Sparta Vegetation Management

Project

Fire Management (Fire & Fuels) Report

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Date: 12/5/2016
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Introduction

The following describes existing and desired conditions relative to fire management for the Sparta project area, objectives for fuels management as described in the Wallowa-Whitman National Forest Plan, and the effects of implementing the alternatives relative to fire management.

A primary fire management challenge in this project area is to reduce uncharacteristic fuel loadings commensurate to the standards established for specific vegetation groups. Fuel loadings and the vegetative composition of those fuel loads are a primary contributing factor influencing fire risk. Implementing treatments that impact fire risk would begin moving the project area toward the historic range of variability for the various potential vegetation groups (PVGs) in the project area, and substantially reduce the risk of uncharacteristic wildfire to natural resources, adjacent private property, and the public. Fuel hazard is one of the key components of fire risk and one of the two most effectively influenced by management actions (the other is ignition hazard).

The National Fire Plan was developed in August 2000, following a catastrophic wildland fire season, with the intent of actively responding to severe wildfires and their impacts to communities while ensuring sufficient firefighting capacity for the future. The National Fire Plan addressed five key points: Firefighting, Rehabilitation, Hazardous Fuels Reduction, Community Assistance, and Accountability.

Hazardous fuels reduction is a key part of the National Fire Plan. Hazardous fuels reduction treatments are designed to reduce the risks of high severity wildland fire to people, communities, and natural resources while restoring forest ecosystems to closely match their historical structure, function, diversity, and dynamics. Such treatments accomplish these goals by removing or modifying wildland fuels to reduce the potential for severe wildland fire behavior, lessen the post-fire damage, and limit the spread or proliferation of invasive species and diseases. Treatments are accomplished using commercial and non-commercial thinning, whip felling, pruning, mechanical and hand piling, grazing, and prescribed fire, or combinations of these and other methods.

Because of the prolonged absence of periodic surface burning, low and moderate severity fire regimes in the analysis area have developed multi layered tree densities, changed species composition proportions, and accumulated live and dead vegetation outside the range of historical fire regimes. These areas will support intense, stand replacing fire events which could result in the loss of late old structure (LOS) and wildlife habitat cover at scales outside historic levels.

What appears to be different about recent fires is that fewer ignitions are contributing to larger burn areas. In 1910, 3.1 million acres in the Northern Rockies were burned, ignited by more than 1,700 fire starts. In 2000, 380,000 acres around Bitterroot valley burned due to 78 starts. In 2002, the 450,000 acre Rodeo-Chediski fire burned as the result of two ignitions, and the 138,000 acre Hayman fire burned as the result of one. On the Wallowa-Whitman National Forest, the average annual fire occurrence and burn acreage over the period 1970-2015 was 139 fires for an average of 25,589 acres burned; however, from 2007-2015 an average of 95.6 fires occurred for an average of 51,215 acres in size. These recent and large wildfires all seem to exhibit uncharacteristically intense wildfire behavior and increased fire severity (RMRS-GTR-120. 2004, Pg. 6). All of these recent fires are occurring in an age of fully mechanized and organized fire suppression response.

Climate Change

The earth has entered an area of rapid environmental changes. The warming and drying trend predicted under the climate change scenarios will also increase the likelihood of intense large fires. These fires will be larger and more severe, especially at higher elevations. There will be fewer trees regenerating after a fire due to increased regeneration mortality from higher insect and pathogen activity (Forest, Insect & Pathogens and Climate Change: Workshop Report, Beukema 2007).
Resource managers will need to integrate adaptation strategies (actions that help ecosystems accommodate changes adaptively) and mitigation strategies (actions that enable ecosystems to reduce anthropogenic influences on global climate) into project design (Climate change and Forest of the Future: Managing in the Face of Uncertainty, et al Milar, 2007).

A review of available information relative to the analysis area indicates the following fire/fuel related climate related trends that are possible or likely (Salo, 2010).

- Increase in the percentage of winter precipitation that falls as rain, rather than snow
- Earlier snowmelt
- Increased potential for higher peak stream flows and extensive droughts
- Extended growing seasons
- Lower soil moistures
- Increased late-season moisture stress on vegetation
- Potential effects on plant growth due to increased levels of atmospheric CO2 (“fertilization”)

Adaptive strategies include:

1. Resistance options – manage forest ecosystems and resources so that they are better able to resist the influence of climate change or to stall undesired effects of change.

2. Promote resilience to change – resilient forests are those that not only accommodate gradual changes related to climate but tend to return toward a prior condition after disturbance either naturally or with management assistance. Promoting resilience is the most commonly suggested adaptive option discussed in a climate-change context (Dale et al. 2001, Price and Neville 2003, Spittlehouse and Stewart 2003). Forest management techniques such as prescribed burning or thinning dense forest, can make forest more resilient to wildfire and decrease fire emissions.

3. Enable forest to respond to change – This group of adaptation options intentionally accommodates change rather than resist it, with a goal of enabling or facilitating forest ecosystems to respond adaptively as environmental changes occur (Milar, 2007).

Desired Condition

The desired future condition for the landscape is a Condition Class 1 (Fire regimes are within or near historical ranges, and the risk of losing key ecosystem components is low. Vegetation conditions in term of species composition and structural stages are intact and functioning within the historical range). Existing surface fuels and ladder fuels would not support large scale crown fire on drier sites, which could affect the Sparta, Surprise Springs, East Eagle/Main Eagle, and Carson/Pine communities, private lands, homes or the National Forest

Existing Condition

Project Area Description

The Sparta project area is approximately 17,951 acres in size and encompasses a large geographical portion of the Eagle Creek watershed, including the following subwatersheds: Little Eagle Creek and Paddy-Eagle Creek. The project area is located north and northwest of the community of Richland, Oregon, with proposed treatment units in Townships 6, 7, and 8 South, Ranges 43, 44, and 45 East.
Management Direction, Wallowa-Whitman Land and Resource Management Plan

The Sparta project lies within 5 management areas identified in the Wallowa-Whitman’s Land and Resource Management plan (Table 1).

<table>
<thead>
<tr>
<th>Management Area</th>
<th>Management Area Description</th>
<th>Percent of Project Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA1</td>
<td>Timber production emphasis</td>
<td>51%</td>
</tr>
<tr>
<td>MA1W</td>
<td>Timber production emphasis w/in identified winter range</td>
<td>3%</td>
</tr>
<tr>
<td>MA3</td>
<td>Wildlife/timber emphasis (big game winter range)</td>
<td>30%</td>
</tr>
<tr>
<td>MA7</td>
<td>Wild and scenic river corridor</td>
<td>13%</td>
</tr>
<tr>
<td>MA15-7</td>
<td>Old growth preservation w/in a wild and scenic river</td>
<td>3%</td>
</tr>
</tbody>
</table>

Prescribed fire is identified as a treatment option under all management areas for management of fuels. Mechanical fuels treatment options are available in management areas MA1, MA1W, and MA3. Mechanical treatments are limited in areas MA7 and MA15-7.

Communities/Private lands

Four wildland urban interface (WUI) communities lie within and/or adjacent to the planning area. These communities are composed of private lands with widely spaced dwellings in a forested setting.

A community wildfire protection plan has been prepared in compliance with the National Fire Plan, the 10-year Comprehensive Strategy, and the Healthy Forest Restoration Act. The Baker County CWPP identified three of the communities, Surprise Springs, Sparta and East Eagle/Main Eagle area as “high risk” and one of the communities, Carson/Pine WUI as “moderate risk” for loss or damage from wildfire. The plan calls for fuel reduction activities as one of the actions necessary to lessen the wildfire risk on all four WUI communities (Baker County Community Wildfire Protection Plan, 2014).

Fire Environment

The fire environment includes available fuels (vegetation conditions), existing topography, and weather. These elements together define fire behavior. Of these, only fuels can be altered by management actions.

Many of the components of fuels work together to influence fire behavior including: vertical and horizontal distribution and continuity, moisture and chemical content, compaction, size and shape of fuels, and fuel loading. These components of the fire environment can be modified to reduce potential fire behavior.

Primary Vegetation Conditions:

Northern aspects and higher elevations of the analysis area consist of mixed conifer types. Ridge tops and southern aspects transition into ponderosa pine, Douglas-fir, and dry Grand fir types. Areas that have not had harvest activity or recent wildfires are overstocked.

Due to fire exclusion, shade tolerant species such as grand fir and Douglas-fir have expanded into areas that were dominated by ponderosa pine or ponderosa pine/western larch mixtures. Regeneration and growth of these species, over time, has created dense multiple canopy layered stands. Due to the lack of disturbance the shade intolerant ponderosa pine, western larch, and aspen have become susceptible to future disturbance from insects, disease (especially dwarf mistletoe), and wildfire.

Topography:

Topography influences on fire behavior include slope, aspect, wind speed, and wind direction. Slopes in this analysis area are quite steep, in some areas in excess of 50%. Slope increases fire behavior by
preheating fuels upslope of the fire and enabling spotting from rolling and aerial fire brands. Flame length and rate of spread increase with increasing slope. All aspects are represented in this analysis area. South and Southwest aspects typically experience the more intense fire behavior due to the duration of sun exposure. Fires in the Sparta project area frequently experience a moderate down-slope push late in the afternoon or early evening hours with the diurnal wind switch.

Weather:
Summers are typically hot and dry with day time temperatures in the 80’s to lower 90’s Fahrenheit with relative humidity’s in the teens (with poor overnight recovery). Lightning caused fires primarily occur in the months of July and August. These storms produce lightning and strong winds, often with little or no precipitation. Of particular concern to this project area are the strong gusty winds, often associated with a frontal passage, especially dry cold fronts.

Fuel Type Description
Fire suppression and past management practices over the last 100 years has resulted in forest communities that are densely overstocked, with more surface, ladder, and canopy fuel available to burn. The ponderosa pine and mixed conifer stands within the project area are densely stocked with small diameter trees and have large accumulations of surface fuels. Under these vegetation and fuels conditions, fire can easily reach the crowns of overstory trees and prevent the use of direct fire suppression tactics, resulting in non-typical high severity stand replacing fires.

The Fuel Characteristic Classification System
A May 12, 2011 kick-off meeting was held at Baker City, Oregon to begin developing and mapping Fuel Characteristic Classification System (FCCS) fuelbeds for the Predictive Service Area E4 zone of northeastern Oregon that includes the Umatilla, Malheur, and Wallowa-Whitman national forests, as well as adjacent BLM forest lands. Fuelbeds were completed in July, 2012 for the Wallowa-Whitman including the Sparta area in collaboration with the Fire and Environmental Research and Applications (FERA) team of the Pacific Wildland Fire Sciences Laboratory for use in the FCCS program (Ottmar et al. 2007; Riccardi et al. 2007)

The Fuel Characteristic Classification System (FCCS) calculates and classifies fuelbed characteristics and their potential fire behavior. Users may access fuelbeds from a fuelbed library or create their own custom fuelbeds. FCCS fuelbeds represent fuels throughout much of North America and were compiled from published literature, fuels photo series, other fuels data sets and expert opinion.

FCCS reports input and calculated fuel characteristics for each existing fuelbed component, from canopy fuels to ground fuels. FCCS also calculates the relative fire hazard of each fuelbed, including surface fire behavior, crown fire, and available fuel potentials, scaled on an index from 0 to 9. These FCCS fire potentials facilitate communication of fire hazard among users and provide an index of the intrinsic capacity of each fuelbed for surface fire behavior, crown fire and available consumption of fuels under dry benchmark environmental conditions (no slope, 4 mph midflame wind speed, and dry fuel moistures).

The FCCS predicts surface fire behavior, including reaction intensity (BTU ft⁻¹ min⁻¹), flame length (ft), and rate of spread (ft min⁻¹) based on benchmark and user-specified environmental conditions. By comparing predicted flame length and rate of spread, FCCS provides a crosswalk to one of the original 13 Fire Behavior Prediction System fuel models and one of the 40 standard fuel models.

Fire Regime
A natural fire regime is a general classification of the role fire would play across a landscape in the absence of modern human mechanical intervention but including the influence of aboriginal burning
Coarse-scale definitions for natural fire regimes were developed by Hardy and others (2001), Schmidt and others (2002) and interpreted for fire and fuels management by Hann and Bunnell (2001). The five natural fire regimes are classified based on the average number of years between fires (fire frequency or Mean Fire Interval [MFI]) combined with the severity of the fire (the amount of vegetation replacement) and its effect on the dominant overstory vegetation (Table 2).

<table>
<thead>
<tr>
<th>Fire Regime Group</th>
<th>Vegetation Types</th>
<th>Frequency (Fire Return Interval)</th>
<th>Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>All ponderosa pine types; Dry-Douglas fir/pine grass; and grand fir/grass.</td>
<td>0 – 35 years</td>
<td>Low severity. Large stand replacing fires can occur under certain weather conditions, but are very rare (200+ years).</td>
</tr>
<tr>
<td>2</td>
<td>True grasslands; juniper/grass; juniper/big sage; Mt big sage/grass; and Mt shrub/grass.</td>
<td>0 – 35 years</td>
<td>Stand replacing.</td>
</tr>
<tr>
<td>3</td>
<td>3a - Mixed conifer: very dry westside Douglas-fir; dry grand fir; 3b - Dry western hemlock; mesic grand fir; eastside western red cedar; 3c - Western hemlock; Pacific silver fir, and white bark pine below 45 degrees latitude; cool, mesic grand fir and Douglas-fir</td>
<td>35 – 100+ years</td>
<td>3a - Low severity tends to dominate.</td>
</tr>
<tr>
<td></td>
<td>3a - &lt; 50 years</td>
<td>3b - 50 - 100 years</td>
<td>3b - Mixed severity</td>
</tr>
<tr>
<td></td>
<td>3c - 100 - 200 years</td>
<td></td>
<td>3c - High severity tends to dominate.</td>
</tr>
<tr>
<td>4</td>
<td>4a - Lodgepole pine above ponderosa pine; aspen embedded in dry grand fir; 4b - Subalpine fir; white bark pine above 45 degrees latitude; and mountain hemlock; 4c - Spruce-fir; western larch; western white pine.</td>
<td>35 – 100+ years</td>
<td>Stand replacing</td>
</tr>
<tr>
<td></td>
<td>4a - 35 – 100+ years</td>
<td>4b - 100 + years</td>
<td>4a - stand replacing</td>
</tr>
<tr>
<td></td>
<td>4c - 100 – 200 years</td>
<td></td>
<td>4b - stand replacing, patchy arrangement</td>
</tr>
<tr>
<td>5</td>
<td>Greater than 200 years</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Fire Regime Group

<table>
<thead>
<tr>
<th>Vegetation Types</th>
<th>Frequency (Fire Return Interval)</th>
<th>Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>5a - Drier Douglas-fir in western Washington; noble fir; mountain hemlock;</td>
<td>5a - 200 – 400 years</td>
<td>5a - Stand replacing</td>
</tr>
<tr>
<td>5b - Douglas-fir; noble fir; western hemlock; western red cedar in western Washington;</td>
<td>5b - 400 years and greater</td>
<td>5b - Stand replacing</td>
</tr>
<tr>
<td>5c - Sitka spruce; coastal Pacific silver fir; very wet western red cedar;</td>
<td>5c - No fire</td>
<td>Non-forest</td>
</tr>
<tr>
<td>5d - Black sagebrush; salt desert scrub; alpine communities; subalpine heath</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Fire Regime Condition Classes

Fire regime condition classes measure the degree of departure from reference conditions, possibly resulting in changes to key ecosystem components, such as vegetation characteristics (species composition, structural stage, stand age, canopy closure, and mosaic pattern); fuel composition; fire frequency, severity, and pattern; and other associated disturbances, such as insect and disease mortality, grazing, and drought. Possible causes of this departure include (but are not limited to) fire suppression, timber harvesting, livestock grazing, introduction and establishment of exotic plant species, and introduced insects and disease (Schmidt and others 2002).

The higher the condition class number the higher the relative risk of fire, insect, or disease caused losses to natural resources and other key ecosystem components. A higher condition class rating or percent from departure shows a higher risk of loss of key ecosystem components landscape wide (Table 3).

Table 3. Condition Class Descriptions

<table>
<thead>
<tr>
<th>Condition Class</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fire regimes are within or near historical ranges, and the risk of losing key ecosystem components is low. Vegetation conditions in terms of species composition and structural stage are intact and functioning within the historical range.</td>
</tr>
<tr>
<td>2</td>
<td>Fire regimes have been moderately altered from their historical range. The risk of losing key ecosystem components is moderate. Fire frequencies have departed from historical frequencies by one or more interval returns (increased or decreased). This results in moderate changes to one or more of the following: Fire size, Intensity and Severity, and Landscape patterns. Vegetation conditions in terms of species composition and structural stage have been moderately altered from historical conditions.</td>
</tr>
<tr>
<td>3</td>
<td>Fire regimes have significantly altered from their historical range. The risk of losing key ecosystem components is high. Fire frequencies have departed from historical frequencies by multiple return intervals. This results in dramatic changes to one or more of the following: Fire size, Intensity and Severity, and Landscape patterns.</td>
</tr>
<tr>
<td>Condition Class</td>
<td>Description</td>
</tr>
<tr>
<td>-----------------</td>
<td>-------------</td>
</tr>
</tbody>
</table>
|                 | - Landscape patterns  
Vegetation conditions in terms of species composition and structural stage have been significantly altered from historical conditions. |

Potential Vegetation Group (PVG) / Biophysical Setting (BpS) –

Biophysical settings (BpS) are the primary environmental settings used in determining a landscape’s natural fire regime(s) and fire regime condition class (FRCC). The term “biophysical setting” replaces “potential vegetation groups” (PVG) in FRCC nomenclature. Biophysical settings were developed from biophysical environment information developed by the project Silviculturist.

In FRCC, a visual dynamics model is used to characterize the pattern of transitional states in each BpS, (Figure 1) in response to growth and maturation over time and changes resulting from disturbance. For any one stand, only one state can occur at any one time. Across a large BpS that contains many stands, all states may be represented at one time. This type of dynamics model has been developed for each BpS.

**Figure 1. FRCC Visual Dynamics Model**
Visual dynamics model (standard 5-box) for a forest ecosystem. (FRCC Guidebook 2005)

**The Standard 5-box dynamics model**

![Diagram of the standard 5-box dynamics model]

**Sparta Fire Regime Condition Class:**

Mixed conifer, Ponderosa pine and Ponderosa pine/Douglas-fir species dominate the forested stands. When condition class is viewed from a landscape level, individual stands exist in varying stages of development within each potential vegetation group in which it belongs. The fire regime vegetative type and structure of the predominant forested stands found within the analysis area are composed of 91 percent Dry Upland Forest PVG’s or BpS which can be described by the Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest (DMMCF-0910450). Less than 9% of the forested stands within the analysis area are moist upland forest PVG’s which occur as small scattered inclusions in the project area. These inclusions also fall below the 20% recommendation for modeling within the FRCC model. Fire behavior in these areas will be primarily influenced by the dry upland forest PVG stands surrounding them; therefore, fire behavior effects for these stands are expected to closely mirror the effects on dry upland forest stands.
The following is an overview of the description of DMMCF characteristics which were used for fire behavior modeling in the Sparta project area.

**Vegetation Description**

Ponderosa pine overstory is typical in fire maintained stands. Older stands tend to be large widely spaced ponderosa pine or Douglas-fir. Early seral forests are often open stands of mostly ponderosa pine. Lack of wildfire causes fill in of understory conifers, mainly ponderosa pine, Douglas-fir, and grand fir. Western larch is locally important.

**Disturbance Description**

Typical disturbance regimes under natural conditions include frequent, low intensity under-burns that maintain open stands of fire resistant trees. Much more infrequent mixed severity and stand replacement wildfire occurred and tended to generate mosaics of older, larger trees and younger regeneration. Endemic bark beetles produced patch mortality. Rarer epidemic bark beetle outbreaks caused larger-scale overstory mortality and released understory trees. Low intensity fire occurred over 67% of the landscape with rarer replacement fire at 15% and mixed severity 18%. Average historical fire size was estimated at 1,000 acres. Fire frequency was 22 years with a reference fire severity of 25%.

**Adjacency or Identification Concerns**

This BpS of the Dry Upland Forest (PVG) occurs below more mesic mixed conifer forest types, and often occurs above ponderosa pine forests. It includes the following plant associations: Douglas-fir/elk sedge, Douglas-fir/pinegrass, Douglas-fir/snowberry, Douglas-fir/ninebark and grand fir plant associations with similar associated species. It does not include Grand fir/queens cup beauldlily, Grand fir/big huckleberry, and similar moist types.

**Seral Stages**

The following table describes the seral stages within the project area.

**Table 4. Sparta project area Seral Stages.**

<table>
<thead>
<tr>
<th>Seral Stage Type</th>
<th>Historic Percent of landscape</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class A – Early Seral Stands (SI)</td>
<td>10%</td>
<td>Open stands of ponderosa pine and other tree seedlings mixed with grass and shrubs. Early seral dominant species include, ceonothus, scouler willow, bromus, some sedges and grasses</td>
</tr>
<tr>
<td>Class B – Mid Seral Closed Stands (SE)</td>
<td>5%</td>
<td>Closed stands of 5-20in DBH early seral tree species. Forests in this type rarely if ever exceed 80% canopy closer.</td>
</tr>
<tr>
<td>Class C – Mid Seral Open Stands (UR)</td>
<td>30%</td>
<td>Open stands of 5-20in DBH early seral species tree species. Dominant understory plants include elk sedge, pine grass, common snowberry, heartleaf arnica and lupines. This class has a low probability of stand replacement fire due to discontinuous fuel in these open stands.</td>
</tr>
<tr>
<td>Class D – Late Seral Open Stands (OFSS)</td>
<td>45%</td>
<td>Open stands of 20+ inch DBH early seral species. Dominant understory plants include elk sedge, pine grass, common snowberry, heartleaf arnica and lupines.</td>
</tr>
<tr>
<td>Class E – Late Seral Closed Stands (OFMS)</td>
<td>10%</td>
<td>Closed stands of 20+ inch DBH early seral species. Forests in this PVG rarely exceed 80% canopy cover. This class has a relatively high probability of replacement fires due to dense understory.</td>
</tr>
</tbody>
</table>


Throughout the project area there are a number of instances where moist stands are surrounded by dry site vegetation. These stands represent the dry end of the classification for cool/warm moist vegetation as they occur on this landscape. This mosaic of cool moist/warm moist vegetation, surrounded by dry
vegetation, poses a challenge when modeling fire regime departure. These stands fit within the drier end of a mixed fire regime spectrum. The adjacency and location on slope of many of the moist stands proposed for treatment are such that fire frequency would have been expected to be similar if not identical to that found on adjacent dry plant associations. As a result frequent, low intensity fire and the vegetative component associated would have been the historical norm within these stands. This disturbance, currently lacking, would have shaped the development of these stands.

The landscape is currently at the high end of Condition Class 2 and a moderate alteration to the historic disturbance regimes are clearly evident, such as one or more missed fire return intervals which may predispose the stand or ecosystem to disturbance events well outside the historic range of variability. Fire regime and vegetative condition departure is moderately high on the landscape. These stands are typical of dry site vegetation that historically developed under the influence of low intensity, high frequency disturbance from wildfire. Mid Seral Closed stand structure is well above historic levels and Late Seral Open is well below historic levels for most species found on drier sites (Table 5).

**Figure 2. Existing FRCC Departure**

![Existing FRCC Departure Dry Upland Forest](image)

Figure 2 above illustrates the current landscape departure from reference conditions for DMMCF for vegetation (54% departure), fire return interval (64% departure), and the combined FRCC departure for the landscape (55% departure). The departure for the landscape is at the high end of condition class 2 which is defined as departure between 34-65% which ties back to the fact that fire regimes in the Sparta project area have been moderately altered from their historic range. The risk of losing key ecosystem components is moderate. Fire frequencies have departed from historical frequencies by one or more interval returns (increased or decreased). This results in moderate changes to one or more of the following:

- Fire size
- Fire intensity and severity, and
- Resulting landscape patterns

Vegetation conditions in terms of species composition and structural stage have been moderately altered from historical conditions.
Many of these stands contain remnant numbers of large diameter ponderosa pine and western larch. The past 100 years of fire suppression have greatly altered these stands, which were historically open stands with large ponderosa pine, Douglas-fir, and western larch. Past management has also resulted in an uncharacteristic distribution of large, fire intolerant overstory trees that support future propagation of high levels of fast growing, understory vegetation that will develop into ladder fuels, perpetuating the fuels issue that currently exists. The heavy fuel loads and high density of small trees could result in a fire that would easily reach into the crowns of the old trees and result in a high mortality of that component of the stands.

Table 5. PVG Seral Stage Distribution comparing Historic Reference to Existing Conditions in Sparta Project Area.

<table>
<thead>
<tr>
<th>PVG</th>
<th>Early Seral Reference</th>
<th>Mid Seral Closed Reference</th>
<th>Mid Seral Open Reference</th>
<th>Late Seral Open Reference</th>
<th>Late Seral Closed Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry Upland Forest</td>
<td>10%</td>
<td>5%</td>
<td>55%</td>
<td>30%</td>
<td>22%</td>
</tr>
<tr>
<td></td>
<td>45%</td>
<td>4%</td>
<td>10%</td>
<td>14%</td>
<td></td>
</tr>
</tbody>
</table>

Fire History

Fire Occurrence: The Fire Occurrence rate equals the number of fires per year per 1,000 acres. The rate is used to compare average fire occurrence per year on a relative basis.

The Sparta analysis area had 33 documented ignitions from 1986 through 2016. The Sparta analysis area has a fire occurrence rate similar to that of the WWF.

Of the 33 fires that occurred within the analysis area 73% were caused by lightning, and 27% were human caused, primarily unattended camp/warming fires (Table 6). With aggressive initial attack efforts 75 percent of all fire starts are kept small (<.25 acre). Table 7 details the number of fire starts by size class.

Road density has not been found to impact fire occurrence on the Wallowa-Whitman NF, where the majority of fires are started by lightning. In general, increased road access improves fire suppression response and as a result lowers overall fire risk on the Wallowa-Whitman.

Table 6. Fires by Cause within Sparta Project Area in Years 1986-2016

<table>
<thead>
<tr>
<th>Statistical Cause</th>
<th>Code</th>
<th>Total Number of Fires</th>
<th>Percent of Fires</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lightning</td>
<td>1</td>
<td>24</td>
<td>73</td>
</tr>
<tr>
<td>Equipment</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Camp Fire</td>
<td>3</td>
<td>8</td>
<td>24</td>
</tr>
<tr>
<td>Warming Fire</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Debris Burning</td>
<td>5</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Railroad</td>
<td>6</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Arson</td>
<td>7</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Children</td>
<td>8</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Other</td>
<td>9</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>33</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 7. Fires by Size within Sparta Project Area during Years 1986-2016

<table>
<thead>
<tr>
<th>Size Class</th>
<th>Total Fires</th>
<th>Percent of Fires</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>25</td>
<td>76</td>
</tr>
<tr>
<td>B</td>
<td>7</td>
<td>21</td>
</tr>
<tr>
<td>C</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>D</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>E</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>F</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>G</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>33</td>
<td>100</td>
</tr>
</tbody>
</table>
Three WUIs are associated with the analysis area; Surprise Springs, Sparta, and Carson/Pine Valley. Surprise Springs and Sparta both have slightly higher fire occurrence rates than the Wallowa-Whitman National Forest. Small acreages of the Carson/Pine Valley WUI are within the analysis area (Table 8). The Carson/Pine Valley WUI’s Fire Occurrence Rate (.04) was slightly lower than the WWF.

Table 8. Summary of Wildland Urban Interface Acreage within Sparta Project Area

<table>
<thead>
<tr>
<th>WUI Name</th>
<th>Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sparta</td>
<td>8,529</td>
</tr>
<tr>
<td>Surprise Springs</td>
<td>2,214</td>
</tr>
<tr>
<td>Carson/Pine Valley</td>
<td>1,113</td>
</tr>
</tbody>
</table>

Fuel Accumulation

Debris accumulations and ladder fuels within the project area would be reduced to approximate historical levels, resulting in summer wildfires that burn primarily on the ground (low intensity).

The desired fuels conditions (live and dead) would support primarily surface fire during typical summer conditions. Average fire intensity would be low to moderate, resulting in consumption of surface fuels, mortality of small diameter vegetation of all species and favoring survival of early seral, fire resistant species of larger diameter (ponderosa pine, western larch, Douglas-fir). The project area would be in a condition that it could be maintained in the appropriate ecological condition with prescribed fire. Tables 9 and 10 illustrate desired down woody material and fuel loading by plant association respectively.

Table 9. Desired Large Woody Material

<table>
<thead>
<tr>
<th>SPECIES</th>
<th>PIECES/AC</th>
<th>PIECE LENGTH AND DIAMETER SMALL END</th>
<th>TOTAL LINEAL LENGTH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ponderosa Pine</td>
<td>3-6</td>
<td>12” 6 ft</td>
<td>20-40 ft</td>
</tr>
<tr>
<td>Mixed Conifer</td>
<td>15-20</td>
<td>12” 6 ft</td>
<td>100-140 ft</td>
</tr>
<tr>
<td>Lodge pole pine</td>
<td>15-20</td>
<td>8” 6 ft</td>
<td>120-160 ft</td>
</tr>
</tbody>
</table>

A district policy for the management of snags has been adopted that is consistent with Forest Plan guidelines and based on Eastside Screens, which calls for 2.25 snags per acre with no differentiation between the biophysical environments. Existing standing large snags (>12 inches, DBH) should be protected during firing operations through avoidance or fuels reduction (FDR) as practical.

Table 10. Desired Down Woody Material

<table>
<thead>
<tr>
<th>Tons Per Acre</th>
<th>Plant Association</th>
</tr>
</thead>
<tbody>
<tr>
<td>7-15</td>
<td>Grand fir/twinflower, grand fir/huckleberry, grand fir/spirea, sub-alpine fir, and lodge pole pine</td>
</tr>
</tbody>
</table>

Fire behavior fuel models and fuelbeds are used as input to the Rothermel (1972) fire spread model, which is used in a variety of fire behavior modeling systems. The Fuelbeds used in this analysis are from the Fuel Characteristic Classification System (FCCS) created by the Pacific Wildland Fire Sciences Laboratory (Ottmar et al. 2007; Riccardi et al. 2007). Fuelbeds represent the past, current, and potential future conditions of major forest types, management activities, and natural disturbances occurring within the region. The fuelbeds (designated 1501_NO through 1710_NO, for Northeastern Oregon are arranged in management and successional pathways initiated by a stand replacing event.
Fuelbeds used to identify existing conditions are as described in Table 11 below.

### Table 11. Sparta Project Area Fuelbed Descriptions. (Pre-treatment)

<table>
<thead>
<tr>
<th>Fuel Bed Number</th>
<th>Structure</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1505_NO</td>
<td>Stand Initiation</td>
<td>15-25 years old stand with no treatment Dry upland Forest (DUF)</td>
</tr>
<tr>
<td>1527_NO</td>
<td>Understory Re-initiation</td>
<td>80-150 year old Dry upland forest with past thinning or select harvest and no follow up treatments. Grand fir/ Douglas-fir dominate understory DUF.</td>
</tr>
<tr>
<td>1526_NO</td>
<td>Stem Exclusion</td>
<td>Warm dry ponderosa pine Douglas-fir and grand fir forests. Stands are 80-150 years old and have had repeated select tree harvests DUF.</td>
</tr>
<tr>
<td>1532_NO</td>
<td>Old Forest Multi-Stratum (OFMS)</td>
<td>Warm, dry Douglas-fir, ponderosa pine, and grand fir forest. Established over 150 years ago following wildfire. Stands have a history of thinning and select tree harvests but little active management in the last 70 years. Douglas-fir and grand fir dominate all tree layers. DUF</td>
</tr>
<tr>
<td>1529_NO</td>
<td>Old Forest Single Stratum (OFSS)</td>
<td>Warm, dry Douglas-fir, ponderosa pine, and grand fir forest. Established over 150 years ago following wildfire. Stands have had recent select tree harvest followed by prescribed burning to reduce woody fuels and have medium density canopy and woody fuels. Western larch may be present in overstory. DUF</td>
</tr>
</tbody>
</table>

### Smoke Management

The Sparta project area is located near the following communities/areas: Richland, Halfway, Sparta, Surprise Springs, Cornucopia, and the Eagle Cap Wilderness (Class I Airshed). Smoke impacts to the Eagle Cap Wilderness are restricted between May 15 and October 1. La Grande in the Grande Ronde Valley, approximately 52 miles northwest of the project area and Baker City in the Baker Valley, approximately 34 miles to the west of the project area are two communities with a history of air quality concerns. The prevailing wind during fire season is out of the southwest.

Air quality monitoring sites are located in three areas, La Grande, Cove, and Baker City. All three sites maintain equipment that is used for estimating both PM10 and PM2.5 levels for health purposes. Visual quality was monitored from the Pt. Prominence fire lookout until 1998 where ODEQ maintained a camera visibility monitoring site (Boutcher, 1994). Currently, visibility is monitored from an automated IMPROVE (Integrated Monitoring for Protected Visual Environments) sites located within Starkey Experimental Forest and near Oxbow, Oregon. This is a joint project with EPA, UC Davis, US Park Service, and US Forest Service. A second visibility site is monitored in Hells Canyon.

### Air Quality Standards

The Clean Air Act (CAA) requires that the EPA establish standards for certain pollutants in order to protect human health and welfare. National Ambient Air Quality Standards (NAAQS) have been established. Management activities that result in emissions are managed to meet established standards.

Particulate matter is the primary pollutant of concern in smoke. Particulate matter is a term used to describe dispersed airborne solid or liquid particles, which will remain in the atmospheric suspension from a few seconds to several months. Particulate matter less than 2.5 microns in diameter (PM2.5) or less than 10 microns in diameter (PM10) describes particles small enough to enter the human respiratory system. Oregon DEQ standards for PM10 and PM 2.5 are shown in Table 12 (OAR 629-048, 2008).
### Environmental Consequences

#### Assumptions

Direct impacts were calculated within the Sparta project area and smoke manage impacts were analyzed to include adjacent projects outside of the project area as smoke impacts are not limited to just the Sparta area. The areas potentially impacted by smoke would be the communities of Halfway, Richland, La Grande, and Baker.

Effects of the action alternatives are based on full implementation of the design criteria and mitigation measures in the Alternatives Description section of the EA.

In order to meet State of Oregon Air Quality guidelines and regulations as well as address regional and local air quality concerns, smoke management forecasts provided by the Oregon Department of Forestry will be used for all prescribed burning activities. With the exception of weather conditions, these forecasts and the desired air quality standards they are designed to achieve can be the largest limiting factor influencing the amount and type of prescribed burning achievable on the planning area.

To reduce the potential for impacts to nesting land birds, prescribed burning activities projected to occur on or after May 20, and/or past the onset of vegetation leaf-out, will be reviewed by a district or forest wildlife biologist. The biologist will then provide recommendations concerning prescribed burning after May 20 and/or past the onset of vegetation leaf-out. This measure may limit the amount of burning that can be accomplished during a given season, particularly during years with higher than average spring precipitation.

#### Methodology

This analysis addresses the effects of implementing the proposed alternatives for the Sparta project area in relation to the issue fire behavior on National Forest Lands. Modified fire behavior was analyzed in terms of fire behavior potential and the ecological risk associated with the presence or absence of fire.

Key Indicators used to compare the alternatives are:

- **Fuel Loading and associated Fire Behavior Potential** –
  - Crown Fire Potential – Measure in percent of seral stage susceptible to crown fire with desired condition less than 25% based on reference conditions for landscape.
  - Flame Length – measured in feet with flame lengths less than 4 feet desired to allow direct attack and reduce overstory mortality.
  - Surface fuel loadings – Measured in tons/acre for material less than 3 inches in diameter with less than 10 tons per acre being desired condition to facilitate low to moderate intensity fire.

- **Fire Regime Condition Class Departure** –

---

1 National Ambient Air Quality Standard
Fire Regime Condition Class of the landscape - Measured in percent departure from reference conditions and a reference fire return interval of 22 years. Desired condition would be a departure of less than 33% from reference conditions where fire regimes are within or near historical ranges, and the risk of losing key ecosystem components is low. Vegetation conditions in terms of species composition and structural stage are intact and functioning within the historical range.

For the purpose of this analysis, mechanical treatments include commercial harvest, post-harvest noncommercial thinning, non-commercial thinning with no prior harvest, and grapple and hand piling. These are all methods of mechanically treating areas that are overstocked, have a ladder fuel component, and/or have heavy concentrations of standing dead and down fuels. Prescribed fire would follow all mechanical pre-treatments in all of the action alternatives except for overstory removal treatments in plantations. Prescribed fire would also be used as a standalone treatment in identified burn blocks.

Fuel Loading & Fire Behavior Potential

Fire behavior modeling was used to predict the changes in fuel loading and fire behavior in the project area for the vegetation conditions that would exist for each alternative. The modeling results show how Alternatives 2 and 3 would change both surface and crown fire behavior within the project area.

Creating fire resilient forests with fuels treatments implies a three part approach; reduce surface fuels through prescribed burning, reduce ladder fuels through small diameter thinning and burning, and reduce crown density in both the understory and overstory (Agee 2002 and Skinner 1996). The recent Cornet/Windy fire (2015) on the Whitman Ranger District post-fuels treatment effectiveness monitoring supports science on a local landscape. The fire had beneficial fire effects on 6,577 acres out of a total area burned of 22,000 acres. Fuels treatments occurred on over 8,000 acres of those acres in the last 15 years with 95% of those acres showing a reduction in fire intensity and severity when compared to the adjacent untreated stands. Acres having all three factors completed had the most favorable outcomes. (Fire Treatment Effectiveness Monitoring database)

The following scientific principles can be used in reducing fire behavior potential in large fires (Table 13):

1. Reduce surface fuel loads
2. Increase crown base heights
3. Reduce canopy density
4. Retain large fire tolerant trees which create shade and moderate wind speed

Crown characteristics that lead to crown fire are described by Finney (1996):

“A surface fire may make the transition to some form of crown fire depending on the surface intensity and crown characteristics (Van Wagner1977 and 1993). The crown characteristics that are used to compute crown fire activity are;

- Crown base height
- Crown height
- Crown bulk density

Lower crown base height (including ladder fuels) facilitates ignition of the crown fuels by the surface fire and then, transition to some form of crown fire. Crown bulk density is used to determine the threshold values for active crown fire, which spreads much faster than a surface fire. Crown height is used as the upper level of the crown space for determining crown fuel loading and the starting height of lofting embers”. 
Table 13. Reduction of Fire Behavior Potential

<table>
<thead>
<tr>
<th>Principle</th>
<th>Effect</th>
<th>Advantage</th>
<th>Concerns</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduce surface fuel</td>
<td>Reduces potential flame length</td>
<td>Control easier, less torching</td>
<td>Surface disturbance less with fire than other techniques</td>
</tr>
<tr>
<td>Increase canopy base height</td>
<td>Requires longer flame length to begin torching</td>
<td>Less torching</td>
<td>Opens understory, may allow surface winds to increase</td>
</tr>
<tr>
<td>Decrease crown density</td>
<td>Makes tree-to-tree crown fire less probable</td>
<td>Reduces crown fire potential</td>
<td>Surface wind may increase, surface fuel may be drier</td>
</tr>
<tr>
<td>Retain larger trees</td>
<td>Thicker bark and taller crowns</td>
<td>Increases survivability of trees</td>
<td>Removing smaller trees is economically less profitable</td>
</tr>
</tbody>
</table>

Source: Agee 2002

Fire behavior fuel models and fuelbeds are used as input to the Rothermel (1972) fire spread model, which is used in a variety of fire behavior modeling systems. The Fuelbeds used in this analysis from the Fuel Characteristic Classification System (FCCS) are described in Table 11 under existing conditions. Post-treatment fuelbeds within treatment units are best characterized by the fuelbeds described in Table 14.

Table 14. Sparta Project Area Post-treatment Fuelbed Descriptions.

<table>
<thead>
<tr>
<th>Pre-Treat Fuelbed Number</th>
<th>Post-Treat Fuelbed Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1505_NO</td>
<td>1513_NO</td>
<td>25-40 year old warm, dry Douglas-fir, ponderosa pine, and grand fir have had recent precommercial thinning followed by prescribed fir, piling and burning.</td>
</tr>
<tr>
<td>1527_NO</td>
<td>1525_NO</td>
<td>Warm dry ponderosa pine Douglas-fir and grand fir forests. Stands are 80-150 years old and have had repeated select tree harvests followed by prescribed fire to reduce woody fuels.</td>
</tr>
<tr>
<td>1526_NO</td>
<td>1525_NO</td>
<td>Warm dry ponderosa pine Douglas-fir and grand fir forests. Stands are 80-150 years old and have had repeated select tree harvests followed by prescribed fire to reduce woody fuels.</td>
</tr>
<tr>
<td>1532_NO</td>
<td>1529_NO</td>
<td>Warm, dry Douglas-fir, ponderosa pine, and grand fir forest. Established over 150 years ago following wildfire. Stands have a history of thinning and select tree harvests but little active management in the last 70 years. Douglas-fir and grand fir dominate all tree layers. DUF</td>
</tr>
<tr>
<td>1529_NO</td>
<td>1529_NO</td>
<td>Warm, dry Douglas-fir, ponderosa pine, and grand fir forest. Established over 150 years ago following wildfire. Stands have had recent select tree harvest followed by prescribed burning to reduce woody fuels and have medium density canopy and woody fuels. Western larch may be present in overstory. DUF</td>
</tr>
</tbody>
</table>

FCCS also uses a 3 digit code to show fire potentials representing surface fire potential or flame lengths, crown fire potential, and available fuel potential or fuel loadings. Each of the numbers in the 3 digit code range from 1-9 with the high the number showing the high potential. For example:

FCCS number 479 would represent the following potential fire behavior.

4. Flame lengths of 4-5 feet in height
7. Crown fire potential of 70-79% or a high potential to initiate and maintain a crown fire
9. Surface Fuel loading above 90 tons/acre (extremely heavy loading)

The fire potential for this rating would be flame lengths in excess of hand crew suppression capabilities, highly likely to have stand replacement fire, and due to surface fuel loading be highly detrimental to soils and resistant to control.

A number of factors including crown and canopy bulk density, crown base heights, torching indices, crowning indices, crown fire potential, spotting potential, and flame lengths were analyzed in determining differences between alternatives. Crown fire potential and flame length were selected as the best
measurements. Many of the other factors listed above are functions of crown fire potential. Fire managers are interested in flame lengths, crowning indices and torching indices because it affects how and where to fight a wildfire.

**Fire Regime Departure**

Modifications in vegetation resulting from treatment actions were evaluated and summarized following the protocols for determination of Fire Regime Condition Class (used in existing condition sections). Using inputs on the Fire Regime Condition Class Worksheet (located in the Sparta Analysis File) factors such as departure of fire return interval, fire intensity, stand structure, and stand composition were developed for each potential vegetation group and then combined for a total landscape analysis.

**Spatial and Temporal Context for Effects Analysis**

Direct and indirect effects will be those generally occurring with 1-20 years of implementation of an action alternative. Cumulative effects would be those actions that include past, present, and proposed in the reasonably foreseeable future following implementation. Past management activities have been accounted for as part of the existing condition. All present and reasonably foreseeable future activities are described in Appendix D of the environmental assessment. Those activities that overlap in time and space which would create a measurable cumulative effect when combined with the activities proposed in Sparta action alternatives are discussed under cumulative effects below. Addition prescribed fire planned adjacent projects outside of the project area in adjacent WUI areas are discussed in the air quality section.

**No Direct, Indirect, or Cumulative Effects**

The following activities in the action alternatives would have a negligible potential to effect fire behavior:

- Danger tree removal
- Snag Retention
- Snag Creation
- Temporary Road Construction
- Bridge Replacement/Reconstruction
- Bridge Abutment Reconstruction
- Culvert Replacement
- Road ROW Acquisition

These activities will not be discussed further in this analysis.

**Direct and Indirect Effects on Fire/Fuels**

**Alternative 1 – No Action**

**Fuel Loading & Fire Behavior Potential**

No action would result in no reduction in surface or aerial fuel loadings and as a result the potential for adverse effects from wildland fire would remain and may increase. Within the analysis area, multilayered stand structures, tree densities, and live vegetation continue to grow, and dead wood continues to accumulate, creating conditions that allow fire to move vertically from the ground level to the forest crown. Overstocked stand conditions would continue to increase the susceptibility of the stands to insects and disease (see Vegetation Effects Section) resulting in increased surface and crown fuel loadings and associated fire behavior potential. These conditions continue to limit firefighting opportunities, pose
undesirable risk to private property, firefighter and public safety, and continue the risk of damaging impacts to natural resources.

The direct effects of Alternative 1 is a continuation of heavy surface and canopy fuel loadings. Flame lengths exceeding four feet could be expected; continuing the risk of a crown fire initiation, active fire spread (including onto private property and homes), and decreased opportunities to fight fire direct with hand tools. Crown base heights would remain low, canopy bulk densities would remain high. The potential for crown fire would remain for both single and individual tree torching (passive) and tree crown to crown spread (active). In some instances fire suppression efforts would require backing off to areas of lighter fuels and natural breaks or using heavy equipment. Not having the opportunity to direct attack a fire combined with the limited access in the project area increases the potential for a large, uncharacteristic wildfire, the potential for resource damage from heavy equipment, and risk to firefighter and public safety.

The direct effects of not treating acres with crown fire potential also increases the risk of mineral soil exposure during wildfire, increasing potential damage to soil, vegetation, and water quality. The continued risk of high intensity fire poses an increased risk to deterioration of the viewsheds along the Eagle Creek, and the areas surrounding the communities of Sparta, Surprise Springs, Carson/Pine Valley, and East Eagle/Main Eagle.

**Fire Regime Condition Class Departure**

The analysis area is this project area currently has approximately 16,553 acres in fire regimes one, which are identified as having a moderate to high FRCC landscape departure of 55% (Figure 2).

Without treatment, Fire Regime Condition Class departure would continue to increase. The likelihood of large scale disturbances (fire, insect epidemics, etc.) would increase over time, compounded by anticipated changes in climate in the area. Fire exclusion would continue to extend the fire return interval, increase fuel loadings, change vegetation profiles, and increase the gap between historical conditions and current conditions. True fir establishment would continue in the absence of low intensity fire. These vegetative conditions would continue to place Late and Old structure, wildlife habitat, and riparian areas at risk to severe wildfire impacts.

Reliance upon natural disturbance to return the area to historic conditions could be expected to take years if not decades. Lacking treatment, the size and intensity of future natural disturbance is expected to be unacceptable on both federal and private land.

**Air Quality**

The Sparta project area is located approximately 5 miles north and northwest of Halfway and Richland, OR and approximately 1 mile south of the Eagle Cap Wilderness, a high visual quality area. Potential impacts from smoke generated from a wildfire will continue to increase as fuel loadings increase over time.

The direct effects of a wildfire burning under the existing conditions has the potential to produce smoke levels that exceed visual and health standards within Halfway and Richland as well as the dispersed communities of Sparta, Surprise Springs, Carson/Pine Valley, and East Eagle/Main Eagle. Local research found PM10 smoke production was twice as high for wildfires as for prescribed fire. This is because wildfires generally occur during drought periods in which there are low fuel moistures. Research in the Grande Ronde River Basin found the following levels of PM10 smoke emissions (Huff, Ottmar, et al (1995):

- Wildfire: 0.318 tons or 635 pounds per acre
- Prescribed burning: 0.167 tons or 334 pounds per acre
Nearby areas that may be impacted by wildfire smoke includes:

- Communities of Halfway, Richland, Sparta, Surprise Springs, Carson/Pine Valley, and East Eagle/Main Eagle
- Eagle Cap Wilderness Area (Class I Airshed)

**Wild and Scenic**

Without treatment, fuel loading (live and dead) and associated fire potential is expected to increase over time. Initial fire suppression response will not change although the resistance to control of summer wildfires is expected to increase and potentially result in larger, more intense burns, effecting both visual and water quality Outstanding Remarkable (OR) values (Environmental Assessment for the Eagle Creek Wild and Scenic River Management Plan, 1993).

The continued and increasing potential for larger, intense fires may result in an increased use of heavy equipment (and associated ground disturbance) and aviation support, primarily outside riparian areas, in order to achieve suppression objectives.

**Action Alternatives – Alternatives 2 and 3**

Vegetation treatments in the action alternatives target canopy, ladder and surface fuels with silvicultural operations and surface fuels with prescribed burning (Table 15).

**Table 4. Sparta Vegetative Treatments**

<table>
<thead>
<tr>
<th>Alternative Elements</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
<th>Alternative 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Harvest/Noncommercial Treatment Acres</td>
<td>0</td>
<td>5,775</td>
<td>5,291</td>
</tr>
<tr>
<td>Harvest Treatment Acres (total)</td>
<td>0</td>
<td>4,413</td>
<td>3,781</td>
</tr>
<tr>
<td>Noncommercial Treatments</td>
<td>0</td>
<td>1,362</td>
<td>1,510</td>
</tr>
<tr>
<td>Total Acres Treated by Prescription Type (Noncommercial)</td>
<td>PCT</td>
<td>0</td>
<td>1,362</td>
</tr>
<tr>
<td></td>
<td>Underburn</td>
<td>0</td>
<td>1,331</td>
</tr>
<tr>
<td></td>
<td>Grapple Pile</td>
<td>0</td>
<td>625</td>
</tr>
<tr>
<td></td>
<td>Hand Pile</td>
<td>0</td>
<td>38</td>
</tr>
<tr>
<td>Post-Harvest Treatment Activities</td>
<td>PCT</td>
<td>0</td>
<td>1,362</td>
</tr>
<tr>
<td></td>
<td>Underburn</td>
<td>0</td>
<td>4,196</td>
</tr>
<tr>
<td></td>
<td>Grapple Pile</td>
<td>0</td>
<td>1,668</td>
</tr>
<tr>
<td></td>
<td>Hand Pile</td>
<td>0</td>
<td>81</td>
</tr>
<tr>
<td>Prescribed Fire (Acres)</td>
<td>Total Burn Block Area</td>
<td>0</td>
<td>4,793</td>
</tr>
</tbody>
</table>

Canopy and ladder fuels are reduced by forest thinning operations that target crown classes, stand basal area and canopy bulk density. Treatments would also maximize managing towards large trees that are resistant to insects, disease, and fire.

Surface fuels would be reduced by prescribed fire and/or a combination of mechanical treatments and burning that remove and reduce fuel (e.g. grapple pile and burn). Reducing surface and crown fuels would reduce crown fire potential and potential flame length.

Crown and canopy base heights would be increased through the thinning of the understory. Prescribed burning will also increase crown base heights by removing live limb wood in the lower portions of the crowns.
Fuel Loading & Fire Behavior Potential

The action alternatives propose a combination of vegetation and fuel treatments that research has shown will be effective at reducing fire potential. Several authors and/or papers have supported vegetation treatment in conjunction with fuels reduction as tools to reduce fire behavior. The principle goal of fuels reduction treatments is to reduce fireline intensities, reduce the potential for crown fires, and improve the ability of forest stands to survive a wildfire (Agee 2002). Stand structure and wildfire behavior are clearly linked (Biswell 1960, Cooper1960, Dodge 1972, McClean 1993, Rothermel 1991, van Wagner 1977), so fuels reduction treatments are a logical approach to reducing extreme fire behavior.

In forest stands that have not experienced fire or thinning for several decades, thinning combined with (often multiple) prescribed-fire or other surface fuels treatments are necessary to effectively reduce potential fire behavior and crown fire hazard (PNW-GTR-628). Prescribed burning alone, particularly in forested stands where past disturbance cycles have been missed, tends to be difficult to implement and variable in effectiveness. Under the best of conditions prescribed burning will be variable in terms of intensities, consumption, and area coverage due to natural variability of vegetation, topography, and weather. This is particularly true on the cool moist sites within the analysis area which, while on the drier end of that environment, are expected to burn in a patchy manner under spring or fall burning conditions, even with other silvicultural treatment.

The most appropriate fuel treatment strategy is often thinning (removing ladder fuels and decreasing tree crown density) followed by prescribed fire, piling and burning of fuels, or other mechanical treatments that reduce surface fuel amounts. This approach reduces canopy, ladder and surface fuels, thereby reducing both the intensity of potential wildfires (Graham, McCaffery and Jain. 2004. RMRS-GTR-120).

Silvicultural treatments that target reduce canopy closure have the potential to reduce the development of all types of crown fires (Cruz et al. 2002, Rothermel 1991, Scott and Reinhart 2001, van Wagner 1977) if surface fuels are concurrently treated. Canopy and ladder fuels will be reduced by forest thinning operations that target crown classes, stand basal area and canopy bulk density. Treatments would also maximize managing towards large trees that are resistant to insects, disease, and fire.

Thinning and prescribed fire is expected to modify the understory microclimate. Expected results include increased solar radiation, increased surface temperatures, decreased fine fuel moistures, and reduced sheltering from wind. An increase in fine fuels, primarily grass and forbs is also anticipated. Combined, these changes are expected to result in a change in fire behavior. Fire will shift from burning in heavier fuels, including ladder fuels, under a more sheltered condition and continuous canopy, with potential for crown fire, to fire burning in light fuels in a more exposed or unsheltered situation, where the predominant fire spread mechanism will be surface fire.

Fires in light fuels are expected to exhibit high intensity where fuel, weather, and topographical conditions align. These high intensities are short lived as fire in light fuels spread relatively rapidly and burnout quickly, pose less resistance to control efforts, and are reactive to changes in fine dead fuel moistures. Reduced ladder fuels and open canopies reduce potential for crown fire initiation and spread. Fire in light fuels are less “severe” than those in heavy fuels as measured by consumption of surface fuels, soil heating, etc. In general, shifting a fire’s behavior from a crown to surface fire produces less severe effects and fewer impacts on resource values (Fitzgerald 2003).

Modification of understory conditions toward a higher proportion of light fuels with reduced surface fuel loading reduces the difficulty in application of prescribed fire, extending the time available when burning objectives can be met (prescription window), and reducing the need to burn when the relative risk of ignition is otherwise high (mid-season). Treatment and maintenance of thinned stands will be required to maintaining surface fuel conditions and manage development of ladder fuels over time so as to limit future crown fire risk.
The action alternatives have a similar impact on the acres undergoing treatment, the difference being in the acreage treated under each alternative.

Acres treated by prescribed fire only are expected to experience higher burn intensities and associated mortality under wildfire conditions as compared to those acres treated with a more comprehensive combination of vegetation and fuel reduction treatments. Application of two to three prescribed fire treatments on stand-alone burn units will reduce this difference.

Debris accumulations and ladder fuels within the project area would be reduced to approximate historical levels, resulting in summer wildfires that burn primarily on the ground (low intensity).

The desired fuels conditions (live and dead) would support primarily surface fire during typical summer conditions. Average fire intensity would be low to moderate, resulting in consumption of surface fuels, mortality of small diameter vegetation of all species and favoring survival of early seral, fire resistant species of larger diameter (ponderosa pine, western larch, Douglas-fir). The project area would be in a condition that it could be maintained in the appropriate ecological condition with prescribed fire.

All treatments are expected to result in fuel loading modification in all stand types. Treatments that address surface, ladder, and canopy fuels will be the most effective at moving expected fires out of the crowns, especially where significant surface, ladder, and canopy fuels exist together. Burn only treatments that address primarily surface and to some degree ladder fuels will be effective in reducing surface fire intensity, particularly where ladder and crown fuels are not a concern, but less effective in reducing crown fire potential under conditions where surface intensity is sufficient to move fire into crown fuels (summer season extreme weather) and crown fuels are continuous. Reducing crown fire potential to a surface fire would reduce the potential for long range spotting to occur.

Table 16. Fire Behavior Potential as a Percent of the Landscape by PVG

<table>
<thead>
<tr>
<th>Fire Behavior Factors</th>
<th>Dry Upland Forest Alternatives</th>
<th>Moist Upland Forest Alternatives</th>
<th>Total 17,951 ac shown as % of landscape Alternatives</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Mod-High Crown Fire potential</td>
<td>66%</td>
<td>36%</td>
<td>38%</td>
</tr>
<tr>
<td>Fuel loadings greater than 30 ton/ac</td>
<td>95%</td>
<td>61%</td>
<td>65%</td>
</tr>
<tr>
<td>Flame lengths in excess of 4ft</td>
<td>95%</td>
<td>62%</td>
<td>65%</td>
</tr>
</tbody>
</table>

Table 17 displays the expected fire behavior potential by key indicator of the post-treatment fuelbeds described in Table 14. FCCS was used to make fire behavior predictions. Fire behavior prediction were based on dry fuel conditions in material 0-3 inches in diameter, 4 mile/hour wind speed, and 30% slope. Stand data backed up by field reconnaissance was used to determine stand characteristics used in the fire behavior modeling. Table 18 describes the desired conditions for each of these fire behavior key indicators.

Table 17. FCCS Fire Potential by Post-treatment Fuelbeds for DUF by Seral Stage.

<table>
<thead>
<tr>
<th>FCCS Fire Potentials Seral Stage</th>
<th>Acres by Seral Stage</th>
<th>Flame Lengths (feet)</th>
<th>Crown Fire Potential (percent susceptible to crown fire)</th>
<th>Fuel Loading (tons/acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Alt 1</td>
<td>Alt 2</td>
<td>Alt 3</td>
<td>Alt 1</td>
</tr>
<tr>
<td>SI</td>
<td>868</td>
<td>6’</td>
<td>2’</td>
<td>2’</td>
</tr>
<tr>
<td>UR</td>
<td>9,490</td>
<td>4’</td>
<td>2’</td>
<td>2’</td>
</tr>
<tr>
<td>SE</td>
<td>4,026</td>
<td>5’</td>
<td>2’</td>
<td>2’</td>
</tr>
</tbody>
</table>
Stocking level treatment effectiveness would last for 20 to 30 years (ladder and crown fuels) while surface fuel treatments are expected to remain effective for about 10 years. Maintenance burning would be used to maintain both future stocking levels, control regeneration, and surface fuel accumulation by maintaining fuel loading in the range of 7–15 tons per acre or less in material 3 inches in diameter and less (Table 17).

Flame lengths would be reduced to 1-4 feet on treated acres (Table 17) decreasing potential flame lengths across an additional 30% of the project area (Table 16). Most fire behavior models show less than 10% overstory mortality with flame lengths less than 4 feet. Hand crews can use direct fire suppression tactics when flame lengths do not exceed four feet. Engines and dozers (where roads and terrain allow) can directly fight fire with 4-8 foot flame lengths. Having the opportunity to utilize direct suppression tactics decreases the potential fire size, the risk to public and firefighter safety, and private property (including homes).

Thinning treatments would be designed to leave the largest/healthiest trees on site to provide shading of surface fuels and reduced surface wind speeds. Smaller diameter tree densities would be reduced to minimize the potential for crown fire initiation. This partially shaded gap between the surface and crown fuels would be increased through pruning with prescribed fire, minimizing the potential for crown fire (Table 16).

This kind of treatment is known as “thinning from below” or “low thinning” and mimics mortality caused by surface fire (Graham et al 1999).

**Figure 3. Forest Vegetation Simulator – Low Thinning***

*Alternatives propose no treatments in these seral stages*
Long range spotting potential decreases as crown fire potential and flame lengths decrease, potential flame lengths are reduced, and firefighting opportunities to direct attack a fire within the corridor are increased.

**Fire Regime Condition Class Departure**

Fire Regime Condition Class Departure is a measure, on a scale of 0 to 100, of the condition of both the vegetation and mean fire interval relative to historic averages. Treatment activities would reduce the departure of Fire Regime Condition Class (FRCC) on the existing landscape from 55% (high end of condition class 2) to between 42-45%. This change, when combined with future maintenance activities, primarily underburning, is expected to strengthen the capability of the stands within the landscape to withstand disturbance events such as wildfire (through reduced intensity), and insect and disease outbreaks. Repeated application of surface fire as a maintenance process is expected to continue the reduction of Fire Regime Condition Class departure moving the landscape toward a condition class 1.

All alternatives used a 25 year analysis of past fire activities, mainly prescribed fire. Implementation of proposed prescribed fire was modeled over the next 10 years and resulted in a 35 year window to model the fire return interval for each alternative. Alternative 2 provides improvement in departure at 42%, followed by Alternative 3 at 45%. Due to lack of planned fire on the landscape over 10 years Alternative 1 continues to further depart from desired conditions (Table 19).

**Table 19. FRCC Departure and Condition Class (CC)**

<table>
<thead>
<tr>
<th>Landscape</th>
<th>FRCC Departure and Fire Regime Condition Class</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Existing Condition</td>
</tr>
<tr>
<td>Percent Landscape FRCC Departure</td>
<td>55%</td>
</tr>
<tr>
<td>Post-Treatment Condition Class</td>
<td>2</td>
</tr>
<tr>
<td>FRCC departure range for CC2</td>
<td>(34-66%)</td>
</tr>
</tbody>
</table>

The area is currently moderately departed from reference conditions (34-66%) and the proposed fuel reduction treatments would result in the area being less departed. Because the entire area is not being treated and it lacks a lot of the old forest single structure stands it would remain a condition class 2 post-treatment, albeit closer to reference condition and at less risk to loss of key ecosystem functions in the event of a wildfire. Alternative 2 treats the most acres and is a slightly more effective alternative relative to reduction of FRCC departure (Table 19). Alternative 2 reduces vegetation departure and fire stratum departure closest to desire condition, as stands continue to grow and maintenance burning occurs over time. Desired conditions would be to have the FRCC landscape departure less than 33% to place fire regimes within or near historical ranges, and lower the risk of losing key ecosystem components. Vegetation conditions in terms of species composition and structural stage are intact and functioning within the historical range. (Table 20).

**Table 20. FRCC Percent Departure for Vegetation, Fire, and Landscape by Alternative**

<table>
<thead>
<tr>
<th>FRCC Departure</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
<th>Alternative 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vegetation</td>
<td>54</td>
<td>50</td>
<td>47</td>
</tr>
<tr>
<td>Fire</td>
<td>64</td>
<td>35</td>
<td>43</td>
</tr>
<tr>
<td>Landscape</td>
<td>55</td>
<td>44</td>
<td>45</td>
</tr>
</tbody>
</table>

Alternatives 3 is slightly less effective in reducing FRCC departure, primarily due to reduced acres treated and fewer acres of post-treatment prescribed burning. (Table 20).
Both action treatment alternatives reduce the mid-seral closed or under story re-initiation stand component from existing levels. Converting the mid-seral component from a closed to open status, in conjunction with maintenance burning, will over time facilitate the development of late seral open structure. Treatment of dry upland forest stands with continued application of fire will move that proportion of the landscape toward a more historical level of mid seral closed structure (Table 21).

### Table 21. Percent Seral Structure Changes in the Sparta Project Area for Mid-Seral and Late Seral Structures for Dry PVGs

<table>
<thead>
<tr>
<th>Seral Structure</th>
<th>Historic Reference</th>
<th>Existing Condition</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
<th>Alternative 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mid-Seral Open (SE)</td>
<td>30%</td>
<td>22%</td>
<td>22%</td>
<td>45%</td>
<td>44%</td>
</tr>
<tr>
<td>Mid-Seral Closed (UR)</td>
<td>5%</td>
<td>55%</td>
<td>55%</td>
<td>33%</td>
<td>34%</td>
</tr>
<tr>
<td>Late Seral Open (OFSS)</td>
<td>45%</td>
<td>4%</td>
<td>4%</td>
<td>6%</td>
<td>4%</td>
</tr>
</tbody>
</table>

Alternative 2 would reduce Late Seral Closed stand structure on the landscape and result in a small increase in Late Seral Open structure, the conversion of mid seral closed to mid-seral open would facilitate long term development of this under represented seral stage. Perhaps more importantly, treatments modify stand structure such that prescribed fire can be used as a maintenance tool in the future to continue the shift toward the level of Late Seral Open structure desired on the landscape and reduce crown fire potential within these stands as ladder fuels are reduced and heavy existing fuel loads are reduced.

### Air Quality

Several management techniques will be implemented to limit air quality impacts. The use of prescribed fire in this area would create a short-term smoke impact. This would be transient and may last for more than 72 hours per occurrence. Prescribed burns would be planned so that factors such as wind direction and air mass stability would help limit the effects of smoke (e.g. smell, eye irritation) on local residents, campers, or the general public. In the evenings, the residual smoke would tend to follow the local wind patterns, and flow down slope in Eagle, Summit, or possibly the Pine Creek drainages, towards Richland and Halfway. Experience from several burns in the area has shown that the effects of this smoke can be minimized by controlling length and time of ignition and burning under favorable mixing conditions for smoke dispersion. Local residents would be contacted and appropriate safety signs and other methods would be used to warn motorists.

Whole tree yarding (WTY) fuels treatments would be used for most harvest units, reducing the amount of residual surface fuel that would otherwise be burned.

Activity and natural fuels burns would be implemented during the spring and fall resulting in the consumption of surface fuels while limiting damage to overstory vegetation. Burns vary in size and would be designed where possible to allow for modification in burn acreage based upon emission limitations. Where burns are a first entry event, smoldering of larger material, particularly stumps and down logs, can be expected to last for several days. Where previous burning has occurred, maintenance or re-entry burns will produce much less smoldering and overall have reduced emission, both in terms of amount and duration.

Landing, grapple, and hand pile burning would most likely occur late fall through mid-winter. Burn areas can be tailored to meet favorable emission conditions by limiting and varying the number and location of piles burned at any particular time. Piles consume with a minimum of smoldering as they burn with a much higher intensity than seen with underburning, due to typical fuel moistures found with piled material and the vertical nature of the piled fuels.
### Table 22. Quantity of fuels to be burned by acre

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Harvest Activity Fuels Acres</th>
<th>Non-harvest Activity Fuels Acres</th>
<th>Forested Natural Fuels Acres</th>
<th>Piled Acres (landing/grapple/hand)</th>
<th>Total Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternative 2</td>
<td>4,196</td>
<td>1,362</td>
<td>4,793</td>
<td>2,412</td>
<td>12,763</td>
</tr>
<tr>
<td>Alternative 3</td>
<td>3,550</td>
<td>993</td>
<td>4,543</td>
<td>2,293</td>
<td>11,379</td>
</tr>
</tbody>
</table>

### Table 23. Quantity of emissions to be released (in tons)

<table>
<thead>
<tr>
<th>Tons pm2.5 (pm10)</th>
<th>Activity Fuels Burn .152 pm2.5 (.157 pm10)</th>
<th>Natural Fuels Burn .070 pm2.5 (.076 pm10)</th>
<th>Landing Pile Burn .279 pm2.5 (.321 pm10)</th>
<th>Grapple Pile Burn .037 pm2.5 (.043 pm10)</th>
<th>Hand Pile Burn .037 pm2.5 (.043 pm10)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternative 2</td>
<td>638 (658)</td>
<td>95 (104)</td>
<td>117 (135)</td>
<td>85 (99)</td>
<td>4 (5)</td>
<td>940 (1001)</td>
</tr>
<tr>
<td>Alternative 3</td>
<td>540 (557)</td>
<td>388 (421)</td>
<td>100 (116)</td>
<td>83 (96)</td>
<td>4 (5)</td>
<td>1115 (1195)</td>
</tr>
</tbody>
</table>

District average emissions from historical burns (2004-2006) were used for calculations.

Air pollutants are measured in microns with pm2.5 being particulate matter 2.5 microns in size and pm10 being particulate matter 10 microns in size. Oregon smoke management and DEQ use pm2.5 to rate air quality for those at risk from respiratory illnesses. Pm 10 is used to measure visibility and is the part of smoke you can physically see. Prescribed burning is monitored to limit impacts primarily by pm 2.5. In comparison to a wildfire prescribed burning generates on average twice the emissions per acre.

All burning will be conducted in compliance with Oregon DEQ requirement and applicable agreements. Burns will be registered, planned, accomplishment reported, and monitoring conducted as specified in the Oregon Smoke Management Plan (OAR 629-048, 2008). Burn plans will address smoke management concerns and requirements. During implementation, certified burn bosses will follow smoke management direction (currently provided by Oregon Department of Forestry smoke forecasters) in their planning and application of fire.

**Wild and Scenic River**

Overall, fuels treatment activities fall within established standards for the Eagle Creek Wild and Scenic River, see the Wild and Scenic River section for details. The applicable Standards and Guidelines from the Eagle Creek Wild and Scenic River Plan (Environmental Assessment for the Eagle Creek Wild and Scenic River Management Plan, II-8) are described under the Compliance section below in this report.

### Summary of Direct and Indirect Effects

Vegetation and fuels treatments outlined in the three action alternatives all address, to differing degrees, the objective of “Move the landscape toward a condition of reduced risk of high severity and extent of disturbance, taking into account changes in climate.”

Fire Regime/Condition Class departure is reduced from 55% to 42-45% across the landscape. The two action alternatives would result in a reduction in intensity and severity of future summer wildfires. Through reduction of accumulated fuels and modification of stand structure toward a more open, fire resilient spacing and species composition, treatments would increase management options for fire managers when determining how deal with future wildfires. Reduced fire potential may increase opportunities to expand beneficial aspects of wildfires originating within the Eagle Cap Wilderness due to a reduced risk of adverse fire impacts and resistance to control for fire outside of the wilderness. Options to allow low intensity fires to spread to existing or created barriers rather than containing at minimum acreage, particularly where fires have escaped initial suppression efforts, may allow for suppression.
strategies that increase firefighter safety and have potential to reduce both immediate and long term suppression costs. Alternative 2 when compared to the no action and Alternative 3 is the most effective in reducing overall crown fire potential and moving landscape to within historic stand structure.

**Cumulative Effects on Fire and Fuels Resources**

**Alternative 1 – No Action**

Values at risk including improvements, wildlife habitat, private lands, and visual concerns within and adjacent to the analysis area will continue to drive protection from disturbance events, primarily wildfire. Without treatment, fuel loading and associated fire risk, as well as fire regime departure will continue to increase, ultimately resulting in vegetative conditions that will support increasingly intense burning conditions. Climatological changes over time may compound these conditions if the predicted changes towards warmer, drier conditions come to pass. Resistance to control, suppression costs, and exposure or risk to personnel managing wildfires can be expected to increase. Similarly, managing natural ignitions for beneficial objectives will become more difficult as fire intensity increases.

**Alternatives 2 and 3**

**Air Quality**

Air resources are somewhat unique in that, the past impacts to air quality are not usually evident. Smoke emissions during the spring and fall months primarily result from Federal prescribed fire activities (BLM and FS) in northeast Oregon and western Idaho. Federal land managers currently coordinate to manage the cumulative effects of prescribed burning across northeast Oregon. Private landowners treated forest fuels where under the protection of Oregon Department of Forestry are required to follow the advice of the Departments smoke management forecaster when burning.

Other emission concerns include summer wildfires, agricultural burning, and home heating in local communities. Both wildfires and agricultural burning typically occur mid to late summer. Home heating is generally limited to the winter months. In all three instances, the additional emissions produced are low and are not expected to impact air quality at the time prescribed fire activities are planned.

Under any alternative that calls for burning, there is a potential for future restrictions to meet air quality standards.

**Fuel treatments including Prescribed Fire**

Past and ongoing Forest Service projects as well as adjacent ownerships and in holdings of private property can influence management options for fuel treatments and prescribed fire. This applies to larger landscapes to be treated or wildland/urban interface areas that go untreated. Numerous recent fuel treatment activities have been planned and implemented or are pending implementation near the Sparta Project Area (Table 24).

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Project Areas Names</th>
<th>Acres</th>
<th>Year Completed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rx Underburn</td>
<td>Goose</td>
<td>3,500</td>
<td>2007-2016</td>
</tr>
<tr>
<td>Rx Pile Burning</td>
<td>Barnard, Sanger, East Eagle,</td>
<td>1,384</td>
<td>2008-2010</td>
</tr>
<tr>
<td></td>
<td>Goose</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rx Underburning</td>
<td>Barnard, Goose</td>
<td>10,500</td>
<td>Planned, 2017-2020</td>
</tr>
</tbody>
</table>
Community assistance plans that identify additional wildland/urban interface and opportunities for fuels treatments in urban interface areas adjacent to national forests would enhance the Forest Service’s ability to treat areas adjacent to urban interface and in protecting high risk, high value areas. The ability to treat acres across agency boundaries and on private ownership contributes to long-term forest health, mitigation of large fires, reduction of suppression costs and greater firefighter and public safety. The amount treated annually is difficult to predict due to a number of factors, but is predicted to increase.

Management of Wildfire

Other ownerships adjacent to or surrounded by lands administered by the Forest Service affect opportunities to use fire, and therefore to emulate historical wildland fire effects, on large landscapes. In general, private landowners use timber harvest rather than wildland fire to manage their vegetation. Wildland fire may be used to treat activity fuels, but treatments are often limited in extent and effect. The proximity or inclusion of private lands can be a limiting factor in the use of wildland fire. These fires can burn large areas for long time periods depending on the vegetation, fuels, weather, and other factors. The recent Eagle Fire in 2015 burned adjacent to the analysis area burning for 3 months and covering more than 13,000 acres, of which 500 acres of private timberland was burned.

Wildland urban interface

Wildland urban interface will continue to change during the life of the forest plan. As community assistance plans are completed, additional WUI area can and will be added beyond what is currently identified. The trend indicates that people will continue to move to western states and build houses adjacent to NFS lands. This will have an effect on wildland fire and fuels projects with input by the public in support or not of those projects. It will also affect the use of wildland fire by limiting wildland fire in some areas because of social and political concerns.

Wildland fire FRCC

The emphasis on treatments of FRCC areas out of historical range (condition class 2 and 3) would continue. In general, lands off of NFS lands are dominated by condition class 2 and 3.

Climate Change and Fire

The combined effects of droughts and insects may lead to a pulse of tree mortality that increases the potential for intense fires. There is a short-term and a long-term facet to the increase in potential fire intensity. In the short-term, warmer, drier conditions will limit the capacity of the ecosystem to maintain the quantity of vegetation currently growing on site. As this stress continues, vegetative capacity to resist insect, disease, and other disturbance mechanisms is reduced and the potential for mortality increases. Increased mortality provides additional available fuel for wildfire, thus increasing fire potential. Once the dead foliage drops, this danger may be considerably reduced for a few years. However, as the trees decay over the next decade or so following the pulse of mortality, they fall and can help create and accumulation of large, heavy fuels. These large fuels contribute to a longer-term potential for intense fires since they may take many years to decompose, especially in the dry environments of the West.

Even in the absence of increased mortality from either drought or insects, a warming climate would likely alter fire regimes in ways that would make it more difficult to manage forests influenced by many decades of fire suppression and other activities. Climate change influences fire regimes in complex ways due to differentials in responses to variation in temperature and precipitation regimes. Both tree-ring records and modeling indicate that the probability of having fires is primarily driven by temperature, whereas the extent and intensity of fires is driven more strongly by precipitation patterns. Warmer temperatures lead to an earlier onset and later end for the drying period, thus increasing the probability of
a fire during the longer fire season. Precipitation influences the growth of vegetation (fuel). The amount of precipitation during the wet season will influence the amount of fuel produced.

All action alternatives manage the forest ecosystem so that it is better able to accommodate climate change and to respond adaptively as environmental changes accrue. The action alternatives encourage gradual adaption to change to a warmer and drier environment by favoring disease and fire resistant trees, reducing stand density, and lowering fuel loadings.

Other Activities
Livestock grazing would continue to reduce fuel loading in fine herbaceous fuels and can limit fire spread rates. Fuelwood cutting would continue to remove large diameter fuels but this would have an insignificant effect on fuel loadings in the 0-3 inch diameter class which is the fuels in which fire spreads.

Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans
All proposed fuel treatments are consistent with Forest Plan standards as well as all applicable state laws and regulations. See the air quality section relative to State of Oregon requirements for smoke management.

The following are fire/fuels specific direction and guidance in the Land and Resource Management Plan pertinent to this project (Land and Resource Management Plan, 1990)
Management Area (MA) 1
- Use prescribed burning to accomplish numerous resource management objectives including silvicultural, fire protection, and wildlife as appropriate. Where not appropriate, use non-fire treatment tools to reduce fuel accumulations as need to meet resource objectives.
- In general, use the lowest cost fuel treatment option available
- Design suppression practices to protect investment in managed tree stands and prevent losses of large acreage to wildfire. MA 1 is high priority for fire suppression. Minimum acceptable suppression response is contain at all Fire Intensity Levels (FIL).

MA 3:
- Favor prescribed fire for treatment of slash fuels where feasible
- Minimum acceptable suppression response will be confine on FIL 1-3 and contain for FIL 4 and greater

MA 7:
- Fuel loading will consist of natural accumulations except as modified by prescribed fire.

MA 15-7:
- Minimal use of heavy equipment for fire suppression and prescribed burning will occur in order to protect old growth characteristics.
- Minimum acceptable suppression response will be contain at all FIL’s

Wild and Scenic River
Overall, fuels treatment activities fall within established standards for the Eagle Creek Wild and Scenic River, see the Wild and Scenic River section for details. The following are applicable Standards and Guidelines from the Eagle Creek Wild and Scenic River Plan (Environmental Assessment for the Eagle Creek Wild and Scenic River Management Plan, II-8).
• #4. “Outstandingly Remarkable Values (ORV) shall be protected or enhanced”. Fuel treatments within the W&S area will include piling of activity slash, pile burning, and prescribed underburning. All are designed to enhance ORV, particularly long term.

• #29. “Short term visual impacts of prescribed fire”, both inside and outside the corridor, are acceptable where vegetation management is necessary to protect scenic values, particularly long term.

Vegetation management and fuel reduction activities within the Wild and Scenic Corridor are expected to improve Scenic ORVs by reducing the potential for large scale, high intensity fire that could impact the area. Specifically, management actions are expected to reduce the potential for the loss due to fire of desired vegetation described in the Wild and Scenic Plan - “late seral stages, large trees, and increased desirable species (ponderosa pine, larch, aspen, hardwoods) would be emphasized (Environmental Assessment for the Eagle Creek Wild and Scenic River Management Plan, II-8).

In the short term, visual impacts from prescribed burning are expected where burning is conducted within the Wild and Scenic Corridor. Crown scorch, primarily in understory vegetation and the lower crowns of overstory trees, is expected to be evident following burning for 2 to 3 years. Mortality in brush, seedlings, and saplings will be evident (2-4 years). Some overstory mortality, generally less than 10% in trees over 9” DBH, can also be expected and will be evident for 10-15 years.

• #38. Prescribed fire should not impact the objective of “Manage for high levels of large woody debris in the channel” as standard design criteria will require limiting ignition within 150’ Eagle creek were burn boundaries extend to the channel banks. Backing fire may reach woody material within riparian areas but is not expected to result in much consumption of large woody material under moisture conditions typical to burning prescriptions.

• #42. Fuel treatments will follow standard design criteria for protection of historic and pre-historic sites, including design and placement of firelines.

• #59. Prescribed fire is identified as a preferred tool for vegetation management. On some sites, prescribed fire alone has been determined to be ineffective due to the quantity and orientation of live and dead fuel, and so has been combined with other treatments, specifically harvest, in order to achieve the desired short and long term results. See vegetation treatment descriptions in the EA for expected residual stand structures and species compositions, which favor an increase in large trees and increased desirable species (ponderosa pine, larch, aspen, hardwoods).

• #99-101. No change to existing fire suppression protocols are expected in the short term. Long term, the expected reduction in potential for higher intensity fire may allow for less intrusive fire suppression strategies.

• #102. Where planned, burn prescriptions will call for low intensity underburns (except for pile burning), typically with flame lengths of 1-4 feet.

**Monitoring Recommendations**

Fuels treatment effectiveness will be monitored using the Region 6 fuels monitoring protocol, currently under development. The protocol uses a three tiered system, involving a combination of short and long term monitoring techniques. All level 3 monitoring should be integrated with other resources. Final results will be documented using Fuels Quick Monitor or its replacement. A complete description of the Region 6 fuels monitoring protocol can be found in the Sparta Analysis File.
Intensity Level 1

Required compliance: 100% of all treatment units

Task and method: Map treatment unit footprint within agency-established GIS systems, protocols, and data standards, including metadata.

Intensity Level 2

Required compliance level: 10% of treatment units

Task: qualitatively assess whether the treatment created the desired vegetation structure and species composition specified in the applicable NEPA decision document and project design and whether the direct effects of the treatment were acceptable.

Minimum standard: a pre- and post-treatment walk through and report describing pre- and post-treatment conditions and how these relate to the prescribed conditions and direct effects.

Intensity Level 3

Required compliance level: situation specific

Level 3 monitoring may occur under any of the following circumstances:

- The project or its expected effects are controversial, or
- The expected project effects are at least moderately uncertain, or
- The activity or treatment is new relative to the unit or ecosystem, or
- The treatment is complex (more than 3 activities in combination), and
- The treatment area is accessible by road or short (<1 mile) hike.

There may be other conditions that would trigger the need for Level 3 monitoring. Some Level 3 monitoring may occur as a check on the accuracy of Level 2 monitoring.

Task: quantitatively assess whether the treatment created the desired vegetation structure and species composition specified in the applicable NEPA decision document and project design and whether the direct effects of the treatment were acceptable.

Minimum standard: follow established protocols and standards when using an existing method, such as a stand exam or range plot. For FIREMON plots, establish a minimum of two permanent plots in the treatment unit. Sample only vegetation/fuels or direct treatment effects relevant to the specific treatment objectives or constraints on allowable impacts.
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