would have adverse effects to all cultural resource sites within the project area because of natural and man-made fire breaks which will protect an unknown number of sites.

DIRECT AND INDIRECT EFFECTS ALTERNATIVE 2-PROPOSED ACTION

This alternative proposes to treat vegetation to begin to restore this area to pre-fire exclusion conditions and discourage fire from spreading throughout the area. Treatments would vary depending on the existing vegetative conditions. In total, approximately 3,810 acres are proposed for some type of treatment. A detailed description of the location and type of treatments can be found in Chapter 2 of this document.

Thirty-five cultural resource sites have been identified within the project area. None of the sites are known to extend off of forest service lands.

Individual Indicator Table	**Effects of the Actions** **Alternative 1-No Action** **Potential wildfire and suppression actions.**			**Effects of the Actions** **Alternative 2** **Thinning and prescribed burning**		
INDICATORS	Avoid	Potential Adverse Effect	Effect but Not Adverse	Avoid	Adverse Effect	Effect but Not Adverse
Sites Listed on National Register of Historic Places	0	0-1	0	1	0	
Sites Eligible to the National Register of Historic Places	0	0-9	0	9	0	Burn over some sites
Sites that may be found Eligible to the National Register of Historic Places	0	0-17	0	17	0	
Sites that are not eligible to the National Register of Historic Places	0	0	0-9	0	0	9

Significant cultural resources sites may not be adversely affected by actions proposed in Alternative 2. The preceding table shows that 35 sites have been documented within the

project area. Of those sites, nine have been evaluated as "not significant" and require no protection or mitigation measures. Under alternatives 1 and 2, there may be effects to these nine sites, but that effect will not be adverse because the sites are not considered significant.

Ten sites have been evaluated as significant and one of them is listed on the National Register of Historic Places (NRHP). Sixteen sites have not yet been evaluated but are being treated as if they are eligible to the NRHP.

Adverse effects could be caused by the following proposed actions:
Thinning (falling trees)- trees could fall on some sites and damage features. Rock walls could be knocked down, wood walls could be knocked down or broken, soil could be exposed by yarding and piling trees.
Fireline Construction: mechanically constructed firelines will naturally expose mineral soil. Archaeological sites can be damaged by ground disturbance. Features and structures can be damaged by being knocked down or crushed by the machinery
Burning: Artifacts and features made of combustible materials such as wood can be damaged or destroyed by fire. Fire can also damage non-combustible items such as glass, ceramics, porcelain and some kinds of metals. Burning can release smoke and radiant heat that could damage pictographs.
Access: Road improvements, repairs, helicopter landing areas etc.

Mitigation Measures:
Of the 35 sites, no mitigation measures are necessary for the nine sites that are not significant and have been found to be "not eligible" to the NRHP. Five other sites, that have been found to be significant will be protected from ground disturbing actions through project design. Burning will be allowed over these sites as there are no artifacts or features which would be damaged by the prescribed burn. The remaining 19 sites will be protected from thinning, fireline construction, prescribed burning and access improvements through project design. There will be no effects to these sites.

To ensure that no **historic properties are affected by the undertaking (36 CFR 800.4 (d)(1)),** the following mitigation measures are required:

- Burning, fire line construction, machine piling of slash and in some cases, hand piling of slash, will be restricted within the boundaries of eligible heritage resource sites as per the implementation requirements specified for cultural resources specified in Chapter 2.
- Mitigation measures detailed above and outlined in (Dryden 2007) will be followed.
- If any additional cultural resources are discovered during the implementation of this project, the Forest Service shall immediately notify the State Historic Preservation Office and the appropriate tribal governments as per the implementation requirements previously mentioned.

Indirect, Long-Term and Cumulative Effects of Alternative 1-No Action
The indirect, long-term and cumulative effects of Alternative 1 are the same as the direct and indirect effects.
Indirect, Long-Term and Cumulative Effects of Alternative 2
Since there would be no effects to cultural resources under Alternative 2 and for other projects under the regulations in the Management Plan, there would be no cumulative effects as summarized below:

Project	Potential Effects	Overlap in		Measurable Cumulative Effect?	Extent, Detectable?
		Time	Space		
Burdoin 1 Allen property thins	Ground disturbance of archeological sites and Burning of combustible artifacts and or features	No	Yes	No	Project is completed. No damage to buried archaeological sites or combustible artifacts and or features occurred because of implemented mitigation measures.
Burdoin 2 Thin	Ground disturbance of archeological sites Burning of combustible artifacts and or features	Yes	Yes	Yes	There may be an overlap in timing of this project with Catherine Forest Restoration project. Mitigation measures will protect sites from adverse effects.
Other Developments on Private and non-Forest Service public lands	Ground disturbance of archeological sites Burning of combustible artifacts and or features	Yes	No	Yes	Other projects on non-forest service lands may occur at the same time as the Catherine Forest Restoration project; however, Gorge Commission reviews and conditions will prevent adverse effects to significant archaeological sites. There is no indication that any known sites in the Catherine Project area extend onto non-forest service lands.

Finding of Effect
Application of criteria of effects [36 CFR 800.5 (A)(1)] suggest that the proposed undertaking would result in a finding of "**No adverse effect**" per 36 CFR 800.5(b) . The undertakings effects do not meet the criteria of adverse effect (36CFR800-5(a)(1). The State Historic Preservation Officer and consulting Tribes had 30-days to review the findings. Concurrence from the State Historic Preservation officer was received on April 9, 2007.

3.5 - EFFECTS TO NATURAL RESOURCES

SOIL AND WATER RESOURCES

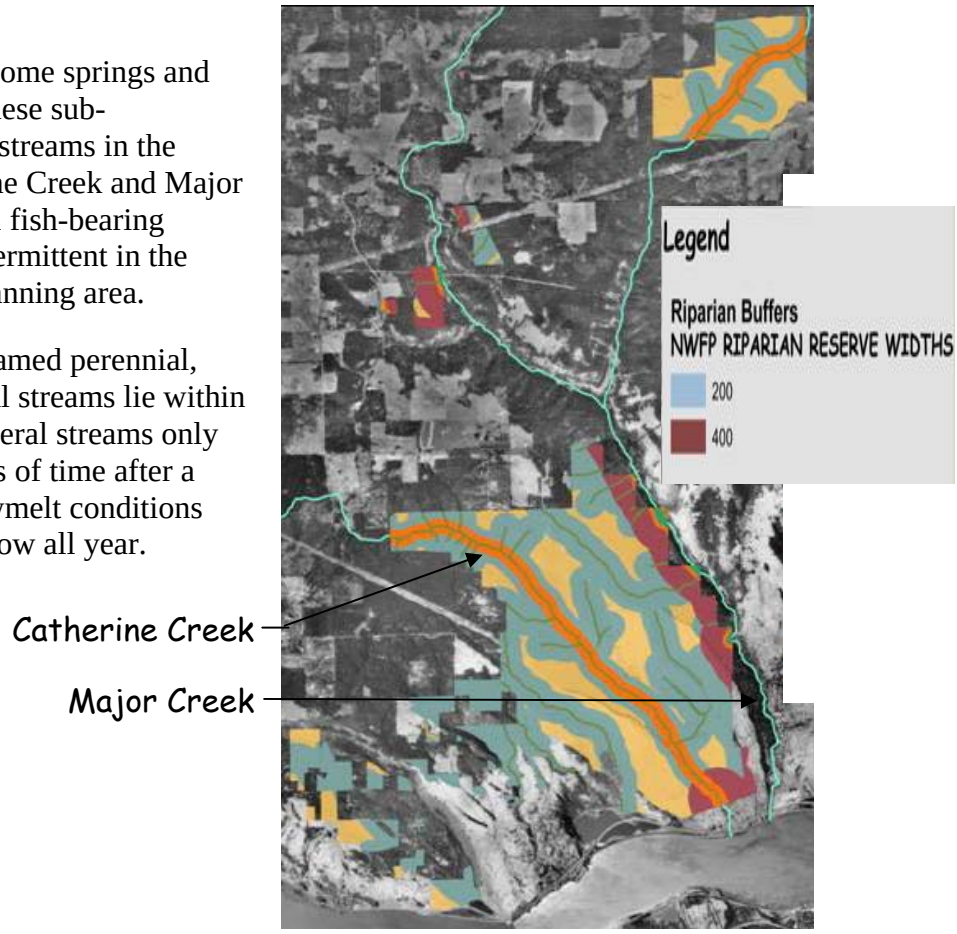
Introduction
The following analysis will describe existing conditions related to the soil and water resources in the Catherine Forest Restoration area. Direct, indirect and cumulative effects will be displayed for soil and water resources, if the project does not go forward (no action) and if the project does go forward.

Analysis Methods and Measurements
The amount of soil disturbance from the project as well as the amount of disturbance in the general area of surface water will be used as measurements for potential erosion and sedimentation. This will be analyzed in the context of proposed mitigation measure to determine the overall potential direct, indirect and cumulative effects from this project.

Existing Conditions
The Catherine Forest Restoration area is located within portions of two 6th field sub-watersheds; Major Creek (31.4 square miles in area) and Rowena Creek (50.5 square miles in area). The planning area is in a portion of the Middle Columbia/Grays Creek 5th field watershed.

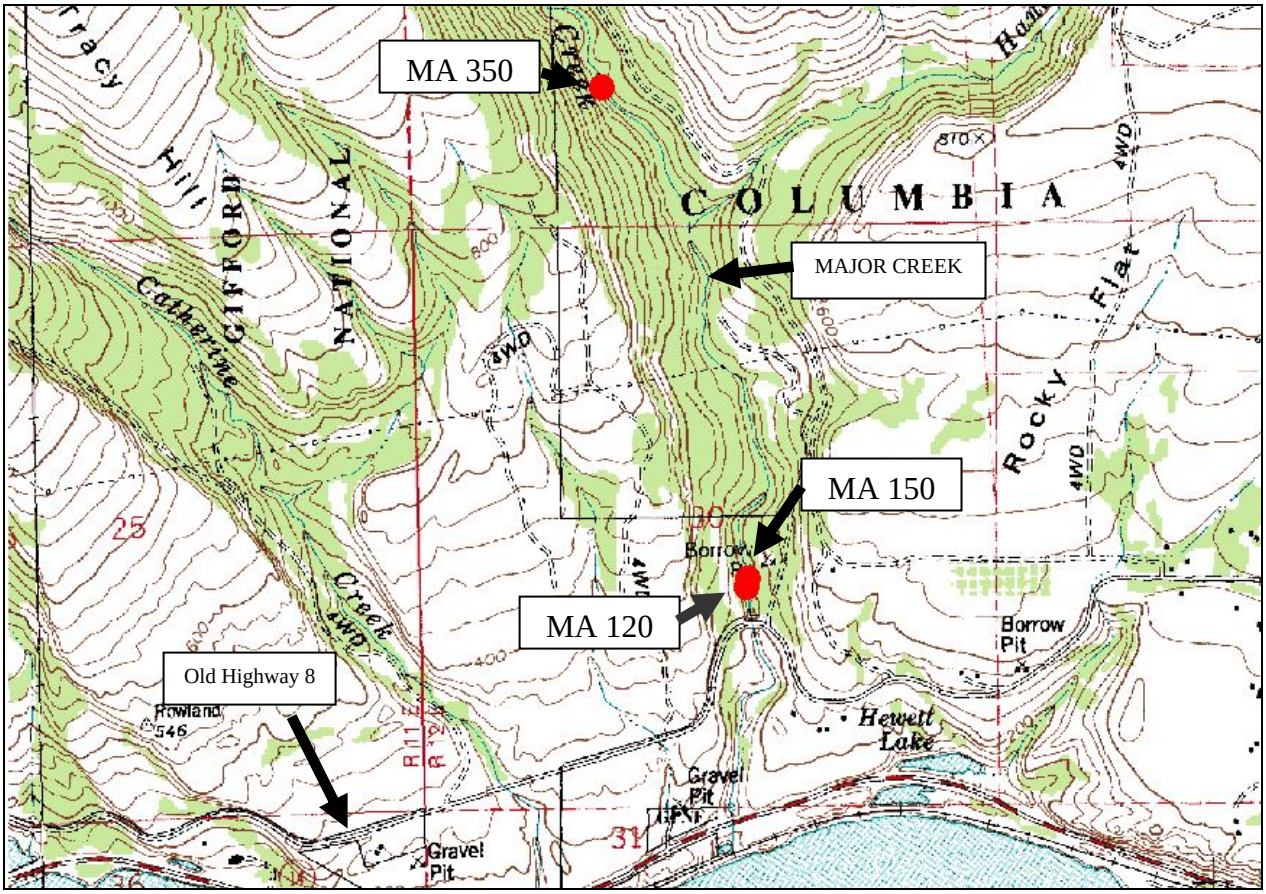
There are many streams, some springs and wetlands located within these sub-watersheds. The primary streams in the planning area are Catherine Creek and Major Creek. Both are perennial fish-bearing streams that change to intermittent in the northern portion of the planning area.

Several other smaller unnamed perennial, intermittent and ephemeral streams lie within the planning area. Ephemeral streams only run water for short periods of time after a storm or during high snowmelt conditions while perennial streams flow all year.



Water Quality

Stream Temperature – Major Creek is the only stream in the planning area where water temperature data has been collected by the Forest Service. Data has been collected on continuous temperature recording dataloggers in three locations on Major Creek (see figure below).



Water temperature monitoring sites on Major Creek. The three sites are labeled MA 120, MA 150 and MA 350.

The highest 7-day average maximum stream temperatures for the years deployed ranged as follows:

Stream	2000	2001	2002	2003	2004	2005	2006
Major Creek Site 120	25.5°C	24.6	ND	23.5	24.2	22.7	23.8
Major Creek Site 150	ND	ND	24.5	ND	ND	ND	ND
Major Creek Site 350	ND	ND	ND	22.4	22.8	21.7	ND

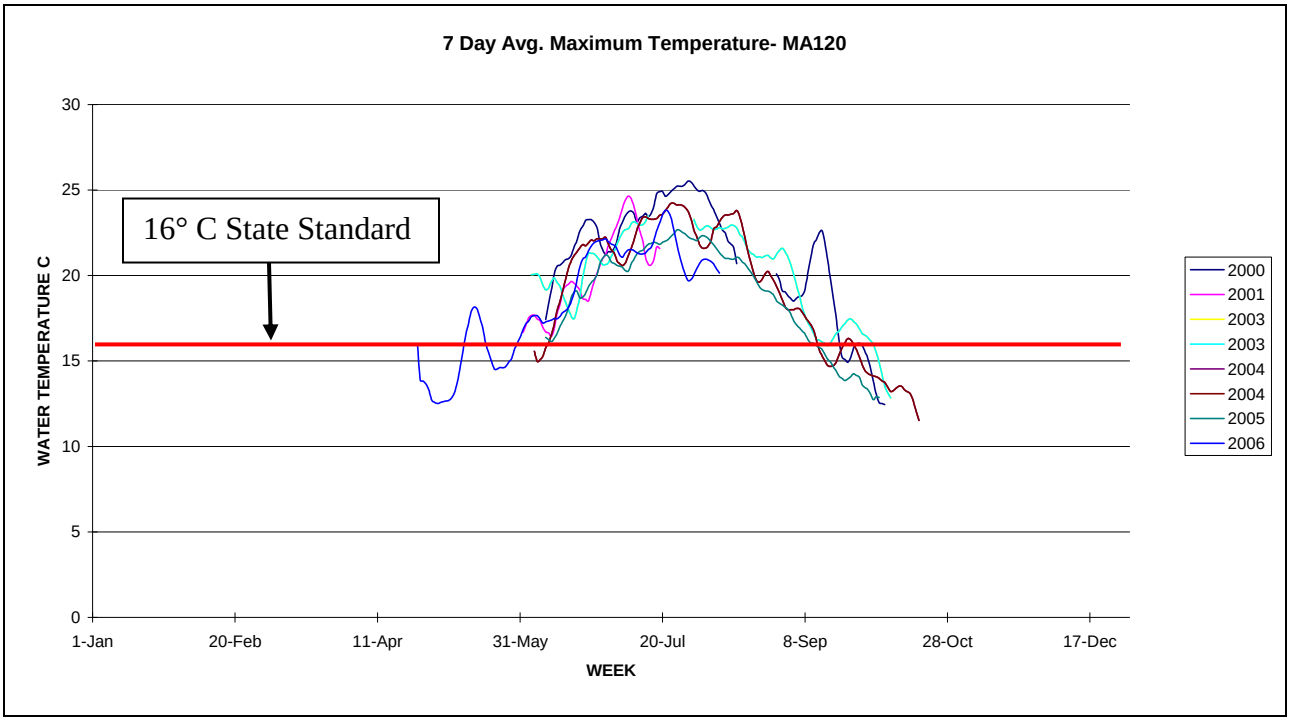
ND = Not Deployed for that Year

Major Creek is listed on the 2004 State of Washington 303(d) list of impaired water bodies. New State Water Quality Standards were adopted on December 21, 2006 which includes new water temperature standards. The new standards identified for Catherine Creek, Major Creek and all of their tributaries are for core summer salmonid habitat temperatures that are not to exceed a 7-day average maximum of 16° C. The table below shows the number of days the 7-day average maximum temperature standard was exceeded for each year that the dataloggers were deployed. The equipment is usually deployed between 120 and 140 days each year.

Stream	2000	2001	2002	2003	2004	2005	2006
Major Creek Site 120	92 days	49	ND	104	98	95	80
Major Creek Site 150	ND	ND	108	ND	ND	ND	ND
Major Creek Site 350	ND	ND	ND	68	99	76	ND

ND = Not Deployed for that Year

The graph below shows the 7-day average maximum stream temperature for all of the years of deployment at site MA120. The y-axis is the temperature and the x-axis is the date. The main finding is that this station consistently exceeds the new temperature standard of 16° C.



Graph showing the 7-day average maximum stream temperatures for monitoring site MA120. Each line represents a separate deployment year. The 16° C standard is routinely exceeded as shown by the amount of time that the lines are above the red line that represents the standard.

High stream temperatures are due primarily to low summer flow conditions and high air temperatures, but stream shading is also a concern in some areas.

Sediment –The main stem and East and West forks of Major Creek were surveyed in 1994 and 2001. The surveys include information on riparian area, stream channel and fish habitat conditions. According to the stream surveys, Major Creek lacks gravel and smaller sediment sized material in the channel. It also lacks large woody material in channel. This is due to the geomorphology of the basin; specifically most of the stream is a confined bedrock channel that traditionally has flashy flows that tend to move smaller substrate out very quickly. This problem is compounded by the lack of channel complexity (LWD) that would provide velocity breaks to retain this smaller substrate component. The only source of finer substrate material identified in stream surveys is the upper reaches of E. Fork. Major Creek. This area has unstable streambanks that are providing finer substrate and wood to the Major Creek system.

Road density (miles of road per square mile of basin) can be used as a general indicator of potential problems associated with roads. One of those problems is introduction of coarse and fine sediment into area surface water. Road densities within a sub-watershed that exceed 3.0 miles per square mile indicate areas that should be examined more closely for specific sediment related problems, although it is possible to have isolated areas of road instability even in areas of low road density. This value is based on several years of observations by local Forest Service hydrologists, fish biologists, and earth scientists. Road density for Major Creek 6th field sub-watershed is 1.6 mi/mi^2 and Rowena Creek 6th field sub-watershed is 4.6 mi/mi^2. These figures represent a number of different road types and surfaces that range from State Highway 14 to native surfaced 4-wheel drive roads. Some erosion was noted during field visits, along native surface roads on non-National Forest land and in ditch-lines along some of the major roads. This erosion appeared to be isolated in ditchlines predominately related to a lack of relief culverts.

The new State of Washington turbidity standards for core summer salmonid habitat state that turbidity shall not exceed 5 Nephlometric Turbidity Units (NTU) over background when background is 50 NTU or less. This applies to Catherine Creek, Major Creek and all of their tributaries. We currently don't have any turbidity measurements for streams in this area.

Soils and Geology

The planning area lies on the south dipping limb of a large syncline that has formed in Columbia River basalt flows. The axis of the syncline trends east west with the Columbia River flowing west along this axis. These basalt flows tend to be fairly competent and no areas of mass wasting were noted within the planning area. Considerable rock-fall occurs along the Major Creek canyon and a large "apron" of talus can be found along the length of the wall.

The productivity and health of entire plant communities depend on the maintenance of healthy soils. Regional soil productivity protection standards were originally implemented in 1976, and have been revised several times since then (Pacific Northwest Region Monitoring and Evaluation Report, 2001). Soils in the Catherine Creek planning area are generally thin, ranging from 0" to 60" in depth. They range from silty clay

loams on the flat grass covered benches to loams to gravelly loams on the steeper, tree covered areas (greater than 3% slope). Numerous areas of basalt outcrop are found throughout the planning area mostly associated with canyon areas. Clasts within the soil range from a few inches in size to approximately 2 feet and are unsorted. Some localized thin clay layers were noted during field reconnaissance in this area.

Regulatory Framework

Numerous existing plans provide guidance for projects in the form of Standards and Guidelines (S & G) and recommended Best Management Practices (BMP). These documents include the Columbia River Gorge National Scenic Area Management Plan (LRMP), the Northwest Forest Plan (NWFP) and associated supporting documents. A summary of applicable water quality S&G's and BMP's from these documents are displayed below.

Gifford Pinchot NF Forest Plan/Northwest Forest Plan (NWFP) Standards and Guidelines:

- Standards and Guidelines dealing with Fire/Fuels Management – FM-1, 4 10% of the activity areas burned at a severe intensity.
- Standards and Guidelines dealing with Riparian Reserves (NWFP ROD pg. C-31 through C-38). The primary S&G's that pertain to this project are Fire/Fuels Management – FM-1, 4.
- The Gifford Pinchot Land and Resource Management Plan requires that prescribed burning activities result in less than 10% of the activity areas burned at a severe intensity.

Columbia River Gorge National Scenic Area Management Plan (LRMP)

SMA Guidelines:

- Water Resources A1,2,6
- Soil Productivity A1,2,3,4
- Practicable Alternatives Test
- Mitigation Plan

Other Pertinent Guidance:

In addition to the plans discussed above other documents such as USFS "General Water Quality Best Management Practices" provide guidance about potential BMP's for this project. Those BMP's will be incorporated where appropriate.

Environmental Consequences

DIRECT AND INDIRECT EFFECTS ALTERNATIVE 1-NO ACTION

This alternative proposes no thinning or prescribed underburn treatments. Effects related to water quality are described below.

Water Quality

Stream Temperature – Stream temperatures would remain at current levels in the watershed due to no reduction in streamside shading. Primary shade zones (areas of riparian vegetation directly adjacent to streams) along perennial streams would continue to fill in with

understory vegetation. Since these areas are already densely vegetated, it is not anticipated that this component will reduce stream temperatures any great degree within the project area.
These densely vegetated areas are more susceptible to high severity burns due to excess fuel loading from fire exclusion. In the event a wildfire burned in this watershed, riparian areas have the potential to burn hot in areas that have high fuel loading. Recent research by Tollefson and others (2004) on 33 burned watersheds in the central, western Cascades of Oregon indicates that fire severity in intense events may be similar between intermittent stream channels and adjacent upland areas. It had been thought that the riparian areas may burn with a lower severity due to the presence water and other fire resistant features. Research on the effects of wildfire on stream temperature is limited, but there is quite a bit of research on burning after clearcut logging. In the central Oregon Cascades, clearcut harvesting along a stream increased summertime maximum stream temperatures by 4° F. This same area was burned the following year and stream temperatures increased 14° F when compared to an undisturbed forest watershed (Levno and Rothacher 1969). In the central Oregon Coast Range, clearcut harvesting along a stream increased maximum stream temperatures by 17° F; after a hot slash burn, an additional increase of 10° F was measured the following summer (Brown 1972). The above mentioned studies indicate that riparian vegetation can experience a high severity burn that has the potential to increase water temperature.

Erosion and Sediment – Erosion and sediment delivery to streams in the project area are expected to remain at current levels. Vegetation that impedes erosion and sediment delivery will be maintained. In the event a wildfire burned in these watersheds, areas that have high fuel loading have the potential to experience high severity burns. These areas have the potential to have high sediment input to adjacent surface water through increased landsliding and surface erosion, increased stream channel and bank erosion from increased runoff and sediment bulking from ash deposits. Sediment yields for the Wilson River watershed in Oregon were 252 tons per square mile per year or 5.7 times higher than for a comparable unburned watershed, after the 1933 Tillamook Fire. The number of days that the river experienced very high turbidity (sediment concentrations greater than 27 mg. per liter) increased from 18 to 102 days per year (Anderson 1976). It is not known to what extent salvage operations in the burned area contributed to this sediment increase. Increased sediment yields were found after a wildfire burned three relatively steep watersheds (average slopes of 50%) in the central Washington Cascades (Helvey 1980, Helvey et. al. 1985). An increased susceptibility to debris torrents was noted following the fire and was an important factor in causing increased sediment yields.

While much of the sediment increase can occur within the first year after the fire (Agee 1993, Debano et. al. 1998), it may take many years for sediment levels to reach pre-fire levels depending on fire severity. DeBano et al. (1996) demonstrated that following a wildfire in ponderosa pine, sediment yields from a low severity fire recovered to normal levels after three years, but moderate and severely burned watersheds took 7 and 14 years, respectively. Robichaud and Brown (1999) reported first year erosion rates after a wildfire from 9 to 22 tons per acre decreasing by one to two orders of magnitude by the second year and to no sediment by the fourth in an unmanaged forest stand in eastern Oregon. Erosion rate reduction was due to recovery of natural vegetation. First year growing season shrubs, forbs and grasses accounted for 28 percent of the total ground cover whereas after the

second growing season, total ground cover was 82 percent. In the event of a high severity burn, area surface water could be severely impaired due to high turbidity levels. It may take many years (5 – 10) for turbidity levels to decrease to background levels.

Soil Productivity
Soil productivity is expected to continue to change at current rates under this alternative. Similar to erosion risk described above, the expected effect is that the soils at landscape and site scales will respond and change proportionate to the severity of natural events such as storms or wildfire. If a wildfire does burn through this area, the risk of decreased soil productivity through increased erosion and nitrogen, sulfur and phosphorus reductions are possible. The amount of productivity loss is related to the burn severity of the wildfire.

In summary, stream temperature, erosion, sedimentation and soil productivity are not expected to appreciably change in the project area. Current riparian and upland areas are overstocked with shrubs and small trees due primarily to fire exclusion creating ample stream shading. If a large wildfire does occur in this project area, it will likely lead to seriously impaired water quality and soil productivity conditions for quite some time. The overstocked riparian and upland areas will encourage higher intensity fires due to high fuel loading that could lead to higher burn severities. As described above, these high severity burn areas have the potential for high erosion, turbidity, increased stream temperatures and loss of soil productivity.

DIRECT AND INDIRECT EFFECTS ALTERNATIVE 2-PROPOSED ACTION

This alternative proposes to treat vegetation to begin to restore this area to pre-fire exclusion conditions and discourage fire from spreading throughout the area. Treatments would vary depending on the existing vegetative conditions. In total, approximately 3810 acres are proposed for some type of treatment. A detailed description of the location and type of treatments can be found in Chapter 2 of this document.

Water Quality
Stream Temperature – This alternative proposes to thin vegetation within Riparian Reserves. Vegetation removal has the potential of increasing solar radiation to surface water which in turn may increase water temperature. The following analysis will utilize tools contained within the "Sufficiency Analysis for Stream Temperature" (2004) document to identify necessary shade so that stream temperatures within treatment areas will not increase as a result of the proposed vegetation treatments. The previously mentioned document is the result of work between the USFS, BLM and State of Oregon DEQ and identifies how to maintain sufficient stream shading while providing the opportunity to treat Riparian Reserve vegetation to improve stand condition. While this project is located in Washington State, the concepts presented in the Sufficiency Analysis document are still applicable for this area. Vegetation treatments in the Catherine Forest Restoration project will have the benefit of minimizing negative effects that may result from a catastrophic wildfire.

The concept of the sufficiency analysis is to maintain a primary shade zone next to the stream and identify a secondary shade zone that can be treated to reach Riparian Reserve Objectives. In order to maintain sufficient shade next to the stream, the primary shade zone

is untreated. The size of this zone is dependant on the current height of the trees and the hill slope. This relationship is shown in the table below.

Height of Tree	Hill slope <30%	Hill slope 30% – 60%	Hill slope >60%
Trees < 20 feet	12 feet	14 feet	15 feet
Trees 20 to 60 feet	28 feet	33 feet	55 feet
Trees > 60 feet	50 feet	55 feet	60 feet

As an example, if the height of trees in the riparian area are predominately <20' tall, the primary shade zone would be 14 feet wide for an area that had 30% to 60% hill slopes next to the stream. Based on field observations in proposed treatment units, most of the hill slopes are between 30% and 60% and existing tree heights range from <20' to 60'+. The majority of riparian area treatments would thin vegetation that would be <60' tall but some trees will be greater than 60'. This translates into a primary shade zone of 33' for most of the project area but some areas will have a primary shade zone of 50' to 55'. Mitigation measures call for a 50' wide untreated area to be left next to all perennial steams in the project area to maintain current shading and stream temperatures.

In addition, vegetation treatments within the secondary shade zone (55' to 100' from the stream), will result in a canopy closure reduction of <50% which will provide consistency with the Sufficiency Analysis. Due to project design that meets and exceeds the Sufficiency Analysis, there should be no increase in stream temperature resulting from implementation of this project.

Erosion and Sediment – Some ground disturbing activities in this alternative have the potential to dislodge soil particles which in turn may increase erosion and sedimentation to surrounding surface water. These features include new temporary roads, landings, skid roads and trails, yarding corridors, burn piles, underburning areas and areas of road maintenance and repair. In general, disturbed areas close to surface water have a greater potential to deliver eroded soil to streams. A GIS analysis indicates the following acres of Riparian Reserve will have ground based equipment out of a total of 1097 treated:

Acres Treated in Riparian Reserves	
Tractor	57
Hand	1040
Max to Contain burn piles <10% high intensity	109

Ground based (skidder, tractor) harvest has a greater potential for erosion and sedimentation due to the amount of ground disturbance (soil compaction and displacement) associated with this type of activity. Since ground based logging equipment will not be allowed within 100 feet of streams, this kind of activity will occur in the outer portion of the Riparian Reserve. In addition to harvest activities, some fireline construction has the potential to expose soil to erosion. A total of approximately 56 miles of fireline is proposed in this alternative of which roughly 37 miles will involve new ground disturbance. Ground disturbance is associated with hand and machine fireline construction.

The table below displays an estimate of the number of fireline miles by fireline type.

Type of Fireline	Total Miles of Fireline	Miles of Fireline in Riparian Reserve
Hand Line	25.7	10.9
Machine Line	11.5	0
Wet Line	11.8	2.0
Existing Road	7.1	1.8
Total	56.1	14.7

The ability of BMPs to reduce erosion and sediment delivery is documented in a number of studies. Rashin et. al. (2006) found that stream buffers were effective at preventing chronic sediment delivery to streams. "Stream buffer practices were most effective where timber falling and yarding activities were kept at least 10m from streams…" They found that the overall effectiveness of streamside buffers was diminished by crossing buffers with skid trails and cable yarding routes. Other studies also support the effectiveness of mitigating sediment delivery by maintaining a buffered area adjacent to surface water. Burroughs and King (1989) found that 80% of sediment reaching streams from roads in the first year after construction came from the fill slope of the road. They also found that transport distances and obstructions between the fill slopes and streams influenced the amount and likelihood of eroded material reaching these streams. Burroughs and King found that windrowed fill slopes, which would act very similar to unharvested Riparian Reserves in that there would be obstructions to flow, had an average travel distance of 3.8 feet for eroded material, and a maximum travel distance of 33 feet. Similar results were found by Packer (1967). He found that "the most important factors that affect the distance that sediment moves are the spacing between down slope obstructions and an interaction between this spacing and the kind of obstruction". He found that logs, rocks, and trees or stumps were the second, third, and fourth most effective materials in reducing sediment movement distances below roads. Travel distances were similar to those reported by Burroughs and King.

Mitigation that includes erosion control (e.g. erosion control blankets, straw wattles, waterbars etc.) will substantially reduce the amount of sediment reaching the streams from this work. Burroughs and King (1989) reported that measures such as erosion control blankets alone can reduce sediment production by 80 to 90 percent. This in conjunction with other measures such as minimizing the amount of ground disturbance and seeding these areas will further decrease the chance of short term direct and indirect sediment production.

Prescribed fire units are not expected to introduce additional sediment into surface water. A literature review by Beschta (1990) states that "Management practices that prevent the occurrence of hot slash burns and encourage rapid revegetation will help minimize potential increases in fire-related sedimentation from upslope sources". Relatively "cool" burns" (such as the prescribed fire units in this project) "should have little impact on erosion and sedimentation, regardless of general watershed slope."

Fuel treatment activities have the potential to increase surface erosion in the harvest units along temporary roads, landings, fireline, skid trails and yarding corridors. The amount of erosion is expected to be low and short lived due to mitigation measures such as ground based logging restrictions on ground over 30 percent side-slope, limiting the amount of soil disturbance to 15% of the area, and ripping, water barring and seeding disturbed areas. It is unlikely that a measurable amount of material will reach any perennial streams due to buffering by the Riparian Reserves and the other required mitigation measures such as ripping skid trails and water barring skid trails and firelines.

Soil Productivity

Detrimental soil conditions such as compaction and intense burning have the potential to alter water movement through the soil and reduce site productivity. In addition, soil biology may be altered because of insufficient amounts of down woody material that provides carbon and nutrient cycles in the less frequent fire plant communities or the burning of large amounts of organic matter in more frequent fire plant communities. Poor soil biological systems may lead to difficulties in revegetation or decline in existing desirable vegetation. Soil biology is extremely difficult to evaluate because of the complex interactions between organisms and the soil habitats. It is assumed that soil biological systems will properly function given certain habitat components are present, such as non-compacted soils, appropriate levels of organic matter, and types of native vegetation under which the soil developed.

Management actions that change soil structure by displacement, compaction or burning or that removes ground cover are considered to result in a greater risk to soil productivity. These actions would include landing use, log skidding with ground based equipment, skyline yarding and corridors, temporary road use, fireline construction, underburning and pile burning. Other aspects of the proposed action would not have a measurable effect on soil productivity and will therefore not be analyzed.

Logging system patterns will be designed to ensure that less than 15% of the area will have ground disturbance. Since not all ground disturbance equates to detrimental soil condition it is not expected that any of the proposed treatment areas will exceed the Scenic Area standard.

Soils underlying skid trails nearest landings are most likely to incur detrimental damage because they receive the most trips with equipment. Further away from landings, soils are impacted less and less as fewer trips occur over them. Forest Plan monitoring conducted on the Mt. Hood National Forest supports this conclusion as there was a reduction of detrimental impacts noted as one moved away from landings. Observations during monitoring also indicate detrimental impacts on main skid trails and landings that receive numerous trips with higher impact machinery (such as skidders), with much less impact on lateral trails and within the unit where harvester equipment typically works. Mitigation measures that restrict the amount of disturbed ground and repair some of the soil damage through ripping and planting will result in minor amounts of soil damage.

Prescribed burning has the potential to reduce nutrients and soil productivity. Nitrogen, and to a lesser extent sulfur and phosphorus are the most common elements lost in a prescribed burn (McNabb et al 1990). If fuel consumption is controlled, losses of these nutrients are less in a prescribed burn than from a wildfire. There appears to be a relationship between the amount of forest floor consumed in a fire and the loss of nutrients. Except for areas underneath fuel piles, the nutrient loss from burning is expected to be low because of the low fire intensities expected. Sites where piles will be burned will likely burn hot enough to cause some soil damage. These areas will be rehabilitated with seeding of native herbaceous plants and bunch grasses and mulching to encourage revegetation.

Cumulative Effects

Water Quality

Stream Temperature – No detrimental cumulative effects are expected as a result of increased water temperature due to mitigation measures designed to maintain existing vegetation adjacent to streams. As described in the direct and indirect effects section, this project will maintain existing water temperatures.

Sediment - No detrimental cumulative effects are expected as a result of sediment introduction due to the small amount of sediment expected from this project. As described in the direct and indirect effects section, mitigation measures and project design features aimed at minimizing erosion and sedimentation reduce the potential of erosion and delivery of the material to adjacent surface water.

Soil Productivity
No detrimental cumulative effects are expected to soil productivity due to mitigation measures designed to maintain existing vegetation adjacent to streams. As described in the direct and indirect effects section, this project will minimize the loss of soil productivity.

Consistency with Direction (GPNF Plan and CRGNSA Management Plan)
As outlined in the effects section this project is consistent with applicable direction. Major highlights include:

- Not more than 15% of a treatment area will have detrimental soil damage.
- The inclusion of a Practicable Alternatives Test and Mitigation Plan.
- Establishment of buffers and Riparian Reserves.
- Designing prescriptions within Riparian Reserves to contribute to attainment of Aquatic Conservation Strategy Objectives.

Summary Cumulative Watershed Effects
The table below provides a qualitative summary of potential cumulative watershed effects. It shows existing and potential projects, effects from those projects that may result in cumulative effects with Catherine Forest Restoration project, whether these projects overlap in time and space and an assessment if a measurable cumulative effect is expected. Findings of this summary are supported by the analysis above which utilizes pertinent research, mitigation measures and design features and applicable management standards and guidelines:

Project	Potential Effects	Overlap in		Measurable Cumulative Effect?	Extent, Detectable?
		Time	Space		
Burdoin 1	Suspended Sediment	No	Yes	No	Project is completed. No remaining sediment, stream temperature and water quantity effects due to mitigation implementation and natural recovery.
	Stream Temperature	No	Yes	No	
	Soil Productivity	No	Yes	No	
Burdoin II	Suspended Sediment	Yes	Yes	No	There may be an overlap in timing of this project with Catherine Forest Restoration project; any minor suspended sediment would not be measurable due to implementation of mitigation measures aimed at minimizing erosion and sedimentation.
	Stream Temperature	Yes	Yes	No	The Catherine Forest Restoration project will maintain the primary shade zone so there should be no increase in stream temperature.
	Soil Productivity	Yes	Yes	No	There may be an overlap in timing of this project with Catherine Forest Restoration project; any minor loss of soil productivity would not be measurable due to implementation of mitigation measures aimed at reducing soil disturbance.
Other Private Tree Removal	Suspended Sediment	Yes	Yes	No	There may be an overlap in timing of this project with Catherine Forest Restoration project; any minor suspended sediment would not be measurable due to implementation of mitigation measures aimed at minimizing erosion and sedimentation.
	Stream Temperature	Yes	Yes	No	The Catherine Forest Restoration project will maintain the primary shade zone so there should be no increase in stream temperature.
	Soil Productivity	Yes	Yes	No	There may be an overlap in timing of this project with Catherine Forest Restoration project; any minor loss of soil productivity would not be measurable due to implementation of mitigation measures aimed at reducing soil disturbance.

Northwest Forest Plan Aquatic Conservation Strategy Objectives

In order for a project to proceed, "a decision maker must find that the proposed management activity is consistent with the Aquatic Conservation Strategy objectives" (ROD B-10). The nine objectives are listed on page B-11 of the ROD. The effects analysis above has focused on key parameters or indicators that make up elements of the nine Aquatic Conservation Strategy objectives, to determine if the project will restore,

maintain, or degrade these indicators. Once this determination is made, the indicators are be examined together to ascertain whether the project is consistent with the objectives. The following table displays the individual indicators and the effect the action alternatives have on those indicators at the 5th and 6th field watershed scale. Fifth field watersheds are generally large in size (40,000 acres to 250,000 acres), while 6th field watersheds are smaller (5,000 acres to 40,000 acres).

Individual Indicator Table	**Effects of the Actions** **Alternative 1-No Action**			**Effects of the Actions** **Alternative 2**		
INDICATORS	Restore[1]	Maintain[2]	Degrade[3]	Restore	Maintain	Degrade
Water Quality: Temperature		X			X	
Sediment		X			X	
Chem. Contam.		X			X	
Habitat Access: Physical Barriers		X			X	
Habitat Elements: Substrate		X			X	
Large Woody Debris		X			X	
Pool Frequency		X			X	
Pool Quality		X			X	
Off-channel Habitat		X			X	
Refugia		X			X	
Channel Cond. &Dynam: Width/Depth ratio		X			X	
Streambank Cond.		X			X	
Floodplain Connectivity		X			X	
Flow/Hydrology: Peak/base flows		X			X	
Drainage Network Increase		X			X	
Watershed Conditions: Riparian Reserves		X		X		

[1]"Restore" means the action(s) will result in acceleration of the recovery rate of that indicator.

[2]"Maintain" means that the function of an indicator does not change by implementing the action(s) or recovery will continue at its current rate.

[3]"Degrade" means to change the function of an indicator for the worse.

The following summarizes the Individual Indicator Table:

- The proposed project will treat vegetation in Riparian Reserves to restore them to a more natural vegetation state. This will result in more natural function of the riparian area.

- Indicators other than those described in the proceeding paragraph will be maintained as outlined in the effects analysis above.

- The following table displays specific Aquatic Conservation Strategy objectives and the indicators from the previous table that comprise each objective. All of the indicators that are checked for a particular objective should be evaluated together to determine whether the action maintains or enhances the specific Aquatic Conservation Strategy objective.

	Aquatic Conservation Strategy Objectives								
Indicators	**#1**	**#2**	**#3**	**#4**	**#5**	**#6**	**#7**	**#8**	**#9**
Temperature		X		X				X	X
Sediment				X	X	X		X	X
Chem. Contam.				X				X	X
Physical Barriers	X	X						X	X
Substrate			X		X	X			X
Large Woody Debris			X					X	X
Pool Frequency			X						X
Pool Quality			X						X
Off-Channel Habitat	X	X	X						X
Refugia	X	X						X	X
Width/Depth Ratio			X					X	X
Streambank Condition			X			X		X	X
Floodplain Connectivity	X	X	X				X	X	X
Peak/base Flows					X	X	X		
Drainage Network Increase					X	X	X		
Riparian Reserves	X	X	X	X	X	X		X	X

The following is a summary the Aquatic Conservation Strategy objectives (ROD B-10) and how the action alternative will influence them:

1. Maintain The Distribution, Diversity And Complexity Of Watershed And Landscape-Scale Features: This project will meet this objective because of the protection that the Riparian Reserves provide. No new road crossings of perennial streams or wetlands are proposed, which would maintain the current level of aquatic habitat fragmentation. Some temporary crossings of ephemeral and intermittent channels will be constructed and removed immediately after project completion. These crossings will not result in any long-term aquatic habitat fragmentation.

2. **Maintain Spatial And Temporal Connectivity Within And Between Watersheds:** The project will meet this objective because decommissioning the new temporary haul route will maintain the connectivity within and between watersheds by encouraging tree growth on roadbeds and re-establishing filtration of water through soil instead of down road surfaces.

3. **Maintain The Physical Integrity Of The Aquatic System, Including Streambanks, Side channels (Refugia), And Channel Bottom Configurations:** This project will meet this objective through the protection provided by Riparian Reserves. Mitigation measures aimed at reducing soil compaction and erosion, and the lack of any new crossings on perennial streams will greatly reduce risks of increased peak flow, and resulting bank erosion and channel bed scour. There are no temporary roads entering the Riparian Reserves.

4. **Maintain Water Quality Necessary To Support Healthy Ecosystems:** This project will meet this objective through protection provided by Riparian Reserves, which will maintain stream temperature. Mitigation measures aimed at reducing erosion will maintain the overall sediment levels in the long term.

5. **Maintain Sediment Regimes:** This project will meet this objective through mitigation measures, repair of some existing erosion areas and protection provided by Riparian Reserves.

6. Maintain In-Stream Flows That Are Closer To Natural Regimes: This project will meet this objective through mitigation measures, protection provided by Riparian Reserves. Loss of the vegetation may cause increased runoff locally in some situations, but these are not expected to result in damage to the aquatic system.

7. Maintain The Timing, Variability, And Duration Of Floodplain Inundation: This project will meet this objective through mitigation measures and protection provided by Riparian Reserves. Floodplains are extremely limited in this area due to the steep nature of the landscape.

8. Maintain The Species Composition And Structural Diversity Of Plant Communities In Riparian Areas And Wetlands This project will meet this objective through protection provided by Riparian Reserves. Treatments within the Riparian Reserves are aimed at producing a more natural vegetative composition and density. This has been lost through many decades of fire suppression.

9. Maintain And Restore Habitat To Support Well-Distributed Populations Of Native Plant And Riparian Dependent Species: The project will meet this objective with mitigation measures, protection provided by Riparian Reserves and vegetative treatments that are designed to simulate a more natural disturbance regime within the area.

FISH, WILDLIFE AND PLANTS

Introduction

This section will examine the effects of the alternatives on fish, wildlife and plants. It would be impossible to assess all the individual species' needs within this document, and as a result, the emphasis here will be on habitat types which are the homes of guilds of species and become proxies for large sets of species diversity. Nonetheless, all federal and state threatened, endangered, and sensitive species will be described individually, and also placed within a habitat context (see the Biological Evaluations in Appendix A for a complete discussion).

The key habitat found within this project area is the oak-pine, a priority habitat recognized by the Washington State Dept of Fish and Wildlife (Larsen and Morgan, 1998). This habitat is not only close to its northern limits, but has many unique species associated with it, such as the disjunct population of California kingsnake and western gray squirrel.

Analysis Methods and Measurements

Assuming that healthy habitats will provide for healthy populations of species diversity, our approach was to evaluate and measure the health and function of the habitats. This would examine habitat components, such as its structure, diversity, resiliency, and complexity. For example, a diversity of native plants will support a diversity of invertebrates which in turn will support diversity in insectivorous bird, which in turn supports a diverse predatory guild, etc.

In addition, this analysis will include the review and protection of all known and new sites of sensitive species (federal and state-listed endangered, threatened, sensitive, and state concern spp.). Background information on those species likely to be found or whose habitat is found within the project area will be collected such that field surveys can be planned and conducted in a manner that is likely to determine their presence within the project area. A field survey will be undertaken as per appropriate protocols and all findings documented. Appropriate protection measures as outlined in this document will then be implemented to ensure protection of the species and their habitats. The continued health of these species and their habitat will be measured through monitoring of pre and post project implementation.

Existing Conditions

The overall existing habitat conditions within the project area are described in chapter 1.4 of this document. Emphasis in this section will be on the specific habitat elements or components that are pertinent to the evaluation of habitat health. Diversity and structure are two very important components that need to be addressed.

The diversity component was once very high and has continued to decrease since the arrival of Europeans, along with their domesticated animals and invasive plants from the Old World. The once diverse groundcover of native bunch grasses and herbaceous flora, including balsam root, lupines, and frasera, supported an equally diverse invertebrate population. This diversity was key to supporting not only the food base for diverse avian populations but a diverse vegetation structure for their habitat needs (nesting and cover).

This under-story flora not only occurred in the open grass lands, but was equally important in the under-story of the oak and pine woodlands. As this under-story diversity collapsed under the onslaught of sheep and cattle grazing during the late 1800's and early 1900's, the diversity of all those populations dependent on them for food and/or habitat likewise decreased.

In addition to grazing damage, the structure of the oak-pine woodland also underwent dramatic changes with logging and fire exclusion beginning in the early 1900's. The diversity and structure of the habitats had developed over thousands of years with frequent, low intensity fires, as described earlier in chapter 1.4. Fire suppression and exclusion, had a profound effect on the structural elements of the habitats (Johnson and O'Neil, 2001) (Agee, 1993). As new seedlings germinated, fire no longer thinned them out and dense stands began to develop under the larger trees competing for scarce water. Larger trees succumbed to drought stress and subsequent beetle attacks. In addition, logging cut down the largest pines and oaks. The old, large tree elements became scarce, mast production dropped (older trees are the largest mast producers), and the upper canopy structure of the oak woodlands virtually vanished.

At the same time, fire exclusion allowed young Douglas-fir trees (that previously had not been able to grow within an unfriendly fire environment) to begin to invade the oak-pine woodlands. This slow, but steady, encroachment has caused thousands of oak-pine acres to become decadent or destroyed. This can yet be witnessed by closely examining young Douglas-fir stands within the project area and noting large, once-open-grown oaks dead or succumbing to over-shading by the firs.

These changes have altered the habitats that once existed throughout the project area. The food sources have changed as mast production has dwindled and diversity of species has dropped. Structural components have likewise changed from more open oak-pine to more thickly shaded fir. Shrubs, once common, are now becoming scarce due to the shaded conditions from the encroaching firs. Tree ages have changed dramatically. Old pines are virtually gone; old oaks with all their cavities are rapidly disappearing. While species dependent on fir communities have taken advantage of this change, those species that were once dependent on the habitats of historic times, have either adapted or their populations have decreased. This is likely the case with such species as the western gray squirrel, the Lewis' woodpecker, flying squirrels, many bats, and a host of invertebrates and pollinators, not to mention those species that are specifically limited to these oak-pine habitats like the California mountain kingsnake and southern alligator lizard.

While many of the floral species are not listed or noted by most observers, their populations have also dwindled as a result of the a-fore mentioned changes. The once common and abundant balsam root, which covered large areas of open grasslands and open woodlands, has now become restricted to small areas where for one reason or another grazing has not eliminated it. Other less common species, such as the mountain lady slipper, being adapted to those more open woodland habitats at mid-elevations which have largely become scarce, have likely shown a dramatic decrease in populations.

The authors of the reference volume "Wildlife-Habitat Relationships in Oregon and Washington" (2001) have concluded that, "Collectively, fire suppression, grazing and

logging have contributed to the loss of most fire-maintained old-growth East-side forests and (oak) woodlands. Today, the two greatest immediate threats to future viability of ponderosa pine forests (this term includes East-side oak woodlands) are high-severity fire occurrences and increased site-specific competition for nutrients and moisture that result in reduced ponderosa pine regeneration and increased mortality over the long term. Little forests remain today that represents historical old-growth (>200 years) ponderosa pine forest. Where stands still contain old-growth ponderosa pine, tree density and fuel accumulation present a significant risk to long-term survival and future restoration of this forest type. Lightning and accidental fires are expected to cause future burns of unprecedented and uncontrollable intensity".

When current habitat types (within 4th field watersheds) of the Columbia River Gorge National Scenic Area are compared to historic habitat types, ponderosa pine and Eastside white oak forest and woodland habitat types has decreased by 196,000 acres, or 36%, while Eastside interior mixed conifer forest has decreased by 257,000 acres, or 41%. Both stand types are functioning much differently than historic stands due to shifts in plant species and density.

Existing condition: Aquatic species and habitat

Major creek has been stream surveyed in 1994 and 2001. The stream ranges in gradient from 7 to 8%, and contains a ratio of 1 pool to 1 riffle habitat. Surveys found rainbow trout throughout the system; up to river mile 1.4 in the west fork of Major Creek, and to river mile 1.2 in the east fork of Major Creek. Sculpin were also found throughout the main stem of Major Creek. Anadromous fish use (coho and steelhead) goes from the mouth and continues upstream to a natural fish barrier, consisting of a series of 3 waterfalls at river mile 0.3. Steelhead has been confirmed past this set of waterfall this spring (2006). It is likely that steelhead spawn in the upper watershed whenever there is sufficient flow during their late winter/early spring upstream spawning run. Upper extent of steelhead spawning and rearing habitat is not known. During summer, Major Creek has some surface water only upstream from approximately river mile 0.5, while all other channels, including Catherine creek and the mouth of Major Creek, becomes dry. As expected, fish use in these intermittent channels are seasonal in nature. The 1994 survey noted the substrate to be largely composed of cobbles and large substrate, with few in-stream large wood pieces. There is currently a deficit of large trees in the riparian area of Major Creek—likely due to historic harvests. This lack of large wood contributes to an increase in substrate particle size and thus a propensity for the stream to subsurface due to lack of smaller size substrates that "seal" the stream bed. Gravel-sized particles cannot be retained in the system without these natural hydraulic control structures. This gravel loss directly decreases available spawning habitat for fish. Lack of large wood also reduces cover and forage components for fish and other aquatic wildlife, such as amphibians and macro-invertebrates.

The following are some particular species and habitats of interest during the planning process:

Bald Eagle
Locally, within the Columbia River Gorge, almost all nests are in relatively undisturbed sites, located on large trees within ½ mile of the Columbia River or a direct tributary. Primary prey species is fish, as well as some waterfowl. Bald eagles often construct multiple nests in one area, although only one is used per season. Twenty-two nest sites are known to have been active in 2006 in the National Scenic Area, with a subset of 14 nests (64%) on Forest Service managed land (Isaacs and Anthony, 2007). Bald eagles often forage around five to seven miles away from their nest sites. Courtship and nest building can start as early as January, with eggs laid by late February to early March. In general, adult eagles become less sensitive to nest disturbance once the young develop by mid-June.

Northern Spotted Owl
The planning area is not within spotted owl designated critical habitat unit (USFWS), late successional reserve (USFS Northwest Forest Plan), or Spotted Owl Special Emphasis Area (WA Forest Practices Rules). The planning area units located within upper Major Creek watershed are near the Washington state core habitat delineation for the spotted owl (NE and east conifer forest types). The nearest known pair was located 1.5 miles to the north, in 1994. In addition, three records of single owls were documented within 1.5 to 2 miles away from the northernmost planning area (N. East conifer), in 1994-1996 (WDFW Database, 2006). Within the planning area, none of the stands currently meet the typical structure that would be defined as quality nesting, roosting, and foraging habitat (typically defined as stand average dbh of 16", and at least 4 trees over 30" dbh per acre). Important structural components, such as large snags, down logs, and open flight space under the canopy are also lacking in the young and dense understory. The current habitat may provide some limited foraging, and clearly some dispersal, habitat in its present seral state.

The NE and east conifer habitat types are classic examples of east-side forests that are shifting to a tree composition and forest structure that are considered unstable or are highly vulnerable to stand-replacing events. The habitat degradation and potential loss of these dry eastside forest types that have developed an unnaturally high canopy closure and dense understory characteristics due to fire suppression, are a concern that have been noted in several recent owl briefing or management reports (Buchanan and Swedeen, 2006; USFWS, 2006). Although unlikely to be nesting habitat, protocol surveys will be completed by USFS Scenic Area staff during the 2007 season to conclusively determine spotted owl use within the planning area.

Western Gray Squirrel
Western gray squirrels are distributed from Washington to California in mixed oak and conifer forests. Currently within Washington, gray squirrels are limited to 3 isolated populations; Puget Trough (Fort Lewis), Klickitat and eastern Skamania County, and Chelan/Okanogan Counties (Linders and Stinson *in draft*, 2006). Although Klickitat County contains the largest population of the 3 areas, it is also believed to be declining (Vander Haegen et. al., 2005). In 1993, the state of Washington listed the western gray squirrel as 'threatened' due to declining populations resulting from: habitat loss and conversion, fluctuating food supplies, disease, interspecific competition, road kills and illegal shooting. In the Klickitat region, habitat for the Western gray squirrel occur in the where oak woodlands and pine forest converge, an ecotone between the upland Douglas-Fir forests and the lowland grassland/oak savanna. Stand composition is typically Oregon white oak,

ponderosa pine, and Douglas-Fir, with riparian area that may include bigleaf maple, Oregon ash, black cottonwood, and quaking aspen. Optimum stands are conifer-dominated of large diameter, mast producing trees, usually of pine and oak. A diversity of trees species, and the presence of oak were also important habitat components (Linders and Stinson *in draft*, 2006). Mature trees produce more mast (acorn, pine/fir seeds) than younger stands; a critical winter food item. Leaf nests are generally found in pine or Douglas-fir trees, with cavities in oaks used whenever available. High-use stands in the Puget Trough included a mix of conifers, oaks, and other hardwoods such as big leaf maple and Oregon ash in the canopy. Large, healthy oaks and conifers (especially ponderosa pine) are more likely to provide greater quantities of mast foods and more nest and den sites compared with smaller trees of the same species. Proximity to water may also be important, with more nests generally found from 540' to 1800' of a water source.

Regulatory Framework

Applicable Standards and Guidelines

The following applicable standards and guidelines were used to form the criteria for this effects analysis:

Gifford Pinchot National Forest LRMP Forest-wide standards and guidelines.

Threatened, Endangered, and Sensitive Species

- All project areas affected by Management activities will be reviewed for Sensitive, Threatened, or Endangered plant and animal species.
- A biological evaluation will be conducted before any ground disturbing activities occur which may adversely affect sensitive species.
- Consultation with the U.S. Fish and Wildlife Service will be required for each program activity or project that the Fish and Wildlife Service determines may affect threatened or endangered species and will be completed before any decision is made on the proposed project. Management activities must be conducted in such a manner that they will not impair recovery of any threatened or endangered species.

Cooperation With Washington Department of Fish and Wildlife

- Projects, programs, policies, and other activities affecting fish and wildlife should receive advice and review of the Washington State Department of Fish and Wildlife.

Special Habitat Management Objectives

- Special habitats, such as caves, cliffs, mineral licks, and talus slopes will be evaluated during project planning to determine biological significance, habitat value, and any necessary protection measures.
- Project planning should consider the need for direct habitat improvements such as forage seeding, fertilization, and prescribed burning, e.g., to benefit mountain goat, deer, and elk.
- Road, trail, and area closures may be employed to reduce wildlife harassment and disturbance to sensitive plants and fungi populations.

Columbia River Gorge National Scenic Area Management Plan

- Determine, based on biology and habitat requirements, if the proposed project would compromise the integrity and function of or adversely affect the wildlife or plant site.
- A buffer zone shall be created around sensitive fauna, the size dependent on the species needs. There shall be a 200 ft buffer on all sensitive flora.
- If the project goals include potential work within the buffer zones, a "no practicable alternative" test and mitigation plan will be required.
- The new developments and uses shall not interfere with fish passage.
- New developments and uses shall occur during periods when fish and wildlife are least sensitive to activities.
- In areas of big game winter range, forage and thermal cover must be maintained. If impacts are to occur, enhancements must mitigate the impacts so as to maintain overall values and function of winter range.

See effects section below for findings on these guidelines.

Environmental Consequences

DIRECT AND INDIRECT EFFECTS OF ALTERNATIVE 1 - NO ACTION

After a century of fire suppression, the no-action plan would maintain forests in an altered stand composition that does not shelter fire-adapted wildlife species. The risk of stand replacement crown fires is high; with increasing risk each year that fire continues to be suppressed. Whether through stand replacement fire, or continued encroachment by faster-growing conifers, oak stands will eventually be lost.

The importance of fire in the maintenance of healthy oak, pine and eastside coniferous forests is evident (Agee, 1993, Arno and Fiedler, 2005, Vesely and Tucker, 2004, Larsen and Morgan, 1998, USDA, 1990). The direct effect of this alternative is the continued existence of dense tree stands and non-native grasses/forbs that do not reflect the historic habitats with which native wildlife has evolved to survive in. Oak, pine/oak, and Eastside mixed conifer forest habitat type will continue to decline in health and distribution, concurrent with the host of wildlife species that has evolved to utilize these habitat types. Some of these species include the western gray squirrel, white-breasted nuthatch, western scrub jay, acorn woodpecker, Ash-throated flycatcher, CA mountain king snake, Lewis' woodpecker, sharptail snake, and southern alligator lizard (Huff et. al., 2005, Larsen and Morgan, 1998). The inherent variability within and among the different forest types that historically had low to moderate fire regimes makes it difficult to generalize and assess the effects of long-term fire suppression at a local or species-specific scale (Huff et. al., 2005). Active management has been delayed as a consequence of this uncertainty of effects and the possible public controversy that may result if action is initiated. The 2004 report "Scientific evaluation of the status of the spotted owl" reported that wildfire has resulted in a net loss of 2.3 percent of spotted owl habitat within the first decade of the NW Forest Plan due to uncharacteristically large stand-replacement fires (Courtney et. al., 2004).

The paradox for land managers is the need to treat these dry forest habitats in order to protect it; a result of centuries of fire suppression. The U.S. Fish and Wildlife Service (USFWS) hosted a workshop in May of 2005 to address this issue, titled "Managing the northern spotted owl habitat in dry forest ecosystems". What followed was a USFWS workshop report which condensed the issue into core recommendations (USFWS, 2006). The primary recommendation stressed was that, "No action is not an option". Failure to take action threatens the long-term sustainability of spotted owls and their habitat. This complex dry forest ecosystem supports a diverse wildlife community.

The indirect effect of taking no action is the ever-increasing risk for fragmentation or loss of large areas of dry forest habitat types to high-intensity human or lightning-caused fire (Thomas et. al., 2006, Spies et. al., 2005, Buchanan and Swedeen, 2005, Agee, 1993). The re-establishment of these forests will take over 200 years to replace, depending on the severity of the soil damage (Johnson and O'Neil, 2001). Once the soil recovers, the habitat will primarily consist of early seral plant communities, that may support species such as the black-tailed deer, voles, sparrows, coyote, robin, rubber boa, gopher snake, rattlesnake, and mourning dove (O'Neil et. al., 2001).

As detailed in section 3.4 of the hydrology and soils section, the increase risk of sedimentation into area streams as well as road building activity to aggressively fight a moderate to high intensity fire would be highly detrimental to fish and wildlife species. Loss of over-story trees and shrubs would effectively remove habitat for wildlife species. A high-intensity fire and resultant soil damage would retard re-colonization of the area, especially by native vegetation. Initial colonization by aggressive, early-seral, and non-native species, such as cheatgrass, thistle, knapweed, and scotch broom would further retard habitat recovery for native species dependent on oak woodland habitat. Loss of riparian vegetation would degrade stream habitat through increased temperatures and sediment pathways. The deer and elk winter range would have degraded forage values for an extended period, with slow recovery to pre-burn levels. Big game numbers may temporarily be affected from this loss of forage and cover. The potential loss of the entire area's oak/pine/Eastside conifer habitat, for up to a century, is a serious threat to an important and priority habitat type.

There are currently 22 sensitive species with habitat that may be in or adjacent to the project area (reference Biological Evaluation). Habitat changes that set the vegetation back to an early seral community (conifer/oak to shrub/forb) would support the following wildlife species on the TES list:

- 0 of these species for breeding habitat,
- 3 species where this habitat would provide some foraging opportunity (golden eagle, merlin, peregrine falcon), and
- 4 species (steelhead, western toad, Dalles sideband snail, and Columbia dusky snail), where the change in terrestrial habitat is somewhat neutral to their life history.

The following are effects for the species that were of particular concern during planning:

Bald Eagle
The no-action alternative will continue to provide for habitat in the short-term, but risks the complete or partial loss of habitat (large dominant trees for nesting and perching) due to uncharacteristically large crown fires.

Northern Spotted Owl
The no-action alternative will continue to sustain a forest that does not have structural components that would be beneficial for spotted owl dispersal or foraging habitat. This alternative will not implement the recommendations from the USFWS workshop on silvicultural practices that support northern spotted owl habitat in dry forest ecosystems (USFWS, 2006). Most spotted owl habitat on the eastside of the Cascade crest owes its structure and species composition to fire. Historically, spotted owls occupied a dynamic landscape that often consisted of large areas of burned and unburned forest (Tesky, 1992). Today, however, habitat is greatly reduced and fragmented, and owl populations have become increasingly vulnerable to loss of large tracts of habitat due to unnaturally high intensity stand-replacement fires. Wildfire has resulted in the loss of 2.3 percent of spotted owl habitat due to uncharacteristically large stand-replacement wildfires in the last decade (Courtney et. al, 2004). The no-action will, initially, have no effect to the spotted owl. In the long-term, this alternative will perpetuate the degradation of potential habitat, to the extent that it will eventually be unsuitable, or lost through high intensity fire.

Western Gray Squirrel
The no-action alternative would have no short-term effects on the Western gray squirrel, as increased human and machinery presence would not occur. The continued fire suppression and the resultant shift in oak-pine-DF habitat to dense stands of DF with remnant pines would slowly eliminate squirrel habitat, as presence of oak seem to be associated with squirrel presence. Moderate to high intensity fires that, may later, become reality due to the unnaturally high fuel load will likely cause direct mortality of squirrels (Kaprowski et. al., 2006). The optimal habitat of large mast producing trees would take 100-200 years to replace, depending on fire intensity and resultant soil damage.

Cumulative Effects of Alternative 1 – No Action
This No Action Alternative would cumulatively contribute to the range-wide decline of ecologically stable, open Oregon white oak woodland and pine habitats within Oregon and Washington. Quality wildlife habitat and oak-woodland dependent species would continue to decline correspondingly with this loss. Furthermore, without actions to reduce fuels, the risk of catastrophic fires continues to increase with loss of large segments of the oak/pine increasingly likely within the next several decades. Once this habitat burns as a result of a catastrophic fire, it will likely take decades, if not a century, before the pine/oak woodlands would re-establish their present habitat values. There are fauna and flora species, many of which are listed and/or sensitive, that are associated with oak woodlands and other dry eastside forest types. The loss of this habitat for decades would likely have profound negative effects on their populations.

CUMULATIVE EFFECTS DETERMINATION					
Past, Current or Reasonably Foreseeable ACTIVITY or PROJECT	**Potential Effects**	**OVERLAP IN**		**Measurable Cumulative Effects?**	**Extent Detectable?**
		TIME	**SPACE**		
Burdoin I	Short term disturbance and possible loss to individuals. Long term beneficial effects on habitats.	No	Yes	Yes	Burdoin I project thinning has helped delay fuel loading, but is not sufficient to prevent catastrophic fires and loss of priority habitat that will occur under this Alternative.
Road work on BPA easement	Effects on riparian habitats. Road was built within riparian area	No	Yes	No	Impacts were minor and riparian area has adjusted.
firehouse	Loss of habitat – increase disturbance	No	Yes	Yes	Minor but adds to the loss of habitat
Courtney Rd widening	Temporary disturbance. Long term - increase numbers of recreationists	No	No	No	Minor but adds to the loss of habitat
Allen Property thinning and structure removal	Short term disturbance and possible loss to individuals. Long term beneficial effects on habitats.	No	Yes	Yes	This project thinning has helped delay fuel loading, but is not sufficient to prevent catastrophic fires and loss of priority habitat that will occur under this Alt.. Structure removal is beneficial: removing disturbance and returning over 100 acres to habitat base in the project area.
Weed treatments	Short term disturbance.	No	Yes	No	Containment is important; spray treatment not very effective – now use bio-control which is more effective. Minor.
Paved accessible trail at Catherine Creek	Short term disturbance. Long term attraction for more people, more disturbance.	No	No	Yes	Thus far the numbers have not increased appreciably. Future is yet unknown. Part of the decision of build this trail was to lessen the numbers of people recreating on north side of county road within project area.
Burdoin II Thin from Below	Short term disturbance and possible loss to individuals. Long term beneficial effects on habitats	No	Yes	Yes	The structure and diversity of the pine/oak habitats will be monitored. This beneficial project thinning is equivalent to the CC thinning but without CC thinning the area will still remain at risk to catastrophic fires. The larger the area treated for fuels, the less the risk of catastrophic fires and loss of habitat.
Coyote wall FS trails	Increased disturbance from recreation	No	Yes	Yes	The use of the area by recreationists will be monitored. Minor but adds to the disturbance of the habitat base.
Land acquisitions	Reduces chronic disturbance. Encourages recreation, protects more habitat.	No	Yes	No	The more land put aside to be managed as habitat will benefit the wildlife and plant species.

DIRECT AND INDIRECT EFFECTS ALTERNATIVE 2-PROPOSED ACTION

This alternative sets the stage to mimic the stand conditions that would have resulted from low-intensity, high frequency fires that had been burning through this project area for the last few thousand years. Thinning dense stands will be followed by the re-introduction of fire. There will be short term impacts from the construction of landings, skid trails and other disturbances to the soil and under-story as a result of the thinning. These impacts to the habitats will be minimized by designing the thinning in such a way as to ensure that, not only will there be no long-term impacts, but that the long-term impacts will be beneficial to the habitats of the project area. Thus, the designs, such as to minimize landings to areas where rehabilitation can occur with relative ease, the use of large-tired machines to lessen soil impacts, re-seeding with native grasses and forbs within a year, and extensive use of hand piling in sensitive habitats, were developed.

The original and fundamental premise for this project was initiated to enhance the ecological integrity and health of the oak-pine and eastern conifer forests. This concept has been repeated by many different sensitive species and priority habitat restoration plans for the last few years (Vesely and Tucker, 2004, Larsen and Morgan, 1998, Linders and Stinson, 2006, USFWS, 2006, ODFW, 2006). Considering that both wildlife and plants have historically evolved with low-intensity fires that has shaped their ecological communities' structure and composition, it follows that restoring these conditions will maintain and enhance the habitats which support their long-term sustainability. Though short duration and individual impacts may occur, this project is anticipated to be beneficial in the long-term to both the fauna and flora species of these dry land communities.

There are currently 22 sensitive species with habitat that may be in or adjacent to the project area (reference Biological Evaluation, Appendix A). Habitat changes that restore and maintain the dryland habitat types (grassland, oak/pine forest, pine-oak-DF forest, and east conifer forest) would have long-term benefits to all these species. This is especially true when coupled with restoration plans of native grass/forb species seeding, snag creation, and species monitoring that will occur during and after implementation.

Specific guidelines speak to specific component of the ecological communities being restored. For example, meeting the guidelines for Desired Forest Structure and Pattern as outlined in the NSA Management Plan further enhances and restores, in the long-term, these forested communities in terms of snags and down wood. Others speak to all large oak trees and their associated snags to not be removed or altered in this project; the purpose of the project is to help create more large oaks and their associated snags with a scattering of large pines. The design of this project shall retain a mix of ages to ensure vertical diversity and replacement potential. The diversity of plant species shall be maintained. All shrubs, herbaceous flora and tree species shall be maintained to retain the habitat viability of the area. (See the detailed vegetation management prescriptions in Chapter 2). All of these specific guidelines are instrumental in helping to achieve the desired structure, composition and pattern of the habitats throughout the project area.

Likewise, disturbance to wildlife and plants is important. To minimize wildlife disturbance work windows are designed into the project as detailed in previous chapters. This work window limitation is expected to preclude potential disturbance to critical nesting/rearing activities (March to August) as well as big game winter range use (mid-December to March). Some temporary disturbance to individuals may occur due to machine thinning activity, hand thinning activity, or vegetation movement (dragged to piles, chipped, or burned) but it is unlikely to be significant for the species in the overall planning area, especially in light of the roads and human activities already present within this 1,845 acre planning area including scattered homes. Disturbance to plants will occur at burn piles, skid trails, and landings causing short-term localized soil damage and vegetation loss. As these areas are going to be limited in size and the vegetation is largely non-native annual grasses in open areas, this action is not likely to reduce native habitat appreciably. These disturbed areas will be rehabilitated and seeded with native grass/forbs mix and/or shrub plugs.

Known sites of sensitive plants and wildlife, of which there are several within the project area, will be protected from unnecessary impacts that would put them at risk, as detailed in the Biological Evaluation (BE) in Appendix A. For specific information related to each species as they relate to this project, see Appendix A. Appropriate buffers and timing restrictions are included in the design of the project to ensure that all sensitive species are adequately protected. If work has to be conducted within the buffer zones, a mitigation plan has been completed to show that the site is not compromised and appropriate enhancement will occur to offset any impacts.

The following are effects for the species that were of particular concern during planning:

Bald Eagle
One active bald eagle nest site is on the NW edge of the planning area. The nest site will have a ¼ mile no-entry buffer from January 1 to August 15 to minimize risk of nest disturbance (Effects Determination Criteria Instructions for Bald Eagle, from Northwest National Fire Plan Project Design and Consultation Process, 2003). The tree will also be protected from damage during thinning (see Natural Resource Mitigation Plan, Chapter 2).

Northern Spotted Owl
The proposed action alternative has thinning activities restricted to occur between July 1 to February 28, and underburning restricted to occur between July 1 to March 15 as to be outside of the general breeding season for most native fauna. If paired owls are detected within the east conifer planning unit, the nest area shall have a ¼ -mile no-action buffer for all action, for the period between March 1 and June 30, so as to have no effect to spotted owl (USFWS correspondence September 28, 2001, and December 6, 2006). The implementation of this project will have no-effect on short-term habitat for the northern spotted owl and will result in the long-term development and maintenance of large over-story trees and creation of habitat components (snags) that may provide quality foraging and dispersal habitat. The thinning of dense under-story trees will result in beneficial effects for owl habitat in the long-term as the older canopy trees gain reductions in competition and provide better quality habitat for spotted owl and other mature forest species.

The proposed action follows the recommendations of the latest USFWS workshop to protect the long-term sustainability of spotted owl and their habitat within dry forest ecosystems (USFWS, 2006).

In the long-term, this alternative would improve habitat for native species by allowing remaining trees to mature to a large size commensurate with historic conditions maintained in this stand by the fire regime. Mature trees produce more habitat (snags, insect colonization, prey base) and mast than their younger and more crowded counterparts. Pockets of existing stands would be retained that had young trees to retain the diversity of stand classes. The planning area would regain a more ecologically stable condition that is resistant to catastrophic fire damage and more representative of habitat conditions under which the plants and animals evolved.

Western Gray Squirrel

The proposed action alternative follows the recommendation of all available management plans for the pine/oak habitat type (ODFW, 2006; Larsen and Morgan, 1998; Altman, 2000), as well as specific management plans for the western gray squirrel (Linders and Stinson *in draft*, 2006; Fimbal, 2004; Ryan and Carey, 1995). All plans unanimously agree on the urgent need to restore, as much as is possible, the pine-oak forests to pre-fire suppression vegetation types to sustain native wildlife species. Habitat restoration to benefit the gray squirrel has occurred, or is on-going, at Fort Lewis (Nature Conservancy), WDFW Klickitat wildlife area, and Columbia Land Trust (BLM). All treatments include thinning, followed by prescribed underburns to maintain open forest structure. As 77% of Western gray squirrel habitat in Klickitat County is privately owned, much area will remain unchanged and be a source for comparison of control versus restoration treatments nearby.

Although adaptive management and restoration has been initiated in many different locations of Northwest oak/pine woodland, the newness of the restoration technique has caused a lag in information on the long-term effect of restoration actions specific to the western gray squirrel populations. Many studies have been completed that described no impacts to small mammals populations after prescribed fire in pine/oak forests, regardless of season (Ford et. al., 1999; Monroe and Converse, 2006; Rowan et. al., 2005; Lyon et. al., 2000; McMahon and deCalesta, 1990). The most important factor was the low intensity (flame lengths less than 3 feet and mosaic burn pattern) of the prescribed burn, rather than the season of burn. Small mammal survival of these low intensity burns is attributed to the inherent adaptations of these species to the frequent fire regimes for this habitat type. Small mammals had fossorial habits and readily took refuge in underground burrows, spaces under rocks, as well as large down wood. Tree squirrel species escape into the forest canopy (Kaprowski et. al., 2006).

The following paragraphs summarize fire effects to the Eastern fox squirrel. The information was clipped directly from the Fire Effects Information System (FEIS) online database of the U.S. Forest Service Rocky Mountain Research Station (Tesky, 1993). All references for this report are available on-line.

Fire effects to the Eastern fox squirrel, *Sciurus niger*.

DIRECT FIRE EFFECTS ON ANIMALS:

Eastern fox squirrels would probably not be able to escape fast-moving (high severity) fires. However, they could probably easily escape low-severity ground fires. Kirkpatrick and Mosby found no evidence that prescribed burning caused significant direct mortality among eastern fox squirrels. Wildfires could destroy leaf nests, nest trees, and eastern fox squirrel nestlings. However, cavities used for denning and leaf nests are usually above the impact zone of prescribed fires.

HABITAT RELATED FIRE EFFECTS:

Fire often has a positive effect on eastern fox squirrel habitat. Fire maintains the pine-oak habitat preferred by eastern fox squirrels and has a direct effect on eastern fox squirrel foods. Under presettlement conditions longleaf pine savannas (preferred eastern fox squirrel habitat) may have burned at average intervals of 3 to 5 years, usually between April and October. The open stands produced by fire result in better pine cone and mast production. Pines and oaks growing in the open receive more light, maintain more branches at lower levels, and produce heavier crops of cones and nuts. Additionally, nutrient availability and the enhanced vigor of burned pine forest are associated with larger crops of fungi, which are also important eastern fox squirrel foods. A lush, grassy understory maintained by fire is important as protective cover.

Fire has probably been a determining factor in the niche separation between gray and eastern fox squirrels on the Coastal Plain. Both exist in mixed pine-oak forests and feed heavily on acorns, but the more competitive gray squirrel dominates where the overlap of oak crowns allows tree-to-tree travel throughout the canopy. Eastern fox squirrels are more abundant where patches of oaks comprise less than 30 percent of pine-hardwood stands and do best in fire-type pine forests with scattered hardwood inclusions. Fire could be a deciding factor in determining the availability of suitable habitat and resources for one or the other species.

FIRE USE:

Prescribed fire can be used to maintain eastern fox squirrel habitat. Prescribed burning at 2- to 5-year intervals can be beneficial to eastern fox squirrels by maintaining an open understory and better foraging habitat. According to Humphrey, ground fires are valuable in maintaining habitats of Big Cypress fox squirrels. In the habitat of this subspecies, future fire management plans call for an increase in prescribed burning to 50,000 acres a year. Pinelands are expected to be burned on a 5- to 7-year rotation.

In summary, the Western gray squirrel is expected to benefit from thinning and prescribed underburning activities within the planning area as this will begin to return their oak

woodland habitat to the more open and mixed age stand that they likely evolved in. Thinning of stands, as occurred with low intensity fires, should result in accelerated growth in the older oaks and pines, which will be retained. The survey of and protection of squirrel nests within the planning area, as well as seasonal restriction of thinning and underburning activities are expected to reduce potential impacts to the western gray squirrel to very low levels. These conservation measures are listed under subsection 2.3 of this document. The unavoidable increase in human and loud machinery within their range may still disturb some individuals, but is not expected to impact the local population (MIIH). In the long-term, the habitat should improve markedly for persistence of this Washington State threatened species.

Threatened, Endangered, and Sensitive Species Review
All known sites of listed species were compiled and surveys for these species and their suitable habitats were completed as per appropriate protocols. All sightings are summarized in the Biological Evaluation (Appendix A). Some additional surveys will be conducted immediately prior to implementation to identify new sensitive sites, such as new nest sites.

Biological Evaluation
A Biological Evaluation was prepared prior to any ground disturbance (Appendix A).

Consultation with U.S. Fish and Wildlife
Consultation with appropriate regulatory agencies was completed. The proposed project, as planned, is not expected to have adverse effect to any species currently listed as federally Endangered or Threatened due to adherence to pre-determined project design criteria and conservation measures (such as seasonal restrictions). These design criteria and conservation measures to prevent adverse effects to T & E species are derived from 2 sources, the current Forest Service programmatic informal consultation with the USFWS (USFWS reference 1-3-01-IR-2231, dated 9/28/2001; extended 12/7/2006, reference #13410-2007-I-0022), and the National Fire Plan Project Design and Consultation (Counterpart Regulations 50 CFR 402.04). The summary table of Biological Effects is in Appendix A, including the rationale for effects determinations. As there are no T&E species or habitat that is likely to have potential for adverse effects, formal consultation, and take statement, will not be required for the Catherine Creek restoration project.

Cooperation With Washington Department of Fish and Wildlife
WDFW was a participating member of the collaborative team. All aspects of the project were developed with input from and reviewed by WDFW.

Special Habitat Management Objectives
All priority habitats were identified and given appropriate protection. While most of the priority habitats, such as cliffs, talus, lakes and ponds do not support forests, these habitats will not be directly affected, they will all be given appropriate buffers to ensure that the habitats are protected from long term adverse impacts. The one priority habitat that will be affected is the pine/oak woodlands. It is the objective of this project to enhance this habitat and therefore entry within this habitat will be required.

Habitat Improvements
All of the project area was within identified winter range and due consideration was given to protection and enhancement of this habitat. Winter range habitat will be enhanced by the proposed actions by retention of all shrubs (which are important browse), opening the canopy to encourage most shrubs and herbaceous plants, encouraging older tree development which will increase mast production. All of these are important components of winter range habitat.

Road, trail, and area closures.
All temporary or existing unneeded roads, skid trails, landings, etc are proposed to be re-contoured and re-vegetated with native species.

Integrity and Function Wildlife Sites.
This project is an enhancement project and all wildlife and plant sensitive sites were protected with appropriate buffers. See effects discussed in this chapter, and the Biological Evaluations in Appendix A.

Appropriate buffers sensitive wildlife and plant site.
The CRGNSA Management Plan requires buffer zones around certain sensitive wildlife and plant sites (see Natural Resource Mitigation plan p.36, #28) for a list of the required buffers and mitigations. See also the prescriptions by each vegetation type in Chapter 2.

Water Resource Buffers (see Chapter 2, pages 29-30.)
The project includes some potential work within the riparian buffer zones, therefore, a "no practicable alternative" test (see page 29) and natural resource mitigation plan has been written as required.

New developments and uses shall not interfere with fish passage.
There were no new crossings or developments to interfere with of fish bearing streams proposed.

New developments and uses shall occur during periods when fish and wildlife are least sensitive to activities.
All activities were timed to occur when the impacts would be least for both wildlife and plant species. No activities were to occur during the Spring when the soils were wet, the plants flowering, wildlife were having young and birds were nesting. Likewise activities were curtailed in late fall and winter to reduce impacts to winter range (see page 36 # 24).

In areas of big game winter range, forage and thermal cover
The project is within winter range and adequate cover was maintained. The canopy closure was only slightly reduced by no more than 30 percent. In addition, disturbance was reduced by identifying work windows if severe winter conditions were in effect (page 36, #24).

Cumulative Effects Alternative 2
A recent article in Partners-In-Flight's Bird Conservation magazine, estimated that 90% of the historical range of oak woodlands has been lost due to urbanization, agriculture and forest conversion, fire suppression and invasion of exotic species (De Groot, 2001).

The decline of the oak woodland eco-type will accelerate the decline of many threatened and endangered species which depend on this habitat component (See Biological Evaluation in Appendix A).

The thinning of under-story vegetation maintained by or initiated by prescribed fire will help slow this range-wide decline of ecologically stable, open Oregon white oak woodlands within Oregon, Washington and California. Quality wildlife habitat and oak-woodland dependent species would benefit from this action and regain a pocket of their former range. These species would then retain the option to re-colonize nearby pine-oak and oak woodland habitats as they are retained or improved in the future.

Cumulative effects on the northern-most fir-dominated forested areas within the project area represent a small fraction of this type of habitat within the Snowden Plateau. The relatively short duration of the project and the temporary disturbances that may occur would not cause any cumulative effects on the wildlife. Most wildlife would temporarily move to adjacent forested habitats to move back at a later date. Furthermore, this project is designed to enhance the long-term quality of this habitat and offer escape habitat when other adjacent areas are being disturbed. There are no known additional forest habitat disturbances being planned for the areas adjacent to this habitat and any that are planned in the future must comply with the SMA forest practices guidelines which are designed to avoid negative cumulative effects on these habitats.

Catherine sub-area from across the Columbia River in Oregon.
Note: 1) Lower elevations predominantly open grass and oak/pine.
2) Upper elevations becoming increasingly dominated with Douglas-fir.
3) Oak-pine encroached by Douglas-fir as a result of fire exclusion.

CUMULATIVE EFFECTS DETERMINATION					
Past, Current or Reasonably Foreseeable ACTIVITY OR PROJECT	**Potential Effects**	**OVERLAP IN**		**Measurable Cumulative Effects?**	**Extent Detectable**
		TIME	**SPACE**		
Burdoin I	Short term disturbance and possible loss to individuals. Long term beneficial effects on habitats.	No	Yes	Yes	Burdoin I project was the first step in reaching fire resiliency. This Alt. will further reduce the risk of fires and give better protection to the habitats.
Road work on BPA easement	Effects on riparian habitats. Road was built within riparian area	No	Yes	No	Impacts were minor.
firehouse	Loss of habitat – increase disturbance	No	Yes	Yes	No cumulative effects of short or long term. The present project is considered as habitat enhancement with short term impacts of one year or less.
Courtney Rd widening	Temporary disturbance. Long term - increase numbers of recreationists	No	No	No	No cumulative effects of short or long term.
Allen Property thinning and structure removal	Short term disturbance and possible loss to individuals. Long term beneficial effects on habitats.	Maybe	Yes	Yes	This project thinning is the first step in reaching fire resiliency. This project Alt. will further enhance the habitats and reduce risk of fire.
Weed treatments	Short term disturbance.	Maybe	Yes	No	No cumulative effects of short or long term. The present project's long term impacts are considered as habitat enhancement with short term impacts of one year or less.
Paved accessible trail at Catherine Creek	Short term disturbance. Long term attraction for more people, more disturbance.	No	No	Yes	No cumulative short or long term effects. The present project's long term impacts are considered as habitat enhancement.
Burdoin II Thin from Below	Short term disturbance and possible loss to individuals. Long term beneficial effects on habitats	Maybe	Yes	Yes	No short term cumulative effects. Long term effects are beneficial – the two projects together will increase the area with fire resiliency and protecting more habitats.
Coyote wall FS trails	Increased disturbance from recreation	No	Yes	Yes	The use of the area by recreationists will be monitored. No cumulative effects will occur as the present project will not add to these impacts.
Land aquisitions	Reduces chronic disturbance. Encourages recreation, protects more habitat.	Maybe	Yes	No	The proposed project will cumulatively add to the enhancement effects of land acquisition.

3.6 - EFFECTS TO RECREATION, ACCESS, AND RECREATIONAL FACILITIES

Existing Conditions

Recreation in the study area is a relatively new use, since much of the land was previously in private ownership. Since the formation of the CRGNSA, dispersed recreation has grown and become an important activity in the area. No formal trail system or facilities have been developed by the CRGNSA. Users, however, formed a well- developed network of mountain bike trails, which intertwine across private and National Forest System lands (attained after SA designation). At least one land owner allows private use on their property with the caveat that no maps be made (which would increase non-local

Mountain bike riding and hiking are the predominant form of recreation in the study area. The majority of bike use occurs on the open slopes around "Coyote Wall" in T3N, R11E sections 26, 27 and 35. Use is significantly lower in the area north of Atwood Road. Hiking and orienteering are popular in the open lands west of Catherine Creek, as well as the natural arch on the east of Catherine Creek, which is highlighted in several hiking books covering the Gorge area. Both uses tend to be seasonal in nature, but for entirely different reasons.

Hikers tend to use the area during the early spring, to view the spectacular early spring wildflowers displays, escape the usually wetter west side, and enjoy the open vistas of the Gorge and its unique geologic features. Hiking during the summer months is relatively low and will not likely experience growth, because of the area's high temperature and lack of water. Fall orienteering is growing in popularity, aided by a Portland orienteering club, and outings by the Lewis and Clark outdoor program. The majority of these users are from the Portland/ Vancouver Metro Area.

Mountain biker use is concentrated essentially during the winter and spring months. This seasonal use results from lack of accessibility to other trails which tend to be snow bound, or too muddy to ride until early summer. The terrain and informal trail network that has been developed in the study area is unique, because it provides opportunities for riders of all levels of expertise and provides good site distance along the trail. Many of the mountain bikers are from the local area (Hood River and White Salmon/Bingen), but is know by users from the outside the local area through bike users networks.

It appears mountain bike is the dominant form of recreation in the area. Observed use by a local Mountain Bike club includes as many as 60-70 riders on weekends and 5-10 riders on weekday during March and April. Participation in hiking appears to be lower, but use figures could not be validated. Most mountain bikers use the system of trails that they developed but a small number engages in "freeriding". Freeriding is generally off trail and the term is claimed by two kinds of users. One, who have heavy bikes with extra shocks and wear body armor, ride straight down the fall line, "hucking" (jumping) off of rocks, landing and continue to ride down. This kind of use is currently taking place. The second users are more interested in agility, and like to ride up and along rocks and logs, and along narrow, above ground, constructed "bikeways". This use is not currently prevalent in the project area, but could be developed as the forest is opened to a more park-like setting.

Off highway vehicle (OHV) use and deer and turkey hunting are other uses that have been observed. Hunting for deer occurs over most of the area during the months of September and November. Turkey hunting takes place in the spring. OHV use tends to be confined to existing roads and trails and most likely occurs during the spring and fall when temperatures moderate. Use appears to be fairly low as compared to hiking and mountain bike use.

Most of the planning area is in SMA Agriculture or Open Space. The Columbia River Gorge National Scenic Area uses a modified version of the Recreation Opportunity Spectrum (ROS) called Recreation Intensity Class (RIC). Most RIC 1 is associated with Open Space. RIC 1 emphasizes providing semi-primitive recreation opportunities in which people can realize experiences such as solitude, tension reduction and nature appreciation. Maximum design capacity should not exceed 35 people at one time (PAOT) and 10 vehicles for this class. RIC 2 provides settings where people can participate in activities such as physical fitness, outdoor learning, relaxation and escape from noise and crowds. Maximum design capacity should not exceed 70 PAOTs and 25 vehicles. RIC 3 emphases are on facilities that are complementary to the natural landscape, yet accommodate a moderate number of people. People are able to realize experiences such as group socialization, nature appreciation, relaxation, cultural learning and physical activities. Maximum design capacity is 250 PAOTs and 50 vehicles. The majority of the Project area is within RIC 1, with portions west of Coyote Wall and the lower area along Catherine Creek and the Arch within RIC 2.

Projected Use

Demand for most recreation opportunities have increased. The Oregon State Comprehensive Outdoor Recreation Plan (SCORP) Recreation Plan (2003) for Regions 2 (Multnomah, Hood River, Columbia, Washington, Yamhill Polk, Marion and Clackamas Counties) and 3 (Linn, Benton, and Lane Counties) were analyzed together, and show an increase in all activities except horseback riding. And according to the Washington State Comprehensive Outdoor Recreation Plan 2002-2007 (2002), recreation use is projected to increase in Washington.

Existing & Projected Recreational Use

Oregon Region 2 & 3 change from 1987- 2002	
Activity	% change
Nature/wildlife observation	253%
Day hiking	20%
OHV (3 & 4 wheelers)	71%
Mountain biking	Change in use data not included in this edition
Horseback riding	-25%

Washington state-wide		
Activity	2000	2010
Nature activities observe/photo	43%	52%
Mtn/forest hiking	52%	63%
No established trail hiking	21%	25%
Mtn/forest biking	8%	8%
Equestrian mtn/forest	17%	20%
Equestrian no established trails	18%	21%

Overall, recreation in general is expected grow in the study area due to the proximity of Portland and as that population becomes aware of the opportunities. As reported in the 2003 Oregon SCORP, "...according to the Travel Industry Association of America, in the U.S. 40% of weekend travelers report they are taking more day trips and/or weekend trips today than 5 years ago. Meeting this demand will be especially challenging for federal agencies with land management responsibilities near urban areas." Pg 4-32.

Areas once restricted to access are now open to the public. Specifically, mountain biking and freeriding are poised for significant growth in the area given its unique riding opportunities and seasonality. Day hiking will continue to grow at a rate at least equal to the projected growth rate. Given the relatively moderate terrain horseback riding could potentially grow locally although the rate has declined in Oregon overall during the past 20 years. The cost of gasoline will play a significant factor in non-local use.

Demand for recreation opportunities are expected to increase, but since the this area is located further east then the more popular trails on the west end, growth is expected to be more moderate. It would seem reasonable to expect a growth rate that could approach Washington's SCORP prediction, given the lack of opportunities for these activities Gorge wide. Nationally, hunting has declined in recent years. There is no reason to expect hunting to increase significantly given its general downward trend nationally. It is assumed many of the areas now in public ownership were probably hunted prior to acquisition. It appears that there may be a potential for increase in dispersed camping, as more people discover the newly acquired lands.

It is expected that conflicts between recreationists and private landowners will increase. Specifically, conflicts between motorized and nonmortorized use, and between mountain bikes, horseback riding and hiking will likely increase as use increases.

Regulatory Framework

Columbia River Gorge National Scenic Area Management Plan

- New developments and land uses shall not displace existing recreational use.
- Recreation resources shall be protected from adverse effects by evaluating new developments and land uses as proposed in the site plan. An analysis of both onsite and offsite cumulative effects shall be required.
- Mitigation measures shall be provided to preclude adverse effects on the recreation resource.

See the effects discussion below for findings concerning these guidelines.

Direct and Indirect, Short & Long Term Effects of Alternative 1
There would be no short-term direct or indirect effects under this alternative, since no treatments would occur.

CUMMULATIVE EFFECTS ALTERNATIVE 1

CUMULATIVE EFFECTS DETERMINATION					
Past, Current or Reasonably Foreseeable ACTIVITY or PROJECT	**Potential Effects**	**OVERLAP in TIME or SPACE**		**Measurable?**	**Extent**
		Yes or no	Yes or no		Description
Recreation Special Use Permits	None	No	No	No	Hike jeep track up Tracy Ridge in early April, below tree line in Oct

Direct and Indirect, Short & Long Term Effects of Alternative 2
There will likely be short-term effects to recreationists predominantly during the implementation phase. The scope of the effects however, will be limited, since most of the significant use (mountain biking and hiking) occurs outside the time of work. There are portions of trails within the treatment area that could be impacted. Direct impacts will be in the form of delays or prohibiting use in the area during treatment activities to protect public safety. These delays or closure would be short and only be implemented during the actual treatment. Road 1230-020 is proposed as a haul route. A portion of the trail (road 1230-020) along Catherine Creek will impact users, as it is a main hiking and biking route and for that short distance, the only place in the canyon for all users to travel. Other overlapping use by the public on haul routs, especially by bikes, also will occur along Atwood Road and the junctions of Roads 1230-020, and BPA 3112-300 with Atwood Road. Bike trails in Sections 26, 27 and 28 will also cross or come very close to proposed underburn areas.

Indirect effects may be more noticeable than the direct effects, due to their longer duration. The proposed thinning and underburning activities may be viewed as unsightly; until the slash is removed and piles are burned in the forested areas and the underburn areas have a chance to green up in the spring. Impacts, however may vary by users. For example, visual impacts may be more noticeable to hikers and hunters, because the duration of exposure to the project area is relatively long in duration. Mountain bikers may be less likely to notice the treatment, since they tend to move through the area faster and riders have a tendency to concentrate on trail and keeping their bikes under control. However, they will see more of the impacted area, as they tend to travel farther than hikers.

The indirect effects, however should not last long. Once the slash is removed, piles are burned and disturbed areas “green” up, the effects on recreationist should be minimal. In fact, it may have a positive effect on the recreation experience in the long term as it will move the landscape to a more diverse, open and aesthetically pleasing setting. The more open setting could entice new trail development once it is cleared. It could also increase site

distances along the existing trails and help reduce conflicts between mountain bikers and hikers.

The road reconstruction and maintenance that is permanent will have a positive effect on recreation by providing better access.

Cumulative Effects

Proposed Action

Cumulative effects to recreation under alternative 2 could be positive. The overall recreation setting should improve as the landscape is moved toward the desired future condition. This diverse landscape would be a more appealing recreation setting. Although more use-especially in the open area- if allowed to occur without management, could result in braided and multiple trails and trampled vegetation. Recovery time is long on these thin soils, resulting in a loss of vegetation and appeal of the recreation setting.

No-Action

The no action alternative could have a long-term negative and cumulative effect to recreation outside the open areas. Generally the open landscape would remain open (too rocky to support brush and trees). Mountain bike users who formed the trails would continue to keep them open in brushy, forested areas. However, hazardous fuels would not be reduced in the forested areas and would continue to accumulate- increasing the risk of a fire start along recreation corridors. The potential for a large wildfire fire would also increase and ultimately result in the loss of recreation facilities and desired settings.

CUMULATIVE EFFECTS DETERMINATION					
Past, Current or Reasonably Foreseeable ACTIVITY OR PROJECT	**Potential Effects**	**OVERLAP IN TIME OR SPACE**		**Measurable?**	**Extent**
		YES OR NO	**YES OR NO**	**YES OR NO**	
Recreation Special Use Permits	Disrupt permitted activities	Not if hauling ends 10-1	Yes	Yes	Minimal
ATV use	Could increase access routes during/after hauling	No	Yes	Yes	Minimal
Recreational hiking & mountain biking	Displace users	Yes	Yes	Yes	Minimal
Recreational freeriding	Access to places previously unrideable	No	Yes	Yes	Minimal

3.7 - OTHER DISCLOSURES

Effects to Wetlands and Flood Plains

The proposed activity does not occur within any floodplains or wetlands. Some vegetative treatments occur within the Riparian Reserves associated with streams. A practical alternative test to consider other options, which eliminate the need to enter these Riparian Reserves was prepared. A No Action alternative was identified which does not require any further intrusion into the Riparian Reserves.

Effects on Prime Farm, Range, and Forest Lands

The proposed action is in keeping with the intent of Secretary of Agriculture Memorandum 1827 for prime lands. The analysis area does not contain any prime farm nor rangeland. Prime forestland does not apply to lands within the National Forest system. In the proposed action, Forest Service land would be managed with sensitivity to the effects on adjacent lands.

Environmental Justice

The Proposed Action would not have adverse effects on Native Americans, women, or any minority group, and the civil rights of any Untied States citizen would also not be affected. No impacts on American Indian social, economic, or subsistence rights are anticipated. There would be no impacts on the American Indian Religious Freedom Act or on American Indian Treaty Rights. All contracts offered by the Forest Service contain Equal Employment Opportunity requirements.

Irreversible and Irretrievable Commitment of Resources

Irreversible commitment of resources refers to non-renewable resources, such as cultural resources, or to those factors, which are renewable only over long time spans such as soil productivity. Irretrievable commitment applies to losses of production, harvest or use of renewable natural resources. No significant irreversible nor irretrievable commitment of resources has been identified with the implementation of any alternative proposed.

3.8 – COMPARISON OF ALTERNATIVES

Introduction

This section will compare the alternatives with respect to meeting the purpose and need of the proposed action and with respect to effects on issues and resources. The following are summaries of the purpose and need along with its measurements, and of the issues and concerns and their measurements. The issues listed are those that

Purpose and Need

Take measured management action that will further the long-term objectives created by the collaborative group:

- Fire Resilience: Wildfires will, as far as can be predicted, be surface fires that stay close to the ground under the majority of conditions. Maintenance underburns will be possible.
- Ecosystem Restoration: Restore, as much as possible, the natural fire regime and associated habitats while protecting threatened, endangered or sensitive species and species.

- Reduce the immediate risk of high intensity wildfires that have the potential to result in loss of life, property, and important forest ecosystem components by removing the small trees that create fuel ladders into the crowns of larger trees and by increasing the spacing between trees.
- Release overtopped oak trees to forestall their rapid decline.
- Improve the growing conditions for large legacy ponderosa pine trees by removing the understory trees competing with them for moisture and light.
- Reduce the risk of bark beetle tree mortality by reducing the number of trees per acre.

Measurements

- Acres in the planning area that would be treated by removing fuel ladders and increased spacing between trees.
- Acres of planning area where prescribed fire would be possible.
- Acres of oak woodland communities with Douglas-fir encroachment.
- Acres of pine-oak Douglas-fir communities with improved growing conditions for ponderosa pine legacy trees and trees per acre reduction.

ISSUES AND CONCERNS

Air Quality

Levels of smoke from slash and prescribed underburning may have a local, transitory effect on air quality and visibility. Limited visibility along roadways may cause short duration public safety issues. Sensitive members of the public may experience eye, throat, or lung irritation from these exposures. There is some risk that chronic, low-level exposure of workers or the public to smoke may lead to adverse health effects.

Measurement: Tons of emissions with high concentrations of particulate matter.

Access and Third Party Rights
Access issues associated with the project area are also very complex as a result of the lands being cobbled together from many different acquisitions. Distinction must be made between legal access and physical access. It is not uncommon to have physical access (an existing road), but no legal right of use to the road. Likewise, there are areas with legally defined access for which a road was never constructed. Lastly, there are areas with neither legal nor physical access.

Measurements: Evaluation of types of legal and physical access.
Solution found to access issue (Yes or No).

Steep Slopes and Soil Stability
Sections of the treatment area are very steep (>50%), with thin soils. Construction of temporary roads and landings to facilitate thinning can increase the chance of landsliding, surface erosion and delivery of sediment to adjacent stream systems.

Measurement: Miles of temporary road construction on very steep slopes (>50%).

Effects to Soils such as Disturbance and Compaction
Log yarding equipment (tractors, skidders, cable yarding) and burning has the potential to damage soil through compaction, displacement and sterilization. This in turn may increase erosion and decrease site productivity.

Measurements: Intensity of acres burned (high-low) and % acres intensive prescribed burn.
Acres of ground based treatment.
% Compacted.

Effects to the Habitats of Plants and Wildlife
Public comment indicated that there would be long term benefits to wildlife and plant habitats as a result of this project, but there were concerns that the short-term impacts would not off-set the long-term benefits. Would the short-term impacts be restored over time?

Measurements: Activity scheduled or buffered to avoid sensitive breeding seasons or life cycles (Yes or No).

Analysis of Effects in Biological Evaluations (BE)

There were concerns that invasive plants would become established in areas with soil disturbance and infestations would occur within fairly pristine oak-pine-Douglas fir habitats.

Measurement: Monitoring, eradication, and prevention requirements established.
(Yes or No).

There was a concern that converting current Douglas-fir habitats (including those with remnant old oaks and pines) into oak-pine habitats, as were likely present when fire regimes were at a more natural frequency and intensity, may not be desirable in all areas.

Measurement: Acres converted of sustainable Douglas-fir habitat
(East Conifer and Northern East Conifer) where dominant species before treatment is Douglas-fir, other species become dominant after treatment.

Effects on Riparian Reserves and Buffers
Tree removal adjacent to streams and wetlands has the potential of increasing stream temperature and increasing sediment due to loss of stream shading and soil disturbance next to the water. This in turn may reduce water quality and degrade aquatic habitat.

Measurement: Miles of fire-line in Riparian reserves, acres treated in Riparian reserves

Effects on Scenic Resources
There may be short term visible disturbance factors such as visible slash, stumps, boundary marking, etc. that will require mitigation to realize the benefits of the long term effect of larger trees in the viewsheds.

Measurements: Acres treated in Foreground, middleground, background distance zones. Degree of deviation from: "form, line, color, or texture common to the natural landscape" pertaining to meeting scenic standards.

Communication
Residents and others who may be affected need to be informed. Bicycles use Courtney and Atwood roads to access areas inside and outside of the proposed project area. Most hiking by non-locals occurs during the spring flowering season in the open meadows of the lower Catherine Creek drainage.

Measurement: Notice required in alternative? (Yes or No).

Prevention of escaped fire during underburning near private property
There are potential risks to adjacent private property from escaped prescribed fires.

Measurements: Expected Fuel load and
Miles of fire-line planned at adjacent property boundaries.

Cultural Resources
There are potential risks to cultural resource sites that will require mitigations in order to realize the benefit of reducing fire risk by reducing excess fuels with prescribed fire.

Measurement: Number of sites adversely affected.

The table on the next page uses the criteria from the above summaries and the information from Chapters 1, 2 and 3 in order to compare the alternatives:

PURPOSE	ISSUE/CONCERN	MEASUREMENT	1-No Action	2-Thin/Underburn
Improve Fire Resiliency		Acres Treated	0	2510
Reduce fire Intensity		Tons per acre Hazardous fuels removed	0	15-oak-pine 92-pine/DF
		Acres low intensity fire Prescribed fire possible	1300	3810
Restore Fire-Regime and Fire Dependent Habitats		Acres Douglas-fir Encroachment	2373	Will remain where pine-oak killed
		Acres Improved conditions for pine legacy trees	0	500
		Fire re-introduced in the landscape on surface rather than in tree crowns	NO	YES
	Air Quality	Tons emissions per acre w/ High concentration particulates	0 > 58 wildfire	12-29
		Impact on Air Quality	None-unless wildfire due to lack of action	Slight
	Access	Solution found	N/A	YES
	Steep Slopes	Miles of temporary road on steep slopes (>50%)	0	0
	Soil	Acres Ground Based Equipment % Compacted	0 0-unless wildfire	588 15% or less
		Risk of Prevalence of intensive burns % acres intensive prescribed burn	HIGH-wildfire 0	MED-wildfire <10%
		Acres disturbed-Compacted soil	0	88
	Wildlife/Plants	Schedule or buffer avoids plant/wildlife disturbance	N/A Wildfire-NO	YES
		Acres DF stands converted Acres oak-pine habitat jeopardy	0-Unless wildfire 2373	0-will not change overall dominance 290-buffers
	Wildlife	# Negatively affected species or habitat	0-species 20 habitat	12-short term 0-long-term
		# Beneficial Impact	0	20 long term
	Plants	# Beneficial Impact	0	9 long term
		# Negatively affected species	13	12-short term 0 –long term
	Invasive Plants	Prevent, monitor, eradicate	YES-eradicate Fewer acres due to funding	YES
	Riparian Reserves and Buffers	Miles fire-line in RR	0	12.9
		Miles mechanical fire-line in RR Reserves	0	0
		Acres RR Treated	0	57-Ground 1040-Hand
		# ACS Objective indicators at risk, degraded, or restored	At risk--All Degraded--0 Restored--0	At risk-Ac Untreated 0 1
	Scenic Resources Foreground	KVA Visible Acres Treated	FG-0 Unless wildfire	135-underburn
	Middlegrounds/ Backgrounds		MG/BG-0 Unless wildfire	2055-thin 1300-underburn
	% Visually Disturbed	% Negatively Affected Viewshed	0-Unless wildfire	Less than 1%
	Scenic standards	Meet scenic standard	YES	YES
	Communication	Notice Required?	N/A	YES
	Prevent Escaped Prescribed Fire	Miles fire-line at adjacent boundaries	0	37
		Expected Fuel Load-tons per acre	9-106	8-43
	Cultural Resources	# sites adversely affected	0-unless wildfire	0