FIRE/FUELS
Specialist Report

Flagtail Fire Recovery FEIS

Malheur National Forest
Blue Mountain Ranger District

Grant County, Oregon

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Introduction

In July 2002, a series of large thunderstorms passed through the Blue Mountains of Eastern Oregon and ignited numerous fires on the Malheur National Forest, including the Flagtail Fire in the Upper Silvies Watershed. Several days of high daytime temperatures with strong winds increased fire activity and expansion of the fire.

The Flagtail Fire was declared contained in September and controlled in December. Approximately 8,200 acres burned in the fire; 7,120 acres burned on the Blue Mountain Ranger District, Malheur National Forest; and 1,080 acres burned on private land.

Fuels, Weather, Topography - General

Fire behavior is a function of fuels, weather, and topography. Throughout much of the lower elevation grassland, woodland, and forest, grasses and forbs are important fine fuels that allow fire to spread. Livestock grazing has had a significant effect on the availability of these fuels since European settlement began (around 1850), although native ungulates probably had similar effects in localized areas or in unusual years. At middle to high elevation, dead conifer needles on the forest floor are important for fire spread.

Weather is important for thunderstorm generation and for precipitation and wind patterns that are affect fire behavior. The weather patterns are influenced by several factors including the position and intensity of upper level wind currents, the high and low pressure systems over the Pacific Ocean, and the variations in the topography. Two major frontal zones affect the Malheur National Forest. One, a Pacific air mass boundary is relatively moist and the second is a drier continental air mass. There is a thermal trough that migrates northward in spring and summer with occasional intrusions of monsoon moisture from the southwest. Strong convection occurring during this time period sets the stage for multiple ignitions. In early summer the drier continental air mass results in a prolonged drying trend.

Forty to sixty percent of the rainfall on the Forest occurs from December through February. The least amount of precipitation occurs from June through October, when temperatures are the highest and fuels are the driest. Thunderstorms occur most often during these months.

The Blue Mountains experience hot, dry east winds several times a month during the summer and fall. These winds have low relative humidity, can quickly dry the fine fuels that carry fire, and can be strong. Valleys that run east-west and have low saddles at their crest are likely to be affected by these winds more than north-south valleys or areas with more topographic definition. Local winds are associated with differential heating of the landscape are important throughout the Blue Mountains: up-valley winds during the day, down-valley at night. Topographic influences interact with weather, but have direct effects on fire as well. Steep slopes are more likely to burn than flat ones, southerly aspects more than northerly, and ridgelines more than valley bottoms.

Fire and Fuels Management

Fuels management is a process of managing the hazard in relation to the size and severity of a potential fire event. The objective of fuels management is to reduce the fire hazard to a level where cost effective resource protection is possible should a wildfire ignite. Of the three components affecting wildland fire behavior (fuels, weather and topography), only fuels can be manipulated.

The influences of fine fuels such as litter, duff, grasses and small woody fuels (less than 3 inches diameter) have the most affect on spread rate and intensity of fires. These fuels are used in fire behavior models developed for predicting the fire behavior of the initiating fire (Rothermel 1983).

Coarse Woody Debris (>3inches) have little influence on spread and intensity of the initiating fire; however, they can contribute to development of large fires and high fire severity. Fire persistence, resistance-to-control, and burnout time (affects to fire fighter and public safety, soil heating and tree mortality) are significantly influenced by loading, size, and decay state of large woody fuel. Torching, crowning, and spotting contribute to large fire growth and are greater where large woody fuels have accumulated under a forest canopy. Large woody fuel, especially containing large decayed pieces, are a suitable fuelbed for firebrands and can hold smoldering fire for extended periods of time (Brown et al 2003). Spot fires can also be started in rot pockets of standing snags. The distance firebrands travel is dependent of size of the firebrand, wind speed, and height above ground of the source. A reburn results when falldown of the burned forest contributes significantly to th e fire behavior and fire effects of the next fire.

Fire hazard most commonly refers to the difficulty of controlling potential wildfire. Fire behavior characteristics such as rate-of-spread, intensity, torching, crowning, spotting, fire persitence, or resitance to control are generally used to determine and describe fire hazard. As Brown et al (2003) indicated, fire severity can be considered an element of fire hazard.

Fire risk is the chance of a fire starting from any ignition source and is determined by using the frequency of past fire starts. Fire frequency is expressed statistically as the number of fire starts per one thousand acres per year. The predominate fire ignition source in the southern Blue Mountains is lightning. Lightning ignitions vary by elevation, aspect and fuel type.

Low risk = 0 to 0.49. At least one fire expected every 20 or more years per thousand acres.

Moderate risk = 0.50 to 0.99. At least one fire expected in 11 to 20 years per thousand acres.

High risk = 1.0 or greater. At least one fire expected in 0 to 10 years per thousand acres.

From the Upper Silvies Watershed Analysis, fire frequency is 1.4 fires per one thousand acres per decade

The Upper Silvies Watershed Analysis states that the fire frequency is 1.4 fires per one thousand acres per decade. For individual subwatersheds, the range is from 0.87 to 2.4

which puts almost the entire watershed into the high fire risk rating. Lightning has been the cause of about 87 percent of the fire starts in the watershed, the rest are human caused.

Based on Brown et al. (2003) and local knowledge, the optimum quantity of downed Coarse Woody Debris (CWD) is 5 to 15 tons/acre for Fire Regime I and 10 to 25 tons/acre for Fire Regime III and IV. These fuel loadings take into account wildlife and soils concerns. A re-burn involving these quantities of CWD should not lead to unusually severe fire effects. If quantities of CWD are at the high end of the range and composed of mostly smaller diameter pieces (3-6 inches), adverse soil heating might occur at very low fuel moisture contents. A modifying factor in determining an optimum CWD is that the larger the diameter of downed CWD, the greater the loading that can be allowed without undesirable fire effects (Brown, Coarse Woody Debris and Succession In The Recovering Forest, 2001).

Of course all of this potential fuel loading is not going to be on the ground at the same time. Many variables influence the rate at which snags fall, including species, diameter, growth rate, age, weather, and site conditions (Evers, 2002). It is generally accepted that most of the snags will be on the ground within 10-30 years creating a future fire and fuels concern.

Fire Regimes - General

Fire regime is a generalized description of the role fire plays in an ecosystem and is an effective way to classify the effects of fire on vegetation (Agee, 1993). The document titled Protecting People and Sustaining Resources in Fire-Adapted Ecosystems – A Cohesive Strategy, October 13,2000 established five primary fire regime groups for all lands managed by the U.S. Forest Service in the United States. These are broad and simplified categories that help us to understand the ecological fundamentals of the biotic systems that occur on this landscape, and its previous relationship with fire as a process which acted upon them at different frequencies and resulting severities for thousands of years.

Fire Regime I

Includes the lower and mid elevation forested plant associations, ponderosa pine, Douglas-fir and warm grand fir groups. These systems historically had rather short fire free periods that prevented high fuel loads to accumulate and limited the layers within the stand.

They have been most affected by human activities over the past century due to the terrain, species composition, and proximity to our communities. They generally have the highest values at risk to loss from disturbance, and often are in proximity to private property. The Cohesive Strategy identified this group as being the primary focus of our current and future management activities (along with Fire Regime II).


Fire Regime I, Condition Class I

Fire Regime II

Includes low and mid elevation grassland plant associations; bunch grasses and fescues as well as other grass types. These systems historically had rather short fire free periods that prevented high fuel loads to accumulate and limited tree and brush encroachment within these areas. There is a variety of current situations found within this fire regime, depending previous grazing, settlement patterns, noxious weed development, and fire frequencies. The expectation within the Cohesive Strategy is this group will also be a high priority for wildland management, along with Group I.

Fire Regime II, Condition Class I

Fire Regime III

Consists of the forest plant associations found at mid elevation, more mesic sites than those of Fire Regime I, moist Douglas-fir, moist grand fir clusters, and some shrub groups. Because of the higher moisture availability normally found within these sites they have evolved with a longer fire regime. This lengthening of the fire free period and the greater site productivity of these sites contributes to a greater degree of biomass accumulation in these plant associations. The combination of tree species adapted to these site that have a somewhat lower resistance to fire and the higher fuel loads creates a mixture of fire effects on the plants associated with this group – the classic "mosaic pattern".

Fire Regime III, Condition Class 2

Fire Regime IV

Consists of forested species found at mid to high elevation sites. This group is well represented by the lodgepole pine types and tree species associated with it such as subalpine fir. Spruce plant associations are included within this group, but would generally be considered as having a fire free period of 100 years +. These species are very fire intolerant of fire. Fire Regime IV areas are lower priority for management treatments and where land management direction and appropriate conditions exist are candidates for the management of natural ignitions.

This Fire Regime is often found at the headwaters of the Forests watersheds and can influence water quality/quantify within the watershed.   This group is currently considered prime lynx and snowshoe hare habitat; consequently management actions will need to consider effects to these terrestrial species.

Fire Regime IV, Condition Class I

Fire Regime V

Given the long fire free period of this group it is considered a fire refuge. Generally the plant associations found within this group are associated with high local moisture availability, rock, lack of fuel availability or other combinations of the physiographic setting that inhibit the propagation of fire.

Fire Regime V, Condition Class I

Fire regimes have been mapped for the Malheur National Forest and are tied to the Plant Association Groups (PAG) that are defined in the Vegetation section of this document.

Fire Regime I is tied to the Hot Dry and Warm Dry Forest PAG. The Hot Dry and Warm Dry PAG's include ponderosa pine sites and dry mixed conifer.

Fire Regime II is tied to the Hot Dry Shrublands and Woodlands and includes juniper and sagebrush sites.

Fire Regime III is tied to the Cool Dry Forest PAG and includes lodgepole sites.

The riparian areas in the Flagtail Fire area are classified either Fire Regime III or IV depending on the location in the riparian and soil moisture.

The following table displays the fire regimes within the Flagtail project area:

Table XX

Fire Regime Group	Frequency (Fire Return Interval)	Severity	Percent of Area
I	0 – 35 years	Low severity	88%
II	0 – 35 years	Stand replacement severity	5%
III	35 – 100+ year	Mixed severity	2%
IV	35 – 100+ year	Stand replacement severity	5%
V	> 200 years	Stand replacement severity	0%

Management activities such as fire suppression, timber harvest, and grazing programs have had significant effects on vegetation and fire regimes within the project area. Generally, fire functioned to remove young regeneration, limiting the potential for future accumulations of large woody material. Because fire burned fairly frequently, fuel accumulation was primarily influenced by previous fire intensity and extent. These high frequency, low severity fires also served to minimize regeneration of tree and brush species, (ladder fuels) leaving relatively large, fire resistant trees in an open park-like distribution with a grassy or low shrub understory. The development of a heterogeneous landscape pattern was interrupted by fire suppression, allowing regeneration and more shade-tolerant (fire-intolerant) species to colonize the project area, along with an accumulation of higher fuel loadings.

Three Condition Classes are used as a qualitative measure describing the degree of departure from historical fire regimes. .

Condition Class 1 areas are within or near historical range and the risk of losing key ecosystem components is low. Vegetation species and structure are intact and functioning within historical range. An example of condition class 1 is the historic open-park like condition much of the project area was in prior to fire suppression.

Condition class 2 develops as one or more fire return intervals are missed, primarily due to well-intentioned suppression efforts, while understory vegetation continues to grow, becoming denser. If this accumulating vegetation is not treated, fires begin to burn more intense – making them more difficult to suppress. The impact of fires to biodiversity, soil productivity and water quality become more pronounced.

Condition Class 3 areas within these same ecosystems, fires are relatively high risk. The forest is littered with considerable amounts of dead material and is choked with hundreds of small trees that reach into the crowns of the larger, older-age forest above. Under these conditions, stands have the potential for severe, high intensity wildland fires. At these intensities, wildland fires kill all of the trees – even the large ones that, at lower fire intensities, would survive (Cohesive Strategy).

Timber harvesting contributed further to changes in vegetation and condition class by removing early seral species (overstory removals), leaving smaller, fire intolerant species. These stands, with similar age class and species, were more conductive to insect and disease infestation and subsequent fires (A Cohesive Strategy).

Eighty-eight percent of the Flagtail Project Area was historically classified as Fire Regime 1, condition class 1. Under these conditions the fuel loadings would have been in the range of 0-15 tons/acre. Fire Regime 3 and 4, condition class 1 designated areas would have had fuel loadings in the range of 15-25 tons/acre. One goal of the National Fire Plan is to reduce the risks associated with wildland fires to communities and the environment by returning areas of condition class 3 back towards condition class 1 through fuels management. Eighty-six percent of the Flagtail project area, prior to the fire was in condition class 3.

The combination of the extreme fire weather and the make up of the fire area, condition class 3, led to the high tree mortality rates.

Regulatory Framework

Malheur Forest Plan and the Fire Management Plan

The Malheur National Forest Plan includes Fire Management Direction to ensure that fire use programs are cost-effective, compatible with the role of fire in forest ecosystems, and responsive to resource management objectives and that fire presuppression and suppression programs are cost-effective and responsive to the Forest Plan (Appendix G).

The goals for fire management are to: 1) initiate initial management action that provides for the most reasonable probability of minimizing fire suppression costs and resource damage, consistent with probable fire behavior, resource impacts, safety, and smoke management and 2) identify, develop, and maintain fuel profiles that contribute to the most cost-efficient fire protection program consistent with management direction (Forest Plan IV-4).

The following applicable Forest wide direction is provided for fire management: manage residue profiles at a level that will minimize the potential of high intensity wildfire and provide for other resources (Forest Plan IV-44). Air quality standards require that air quality impacts be minimized, especially to Class I airsheds and smoke sensitive areas, mitigation measures be used when appropriate, and burning is conducted in accordance with the State Smoke Management Plan (Forest Plan IV-40).

The Malheur National Forest Fire Management Plan (FMP) provides operational guidance on how to carry out fire management policies that will help achieve resource management objectives. The Fire Management Plan is updated annually or as policy and Land and Resource Management Plans change. A fire management planning system that recognizes both fire use and fire protection as inherent parts of natural resource management will ensure adequate fire suppression capabilities as well as support fire reintroduction efforts (FMP).

The fuels management portion states that the appropriate type and amount of fuel treatment is tiered to the Forest Plan Management Area specific Standards and Guidelines. Levels and methods of fuel treatment will be guided by the protection and resource objectives of each management area. Emphasis will be on ecological restoration treatments. Where appropriate, fuels treatments will allow for the utilization of wood residues using a marketing strategy.

National Fire Plan

In August 2000, President Clinton asked Secretaries Babbitt and Glickman to prepare a report recommending how best to respond to the severe fires, reduce the impacts of those fires on rural communities, and ensure sufficient firefighting resources in the future. President Clinton accepted their report, *Managing Impacts of Wildfires on Communities and the Environment*, in September 2000. This report provides an overall framework for implementing fire management and forest health programs.

Operating principles directed by the Chief of the Forest Service in implementing this report include: firefighting readiness, prevention through education, rehabilitation, hazardous fuel reduction, restoration, collaborative stewardship, monitoring, jobs, and applied research and technology.

The Flagtail Fire Recovery Project addresses the hazardous fuel reduction element, which states: Assign highest priority for hazardous fuels**Error! Bookmark not defined.** reduction to communities at risk, readily accessible municipal watersheds, threatened and endangered species habitat, and other important local features, where conditions favor uncharacteristically intense fires (Laverty & Williams 2000).

The focus of the Cohesive Strategy, which was signed October 2000, is on hazardous fuel reduction to restore ecosystems that evolved with frequent, low intensity fire with a high priority for treatment of Wildland Urban Interface (WUI) areas. Approximately 50% of the Flagtail Fire falls within a WUI area because of structures on private land.

The 10-Year Comprehensive Strategy, signed August 2001, reflects the views of a broad cross section of stakeholders with a desired end result of healthier watersheds, enhance community protection, and diminished risk of and consequences of severe fire. The strategy established 4 primary goals: 1)Improve Prevention and Suppression, 2)Reduce Hazardous Fuels, 3)Restore Fire Adapted Ecosystems, and 4)Promote Community Assistance. A set of actions to facilitate attaining each goal was also established.

The Implementation Outcome as described in the National Fire Plan 10-year Implementation Plan is reduced risks associated with wildland fires to communities and the environment due to hazardous fuel reduction. The Flagtail Project addresses the potential of fires in decades to come, rather than fires in the immediate future. The project recognizes the values at risk in the structures in close proximity to the project area and values in the resources within the Flagtail area that will be developing.

Analysis Methods

The following topics were analyzed with this project:

- Fuel loading and fire behavior
- Public and Firefighter Health and Safety
- Air Quality

Future fuel loading (tons/acre) and fire behavior for the Flagtail Fire were predicted by modeling data obtained through stand exams. Stands within the project area were stratified based on species, structure, and burn severity to the vegetation. Exams were completed on a sample of the stands within each grouping. The data from these exams was extrapolated to all stands within that grouping. Weights of standing dead trees were calculated from the Handbook for Predicting Residue Weights of Pacific Northwest Conifers (Brown and Snell,1980). These weights include limbs, branches, needles and bole of dead trees. Tons per acre for each plant association group were determined by averaging the fuel loadings for each stand within that plant association group.

With the results of these exams, we are able to predict future fire behavior and effects, using BEHAVE, a fire behavior prediction and fuel modeling system that predicts fires rate of spread, flame length and spotting potential. This model assumes a continuous bed of fuels with no change in aspect, slope, moisture, wind speed and direction. The contribution of large woody fuel to surface fire intensity is likely underestimated in fire behavior models that treat large wood pieces as smooth cylinders (Brown et al. 2003). The effects of the predicted fire behavior is modeled using FOFEM – First Order Fire Effects Model, a computer program used to analyze and predict fire's effects on vegetation, soils, and air.

The data from these exams and models is also used to measure the effects to public and firefighter health and safety and air quality. For air quality, the measure is the amount of PM-10 and other emissions produced and can be modeled with FOFEM.

The fire and fuels direct and indirect effects can be measured by fuel loads and fire behavior, public and fire fighter health and safety, and air quality. The greater the fuel loading is, the greater the effect on the environment. For fire and fuels management, direct and indirect effects are those that occur from the proposed activity from 1-20 years and 20-50 years. Cumulative effects are those effects from other activities, past, present, and future, that add to or subtract from the effects of this project.

Fuel Loading and Fire Behavior

Introduction

Future fire hazard is complex with or without wood removal. Current research suggests that salvaged areas may have elevated fire hazard over tree retention sites in the first 20 years, but retention sites would have elevated risk past 20 years. Snag longevity models for ponderosa pine, Douglas-fir and grand fir following fire indicate a significant pulse of log biomass from burned snags 6 to 9 inches in diameter occurs after approximately 20 years. Standing snags present a much reduced fire hazard than logs, thus there is reduced fire hazard until snags fall (Everett).

The real concern is the potential fire behavior and fire effects that may result several years after a stand replacing fire where natural processes are allowed to proceed. The risks of high intensity and high severity fires vary a great deal by fire regime and plant community within a fire regime. Fire intensity is driven by the amount of fine fuel in the fuel complex and fuel moisture, both dead fuel and live fuel where it is a significant component of the fuels complex. Fire severity as it relates to soil damage is a function of fire duration. Fire duration, in turn, is a function of fuel loading, fuel moisture, particle size, and packing ratio. When large amounts of fuel are present, soil temperature can remain high for several hours with large changes in soil properties. (Evers, 2002).

Existing Condition

Fire Regimes and Condition Classes within the Flagtail Project area

Fire regime is a generalized description of the role fire plays in an ecosystem and is an effective way to classify the effects of fire on vegetation (Agee, 1993). The Cohesive Strategy established five primary fire regime groups for all lands managed by the U.S. Forest Service in the United States. These are broad and simplified categories that help us to understand the ecological fundamentals of the biotic systems that occur on this landscape, and its previous relationship with fire as a process which acted upon them at different frequencies and resulting severities for thousands of years.

Fire regimes have been mapped for the Malheur National Forest and are tied to the Plant Association Groups (PAG) that are defined in the Vegetation section of this document.

Fire Regime I is described as low severity fire with a frequency of 0-35 years. Plant communities within this Fire Regime include ponderosa pine, dry Douglas-fir and very dry white fir. The Hot Dry and Warm Dry Forest PAG are inlcluded in this Fire Regime.

Fire Regime II is described as having mixed and high severity fires with a return interval of 0-35 years. This fire regime includes mesic sagebrush communities with return intervals generally of 25-35 years and mountain shrub communities (bitterbrush, ceanothus among others) with typical return intervals of 10-25 years. Plant Association Groups within the Flagtail area include Hot Dry Woodlands (Western Juniper with low or stiff sagebrush) Other specific communities include mountain big sagegrush and low sagebrush. off tied to the Hot Dry Shrublands and Woodlands and includes juniper and sagebrush sites.

Fire Regime III is mixed severity fire with a frequency of 35-100+ years. This regime usually results in heterogeneous landscapes. Large, high severity fires may occur but are usually rare events. This regime is subdivided into three subregimes based on the Pacific Northwest variant. Subregime A has a return interval of less than 50 years and includes mixed conifer, dry grand fir. Lower severity fire tends to predominate in many events. Plant Association Groups within this regime include the Cool Dry Forest. Lodgepole sites within the project area are included in this PAG. Subregimes B and C have longer return intervals (50-100 and 100-200 years respectively) but are still of mixed severity.

The riparian areas in the Flagtail Fire area are classified either Fire Regime I or III depending on the location in the riparian and soil moisture.

The following table displays the fire regimes within the Flagtail project area:

Table FF-1: Fire Regimes within the Flagtail project area

Fire Regime Group	Frequency (Fire Return Interval)	Historical Severity	Percent of Project Area
I	0 – 35 years	Low severity	83%
II	0 – 35 years	Stand replacement severity	8%
III	35 – 100+ year	Mixed severity	4%

*There is also 5% of the area in non-forest

Fire Current Condition Classes are a qualitative measure describing the degree of departure from historical fire regimes, possibly resulting in alterations of key ecosystem components such as species composition, structural stage, stand age, canopy closure, and fuel loadings. An appropriate mix of seral structure stages on the landscape for the particular PAG and therefore fire regime, is the primary indicator of Fire Condition Class. Departure from the historical fire regime may have been caused by a number of things including but not limited to: fire suppression, timber harvesting, grazing, introduced insects or disease, or other past management activites. Stands within each Fire Regime can be qualitatively described by these condition classes.

<u>Condition Class 1:</u> Fire regimes are within an historical range and the risk of losing key ecosystem components is low. Vegetation species and structure are intact and functioning within historical range.

<u>Condition Class 2:</u> Fire regimes have been moderately altered from their historical range. Risk of losing key ecosystem components is moderate. Fire frequencies have departed from historical frequencies by one or more return intervals (either increased or decreased). Vegetation attributes have been moderately altered from their historical range.

<u>Condition Class 3:</u> Fire regimes have been significantly altered from their historical range. Risk of losing ecosystem components is high. Fire frequencies have departed from historical frequencies by multiple return intervals.

Most of the Flagtail Fire area burned under extreme fire weather conditions when much of the area was in a Fire Condition Class 3. The condition class was due change an excess of late seral species and excess multi-story structure. The extreme weather included minimum relative humidity of 15%, winds that exceeded 12 mph, and temperature close to 90 degrees. A weather related factor is the Energy Release

Component (ERC). ERC gives seasonal trends based on humidity, daily temperature, and precipitation. Wind is not factored in. Average ERC during the summer months ranges from 20 to 60. An ERC of 67 or higher has been reached only 10% of the time over the last 10 years. The ERC at the time the Flagtail fire stared was 68-70. The fire burned with higher intensity and severity than would have been the case if the area had been in condition class 1. Burning under these conditions led to higher mortality thus leading to the potential for higher fuel loads in the future. If those fuel loads are not treated within 10 – 15 years, the potential for a re-burn with high severity exists.

The following table FF-I displays the severity of the fire by plant association group and Fire Regime in acres.

Table FF-I Severity of Fire by Plant Association Group in Acres

Plant Association Group/Fire Regime	No Burn	Low Severity 30-60% Mortality	Moderate Severity 60-90% Mortality	High Severity 90-100% Mortality
Hot Dry/ I	10	20	90	120
Warm Dry/ I	140	440	2210	2870
Cool Dry/ III	20	0	100	160
Total Acres	170	460	2400	3150

The total acres burned in the Flagtail Fire are 6,010 acres.

Currently, 35% of the Hot-Dry PAG and 54% of the Warm-Dry PAG are in stand initiation stage (See also the Vegetation section of this Chapter). Historically, 5-15% of each PAG was in the stand initiation structural stage. In the Hot-Dry PAG, there is 20%-30% more area in the stand initiation structural stage and in the Warm-Dry PAG, there is 39%-49% more area in the stand initiation structural stage than was within the historical range for the Blue Mountians. Both these PAGs have been moderately to signifcantly altered from their historical range due to the fire. Much of the area can currently be considered to be in Condition Classes 2 and 3 because of this excess of early seral structure stage (per comm Louisa Evers).

Fuel loading (tons/acre) can be modeled into fire behavior predictions, which will produce anticipated flame lengths. Flame lengths are an indicator of fire intensity and the type of fire attack that can be used on a fire. A flame length less than four feet can be attacked with hand tools, and fire fighters can work close to the flame. Flame lengths of 4-8 feet will require heavy equipment, such as bulldozers, and fire size will be larger and more costly to suppress. In short, the probability of suppressing fires at small acreages decreases as flame length increases.

83% of the Flagtail Project Area was historically classified as Fire Regime 1, condition class 1. Under these conditions the fuel loadings would have been in the range of 0-15 tons/acre. At the time the Flagtail fire burned, these areas were in condition class 3 due to change in species composition and stand structure.

4% of the Flagtail Project Area was historically classified as Fire Regime 3, condition class 1. Under these conditions the fuel loadings would have been in the range of 15-25 tons/acre. At the time the Flagtail fire burned, these areas were either condition class 2 or 3.

Current fuel loads have been reduced significantly from pre-fire levels. In all biophysical environments with moderate to high severity the current fuel loads are from 0 to 5 tons\acre with little or no ladder fuels. See the following pictures. The fire intensity and severity in these areas is expected to be low for the next 1-10 years. Within 2-3 years, the grass and shrub layer will be continuous enough to carry a fire and may be represented by the National Fire Danger Rating System (NFDRS), fuel model 2 and condition class 1. This description also applies to the private lands affected by the Flagtail Fire.

High severity burn in the Flagtail fire

Moderate severity burn (on vegetation) in the Flagtail fire.

In all biophysical environments with low severity the current fuel loads are from 5 to 10 tons\acre and still have much of the ladder fuel component. Surface fuels were consumed in a mosaic pattern. Fine fuels are accumulating from fire killed needles and branches. Low to moderate fire intensity and severity can be expected, burning in a mosaic pattern. These areas may be represented by the NFDRS fuel model 9 and are condition class 2.

Forest Service lands outside the fire area but in the same sub-watersheds as the project area are mostly Fire Regime I condition class 3. These areas are still at risk for uncharacteristically severe fires.

Private lands affected by the fire have had salvage logging and fuel treatments completed or in the process. There are therefore low fuel loadings on private land.

Fuel Treatments

There are several methods used to treat fuels such as logging, yard top attached, whole tree yarding, lop and scatter, machine pile, hand pile and prescribed underburning. Yard tops attached and whole tree yarding are done during the salvage operations. Both methods bring top and limbs to a landing, where it is piled and burned or allowed to be used commercially as chip or firewood. Lop and scatter is used with lighter fuel loads and helps break up concentrations and places the material closer to the ground to help speed up decomposition. Machine piling is done with a grapple on a low ground pressure (<8 psi) track excavator on slopes less than 35%. Grapple piling is used in areas with moderate to high fuel loads. Piles are then burned during the late fall after sufficient moisture to minimize fire spread. Grapple machines minimize ground disturbance and compaction. Cost is approximately $100.00 per acre. Hand piling is primarily used on slopes greater than 35% with moderate to high fuel loads. Piles are burned in the late fall after sufficient moisture to minimize fire spread. Cost is approximately $150.00 per acre. Prescribed underburning is used with lighter fuel loads over large areas. The cost is approximately $58.00 per acre.

Yard tops attached, grapple piling and hand piling are proposed in this document as options for fuel treatment.

Units will be examined after harvest to determine if fuel objectives were met and actual treatment needs. Any changes (other than no further treatment needs) from methods prescribed will require additional NEPA analysis. Fuel treatments other than harvest are usually done as service contracts. The work is monitored to ensure contract requirements are being met.

Environmental Consequences

Direct/Indirect Effects

Common to All Alternatives

Within the first 10 years, grasses and shrubs will be reestablished, allowing fires to burn under historical fire regimes. Most fires in the Flagtail Fire area will exhibit low severity and have low resistance to control. The fire area can be used as a location to stop fires that start on adjacent lands.

Many riparian areas will exceed the range of historical levels of fuels in 10-20 years. This will leave those areas susceptible to higher fire severity.

Common to All Action Alternatives

Grapple piling and handpiling with removal of the piles through utilization (grapple piles) or burning the piles are methods used to treat fuels under these alternatives. These methods have the similar effects on fuelbeds, both reduce the quantity of fuels and the continuity of fuels across the landscape.

During salvage and other fuel treatments, there is increased human activity and equipment that could cause fire starts. However, past records do not indicate high numbers of fire starts due to human activity during harvest and fuel treatments. The Malheur National Forest Fire Management Plan states between 1970 and 2001, 2% of the fires were caused by smoking, 1% by slash burning, 1% were industrial caused, and 2% were miscellaneous human caused combining for only 3% of the acres burned. This summary includes areas of increased activity that occurred during this time period. In addition, contract provisions during logging operations and provisions included in service contracts mitigate both the potential for fire starts and require equipment for fire suppression when conditions warrant this.   In the long-term, the potential for human-caused fire starts will decrease due to road closures.

3,150 acres or 52% of the forested area burned at high severity to the vegetation (90-100% mortality). In these areas, most to all of the crowns were consumed in the fire so as a result, there would be little increase in fine fuels due to harvest. 2,400 acres or 39% of the forested area burned at moderate severity to the vegetation (60-90% mortality). The balance of the trees will die of basal, root, or crown scorch. In areas that burned with moderate to high severity, the current fuel loads are 0 to 5 tons per acre with little or no ladder fuels. In these, areas, crown consumption was variable. An increase of fine fuels can be expected where the crowns remained largely intact following the fire. However, this will be adding to a surface fuel load of only 0 to 5 tons per acre.

The spacing and species for planting will vary depending on the Plant Association Group. The spacings are wider (see Vegetation section) and are to be varied to duplicate the irregular patterns of natural reforestation. This is closer to the natural range of variability for each Fire Regime and Plant Association Group.

Common to Alternatives 2, 3, and 5

Utilization through harvest as a fuels treatment has the most significant affect on fuelbeds as it reduces the quantity through removal. It has the most impact on the larger fuels. Harvest also lowers the continutiy of fuels across the landscape. The alternatives vary by the number of acres treated.

Alternative 1

As shown in Table FF-I, untreated fuel levels in 20 years would be above threshold (Historic). A low severity, frequent burn would not be possible with the high amounts of debris left in the untreated forest (see Table FF-III). For an example, unit 34 is a unit in Fire Regime I that burned with high severity. With the number of snags left in the unit the expected future fuel load is calculated to be 66.9 tons/acre.

The no action alternative would allow increased fuel loading, increased future fire severity, and changes to the historical disturbance cycle. This alternative would not meet the purpose and need to restore/reintroduce fire to a more natural role of controlling undergrowth and allowing seral species to dominate their historical range (see Table FF-II).

Within 10-20 years, the majority of fire-killed trees will have fallen onto a bed of grass and shrubs interspersed with conifer seedlings and saplings. Fire behavior predictions indicate that this fuel bed would support a fast moving, high intensity fire. Flame lengths could exceed 7 feet, making hand-line suppression impossible. Tree mortality on the trees that naturally regenerated the area would be near 100%. The fuels contributed by the Flagtail Fire would probably need 80-150 years to decay to a point where the only likely fire would be a low severity ground fire.

Fire suppression would continue within the project area, though the amount of fuels left on site will affect fire suppression efforts. Aggressive fire suppression in the untreated forest may provide protection to life, property, and habitat for 5-10 years. Past this time-frame, the risk for a large intense fire will continue to increase as biomass collects on the forest floor and stands grow dense. Resistance to control would be high.

Fuel loads in the Wildland Urban Interface areas would exceed the threshold for historic levels. This would increase the likelihood of a high intensity fire entering the private land adjacent to the project area.

Hot Dry/Warm Dry Biophysical Environments (86% of Project Area)

The No Action alternative would not allow for recovery of the historical fire regime. Frequent, low intensity burns kept the fuel loadings low and favored large, open-grown Ponderosa Pine. Forests that once were characterized by large pines and sparse grass and shrubs will be converted to vast areas of early seral stands of regeneration in which grass and shrubs are the dominant ground vegetation. The post-fire level of large woody debris would become heavier over time, as dead trees begin to fall. Future fires (20-50 years) may be high severity fires similar to the Flagtail Fire.

Cool Dry Biophysical Environments (4% of Project Area)

These areas contain lodgepole pine plant associations. Lodgepole Pine associations are generally a moderate frequency, mosaic pattern fire regime. Trees grow close together and form dense stands subject to stagnation and bark beetle attacks that often result in high mortality. In the Flagtail project area these stands are surrounded by Fire Regime I areas, which would increase the likelihood of low intensity fire entering more frequently. This would thin some trees and reduce the ground fuels, thus allowing a mosaic type burn when a high intensity fire occurs.

The No Action Alternative would not allow recovery of the historical fire behavior in Fire Regime III. Because of the higher moisture availability normally found within these sites, they have evolved with a longer fire regime with a mosaic of fire effects. The adjacent Fire Regime I areas will burn with higher intensity. Within 20 years much of the standing dead snags in the Lodgepole areas will be on the ground, leaving many or these areas susceptible to stand replacing fire instead of mosaic.

Alternative 2

Salvage logging would remove dead tree volume, leaving low to moderate amounts of dead trees (up to 12”dbh) and leaving 2.39, 21+ inch dbh snags/acre. Yard tops attached is planned to further reduce fuels in the tractor and skyline units. Additional fuel treatments on the small diameter dead and dying material could occur in units that still exceed the threshold. These treatments would be hand piling 1240 acres on slopes greater than 35% and grapple piling 1450 acres on slopes less than 35%. The piles would then be burned. The need for these treatments will be verified after harvest. As an example, the fuel loads in unit #34 would be reduced from 66.9 tons/acre to 7 tons/acre by salvaging with yard tops attached and then cutting and grapple piling the material under 8 inches dbh. The 7 tons/acre that will be on the ground in 20 years includes approximately 2.5 tons/acre from the large snags and 4.5 tons/acre from the material between 8-12 inches dbh that will be left on site**.**

As shown in table FF-I, the fuel load in all biophysical environments will meet threshold (Historic) in 20 years. This allows for maintenance of condition class 1 areas through future low intensity prescribed fires (see Table FF-III). Fire suppression would continue in these areas, but fires would show low to moderate fire behavior with low resistance to control (see Table FF-II).

Fuel loads in the Wildland Urban Interface areas would meet the threshold for historic levels. Wildfires are more likely to be contained before they enter the private land.

Alternative 3

Salvage logging would remove dead tree volume on 3860 acres, leaving low to moderate amounts of dead trees (up to 12"dbh) and leaving 13 snags/acre from 10 to 21 inches dbh. These snags would be left mostly in clumps of 2-6 acres. These clumps of standing dead trees would present difficulties for future fire suppression and fuels management activities; however, the scope of the effect would be primarily limited to these patches. None of these patches will be left directly adjacent to private land. Additional fuel treatments on the small diameter dead and dying material could occur in units that still exceed the threshold. These treatments are combinations of yarding tops attached, grapple piling and hand piling. As shown in table FF-I, the fuel load in salvaged units in all biophysical environments meets threshold (Historic). This allows for maintenance of condition class 1 areas through future low intensity prescribed fires (see Table FF-III). Fire suppression would continue in these areas, but fires would show low to moderate fire behavior with low resistance to control (see Table FF-II). As an example, the fuel loads in unit 34 would be reduced from 66.9 tons/acre to 12.5 tons/acre by salvaging with yard tops attached and then cutting and grapple piling the material under 8 inches DBH. The 10 tons/acre that will be on the ground in 20 years includes approximately 7.5 tons/acre from the snags and 5.0 tons/acre from the material between 8-12 inches dbh that will be left on site.

1150 forested acres identified as needing fuel reduction treatments within the Flagtail Project area will exceed the threshold for historical fuel loads. Of the 1150 acres, 550 acres would not have commercial harvest but are available for fuel treatments on the dead and dying un-merchantable trees. 290 acres would be available for hand piling and 260 acres would be available for grapple piling. These treatments would treat smaller standing dead trees only, which are expected to start adding to the ground fuels in the next 5-10 years. Over this time, the trees larger than 8 inches dbh are also becoming part of the fuel profile but by reducing the small material, a reduction in the intensity and severity of a re-burn would be extended an additional 5 to 10 years, from that of no action.

Of the 1150 acres, 300 acres of the forested burned areas will not have any salvage or fuel treatments. These areas do not have enough dead tree volume to warrant salvage or a high enough level of small diameter trees to affect total fuel loadings through un-merchantable fuel treatments. Leaving the trees on these acres would result in fuel loadings that are over thresholds (see Table FF-II).

Other areas are set aside for Black-Backed Woodpecker habitat in 75 acre blocks (303 acres). These areas are not available for salvage or un-merchantable fuel treatments.

All of these areas will have increased fuel loading, and increased future fire severity with high resistance to control. The areas are scattered with the largest block being approximately 400 acres. Fire suppression would continue within the non-salvaged areas, though the amount of fuels left on-site will increase future fire severity and resistance to control. The use of future low intensity prescribed fires would be prohibitive in these areas. The continuity of the fuels across the project area would be broken up, reducing the potential for a large fire similar to the Flagtail Fire. Further treatments would be needed in 10-30 years to reduce fuels from larger dead trees to historic levels.

Fuel loads in the Wildland Urban Interface (WUI) areas would meet the threshold for historic levels in a majority of the areas. Areas that exceed the threshold for fuel loads are scattered. Fire suppression would continue within these WUI areas though the amount of fuels left areas will increase future fire severity and resistance to control in these scattered areas.

Alternative 4

No commercial salvage would occur in this alternative. Treatment of dead and dying un-merchantable material would be allowed to reduce fuel loads. These treatments would be hand piling 1800 acres on slopes greater than 35% and grapple piling 3190 acres on slopes less than 35%. The piles would then be burned. These treatments would treat smaller standing dead trees only, which are expected to start adding to the ground fuels in the next 5-10 years, reducing the intensity and severity of a re-burn, from that of no action, in that time period. Further treatments would be needed in 10-30 years to reduce fuels from larger dead trees to historic levels.

As shown in table FF-I, fuel loads in all bio-physical environments exceed the threshold (Historic) in 20 years. This alternative would allow increased fuel loading, increased future fire severity, and changes to the historical disturbance cycle, although slightly reduced from the No Action alternative. As shown in Table FF-III this alternative would not meet the purpose and need of restoration/reintroduction of fire to a more natural role of controlling undergrowth and allowing seral species to dominate their historical range. As an example, the fuel loads in unit 34 would be reduced from 66.9 tons/acre to 47.8 tons/acre by cutting and grapple piling the material under 8 inches DBH.

Fuel loads in the Wildland Urban Interface areas in 20 years would exceed the threshold for historic levels in most areas. This would increase the likelihood of a high intensity fire entering the private land adjacent to the project area.

Within 20 years, the majority of the remaining fire-killed trees will have fallen onto a bed of grass and shrubs interspersed with conifer seedlings and saplings. As shown in table FF-II fire behavior predictions indicate that this fuel bed would support a fast moving, high intensity fire. Flame lengths could exceed 7 feet, making hand line suppression impossible. Tree mortality on the trees planted in the area would be near 100%. The fuels contributed by the Flagtail Fire would probably need 80-150 years to decay to a point where the only likely fire would be a low severity ground fire.

Fire suppression would continue within the project area, though the amount of fuels left on site will affect fire suppression efforts. Aggressive fire suppression in the untreated forest may provide protection to life, property, and habitat for 5-10 years. Past this time frame the risk for a large, intense fire will continue to increase as biomass collects on the forest floor and stands grow dense. Resistance to control would be high.

This alternative would not allow for recovery of the historical fire regime. Frequent, low intensity burns kept the fuel loadings low and favored large, open-grown ponderosa pine forests that once were characterized by large pines and sparse grass and shrubs will be converted to vast areas of early seral stands in which grass and shrubs are the dominant vegetation. The post-fire level of large woody debris would become heavier over time, as dead trees begin to fall. Future fires (20-50 years) may be high severity fires similar to the Flagtail Fire.

Alternative 5

This alternative was designed to mimic snag distributions expected at the landscape level on dry forests. Snag level prescriptions varied between salvage units based on a variety of criteria including forest type, aspect and slope, visual quality in the County Rd 63 Visual Corridor, Wildland Urban Interface, and economics.

Salvage logging would remove dead tree volume on 3,740 acres, leaving low to moderate amounts of dead trees (up to 12"dbh) and leaving a range of 2.39 to13 snags/acre from 10 to 21 inches dbh. Additional fuel treatments on the small diameter dead and dying material could occur in units that still exceed the threshold. Treatments include; yarding tops attached, grapple piling, hand piling, post and pole removal, or a combination of yard tops attached and one of the other mentioned treatments. As shown in table FF-3, the average fuel load in salvaged units in all biophysical environments meets threshold (Historic). This allows for maintenance of condition class 1 areas through future low intensity prescribed fires (see Table FF-III). Fire suppression would continue in these areas, and fires would show low to moderate fire behavior with low resistance to control (see Table FF-II). As an example, the fuel loads in unit 34 would be reduced from 66.9 tons/acre to 5 tons/acre by salvaging with yard tops attached and then cutting and grapple piling the material under 8 inches DBH. The fuels that will be on the ground in 20 years includes approximately 2.5 tons/acre from the snags and 2.5 tons/acre from other material that will be left on site.

Other areas are set aside for Black-Backed Woodpecker habitat. These areas are at least 75 acres in size and not available for salvage or un-merchantable fuel treatments. Higher future fire severity can be expected in these areas with high resistance to control, however surrounding areas that are treated would show low resistance to control and allow for probable success suppression efforts.

Fuel loads in the Wildland Urban Interface (WUI) areas would meet the threshold for historic levels in a majority of the areas. Areas that exceed the threshold for fuel loads are scattered throughout the WUI and are small in size. Fire suppression would continue within these WUI areas though the amount of fuels left will increase future fire severity and resistance to control in these scattered areas. Across the project area, fire suppression abilities will be improved from that of the No Action providing for firefighter safety.

The following Table shows the expected fuel loads in 20 years by Fire Regime and Ecoclass for each alternative.

Table FF-I: Expected Fuel Loads in 20 years by Fire Regime and Ecoclass

<table>
<tr><th rowspan="2">Regime / Plant Association Group</th><th rowspan="2">Historical Tons/Acre</th><th rowspan="2">Alt. 1</th><th rowspan="2">Alt. 2</th><th colspan="2">Alt. 3</th><th rowspan="2">Alt. 4</th><th colspan="2">Alt. 5</th></tr>
<tr><th>Salvage</th><th>No Salvage & Treat Small Fuels</th><th>Salvage</th><th>No Salvag e & Treat Small Fuels</th></tr>
</table>

1/Hot Dry, Ponderosa Pine	5-7	42	8	12	15	34	12	N/A
1/ Warm Dry, Mixed Conifer	7-15	46	12	13	17	33	12	20
3/Cool Dry, Lodgepole Pine	15-25	48	21	19	22	28	21	N/A
1,3/Riparian Class 1 and 2	7-25	44	N/A	N/A	N/A	N/A	N/A	N/A

The following table shows fire behavior effects by alternative. All predictions are calculated out 20 years at extreme fire conditions similar to the Flagtail fire for the Hot Dry/Warm Dry biophysical environment. All predictions assume a continuous bed of fuels with no change in aspect or slope. Actual flame length and tree mortality will be either higher or lower depending on these factors. Mortality is expected to be in a mosaic pattern for Alternatives 2 and 3.

Table FF-II: Fire Behavior Effects at Extreme Fire Conditions at 20 Years.

Effects in 20 Years	**Alt. 1**	**Alt. 2**	**Alt. 3**		**Alt. 4**	**Alt. 5**	
			Salvage	**No Salvage & Treat Small Fuels**		**Salvage**	**No Salvage & Treat Small Fuels**
Flame Length	7	2	2	7	7	2	7
Tree Mortality	100%	50%	50%	100%	100%	50%	100%

The Following table shows fire behavior effects by alternative at prescribed fire conditions. All predictions are calculated out 20 years at conditions that are prescribed for a low intinsity, stand management type of burn. All predictions assume a continuous bed of fuels with no change in aspect, slope, moisture, wind speed and direction. Actual flame length and tree mortality will be either higher or lower depending on these factors. The mortality shown in all alternatives can be reduced somewhat by using different lighting techniques than the model allows.

Table FF-III: Fire Behavior Effects at Prescribed Fire Conditions at 20 Years

Effects in 20 Years	**Alt. 1**	**Alt. 2**	**Alt. 3**		**Alt. 4**	**Alt. 5**	
			Salvage	**No Salvage & Treat Small Fuels**		**Salvage**	**No Salvage & Treat Small Fuels**
Flame Length	4	1	1	4	4	1	4
Tree Mortality	75%	25%	25%	75%	75%	25%	75%

Cumulative Effects

For this project, the cumulative effects analysis area was considered to be the project area. Ongoing and reasonably forseeable actions, as listed in Appendix J of the FEIS, that could affect fire and fuels include; fuel treatments (private lands), livestock grazing, personal use firewood, hazard tree removal, and riparian fuel treatment.

Fuel treatment on private lands would reduce the fuel loading on adjacent lands This would improve suppression capabilities on that land should another fire occur.

Domestic livestock grazing would not occur for at least two growing seasons under all alternatives. By the end of this time period, the grass and shrub layer will become continuous enough to carry a fire and may be represented by the Fire Behavior Prediction System (FBPS), fuel model 2. These fine fuels, along with dead branches and twigs would affect fire intensity. The resumption of grazing under all alternatives can affect the fine fuel component of the fuel profile. Where fine fuels are reduced substantially, decreased flame lengths and decreased rates of spread could be observed. Lower flame lengths and rates of spread increase suppression capabilities.

Hazard tree removal would slightly reduce fuels within the areas that are being treated. This reduction would not be enough to affect fire behavior except on a limited basis if there are enough trees removed due to them being a hazard.

A fuel reduction project is planned for the Flagtail Fire project area to reduce future fuel loads in riparian areas. This project could include cutting and hand-piling dead and dying trees under 8-inch DBH, then burning the piles, or future low intensity prescribed fires. The effect of this project would be to reduce future fuel loadings in certain riparian areas from approximately 50 tons/acre to approximately 34 tons/acre moving towards the threshold of 25 tons/acre. The potential for future high severity fire effects would be reduced allowing low intensity prescribed fires to back into the riparian areas.

All other ongoing and future projects listed in Appendix J of the FEIS would not affect fuels and future fire severity.

A fuel reduction project is planned for the Flagtail Fire project area to reduce future fuel loads in riparian areas. This project could include cutting and hand-piling dead and dying trees under 8 inch dbh, then burning the piles, or future low intensity prescribed fires. The effect of this project would be to reduce future fuel loadings in certain riparian areas from approximately 50 tons/acre to approximately 34 tons/acre moving towards the threshold of 25 tons/acre. The potential for future high severity fire effects would be reduced allowing low intensity prescribed fires to back into the riparian areas.

Public and Fire Fighter Health and Safety

Existing Condition

In areas burned with high and moderate severity fire there are many continuous acres with standing dead trees, or snags. Snags pose a threat to public and firefighter safety as they can fall at any time and without warning. Hazard trees along the open roads in the project area have been identified. At this time all roads have been closed until that hazard can be removed.

In order to protect important values from undesired fire, firefighters must be able to remove the fuel and contain the fire. They must be able to do this in a manner that is safe for them. The shorter the fire's duration, the less potential exists for adverse weather changes or extreme fire behavior that can make conditions less safe for firefighters. There is also less exposure to elements such as smoke. Firefighters can more safely fight a fire if it stays small, has lower intensities, low spotting potential, and low resistance to control. High resistance-to-control ratings are reached when large woody fuels exceed 25 tons per acre in combination with small woody fuels of 5 tons per acre or more. The number of pieces larger than 10 inches in diameter is more important than the loading in determining resistance-to-control (Brown, 2003).

Resistance to control relates directly with firefighter safety. High resistance to control leads to more accidents to the firefighters from a variety of hazards including smoke inhalation and burnovers. As a result of surface fuel consumption during the Flagtail Fire, the resistance to control was lowered in all severely and moderately burned areas. A lack of canopy fuels in the severely burned areas has reduced the potential for crown fires.

Environmental Consequences

Direct/Indirect Effects

The primary concern for public and firefighter safety is how many snags will be left on site. Trees that have been killed by fire are left in varying conditions of soundness. Some are partially hollowed out, leaving the tree weakened. Others have had the roots partially exposed. These trees are extremely hazardous because one can never tell exactly when they will come down. Sometimes a slight wind can bring a 30 inch dbh, 100 foot tall tree to the ground without any warning. Over time, the wood starts to decay, further weakening the tree. The No-Action alternative and Alternative 4 leave, by far, the most snags. Alternatives 2 and 3 leave the least.

The other concern is the amount of large fuels once the snags are on the ground. The higher the fuel load, the more resistance to control, the increased hazard to firefighters, and the increased risk of a fire adversely affecting the public. See table FF-I for a comparison of fuel loads by alternative.

Cumulative Effects

A fuel reduction project is planned for the Flagtail Fire project area to reduce future fuel loads in riparian areas. The potential for future high severity fire effects would be reduced thus reducing resistance to control and decreasing hazards to firefighters and public. Other projects as listed in Appendix J are not expected to have an effect on public and firefighter health and safety.

Air Quality

Existing Condition

The Flagtail project area lies adjacent to Bear Valley, a large high mountain valley with the Silvies River draining the surrounding area. The lowest elevation of the valley is at Seneca, were the river flows from the valley to the South. The prevailing winds are from the Southwest and West. During the day, diurnal heating forces air up valley and up slope out of the valley. During the night, air follows the drainages in the valley towards Seneca. Inversions effect air quality the most during the winter months, but during the rest of the year inversions sometimes develop in the morning hours, but dissipate by noon.

The Strawberry Mountain Wilderness Area is the only Class I air shed located in the analysis area. It is located 14 miles to the Northeast of the project area. A Class I area allows only very small increments of new pollution above already existing air pollution levels. There are several homes scattered in Bear Valley that are often effected by smoke from nearby burning, with the town of Seneca being affected the most. When smoke is lifted up and out of the valley area, as was the case with the Flagtail Fire, communities to the Northeast are affected. These communities include John Day, Prairie City and Baker.

Currently air quality in surrounding sensitive areas is limited to short term impacts. These impacts are from wood burning, prescribed burning and field burning to the west. The greatest impact to the Strawberry Mountain Wilderness Area is from field burning in the Willamette Valley and Central Oregon. This burning affects haziness and can last for several days in the spring and summer. Bear Valley seems to be impacted the most from wood smoke during the winter months and from prescribed burning in the spring and fall. The impacts from prescribed burning are usually for 2-3 days after completion of the burn, and are worst at night.

The Clean Air Act establishes certain minimum requirements which must be met nationwide, but states may be able to establish additional requirements. Users of prescribed fire must comply with all applicable federal, state and local air quality regulations. The Clean Air Act establishes major air quality goals, and provides means and measures to attain those goals by addressing existing and potential air pollution problems. The major air quality goals include attaining National Ambient Air Quality Standards (NAAQS), preventing significant deterioration of air quality in areas cleaner than the NAAQS.

Each state, including Oregon, has a State Implementation Plan (SIP) which provides the means by which these goals are to be attained. The SIP may contain measures such as emission standards for air pollution sources, air quality permit programs, and regulations controlling specific air pollutant sources such as mobile sources, wood-burning stoves and slash burning. Any burning in Oregon needs to comply with the State of Oregon Smoke Management Implementation Plan. Forest Service policy is to integrate air resource objectives into all Forest Service planning and management activities. The Forest Service and Oregon Department of Environmental Quality entered into a Memorandum of Understanding (MOU) concerning air quality. All alternatives would follow the agreements within the MOU. Because of this, the impacts from any activity are minimized. Fastracs is the program that is used to meet our requirement to report prescribed fire smoke management to the State of Oregon. Registering, planning and reporting accomplishment of prescribed fire activities will be accomplished using this program.

Environmental Consequences

Direct/Indirect Effects

Along with implementing the MOU, there are seven items the Forest Service addresses in an environmental document when proposing alternatives that may affect air quality.

These seven items are:

1. Describe alternative fuel treatments considered and reasons why they were not selected over using fire.

A. No Treatment

Not selected due to the need to remove debris at landings and reduce future fuel loads over entire area.

B. Mechanical Treatment

Tops and limbs are utilized at the landing for chip and are hauled off. This may be used if the chip market becomes favorable.

C. Lop and Scatter

This method is not recommended because of the high fuel loads.

D. Yard Tops Attached

This method was chosen to remove much of the fuels to a landing for possible utilization.

2. Quantity of fuels to be burned (acres, tons, type).

Alternative 1: No fuels are to be burned under this alternative.

Alternative 2: Would burn approximately 15.0 tons of slash per acre treated at landing piles. Would burn approximately 10 tons of slash per acre of hand and machine piles throughout each unit.

Alternative 3: Would burn approximately 13 tons of slash per acre treated at landing. Would burn approximately 10 tons of slash piled with hand and machine piles throughout each treated acre.

Alternative 4: Would burn approximately 10 tons of slash per acre treated.

Alternative 5: Would burn approximately 14 tons of slash per acre treated at landing piles and approximately 10 tons of slash piled with had and machine piles thoughout each treated acre.

3. Describe the type of burns (broadcast,pile understory etc.)

Alternatives 2, 3, and 5: Machine piles at landings, machine and hand piles scattered throughout the project area.

Alternative 4: Machine and hand piles scattered throughout the project area.

4. Describe measures taken to reduce emissions (fuel moisture content, site preparation, removal of debris-YUM/PUM whole tree yarding etc).

Piles will be burned when the slash is at low fuel moisture. Pile burning will be occur over several years, which will reduce daily emissions.

Alternatives 2, 3, and 5: Reduced threat of large reburn, reducing future emissions.

5. Quantify the amount of emissions to be released.

Alternative 1: No emissions short term. Potential for excessive emissions long term.

Alternative 2: Approximately .4 tons of PM 10 emissions are produced per acre treated from burning of piles.

Alternative 3: Approximately .3 tons of PM 10 emissions are produced per acre treated from burning of piles.

Alternative 4: Approximately .2 ton of PM 10 emissions are produced per acre treated from burning of piles. Potential for excessive emissions long term.

Alternative 5: Approximately .4 ton of PM emissions are produced per acre treated from burning of piles.

See emissions table below.

6. Describe the regulatory/permits requirements for burning; i.e., the applicable parts of the smoke management plan.

Alternative 1: None

Alternatives 2 through 5: Action alternatives need to meet the Oregon State Smoke Management Plan as amended by the MOU with the Forest Service.

7. Provide a quantitative description of air quality impacts of burning activities, focusing on new or increased impacts on downwind communities, visibility in Class I Wildernesses, etc.

Alternatives 1: No impact from management ignited fire.

Alternatives 2, 3, 4, and 5: There are five areas of concern for health standards

The amount of smoke produced per day is so little that it will be dispersed before it reaches any populated areas or the nearest Class I area. Measures will be taken to reduce hazards from smoke impacts on roadways. The nearest Class I Area for air quality that can be affected by burning in the watershed is the Strawberry Mountain Wilderness area. Air quality standards are to be met from July 1 through September 15 in Class I Areas.

Emissions limits have been established for the Blue Mountains that take into account wildfire emissions. When the emissions limit is reached, no more burning is allowed for the year.

Total Emissions from Action Alternatives in lbs/acre

	Alt 2	Alt 3	Alt 4	Alt 5
PM 10	477	440	185	462
PM 2.5	404	373	157	391
CH 4	232	214	93	225
CO	4913	4513	2000	4756
CO 2	49118	46683	13990	47815

Cumulative Effects

None of the present and ongoing actions listed in Appendix J are expected to have effects on air quality. Any burning of fuels on private land would potentially add to the emission amounts described above but would only increase the amounts slightly. A fuel reduction project is planned for the Flagtail Fire project area to reduce future fuel loads in riparian areas. This project could include cutting and hand-piling dead and dying trees under 8 inch dbh, then burning the piles. The effect of this pile burning would add to the amount of emissions released by .3 tons/acre treated.

Consistency with Direction and Regulations (as described in Regulatory Framework)

Malheur National Forest Plan and Fire Management Plan

Alternative 1 is not responsive to the objectives and standards in the Forest Plan as it will not allow the utilization of prescribed fire in the future because fuel loadings will be high and outside of the historic range. These fuel loadings would create conditions allowing for another high severity fire. Potential for excessive emissions that would impact air quality from high intensity fire are higher.

Alternative 2 is responsive to the objectives and standards in the Forest Plan. Proposed fuel reduction activities will minimize the potential of high intensity fire that also results in a cost-efficient protection program, as fires would show low resistance to control. Reduced fuel levels would allow future use of prescribed fire to meet land management objectives. Fuel levels would be within the historic range on much of the landscape allowing compatibility with the role of fire. This alternative would meet standards relating to air quality.

Alternative 3 is responsive to Forest Plan direction as described above for Alternative 2 on the acres proposed for treatment.

Alternative 4 is only partially responsive to the objectives and standards in the Forest Plan. Burning activities proposed with this alternative will meet standards relating to air quality.

Alternative 5 is responsive to Forest Plan direction as described above for Alternative 2.

National Fire Plan

Alternative 1 is not responsive to the National Fire Plan.

Alternatives 2, 3, and 5 are responsive to the National Fire Plan by reduction of hazardous fuels. Alternative 2 reduces more acres of hazardous fuels than Alternative 3 or 5. Alternative 2 would reduce fuel in all Wildland Urban Interface areas to historical levels, while Alternatives 3 and 5 treat most but not all of these areas. The acres treated are however, sufficient to make the 3 Alterntives equally responsive to the NFP.

Alternative 4, because it includes fuel reduction of small diameter material, is responsive to the National Fire Plan but it only reduces risks associated with wildland fires to the environment for short time periods without additional future fuel reduction activities.

Laws and Regulations

State and federal air quality regulations would be followed. All burning would be done in accordance with the Oregon State Smoke Management Plan and Oregon State Implemention Plan in order to ensure that clean air requirements are met. All alternatives are designed to meet National Ambient Air Quality standards through avoidance of practices that degrade air quality below health and visibility standards.

Irreversible and Irretrievable Commitments

There are no irreversible and irretrievable commitments of resources that may result from the alternatives with respect to fire and fuels.

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