Fire and Fuels

Key Points

- Fire, as a natural disturbance agent, differs in severity and frequency between the northern and southern BLM districts.
- Fire exclusion has increased the risk of high severity fires in the Medford District and Klamath Falls Resource Area.
- High-frequency, low severity fires historically created fire-resilient stands in the Medford District and Klamath Falls Resource Area. Fire exclusion and vegetative growth has reduced fire resiliency of current stands.
- Current vegetation in all districts shows a high percentage of departure from historical reference conditions across all fire regimes.

Fire Regimes

Fire is a natural disturbance agent that has played a major role in shaping the forests within the planning area. A natural fire regime is a general classification of how fire would behave in the absence of human intervention.

This analysis uses LANDFIRE data (current as of 1/30/2008) to describe fire regimes and fire regime condition class at a stand-level scale for all ownerships within the planning area. LANDFIRE, also known as the Landscape Fire and Resource Management Planning Tools Project, is a shared project between the U.S. Department of Agriculture Forest Service and U.S. Department of the Interior. The LANDFIRE project produces consistent and comprehensive maps and data that describe vegetation, wildland fuel, and fire regimes across the United States. LANDFIRE data products include layers of vegetation composition and structure, surface and canopy fuel characteristics, and historical fire regimes. LANDFIRE data products are designed to facilitate national- and regional-level strategic planning and reporting of wildland fire management activities. Additional information about LANDFIRE can be found at the LANDFIRE website (http://www.landfire.gov/index.php)

For a description of the five fire regime groups, as defined by LANDFIRE, and also the frequencies and severities of natural fire by fire regime group, see *Table 3-66 (Frequencies and severities of the natural fire regimes)*. Group I includes ponderosa pine, other long-needle pine species, and dry-site Douglas fir. Group II includes the drier grassland types, tall grass prairie, and some chaparral ecosystems. Group V is the long-interval (infrequent), stand-replacement fire regime.

The first two fire regime groups (Groups I and II) occupy nearly all of the lower elevation zones across the United States. These two groups have been most affected by the presence of human intervention, and

Table 3-66. Frequencies And Severities Of The Natural Fire Regimes

The Five Historic Natural Fire Regime Groups		
Fire Regime Group	Frequency (Fire Return Interval)	Severity
I	0 to 35 years	low severity
II	0 to 35 years	stand replacement severity
III	35 to 100+ years	mixed severity
IV	35 to 100+ years	stand replacement severity
V	>200 years	stand replacement severity

analysis shows that these types demonstrate the most significant departure from historical levels. The departures are affected largely by housing development, agriculture, grazing, and logging. These areas are at greatest risk to loss of highly valued resources, commodity interests, and human health and safety. It is expected that these areas will receive primary focus of wildland management agencies in the future. (http://www.nifc.gov/preved/comm_guide/wildfire/fire_5.html)

Figure 3-121 shows fire regimes by BLM district within the planning area.

The Salem, Eugene, and Coos Bay Districts have high components of fire regime V. The Roseburg District is primarily fire regime III with mesic conditions. Klamath Falls is primarily fire regime III with xeric conditions. Because LANDFIRE does not distinguish between different conditions within a fire regime, Klamath Falls and Roseburg both contain large portions of fire regime III although they have dissimilar plant communities. Medford is primarily fire regime I. The Medford District and the Klamath Falls Resource Area have had less severe, but more frequent, fire regimes than the northern districts. These frequent low-severity fire events have historically contributed to the fire resiliency of the forests of southern Oregon by removing understory vegetation, reducing ground and surface fuels, and reducing tree density.

Fire Regime Condition Class

The fire regime condition class is a measure of departure of current vegetation from the historic fire regime, as determined by the number of missed fire return intervals with respect to: (1) the historic fire return interval, and (2) the current structure and composition of the system resulting from alterations to the disturbance regime. The departures may result 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 drought, grazing, and mortalities from insect and disease infestations.

Possible causes of departure include but are not limited to: fire suppression, timber harvesting, livestock grazing, introduction and establishment of non-native vegetative species, and introduced insects and disease. Additional information about fire regime condition class can be found on the LANDFIRE website (http://www.landfire.gov/NationalProductDescriptions10.php).

There are three levels of departure under the Fire Regime Condition Class System (FRCC) that describe departure from the central tendency of reference conditions:

- FRCC 1 has little or no departure.
- FRCC 2 has moderate departure.
- FRCC 3 has high departure.

This central tendency is a composite estimate of reference characteristics which include: fuel composition, fire frequency, fire severity and pattern; and other associated natural disturbances. To determine departure and assign fire regime condition class, LANDFIRE identifies reference condition characteristics for each biophysical setting. Descriptions of LANDFIRE biophysical settings can be found at LANDFIRE National Vegetation Dynamics Models website (http://www.landfire.gov/national_veg_models_op1.php)

See *Figures 3-122 through 3-127* for fire regime condition class acres by BLM district within the planning area.

All districts show a high percentage of Fire Regime Condition Class 3 across all fire regimes, with few exceptions. *Figures 3-122 through 3-127* show departure from reference conditions by district across all ownerships within the district boundaries.

Figure 3-121. Fire Regimes By BLM District Within The Planning Area.

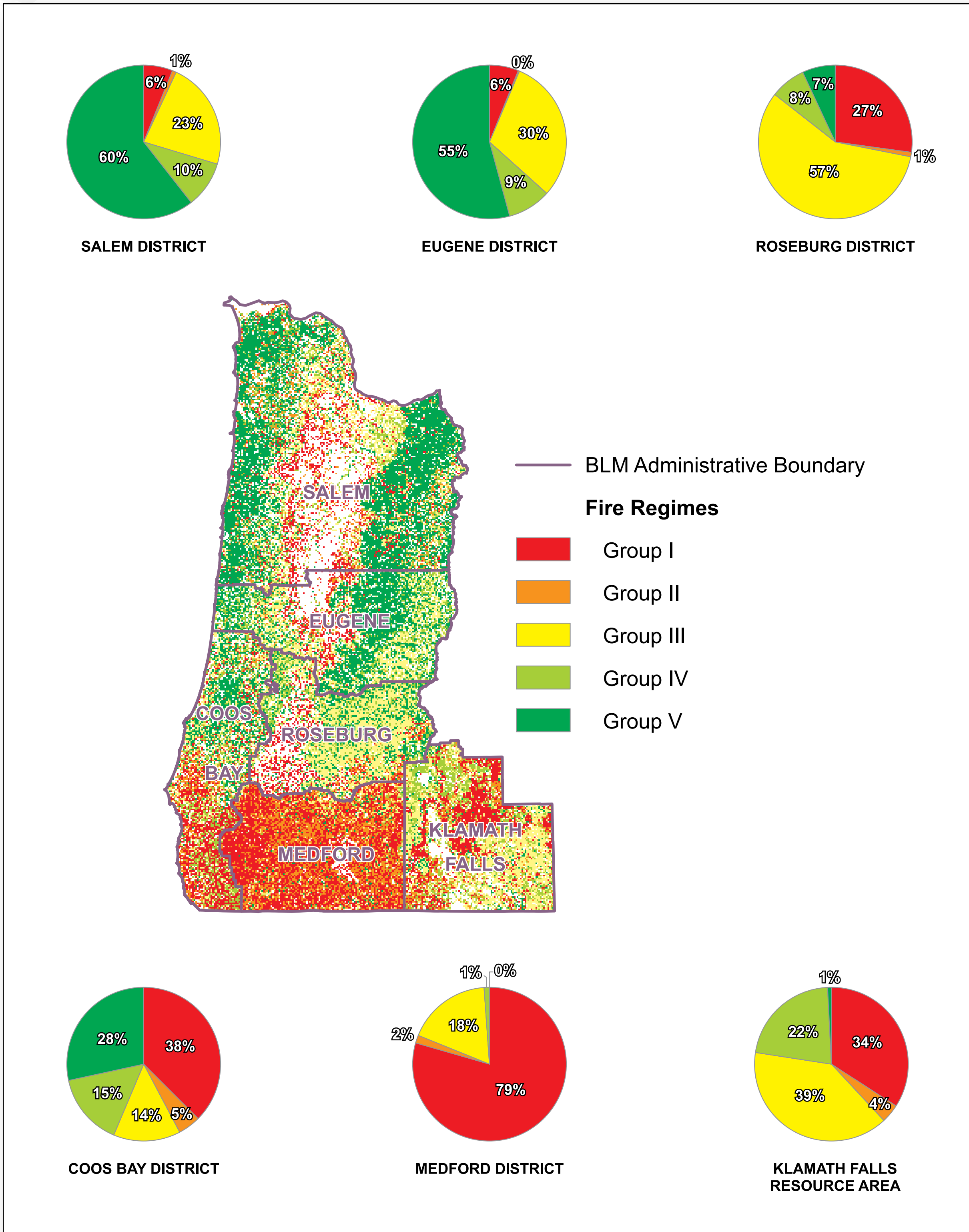


Figure 3-122. Fire Regime Condition Class Acres By Fire Regime, Salem District

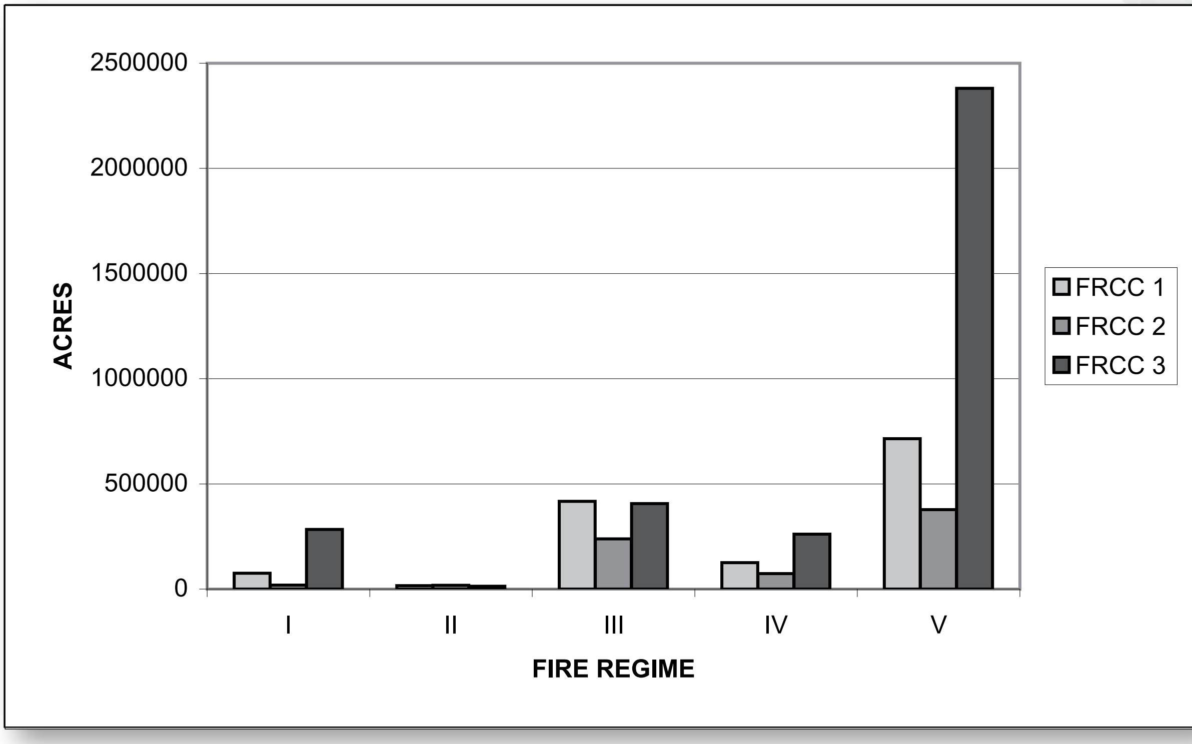


Figure 3-123. Fire Regime Condition Class Acres By Fire Regime, Eugene District

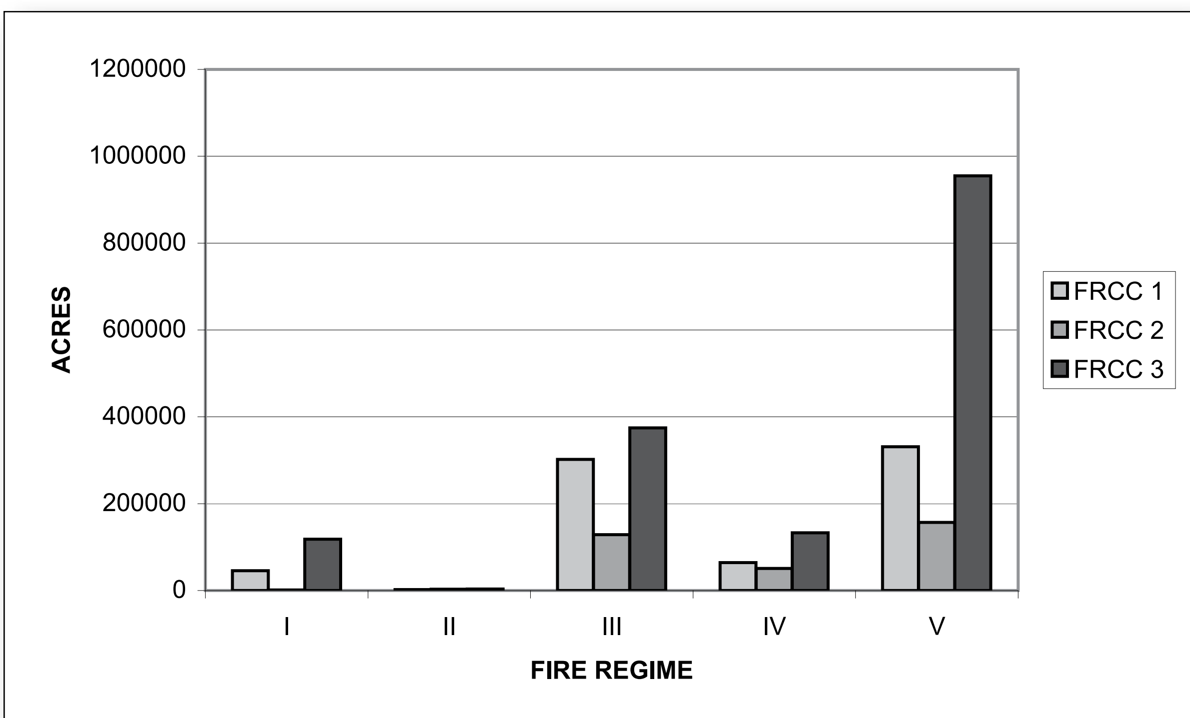


Figure 3-124. Fire Regime Condition Class Acres By Fire Regime, Coos Bay District

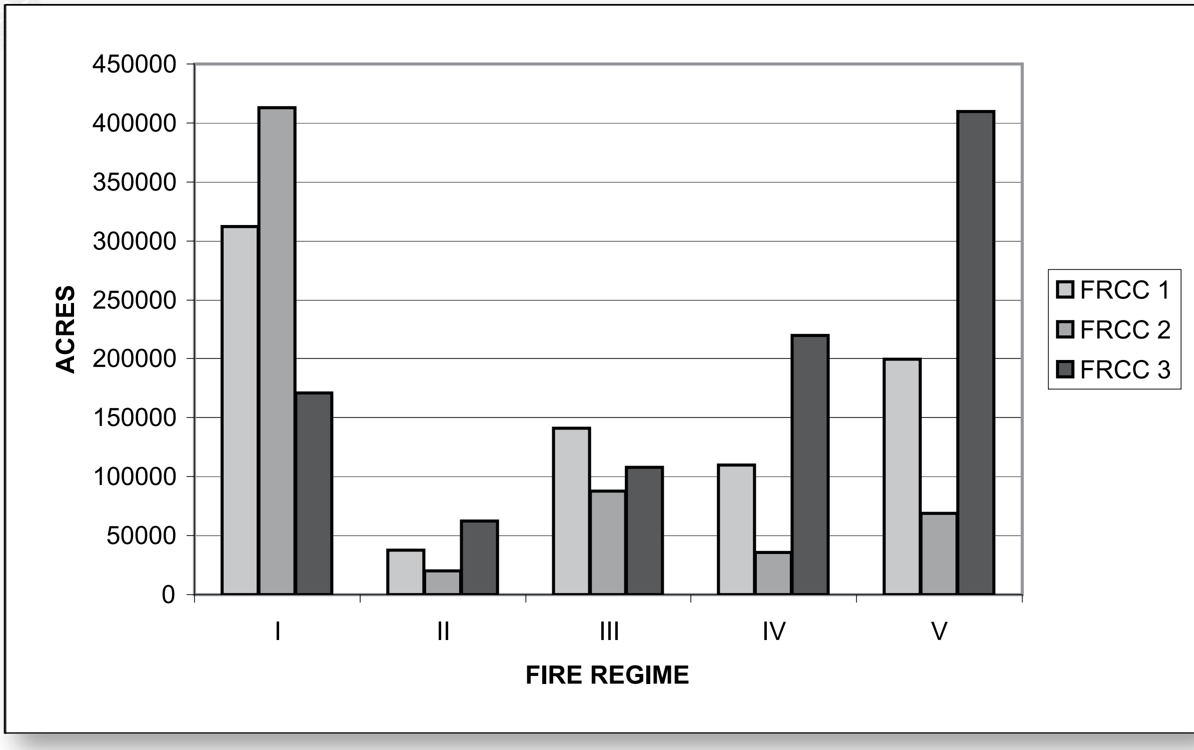


Figure 3-125. Fire Regime Condition Class Acres By Fire Regime, Roseburg District

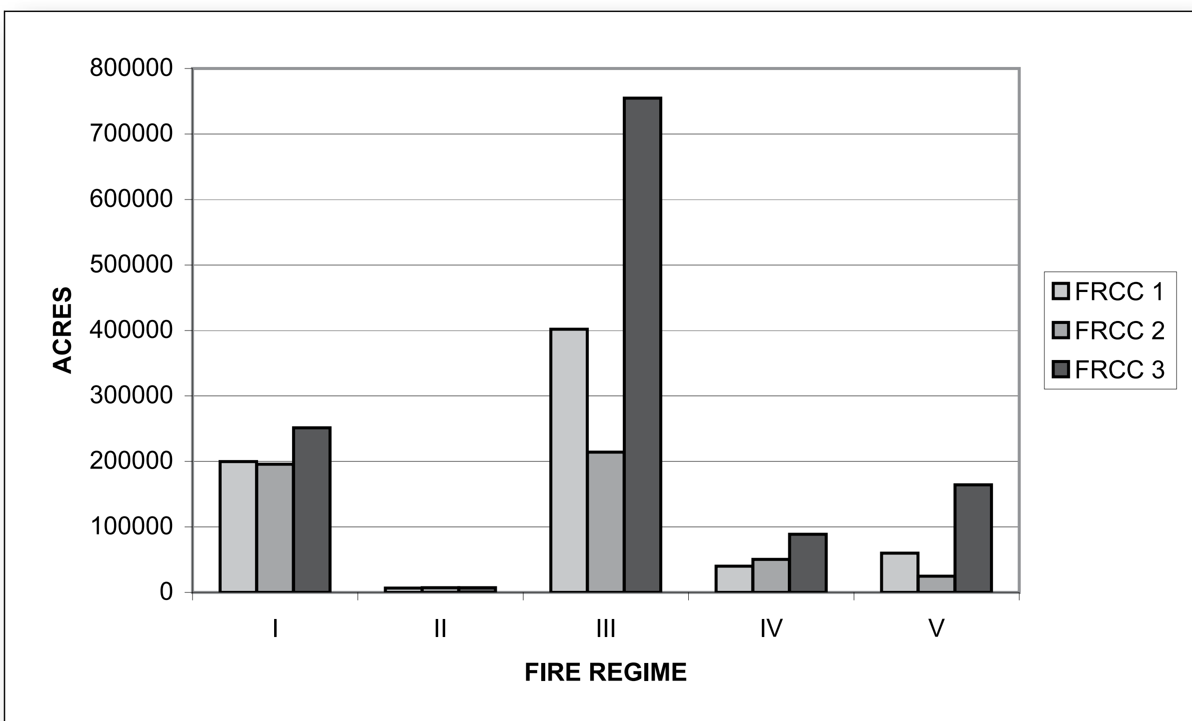


Figure 3-126. Fire Regime Condition Class Acres By Fire Regime, Medford District

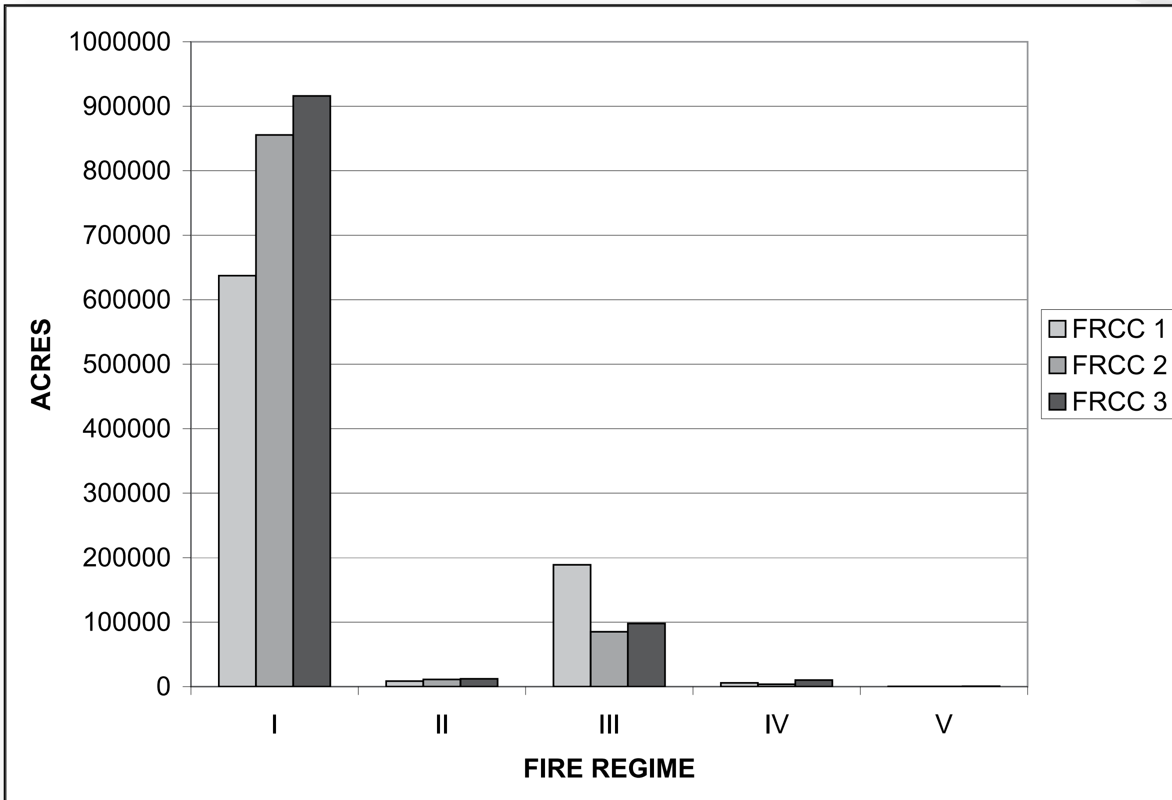
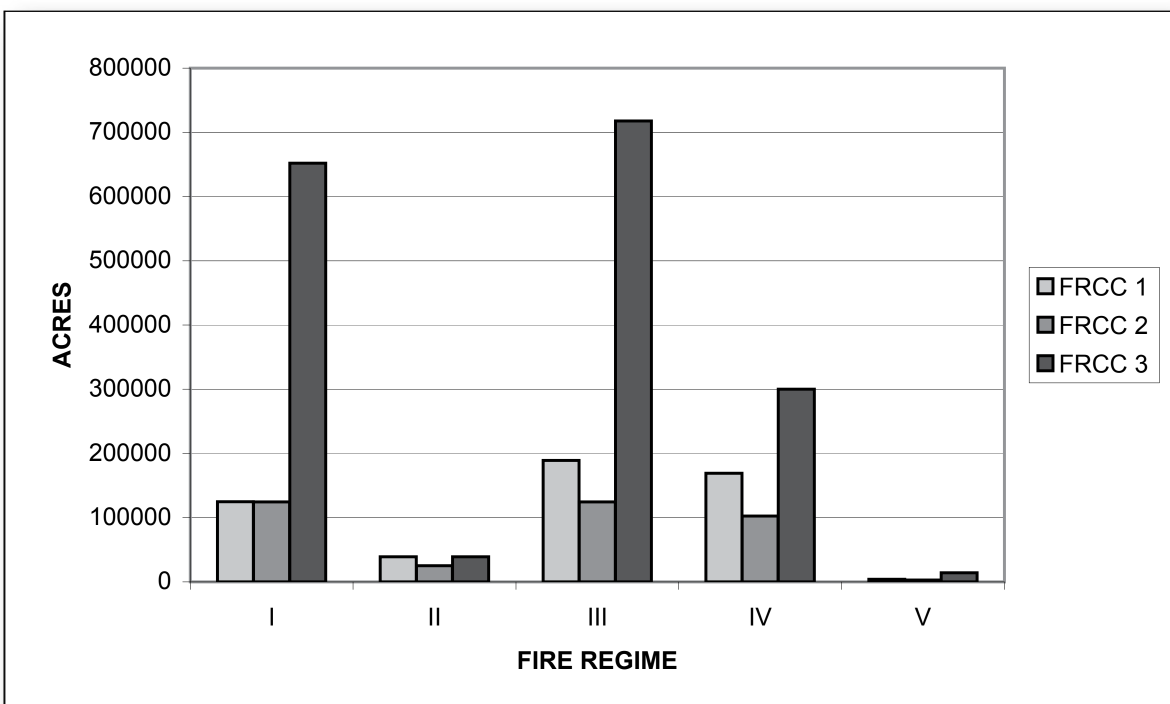


Figure 3-127. Fire Regime Condition Class Acres By Fire Regime, Klamath Falls Resource Area Of The Lakeview District



There appears to be an emerging trend toward higher severity fires in the southern portion of the planning area (USDA USFS and USDI BLM 2004d). In the dry Douglas fir forests of southern Oregon, forests that currently would burn at a high severity level compose 50% of the landscape compared to 20% historically. This increased fire potential is a result of fire exclusion and harvesting practices that have fundamentally changed current fuel conditions from historic fuel conditions (Peterson et al. 2005). These changes from historic fuel conditions include:

- an increase in shade-tolerant species (such as true firs), which are less fire resistant. Frequent, low-intensity fires control the establishment of fire-intolerant species, which are more susceptible to mortality from bowl scorch and have increased the risk of crown fires due to lower canopy base heights.)
- a lower height to live crown ratio of shade-tolerant species, which increases ladder fuels.
- increased tree stocking levels. Frequent, low-intensity fires maintained a higher proportion of low-density stands. Surface fuels accumulate over time as smaller trees crowd out and die.
- a decrease in canopy base height. Frequent, low-intensity fires pruned the lower limbs of the trees that survived and reduced the threat of crown fires.
- an increase in ground fuels as duff and large woody material accumulate and decompose. This build-up of ground fuels is a long-term process that occurs over decades. These fuels do not influence the rate at which fires spread, but do contribute heavily to fire severity.

Ground fuels that consume large amounts of woody fuels and organic soil horizons produce disproportionately large amounts of smoke compared to fires generated from other types of fuels. Ground fires reduce the accumulation of organic material and carbon storage, and contribute to smoke production long after the flaming front of a fire has passed (Graham et al. 2004). Under drought conditions, these fires also damage and kill large trees by killing or damaging their roots and lower stem cambium (Graham et al. 2004). The long duration of ground fires may result in greater soil heating than surface and crown fires, which could potentially reduce organic material, volatize nutrients, and create a hydrophobic layer that contributes to soil erosion (Graham et al. 2004). Crown fires have the largest immediate and long-term ecological effects and the greatest potential to threaten wildland urban interfaces (Graham et al. 2004).

The following management practices have increased the potential for uncharacteristic wildfires:

- Fire exclusion has created thickets of ladder fuels and increased fuel loadings (USDA USFS 2005).
- A lack of thinning and slash treatments has created higher density stands, understory vegetation, and fuels that favor large, high-severity fires (USDA USFS 2005).
- Harvesting practices have removed the more fire-resilient larger trees (Brown et al. 2004a, Peterson et al. 2005, Noss et al. 2006).
- Excluding areas (such as reserved areas) from the practices of thinning, prescribed burns, or fuel reduction activities makes them susceptible to wildfires of uncharacteristically high intensity and severity. This exclusion also makes them less fire resilient. The more frequent the fire regime, the more pronounced the effect of exclusion (Brown et al. 2004a, USDA USFS 2005).

Most of the northern area is characterized by a low fire return interval with high severity fires. However, under current fuel conditions, fires in the northern portion of the planning area are typically small and scattered. In the northern portion of the planning area, fire exclusion is not a significant factor in future fire severity as it is in the south. Additionally, weather conditions that are conducive to large fires and multiple ignitions are rarer in the northern portion than in the southern portion of the planning area. Historically, lightning has been the primary cause of large wildfire ignitions within the southern portion of the planning area. The area in western Oregon south of the Rogue-Umpqua divide generally has more severe and frequent thunderstorms with little precipitation. Storms tend to track up the crest and east side of the Cascade Range (Agee 1996).

Weather factors that influence fire behavior are temperature, relative humidity, and wind speed. On a 10-year average, extreme fire weather conditions (based on the Burning Index [see glossary]) occur:

- 37 days a year in coastal areas
- 51 days in the Willamette Valley and the Central Cascades
- 69 days in Roseburg, Medford and Klamath Falls (ODF Hazard and Risk Assessment 2005)

Fire Resiliency

In the southern portion of the planning area, high-frequency, low severity fires historically created more open forest stands with light surface and ladder fuels. These fuels presented low to moderate probabilities of crown and stand replacement type fires. The type of fire activity created fire-resilient stands. However, fire exclusion and harvesting practices have reduced fire resiliency (USDA USFS 2005).

Fire-resilient stands have the following characteristics:

- reduced surface fuel loading (Cram et al. 2006, Brown et al. 2004a, Peterson et al. 2005)
- lower density and basal area (Cram et al. 2006, Brown et al. 2004a)
- large-diameter trees of fire-resistant species (Brown et al. 2004a, Cram et al. 2006, Noss et al. 2006)
- increased height to live crown (Brown et al. 2004a, Peterson et al. 2005).

Fire resilient forest

A forest having characteristics that limit fire severity and increase the resistance of the forest to mortality (Brown et al. 2004a).

Legacy trees (large trees remaining from a previous stand) increase fire resiliency within a forest. Currently, 27% of the stand establishment and young stands in the Medford District contain legacy trees, and 19% of the stand establishment and young stands in the Klamath Falls Resource Area contain legacy trees.

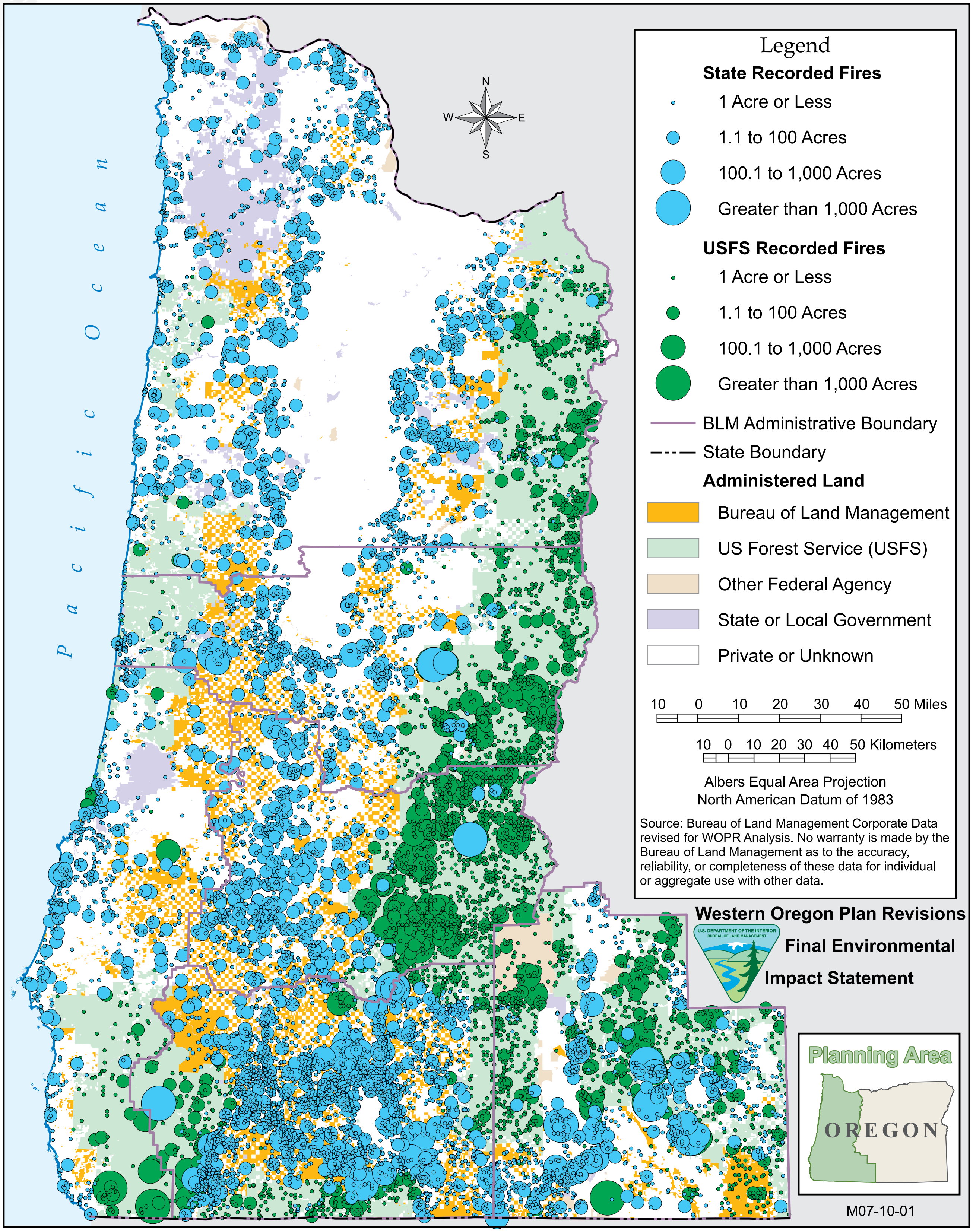
The Klamath Province and the southern portion of the West Cascades Province (which includes Medford and Klamath Falls have a greater abundance of fires than the northern portion of the planning area. There are more large fires in those provinces than in the northern portion of the planning area. See *Map 3-9 (Incidence of forest fires within the planning area between 1994 and 2004).*

Fire Hazard

The complexities and difficulties of fire management are increased by the checkerboard land ownership pattern of the BLM-administered lands within the planning area. The BLM-administered lands are interspersed with a variety of other lands (including intensively managed private, industrial forests and residential areas where residents may not want active forest management). Although the goal of rapid fire suppression may be common to all landowners, it is often difficult to treat fuel loadings in mixed ownership situations. This situation of mixed land ownership often reduces the effectiveness of fuels treatments. Treatment of broader landscape patterns may improve the effectiveness of fuel treatments. (USDA USFS 2005)

The wildland urban interface encompasses a large portion of BLM-administered lands within the planning area. The wildland urban interface is an area where structures and other human development meet or intermingle with undeveloped wildland. Under the National Fire Plan (available online at http://www.forestsandrangelands.gov), the wildland urban interface is being refined under Community Wildfire Protection Plans (CWPP). An increasing population in the wildland urban interface is increasing the incidences of human-caused fires. Currently in southwest Oregon, the primary source of ignitions is shifting from lightning to human-caused fires (Thorpe, pers. comm. 2007).

Map 3-9. Incidence Of Forest Fires Within The Planning Area Between 1994 And 2004



Fire hazard ratings consider slope, aspect, climate, elevation, fuel type, and crown fire characteristics. A fire hazard and risk assessment was completed in 2006 by the Oregon Department of Forestry. See *Figure 3-128 (Ratings of fire hazards within the planning area).*

As detailed below, fire hazard ratings are generally lower in the northern portion of the planning area and higher in the southern portion of the planning area:

- About 92% of the lands in the northern districts (Salem, Eugene, and Coos Bay) have a moderate fire hazard rating.
- The Roseburg District and Klamath Falls Resource Area have roughly equal amounts of moderate hazard acres (56%). Both locations have a high percentage of Fire Regime III lands that are also Fire Regime Condition Class 3, even though vegetation and climate are very different. However, a large portion of the Klamath Resource Area has relatively low slope gradients, which contributes to a reduced fire hazard rating.
- About 48% of the lands in the Medford District have a high fire hazard rating, and 25% falls into the very high hazard category.

See *Table 3-67 (Current fire hazard ratings by percent of land within the districts of the planning area)* and *Figure 3-129 (Current fire hazard ratings by percent of land within the Salem District)* through *Figure 3-135 (Current fire hazard ratings by percent of land within the Klamath Falls Resource Area of the Lakeview District)* for an illustration of these trends across the districts within the planning area.

Figure 3-128. Ratings Of Fire Hazards Within The Planning Area

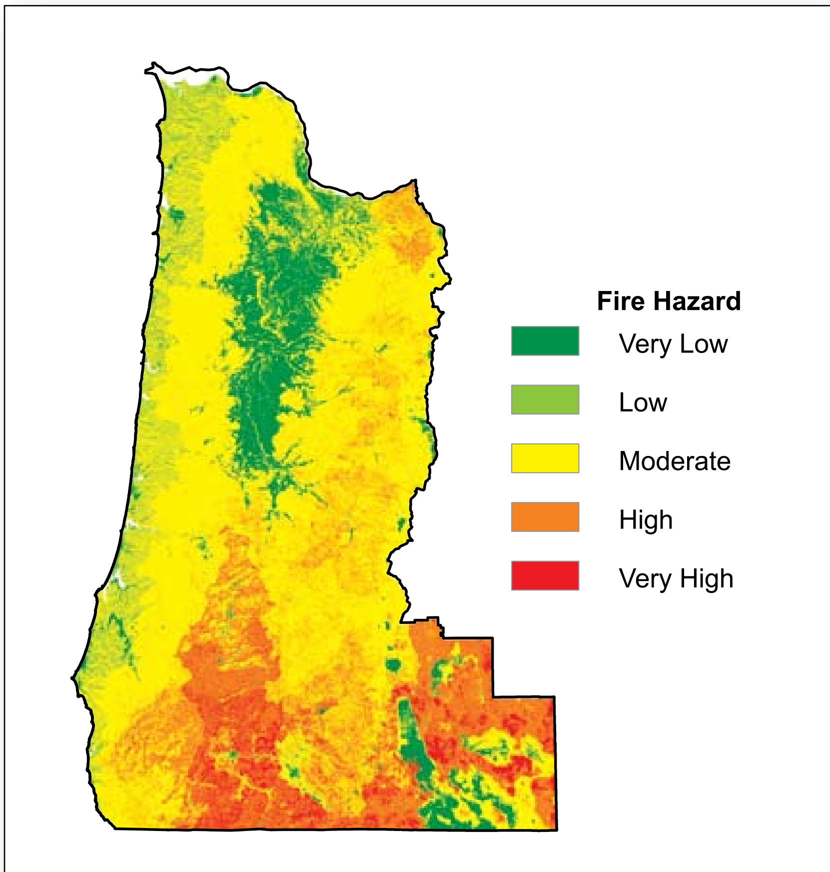


Table 3-67. Current Fire Hazard Ratings By Percent Of Land Within The Districts Of The Planning Area

BLM Districts	Fire Hazard Ratings (by % of land)			
	Very Low/Low	Moderate	High	Very High
Salem	2.4	92.9	4.6	0.1
Eugene	0.9	91.5	7.4	0.1
Roseburg	0.1	55.6	35.4	8.8
Coos Bay	5.8	91.0	3.1	0.1
Medford (northern portion)	0.2	35.9	47.1	16.9
Medford (southern portion)	0.2	18.6	48.6	32.6
Klamath Falls Resource Area (Lakeview District)	2.0	73.0	13.0	12.0

Figure 3-129. Current Fire Hazard Ratings By Percent Of Land Within The Salem District

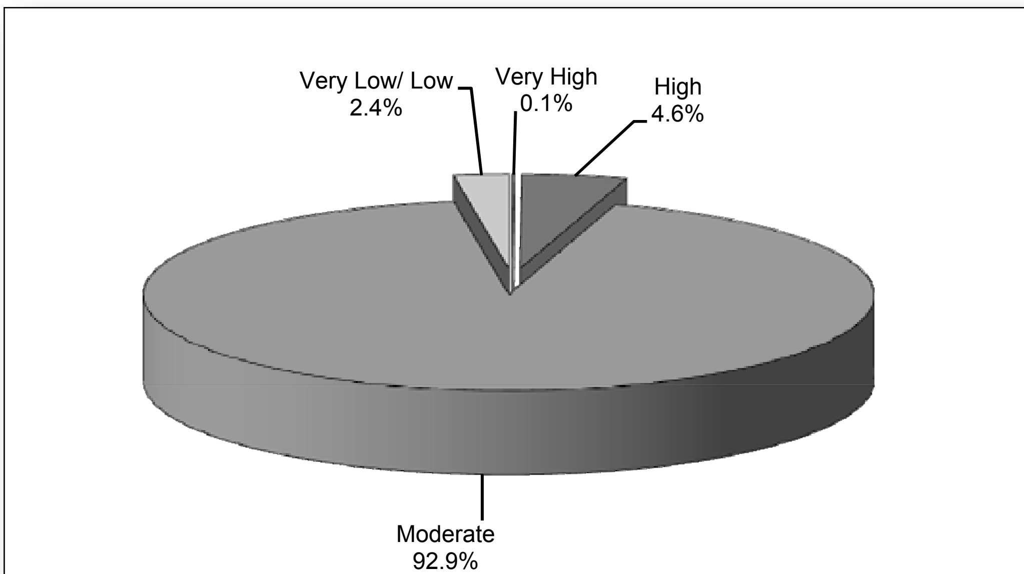


Figure 3-130. Current Fire Hazard Ratings By Percent Of Land Within The Eugene District

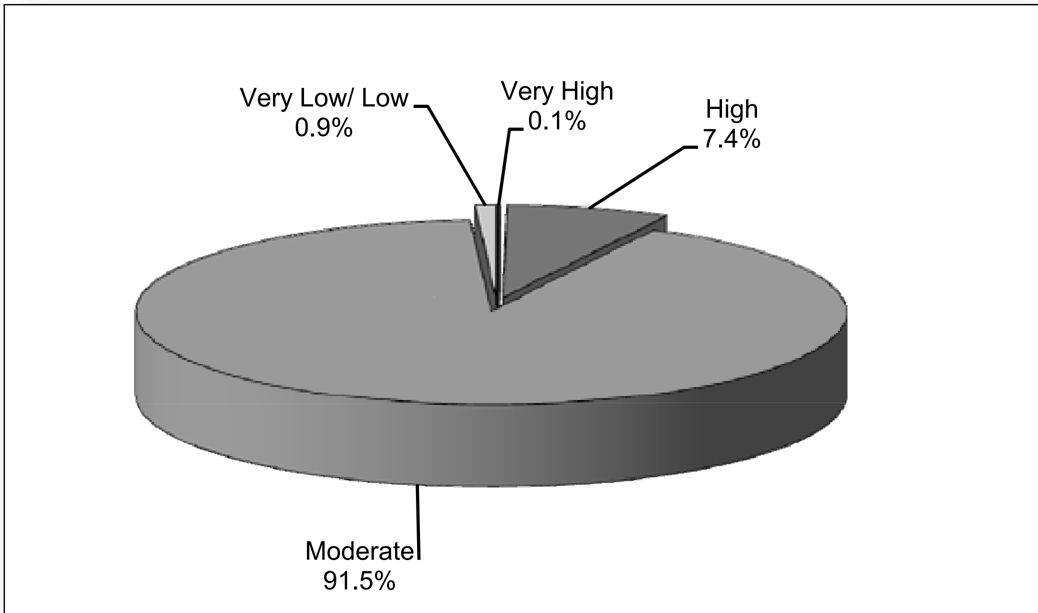


Figure 3-131. Current Fire Hazard Ratings By Percent Of Land Within The Roseburg District

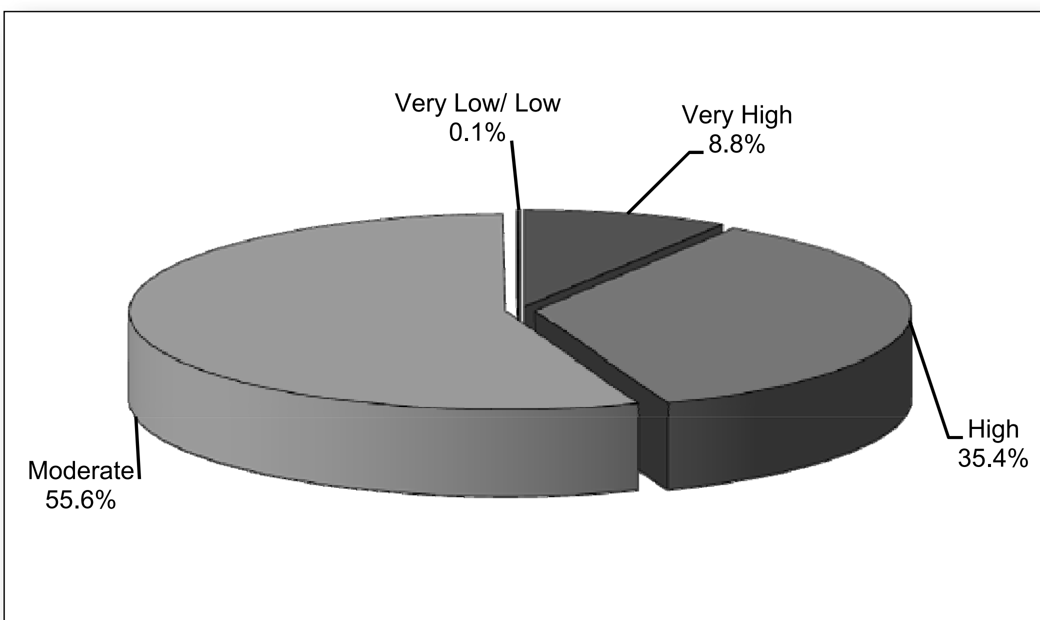


Figure 3-132. Current Fire Hazard Ratings By Percent Of Land Within The Coos Bay District

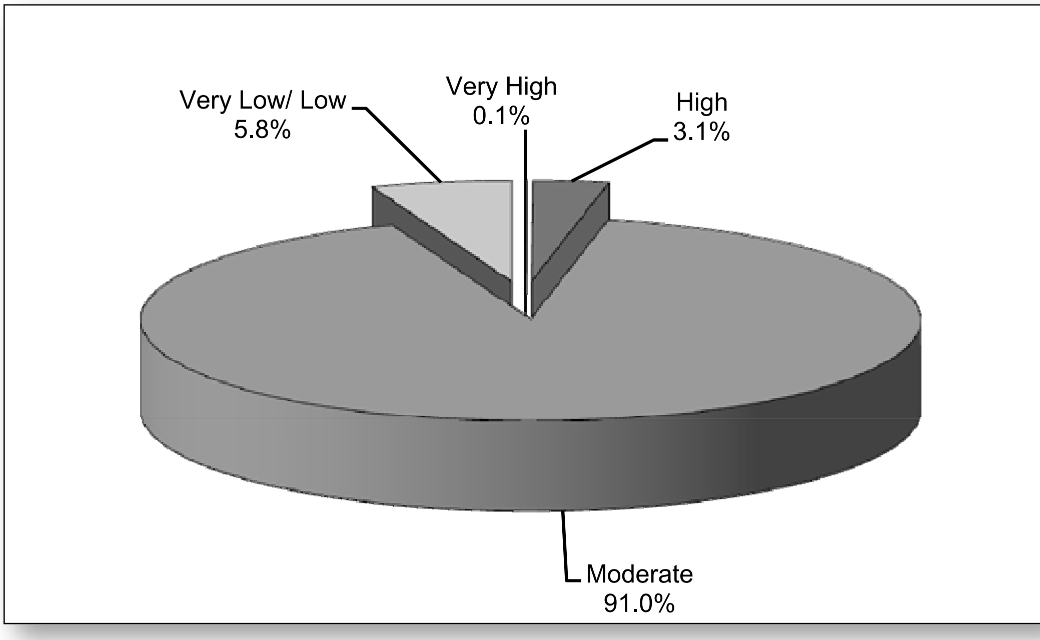


Figure 3-133. Current Fire Hazard Ratings By Percent Of Land Within The Northern Portion Of The Medford District

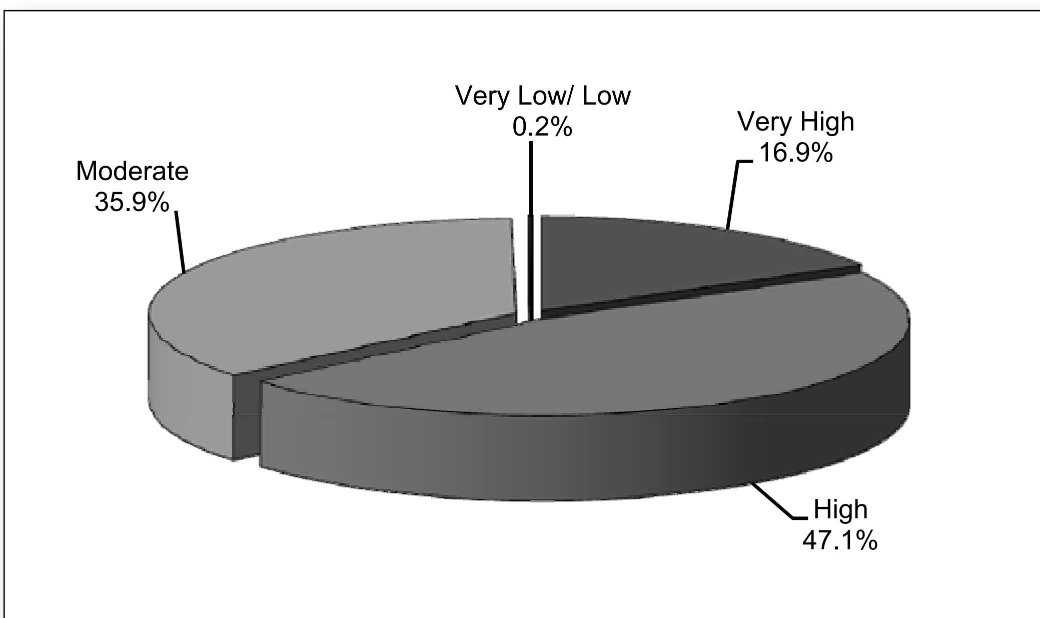


Figure 3-134. Current Fire Hazard Ratings By Percent Of Land Within The Southern Portion Of The Medford District

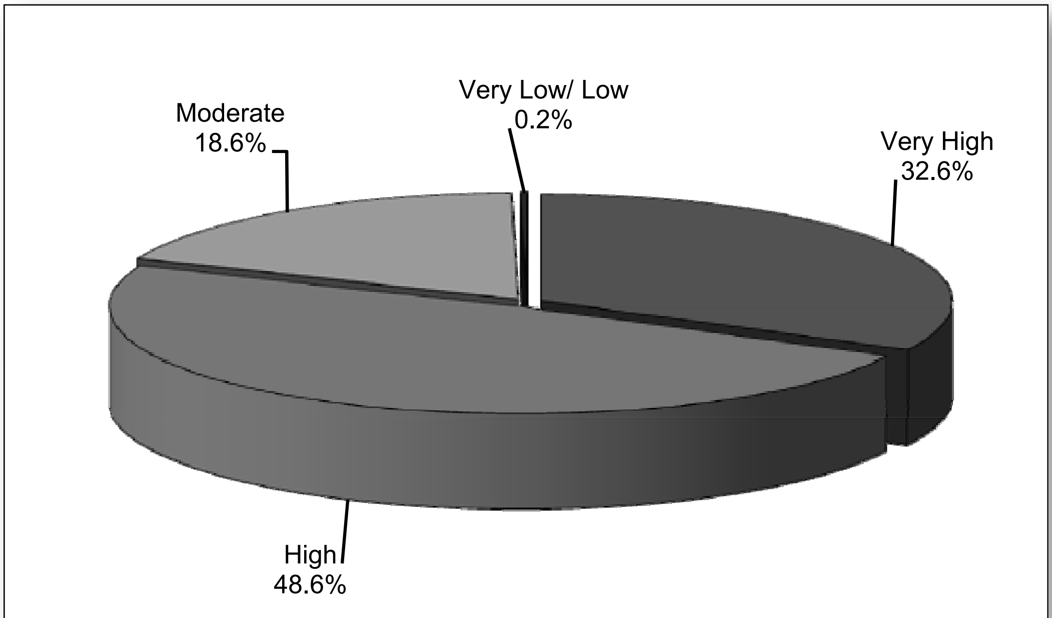
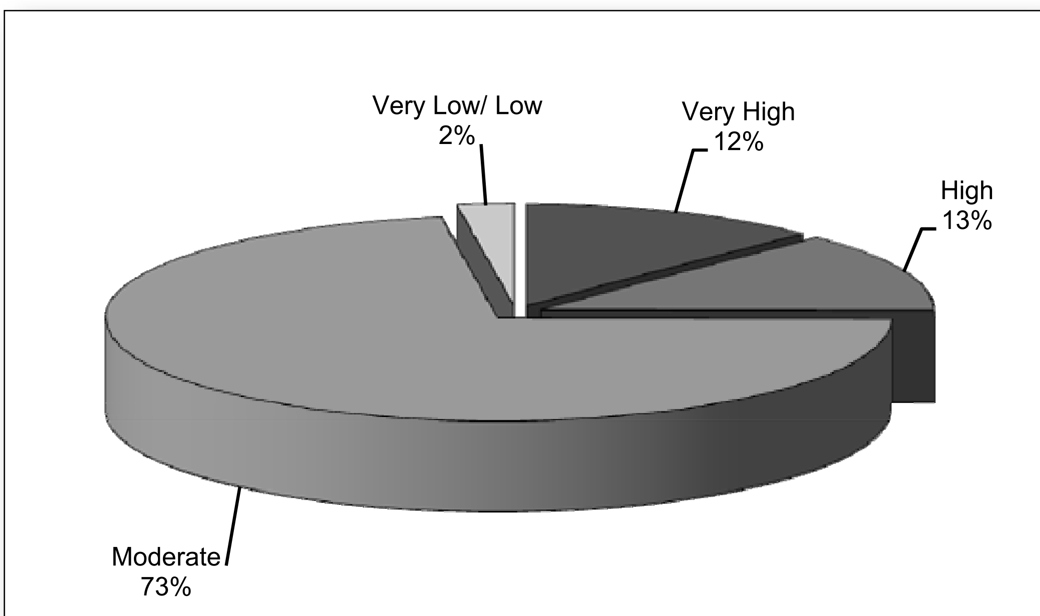


Figure 3-135. Current Fire Hazard Ratings By Percent Of Land Within The Klamath Falls Resource Area Of The Lakeview District



Air

Key Points

- Wildfires contribute large amounts of air pollution to episodic events that often exceed air quality standards over vast areas.
- Prescribed burns contribute negligible amounts of air pollution in smaller, controlled events that exceed air quality standards over smaller, controlled areas.

The standards for air quality are set by the Environmental Protection Agency under the authority of the federal Clean Air Act. There are two primary concerns regarding air quality—health standards and visibility.

Inversion

A layer of warm air that prevents the rise of cool air and traps pollutants beneath it.

Western Oregon has a history of air quality issues due to weather patterns and topography. Weather patterns are dominated in western Oregon by the Pacific high pressure system. This weather pattern creates inversions during the summer and late-winter months that cause air stagnation by trapping pollutants at the lower elevations for extended periods of time. Topography compounds this issue by forming topographic bowls with the valleys in western Oregon and Klamath County. These topographic bowls create the need for moderately intense storms to move the inversions and to mix the air layers. Most prescribed burning is conducted in the spring and fall when the atmosphere is generally unstable, allowing air to mix and pollutants to be transported offsite. All prescribed burning in western Oregon is conducted under the Oregon Smoke Management Plan. This plan requires dispersion, dilution, and avoidance techniques to minimize smoke impacts on local communities and to direct smoke away from Smoke Sensitive Receptor Areas.

> A **Smoke Sensitive Receptor Area** is an area that receives the highest level of protection under the smoke management plan because of its past history of smoke intrusions, incidents, density of population, or other legal status related to visibility such as the Columbia Gorge Scenic Area.
>
> **Class I visibility areas** are areas that have very clean air and are subject to the tightest restrictions on how much additional pollution can be added to their airshed.

The following areas within the planning area have been designated as Smoke Sensitive Receptor Areas, per Oregon Administrative Rules (OAR), accessed March 2008 and available for review at website http://arcweb.sos.state.or.us/rules/OARS_600/OAR_629/629_048.html:

- Carlton, Corvallis, Cottage Grove, Eugene, McMinnville, Portland, Sheridan, Silverton, Springfield, St. Helens, Stayton, Sublimity, Veneta, Willamina, and Yamhill.
- Within the acknowledged urban growth boundaries of the following cities: Astoria, Coos Bay, Grants Pass, Klamath Falls, Lakeview, Lincoln City, Newport, North Bend, Oakridge, Roseburg, The Dalles, and Tillamook.
- The area within the Bear Creek and Rogue River Valleys described in OAR 629-048-0160, including the cities of Ashland, Central Point, Eagle Point, Jacksonville, Medford, Phoenix, and Talent.
- The area within the Columbia River Gorge Scenic Area, as described in 16 U.S.C. Section 544b, (2003).

In Class I visibility areas, the primary concern is protection of visibility. These areas are protected under the Oregon State Implementation Plan, which governs regional haze. The following sites in western Oregon and

Klamath County are designated as Class I visibility areas:

- Mount Hood Wilderness
- Mt. Jefferson Wilderness
- Mt. Washington Wilderness
- Three Sisters Wilderness
- Diamond Peak Wilderness
- Crater Lake National Park
- Kalmiopsis Wilderness
- Mountain Lakes Wilderness
- Gearhart Mountain Wilderness

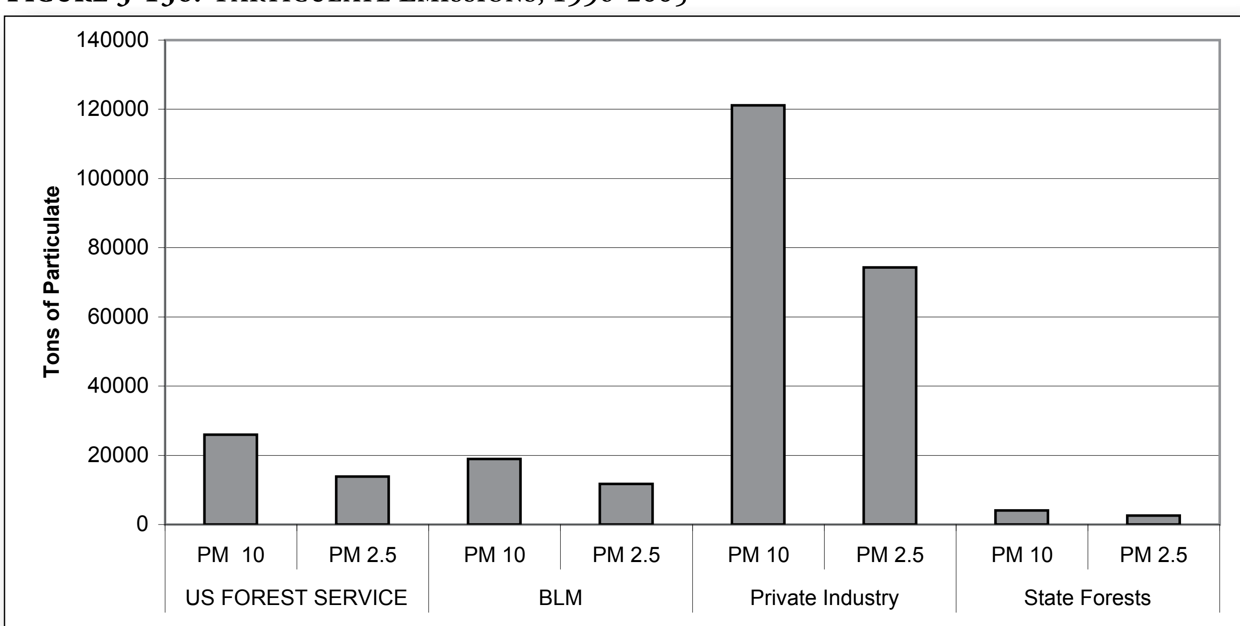
See *Map 3-10 (Smoke sensitive receptor areas and class I visibility areas within the planning area).*

Particulate matter (PM) is measured by two diameter classes: 10 micron (PM10) and 2.5 microns (PM2.5). *Figure 3-136 (Particulate emissions, 1996-2005)* shows particulate emissions by landowner.

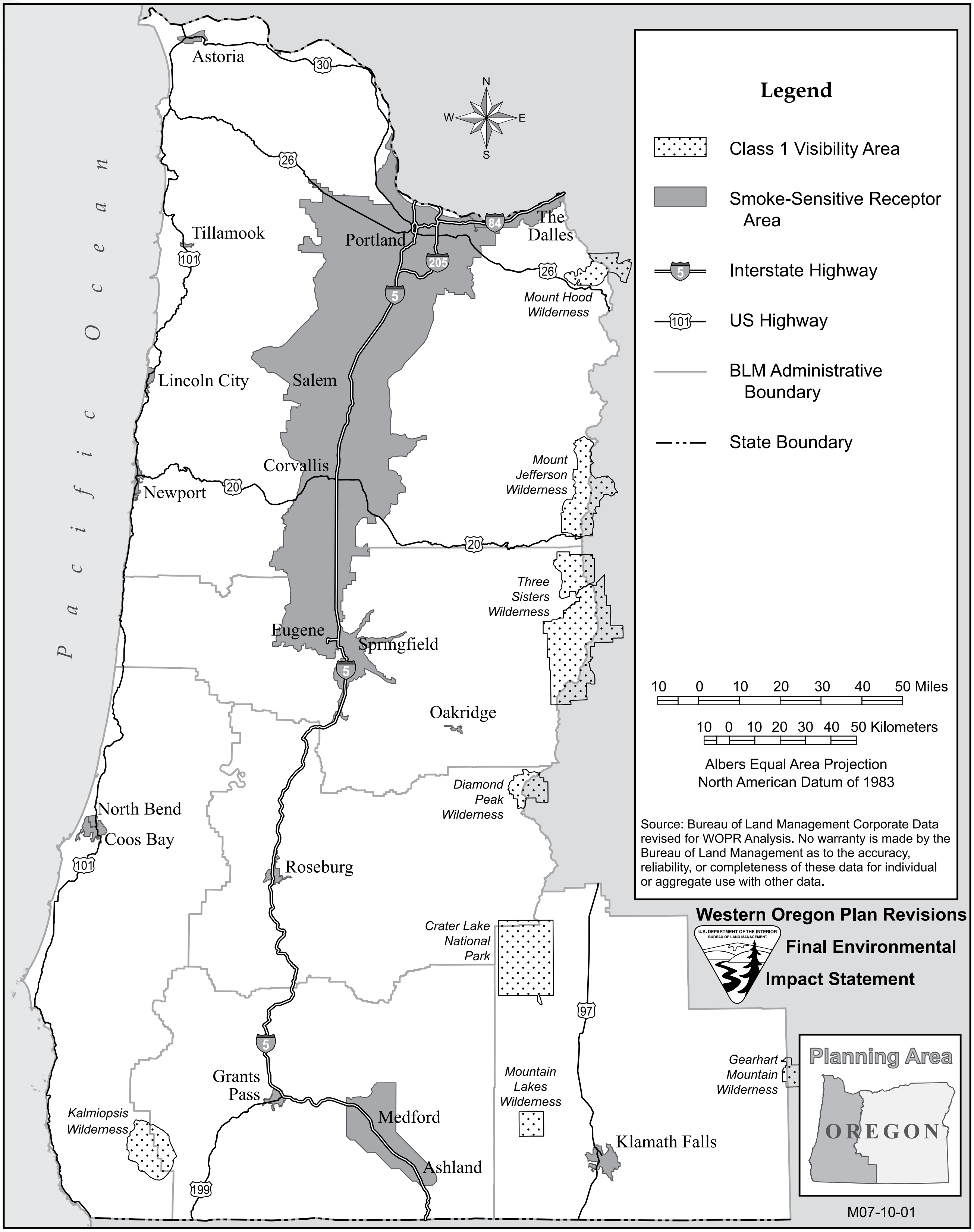
Both classes contribute to regional haze and reduced visibility. Data from air monitoring stations has shown that wildfire has not been a predominant long-term source of visibility impairment in any Class I area, although emissions from fire are an important short-term episodic contributor to visibility aerosols (Sandberg 2002).

Smoke from wildfires and smoke from hazardous fuels treatments are similar in composition; however, the amount of emissions from wildfire is roughly double that from fuels treatments (Huff 1995). In general, particulate matter from the smoke of wildfires and hazardous fuels treatments is the major pollutant of concern to health. Particulate is a general term for a mixture of solid particles and liquid droplets found in the air. Particulate from smoke tends to be very small (less than 1 micron in diameter) and, as a result, is more of a health concern than the coarser particles that typically make up road dust. Particulate matter from wood smoke has a size range near the wave length of visible light (0.4 to 0.7 micron). This makes the particles excellent at scattering light and, therefore, excellent at reducing visibility.

Figure 3-136. Particulate Emissions, 1996-2005



Map 3-10. Smoke Sensitive Receptor Areas And Class I Visibility Areas Within The Planning Area



Carbon monoxide (CO) is a colorless, odorless gas produced from incomplete combustion. It is produced in the largest amounts during the smoldering stages of a fire. Carbon monoxide is potentially one of the most dangerous components of smoke. Concentrations of carbon monoxide drop rapidly as the distance from the fire increases and are usually of concern only to firefighters.

Hazardous air pollutants (such as acrolein, benzene, and formaldehyde) are present in smoke, but in far less concentrations than particulates and carbon monoxide. Nitrogen oxides and volatile organic gasses combine to form ozone. Although not confirmed, there appears to be an indirect link between the large smoke plumes from wildfires and increased ozone levels. The data used to compile the totals of emissions in this document show that approximately 60% of total emissions are 2.5 microns or smaller in diameter.