Appendix H – Fire and Fuels

Issue 1 - Assumptions, Methods, etc.

Methods

Study Area

The Nature Conservancy assessed forest vegetation restoration needs across five million acres of forest across southwestern Oregon (**Figure H-1**). Within the study area, they focused on the 1.2 million acres of BLM land as the lands that changed by Alternative (**Figure H-2**). This geography generally includes the extent of historically frequent fire forests within SW Oregon. These forests cover very broad climatic, edaphic, and topographic gradients with varying natural disturbance regimes.

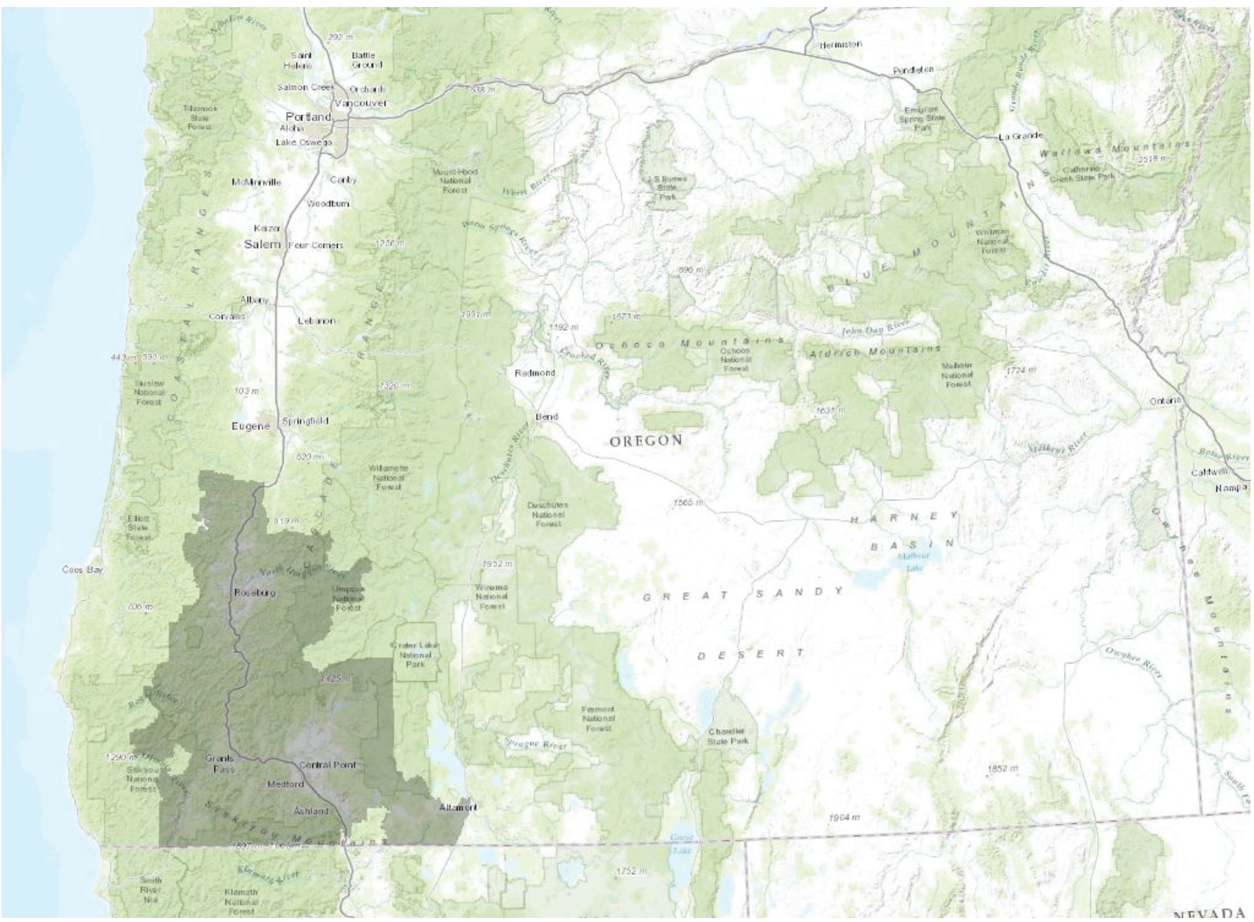

Figure H-1. Analysis area.

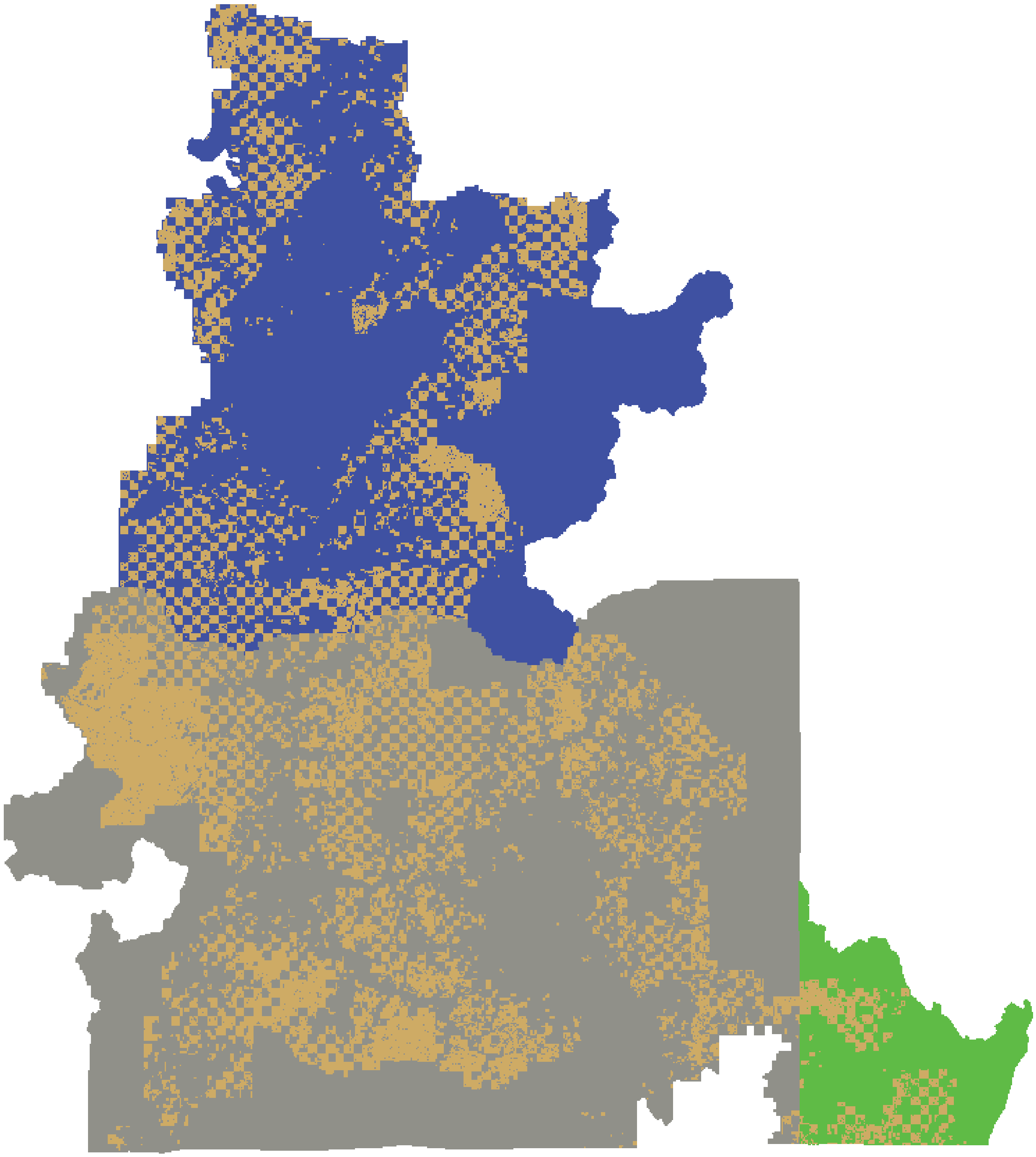

Figure H-2. BLM-administered land within the analysis area.

Core Concepts and Data Sources

The Nature Conservancy (TNC) built upon the conceptual framework of the LANDFIRE and Fire Regime Condition Class (FRCC) programs (Barrett *et al*. 2010, Rollins 2009) and incorporated Oregon and BLM specific datasets. TNC's assessment of forest vegetation departure is based on four primary data inputs: 1) a classification and map of forested biophysical settings, 2) NRV reference conditions for each biophysical setting, 3) a delineation of "landscape units" for each biophysical setting, and 4) a map of present day forest vegetation structure.

Mapping Forested Biophysical Settings

Biophysical settings are potential vegetation units associated with characteristic land capabilities and disturbance regimes (Barrett *et al*. 2010). Many different forested biophysical settings are found across Washington and Oregon based on vegetation, soils, climate, topography, and historic disturbance regimes (Keane *et al*. 2007, Pratt *et al*. 2006, Rollins 2009). They provide the framework for describing fire regimes. TNC mapped biophysical settings using the 30m pixel Integrated Landscape Assessment Projects' Potential Vegetation Type (PVT) dataset (Halofsky *et al*. In press), which compiled previous potential forest vegetation classification and mapping efforts including Simpson (2007) and Henderson *et.al*. (2011). TNC also incorporated subsequent refinements to PVT mapping in southwestern Oregon by Henderson (2013).

A biophysical setting model from either the LANDFIRE Rapid Assessment or the later LANDFIRE National program (Rollins 2009, Ryan and Opperman 2013) was assigned to each PVT mapping unit (**Table H-1**). Assignments were made by staff in the U.S. Forest Service Pacific Northwest Region Ecology Program based upon the geographic, environmental, and biological characteristics of the biophysical setting models and the PVT mapping units. TNC defined forests across our study area as those described as a "forest" or "forest and woodland" land cover class in the biophysical setting model. National Forest System lands are typically considered "forest" if they have >10% tree canopy cover, and this generally coincides with forest, and forest and woodland land cover classes (USDA FS 2004).

Table H-1. ILAP PVT to LANDFIRE BpS model crosswalk.

Integrated Landscape Assessment Project Potential Vegetation Type (ILAP PVT)	LANDFIRE Biophysical Settings (BpS)
Douglas-fir - White oak	0210290
Oregon white oak	0210290
Douglas-fir - Dry	0710270
Douglas-fir - Moist	R#DFHEwt
Douglas-fir - Moist	R#DFHEwt
Western hemlock - Coastal	R#DFHEwt
Western hemlock - Cold	R#DFHEwt
Western hemlock - Moist	R#DFHEwt
Western hemlock - Moist (Coastal)	R#DFHEwt
Western hemlock - Wet	R#DFHEwt
Douglas-fir - Dry	R#MCONdy
Douglas-fir - Dry	R#MCONdy
Douglas-fir - Dry	R#MCONdy
Douglas-fir - Xeric	R#MCONdy
Grand fir - Warm/Dry	R#MCONdy
Mixed Conifer - Dry	R#MCONdy
Mixed Conifer - Dry (Pumice soils)	R#MCONdy
Grand fir - Cool/moist	R#MCONms
Grand fir - Cool/moist	R#MCONms
Grand fir - Cool/moist	R#MCONms
Mixed Conifer - Moist	R#MCONms
Douglas-fir - Moist	R#MCONsw
White fir - Intermediate	R#MCONsw
White fir - Moist	R#MCONsw

Integrated Landscape Assessment Project Potential Vegetation Type (ILAP PVT)	LANDFIRE Biophysical Settings (BpS)
Tan oak - Douglas-fir - Dry	R#MEVG
Ultramafic	R#MEVG
Idaho fescue - Prairie junegrass	R#MGRA
Oregon white oak - Ponderosa pine	R#OAPI
Lodgepole pine - Dry	R#PICOpu
Lodgepole pine - Wet	R#PICOpu
Jeffery Pine	R#PIJEsp
Ponderosa pine - Dry	R#PIPOm
Ponderosa pine - Lodgepole pine	R#PIPOm
Ponderosa pine - Dry, with juniper	R#PIPOxe
Ponderosa pine - Xeric	R#PIPOxe
Shasta red fir - Dry	R#REFI
Shasta red fir - Moist	R#REFI
White fir - Cool	R#REFI
Mixed Conifer - Cold/dry	R#SPFI
Subalpine fir - Cold/Dry	R#SPFI
Sitka spruce	R#SSHE
Tan oak - Douglas-fir - Moist	R#TAOAco
Tan oak - Moist	R#TAOAco
Shasta red fir - Moist	R1RFWF
White fir - Cool	R1RFWF

Natural Range of Variability Reference Conditions

Each biophysical setting model is composed of a suite of 3-5 successional/structural stages (s-classes). These classes typically include: A) Early Development, B) Mid-Development Closed Canopy, C) Mid-Development Open Canopy, D) Late Development Open Canopy, and E) Late Development Closed Canopy. The definition of each s-class in terms of species composition, stand structure, and stand age is unique for each biophysical setting (**Table H-2** and **Table H-3**). The percentage of a biophysical setting in each s-class will differ depending on disturbance frequencies and/or intensities. The LANDFIRE and FRCC conceptual framework assumes that, given natural processes, a biophysical setting will have a characteristic range of variation in the proportion in each s-class and that an effective indicator of "ecological condition" for a given landscape is the relative abundance of each s-class within biophysical settings (Barrett *et al*. 2010, Keane *et al*. 2011).

Table H-2. BLM-administered lands.

	LANDFIRE BpS	Included in BLM Dry Extent	Early-Seral (A)				Mid-Seral Closed (B)				Mid-Seral Open (C)				Late-Seral Open (D)				Late-Seral Closed (E)			
			Size Class*		Canopy Closure		Size Class*		Canopy Closure		Size Class*		Canopy Closure		Size Class*		Canopy Closure		Size Class*		Canopy Closure	
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Standard LANDFIRE 5-Box Models	0210290	x	1	2	0	100	3	4	31	100	3	4	0	31	5	5	0	30	5	5	31	100
	0710270	x	1	2	0	100	3	4	41	100	3	4	0	40	5	5	0	40	5	5	41	100
	R#DFHEwt	x	1	2	0	100	3	4	61	100	3	4	0	60	5	5	0	60	5	5	61	100
	R#MCONdy	x	1	2	0	100	3	4	41	100	3	4	0	40	5	5	0	40	5	5	41	100
	R#MCONms	x	1	2	0	100	3	4	56	100	3	4	0	55	5	5	0	55	5	5	56	100
	R#MCONsw	x	1	2	0	100	3	4	41	100	3	4	0	40	5	5	0	40	5	5	41	100
	R#MEVG	x	1	2	0	100	3	4	41	100	3	4	0	40	5	5	0	40	5	5	41	100
	R#OAPI	x	1	2	0	100	3	4	31	100	3	4	0	30	5	5	0	30	5	5	31	100
	R#PICOpu	x	1	2	0	100	3	4	41	100	3	4	0	40	5	5	0	40	5	5	41	100
	R#PIPOm	x	1	2	0	100	3	4	31	100	3	4	0	30	5	5	0	30	5	5	31	100
	R#PIPOxe	x	1	2	0	100	3	4	26	100	3	4	0	25	5	5	0	25	5	5	26	100
	R#REFI	x	1	2	0	100	3	4	41	100	3	4	0	40	5	5	0	40	5	5	41	100
	R#TAOAco	x	1	2	0	100	3	4	61	100	3	4	0	60	5	5	0	60	5	5	61	100
	R1RFWF	x	1	2	0	100	3	4	41	100	3	4	0	41	5	5	0	41	5	5	41	100
	R#PIJEsp	x	1	2	0	100	3	4	41	100	3	4	0	40	5	5	0	40	5	5	41	100

LAND-FIRE BpS	Included in BLM Dry Extent	Early-Seral (A)				Mid-Seral Closed (B)				Mid-Seral Open (C)				Late-Seral Open (D)				Late-Seral Closed (E)			
		Size Class		Canopy Closure		Size Class		Canopy Closure		Size Class		Canopy Closure		Size Class		Canopy Closure		Size Class		Canopy Closure	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
F#SPFI	x*	1	2	0	10	1	2	11	100	3	4	41	100	3	4	0	40	5	5	0	100

* BLM size-class values are numeric representations of structure classes used to categorize early, stand establishment, young, mature and older complex structural stages (see Vegetation Modeling Appendix). Canopy cover from BLM vegetation-modeling outputs was used for open and closed thresholds.

The term canopy closure in this table is synonymous with canopy cover and is based on modeled cover and not field bases closure measurements.

Table H-3. Other non-BLM lands

	LANDFIRE BpS	Early-Seral (A)				Mid-Seral Closed (B)				Mid-Seral Open (C)				Late-Seral Open (D)				Late-Seral Closed (E)			
		Size Class		Canopy Closure		Size Class		Canopy Closure		Size Class		Canopy Closure		Size Class		Canopy Closure		Size Class		Canopy Closure	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Standard LANDFIRE 5-Box Models	0210290	1	2	0	100	3	5	31	100	3	5	0	31	6	7	0	30	6	7	31	100
	0710270	1	2	0	100	3	6	41	100	3	6	0	40	7	7	0	40	7	7	41	100
	R#DFHEwt	1	2	0	100	3	5	61	100	3	5	0	60	6	7	0	60	6	7	61	100
	R#MCONdy	1	2	0	100	3	5	41	100	3	5	0	40	6	7	0	40	6	7	41	100
	R#MCONms	1	2	0	100	3	5	56	100	3	5	0	55	6	7	0	55	6	7	56	100
	R#MCONsw	1	2	0	100	3	5	41	100	3	5	0	40	6	7	0	40	6	7	41	100
	R#MEVG	1	2	0	100	3	4	41	100	3	4	0	40	5	7	0	40	5	7	41	100
	R#OAPI	1	2	0	100	3	3	31	100	3	3	0	30	4	7	0	30	4	7	31	100
	R#PICOpu	1	2	0	100	3	5	41	100	3	5	0	40	6	7	0	40	6	7	41	100
	R#PIPOm	1	2	0	100	3	4	31	100	3	4	0	30	5	7	0	30	5	7	31	100
	R#PIPOxe	1	2	0	100	3	5	26	100	3	5	0	25	6	7	0	25	6	7	26	100
	R#REFI	1	2	0	100	3	5	41	100	3	5	0	40	6	7	0	40	6	7	41	100
	R#TAOAco	1	2	0	100	3	4	61	100	3	4	0	60	5	7	0	60	5	7	61	100
	R1RFWF	1	2	0	100	3	5	41	100	3	5	0	41	6	7	0	41	6	7	41	100
	R#PIJEsp	1	2	0	100	3	5	41	100	3	5	0	40	6	7	0	40	6	7	41	100
	LAND-FIRE BpS	Early-Seral (A)				Mid-Seral Closed (B)				Mid-Seral Open (C)				Late-Seral Open (D)				Late-Seral Closed (E)			
		Size Class		Canopy Closure		Size Class		Canopy Closure		Size Class		Canopy Closure		Size Class		Canopy Closure		Size Class		Canopy Closure	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
	R#SPFI	1	2	0	10	1	2	11	100	3	4	41	100	3	4	0	40	5	7	0	100

The term canopy closure in this table is synonymous with canopy cover and is based on modeled cover % and not field bases closure measurements.

NRV reference models describe how the relative distribution of s-classes for a biophysical setting were shaped by succession and disturbance prior to European settlement and provide a comparison to present-day forest conditions (Keane *et al*. 2009, Landres *et al*. 1999). LANDFIRE biophysical setting models are used to develop NRV estimates using state-and-transition models incorporating pre-European settlement rates of succession and disturbance. Rates were determined through an intensive literature and expert review process (Keane *et al*. 2002, Keane *et al*. 2007, Pratt *et al*. 2006, Rollins 2009).

The distribution of s-classes for each biophysical setting, which results from running state-and-transition models for many time-steps (**Table H-4**) does not represent a specific historical date, but instead approximates characteristic conditions that result from natural biological and physical processes operating on a landscape over a relatively long time. NRV is frequently represented by a single value, the mean relative abundance of each s-class from a collection of Monte Carlo state-and-transition model simulations (e.g., Low *et al*. 2010, Shlisky *et al*. 2005, Weisz *et al*. 2009). However, TNC developed and used ranges for each s-class resulting from the stochastic variation within the state-and-transition models. TNC ran 10 simulations for each biophysical setting state-and-transition model over 1,000 pixels and 1,000 annual time steps. Simulations were started with an equal portion in each s-class and it took 200 to 400 years for the initial trends to stabilize. TNC calculated the range for each s-class as ±2 standard deviations from the mean abundance from the last 500 time steps (Provencher *et al*. 2008). Simulations were modeled using the Vegetation Dynamics Development Tool (ESSA Technologies 2007).

Table H-4. Reference condition range by PVT/BpS.

LANDFIRE BpS	BpS Name	Early-Seral (A)				Mid-Seral (B)				Mid-Seral (C)				Late-Seral Open (D)				Late-Seral Closed (E)			
		LAND-FIRE RC	VDDT Mean	HRV Low	HRV High	LAND-FIRE RC	VDDT Mean	HRV Low	HRV High	LAND-FIRE RC	VDDT Mean	HRV Low	HRV High	LAND-FIRE RC	VDDT Mean	HRV Low	HRV High	LAND-FIRE RC	VDDT Mean	HRV Low	HRV High
0210290	Mediterranean California Mixed Oak Woodland	10	9.3	7	11	1	1.1	0	2	20	21.2	19	24	64	64.9	62	68	5	3.5	2	5
0710270	Mediterranean California Dry-Mesic Mixed Conifer Forest and Woodland	10	9.0	7	11	5	6.3	5	8	20	20.1	18	22	40	42.3	40	45	25	22.3	20	25
R#DFHEwt	Douglas-fir Hemlock-Wet Mesic	5	4.6	3	6	15	17.0	15	19	1	0.6	0	1	4	3.5	2	5	75	74.3	71	77
R#MCONdy	Mixed Conifer - Eastside Dry	15	14.0	12	16	1	0.7	0	1	30	31.6	29	34	40	41.5	38	45	14	12.3	10	14
R#MCONms	Mixed Conifer - Eastside Mesic	15	14.5	12	17	40	44.4	42	47	15	12.5	10	15	10	9.6	8	11	20	18.9	17	21
R#MCONsw	Mixed Conifer - Southwest Oregon	15	14.6	12	17	5	2.9	2	4	10	12.6	11	14	50	51.9	49	55	20	18.1	16	20
R#MEVG	California Mixed Evergreen North	15	16.6	14	19	10	7.5	6	9	50	51.6	48	55	20	20.5	18	23	5	3.8	3	5
R#OAPI	Oregon White Oak/Ponderosa Pine	25	25.1	22	28	5	3.8	3	5	20	19.2	17	22	47	48.7	45	52	3	3.2	2	4
R#PICOpu	Lodgepole Pine - Pumice Soils	20	21.6	19	24	15	13.9	12	16	50	47.7	45	51	10	10.9	9	13	5	5.9	4	7
R#PIJEsp	Pine Savannah - Ultramafic	15	15.0	13	17	0	1.0	0	3	45	44.0	41	47	40	39.0	36	42	0	1.0	0	2
R#PIPOm	Dry Ponderosa Pine - Mesic	10	10.8	9	13	10	6.9	5	8	35	37.2	34	40	40	42.4	39	45	5	2.8	2	4
R#PIPOxe	Ponderosa Pine - Xeric	25	23.6	21	26	5	5.8	4	7	25	22.4	20	25	40	43.2	41	46	5	4.9	4	6
R#REFI	Red Fir	10	6.9	5	8	20	22.5	20	25	15	13.2	11	15	20	21.9	19	24	35	35.5	33	39
R#TAOCco	Oregon Coastal Tanoak	10	9.7	8	12	10	12.5	10	15	50	47.4	44	51	25	26.2	23	29	5	4.2	3	5
R1RFWF	Red Fir / White Fir	15	16.9	15	19	25	25.2	23	28	10	8.8	7	11	20	16.6	14	19	30	32.5	30	35
R#SPFI	Spruce-Fir	3	3.0	2	4	22	22.3	19	25	30	24.6	22	27	20	20.6	18	23	25	29.4	27	32

Landscape Units

Following the LANDFIRE and FRCC conceptual framework, TNC defined discrete landscape units to compare present-day forests to modeled NRV reference conditions (Barrett *et al*. 2010, Pratt *et al*. 2006). Landscape units were chosen that would adequately represent the scale of disturbance of a particular PVT and were composed of forested lands within a BLM management district. This would allow summarization in an accurate and usable way for managers (**Figure H-3**).

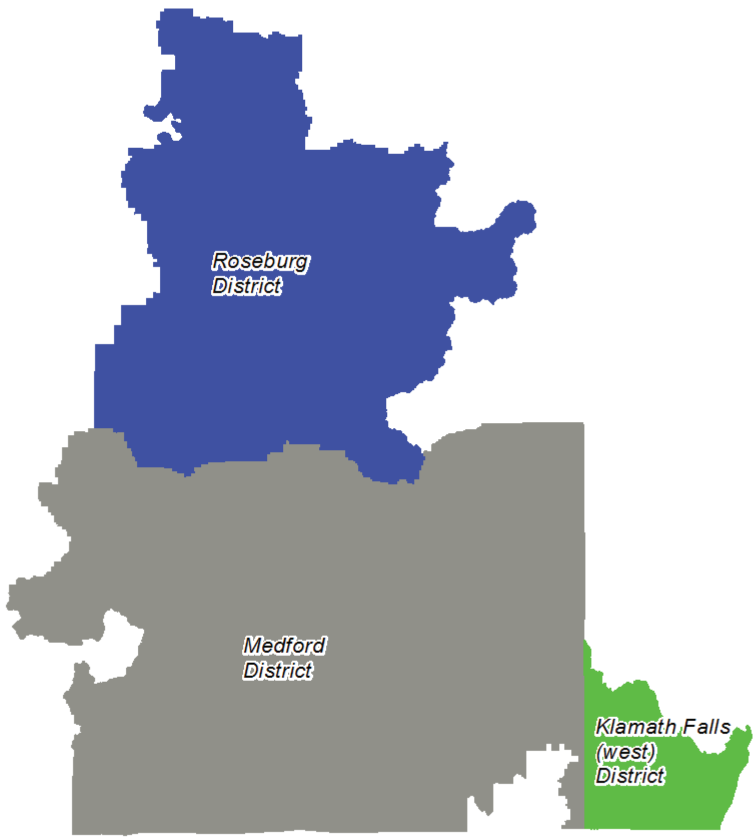

Figure H-3. Landscape units.

Present-Day Forest Structure and Composition

TNC characterized present-day forest vegetation with the gradient nearest neighbor imputation (GNN, Ohmann and Gregory 2002, Figure 3) datasets produced by the US Forest Service Pacific Northwest Research Station and Oregon State University Landscape Ecology, Modeling, Mapping, and Analysis research group (www.fsl.orst.edu/lemma) and outputs from the BLM vegetation modeling process (see the Vegetation Modeling Appendix).

All lands that are outside of BLM ownership used the GNN data for current conditions; the BLM land used the RMP data.

To compare present-day forest vegetation to the NRV reference conditions, TNC mapped the current distribution of s-classes for each biophysical setting using BLM Alternative data for the BLM lands and GNN data for all other ownerships. S-class mapping was based upon tree canopy cover and tree size thresholds provided for each s-class in the biophysical setting model descriptions (**Appendix A.2**).

Departure Analysis

Departure in ths project is defined as is the difference between a modeled reference condition and the current conditions in acres (**Figure H-4**). In an effort to frame ecological departure appropriately, TNC chose to look at the whole landscape and summarize departure for each analysis area (district) by alternative. This meant that the BLM s-class by alternative (**Figure H-5**) was mosaiced with the base GNN data (**Figure H-6**) to create a landscape s-class layer that combined both the BLM data and the GNN data (**Figure H-7**).

This process of combining BLM data and GNN data was completed for each Alternative and departure was calculated for each of these mosaiced dataset. Seven different landscape s-class layers were developed: Current Condition, Alternative A, Alternative B, Alternative C, Alternative D, No Action alternative, and No Timber Harvest alternative.

Departure was calcuated for each combination of PVT and landscape unit (strata) and summarized as an acre value. Departue can be summarized in a deficit or excess acres of s-class or in a combined overall departure acres; both were summarized in this analysis.

All the results were summerized by alternative and analysis unit in Excel as well as summarys of s-class by alternative to help frame the conversation and discussion in the RMP.

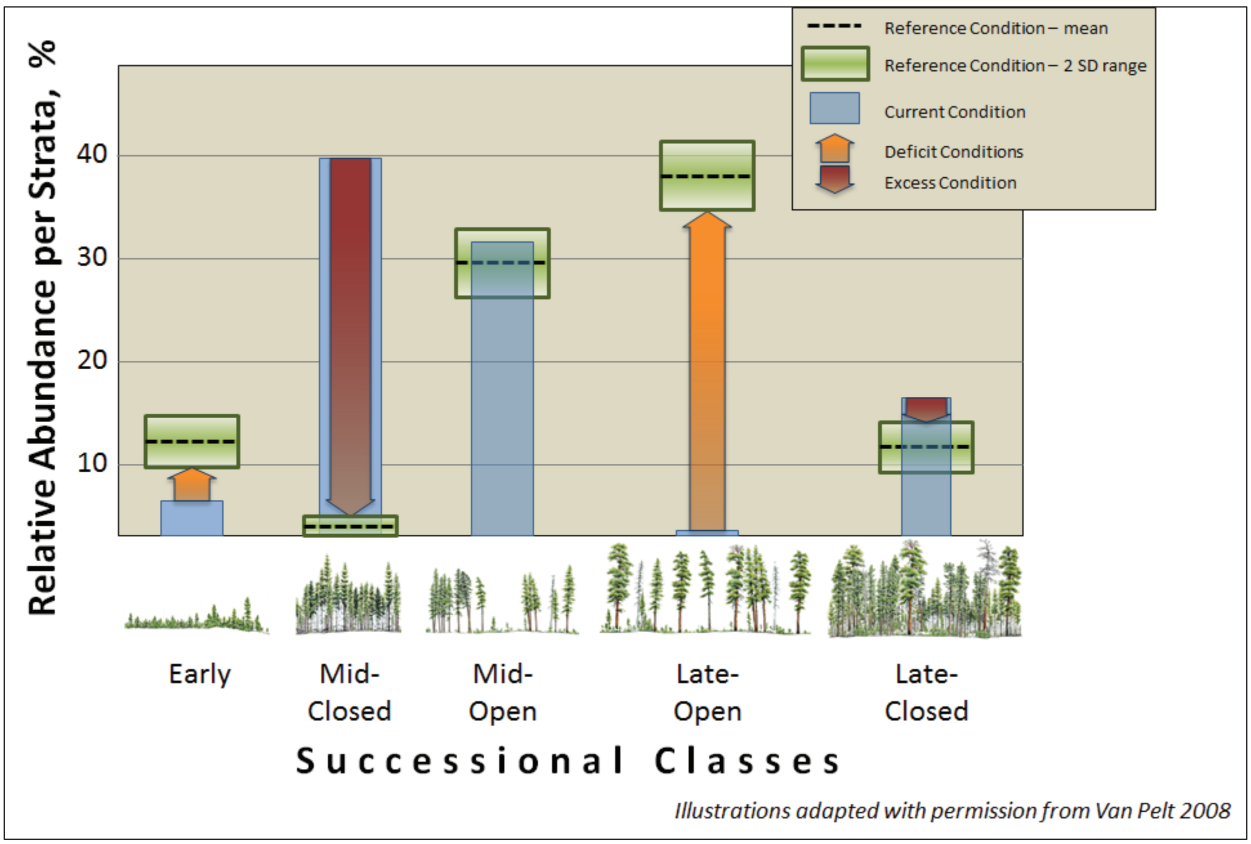

Figure H-4. Example strata departure summary calculation.

Figure H-5. BLM s-class.

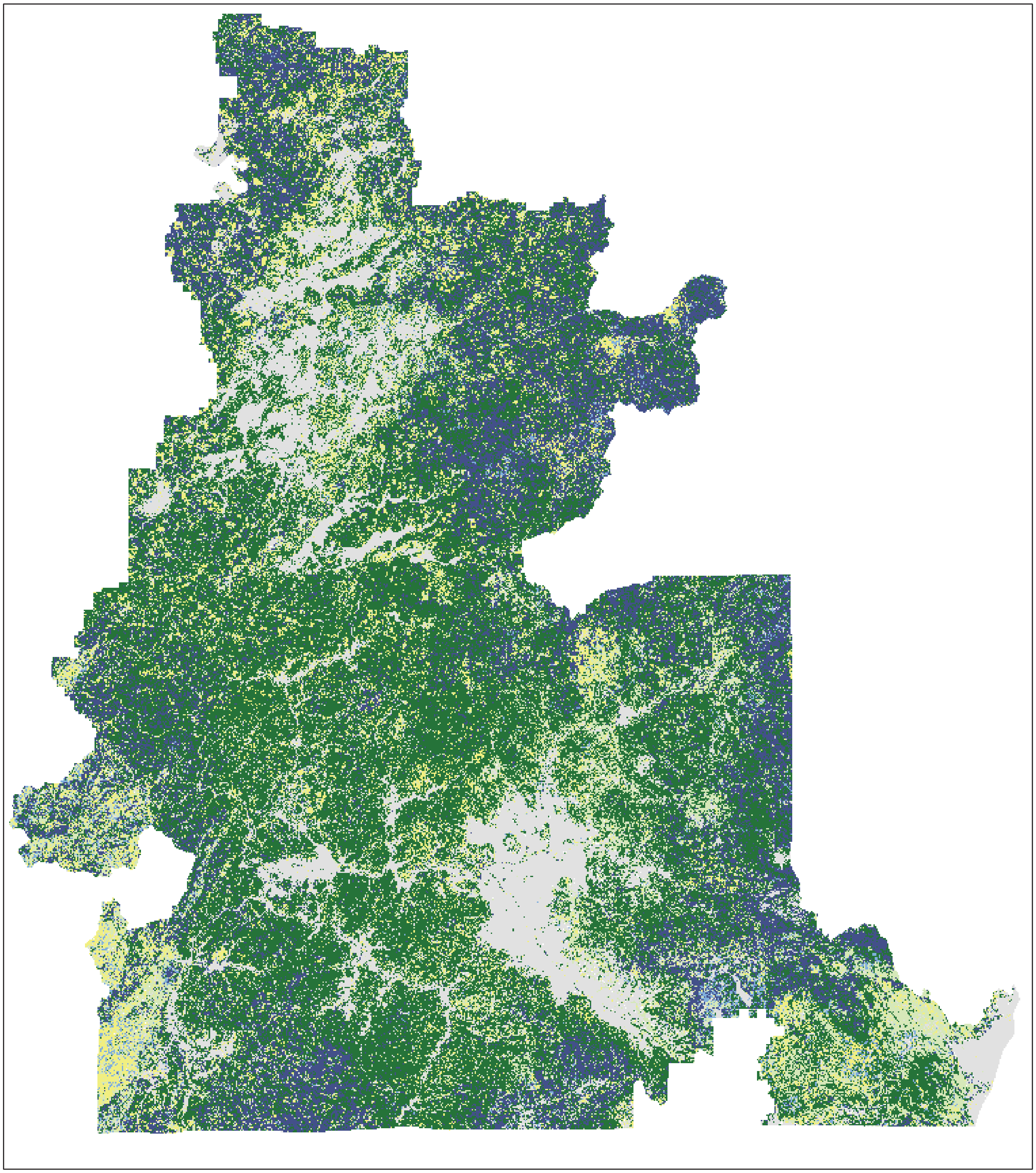

Figure H-6. GNN s-class data.

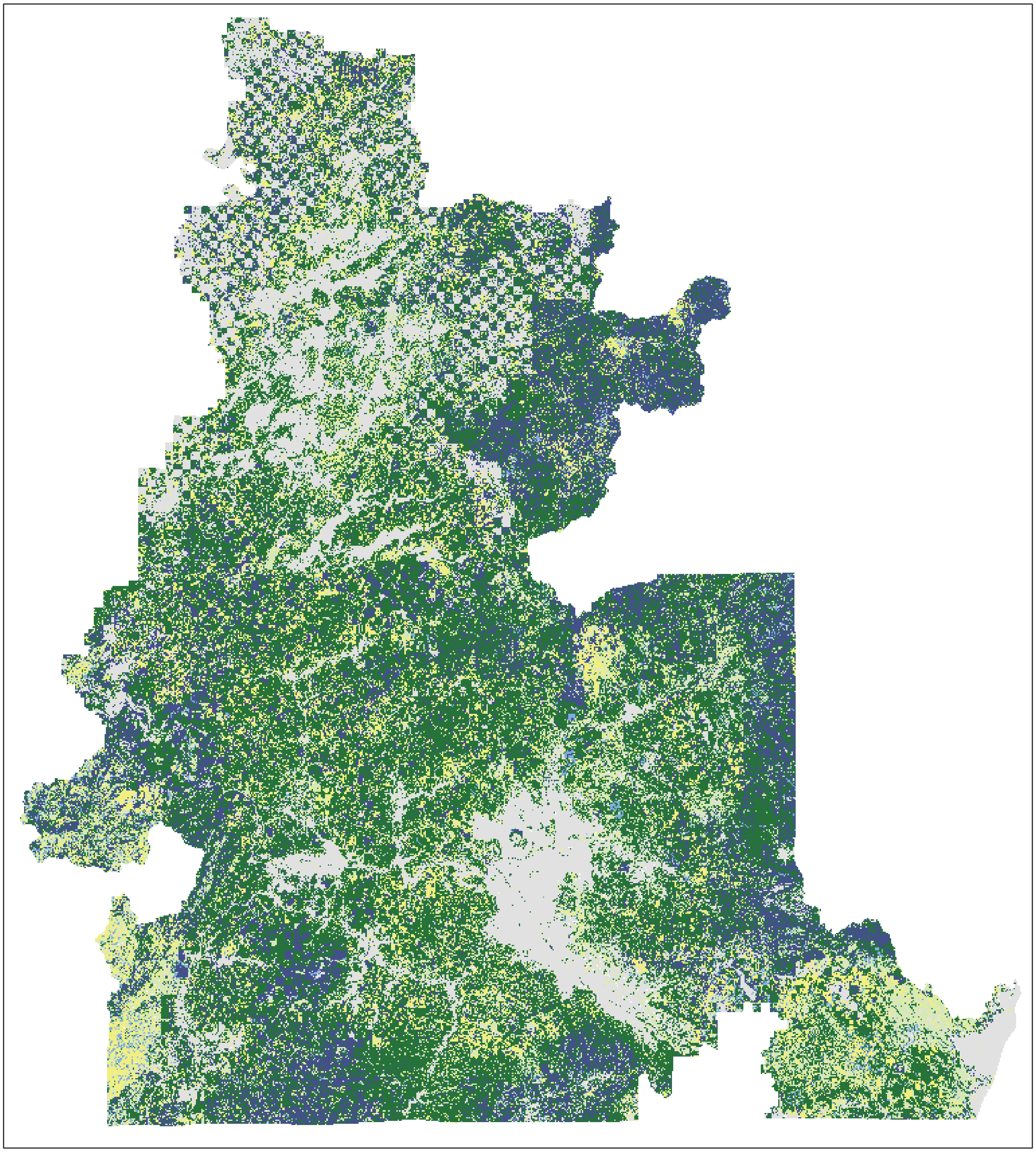

Figure H-7. BLM and GNN s-class data combined.

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Issue 2 and 3 - Assumptions and District-Specific Results

Issue 2

How would the alternatives affect fire resistance in the fire-adapted dry forests at the stand level?

Issue 3

How would the alternatives affect wildfire hazard at the stand – level within close proximity to developed areas?

Common Analytical Assumptions

- The results of this analysis does not include effects from non-commercial hazardous fuels work, which would contribute toward increasing fire resistance and reducing fire hazard similarly among all alternatives. A large portion of non-commercial hazardous fuels work takes place on non-forested lands, which are not included in this analysis.

- Vegetation community structure is an important factor affecting potential fire behavior, post-fire effects, fire resistance, and fire hazard.
- General assumptions regarding vegetation structural stage classification and the probable fire behavior based on vertical and horizontal fuel profile were used to generate relative stand-level resistance to replacement fire and fire hazard ratings.

Table H-5. Acres of forested and non-forested BLM-administered lands within the planning area by district/field office.

District/Field Office	Forest (Acres)	Non-Forest (Acres)	Totals (Acres)
Coos Bay	304,031	20,206	324,237
Eugene	297,223	13,841	311,065
Klamath Falls	46,773	167,312	214,085
Medford	749,112	66,556	806,678
Roseburg	399,165	24,477	423,642
Salem	374,394	24,765	399,159

Assumptions of General Stand Structure-Stage and Fire Interactions

Early-Successional

The BLM assumes that although early-successional communities have less than 30 percent canopy cover, resulting in somewhat discontinuous surface fuel loading, this structural stage is typically comprised of highly flammable vegetation (Agee 1993). When combined with open conditions that can increase surface wind speeds and flames lengths (Pollet and Omi 2002, Rothermel 1983), in general, this structural stage presents relatively moderate resistance to replacement fire and moderate fire hazard.

Stand–establishment and High-Density Young Stands

The stand establishment and high-density young stand structural stages maintain low canopy base heights and a combination of highly flammable early-successional vegetation, along with increased cover. In general, these structural stages present relatively low resistance to replacement fire and high fire hazard (Odion *et al*. 2004, Weatherspoon and Skinner 1995).

Low-Density Young Stands

Although, the canopy base height may be low in young stands of lower density, in general, there is greater separation between crowns (vertically and horizontally). This discontinuity in the fuel profile results in relatively lower canopy bulk densities, moderate fire hazard, and moderate resistance to replacement fire within both the younger and structural legacy components of the stand.

Structural Legacies

The stand establishment and high-density young stand structural stages maintain low canopy base heights and a combination of highly flammable early-successional vegetation, along with increased cover. In general, these structural stages present relatively low resistance to replacement fire and high fire hazard (Odion *et al*. 2004, Weatherspoon and Skinner 1995). However, both early-successional and stand establishment phases with structural legacies would have some separation of crown layers between legacy trees and understory vegetation, resulting in somewhat discontinuous ladder fuels and increased fire resistance in structural legacies. Pockets of heavy surface and ladder fuels may result in potential mortality to structural legacies from cambial damage (trees < 20" DBH have a 35-70% mortality, USDI BLM 2008 WOPR) or passive torching. This potential for cambial damage to overstory legacy structures increases along with understory vegetative cover and height (Peterson *et al*. 2005). Despite some potential separation in crown layers, in general, young high density stands have high continuous surface and ladder fuel loading, low canopy fuel base heights, and taller vegetation, relative to early successional and stand establishment vegetation. This fuel profile in the young high density stands increases crown fire potential of the young stand component and structural legacies (Odion *et al*. 2004), resulting in lower relative resistance to replacement fire and higher fire hazard.

Overstory canopy cover from structural legacies could also partially shelter the stand, reducing surface winds and slowing the drying of fuels (NWCG 2014 Fire Behavior Field Reference Guide), and thus help moderate fire behavior. Alternatively, open stand conditions have the potential to increase surface winds and thus flame lengths (Pollet and Omi 2002, Rothermel 1983). Increased winds in combination with low canopy base heights can increase torching potential and fire hazard, therefore no distinction is made between early-successional, stand establishment, and young stands with structural legacies in regards to fire hazard.

Mature Single-layered Canopy

In general, mature single layer stands have low surface fuel loading (due to closed canopy shading inhibiting understory growth), higher canopy base heights, and thus a lower probability of torching and crown fire initiation within stand, creating a low stand-level fire hazard condition (Jain *et al*. 2012). Although, continuous canopy cover of high canopy bulk density is susceptible to crown fire spread from adjacent stands (Scott and Reinhardt 2001, Jain and Graham 2007, Jain *et al*. 2012).

Mature Multi-layered Canopy and Structurally-complex

Multi-layered and structurally mature and older forests have the potential to exhibit the full range of fire behavior (surface to crown fire). In general, these structural stages have heterogeneous composition, which can alter fire spread (Jain *et al*. 2012, Finney 2001) and a greater number of large diameter (> 20 in. DBH) trees with thick bark, improving stand-level fire resistance, and reducing stand-level fire hazard (Agee and Skinner 2005) and potentially increasing the likelihood of burning at low to moderate severity (Alexander *et al*. 2006). Multi-aged closed forest conditions can potentially create a vertical fuel ladder for surface fire to reach the canopy (North *et al*. 2009) and support accumulations of continuous heavy surface and ladder fuels, and increase the potential for torching and crown fire, significantly reducing resistance to control. Alternatively, these structural types can create influential microclimates and shelter surface winds, harboring conditions that are more likely to result in lowered fire severity (Odion *et al*. 2004), particularly in topographic locations with low fire probability.

Ultimately, fire behavior in these structural stages will result from several factors, including weather, fuel moisture, and topographic influences, along with the vertical and horizontal continuity of the fuel profile.

Table H-6. BLM defined structural stages and subdivisions, relative stand-level resistance to replacement fire ratings and assumptions regarding overall fuel profile continuity, and vertical and horizontal fuel continuity.

Structural Stages	Subdivisions	Resistance to Replacement Fire	Assumptions Behind Resistance Ratings		
			Entire Fuel Profile continuity	Horizontal Fuel Profile Continuity	Vertical Fuel Profile Continuity
Early Successional	with Structural Legacies	Moderate	Semi-discontinuous	Semi-discontinuous	Semi-discontinuous
	without Structural Legacies	Moderate	Semi-discontinuous	Continuous	Semi-discontinuous
Stand Establishment	with Structural Legacies	Moderate	Semi-discontinuous	Semi-discontinuous	Continuous
	without Structural Legacies	Low	Continuous	Continuous	Continuous
Young Stands – High Density	with Structural Legacies	Low	Continuous	Continuous	Continuous
	without Structural Legacies	Low	Continuous	Continuous	Continuous
Young Stands – Low Density	with Structural Legacies	Moderate	Semi-discontinuous	Continuous	Semi-discontinuous
	without Structural Legacies	Moderate	Semi-discontinuous	Continuous	Semi-discontinuous
Mature	Single-Layered Canopy	High	Discontinuous	Discontinuous	Continuous
	Multi-layered Canopy	Mixed	Mixed continuity	Mixed continuity	Mixed continuity
Structurally Complex	Developed Structurally Complex	Mixed	Mixed continuity	Mixed continuity	Mixed continuity
	Existing Old Forest	Mixed	Mixed continuity	Mixed continuity	Mixed continuity
	Existing Very Old Forest	Mixed	Mixed continuity	Mixed continuity	Mixed continuity

Table H-7. BLM defined structural stages and subdivisions, relative stand-level fire hazard ratings and assumptions regarding surface fuel loading, canopy base height, and canopy fuel bulk density (continuity) as the basis for the hazard rating.

<table>
<tr><th rowspan="2">Structural Stages</th><th rowspan="2">Subdivisions</th><th rowspan="2">Fire Hazard Rating</th><th colspan="3">Assumptions Behind Hazard Ratings</th></tr>
<tr><th>Surface Fuel Loading</th><th>Canopy Base Height</th><th>Canopy Fuel Bulk Density (Continuity)</th></tr>
<tr><td rowspan="2">Early Successional</td><td>with Structural legacies</td><td>Moderate</td><td rowspan="8">Low</td><td rowspan="8">Low</td><td rowspan="2">Moderate</td></tr>
<tr><td>without Structural Legacies</td><td>Moderate</td></tr>
<tr><td rowspan="2">Stand Establishment</td><td>with Structural Legacies</td><td>High</td><td rowspan="4">High</td></tr>
<tr><td>without Structural Legacies</td><td>High</td></tr>
<tr><td rowspan="2">Young Stands – High Density</td><td>with Structural Legacies</td><td>High</td></tr>
<tr><td>without Structural Legacies</td><td>High</td></tr>
<tr><td rowspan="2">Young Stands – Low Density</td><td>with Structural Legacies</td><td>Moderate</td><td rowspan="3">Moderate</td></tr>
<tr><td>without Structural Legacies</td><td>Moderate</td></tr>
<tr><td rowspan="2">Mature</td><td>Single-Layered Canopy</td><td>Low</td><td>Moderate</td><td>High</td></tr>
<tr><td>Multi-Layered Canopy</td><td>Mixed</td><td colspan="3" rowspan="4">Mixed</td></tr>
<tr><td rowspan="3">Structurally Complex</td><td>Developed Structurally Complex</td><td>Mixed</td></tr>
<tr><td>Existing Old Forest</td><td>Mixed</td></tr>
<tr><td>Existing Very Old Forest</td><td>Mixed</td></tr>
</table>

Issue 2 - Stand-Level Fire Resistance in the Harvest Land Base by District

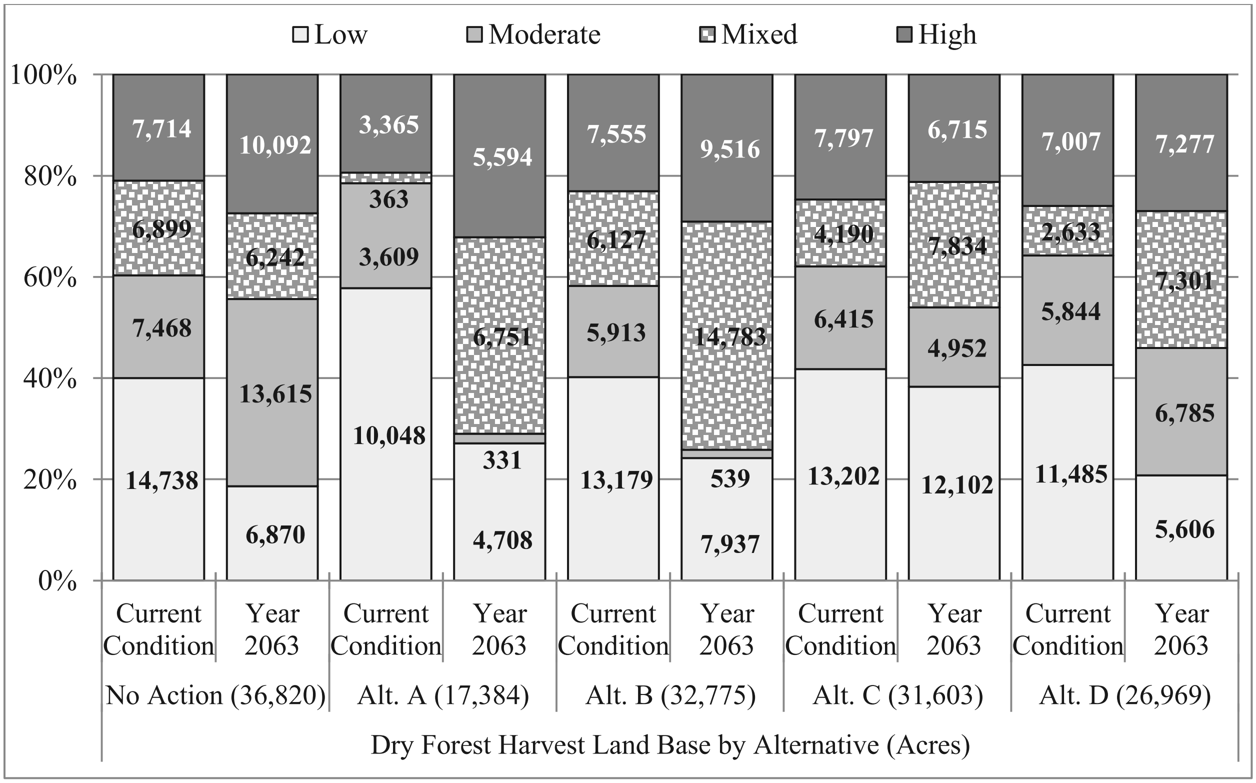

Figure H-8. Stand-level fire resistance categories in the Harvest Land Base in the dry forest in the Klamath Falls Field Office for the current condition and each alternative in 50 years.

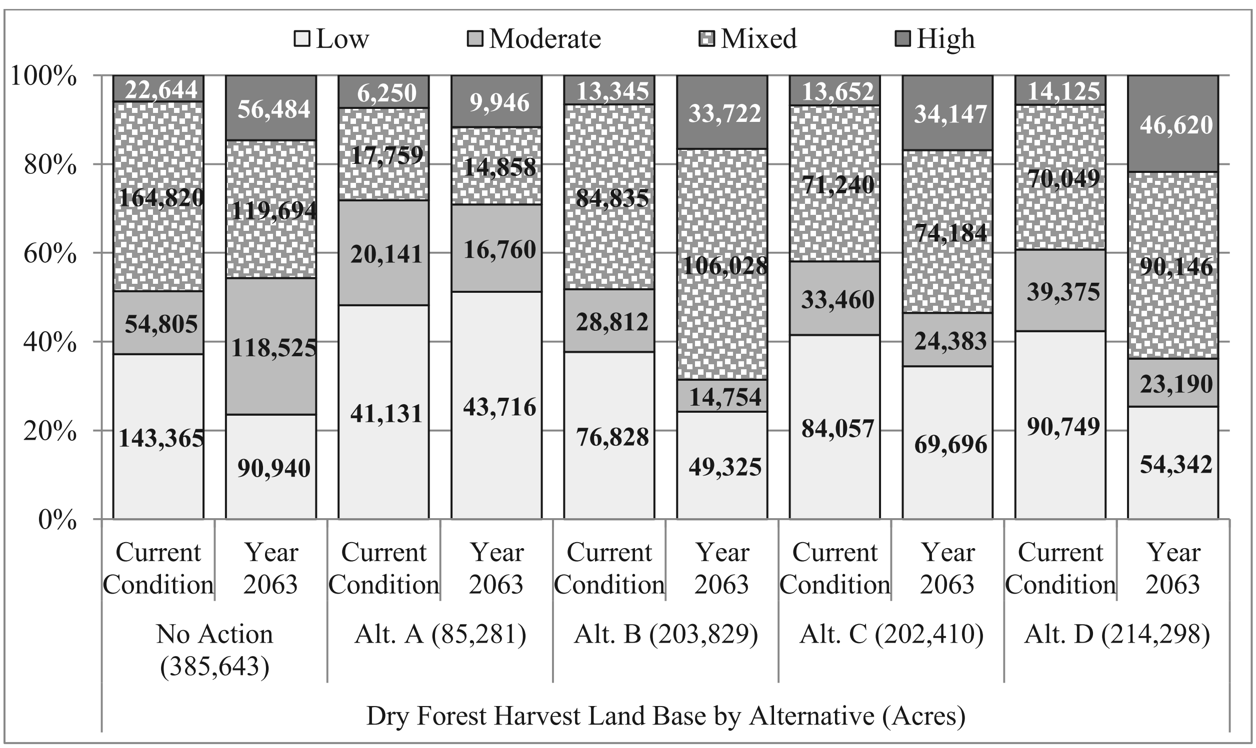

Figure H-9. Stand-level fire resistance categories in the Harvest Land Base in the dry forest on the Medford District for the current condition and each alternative in 50 years.

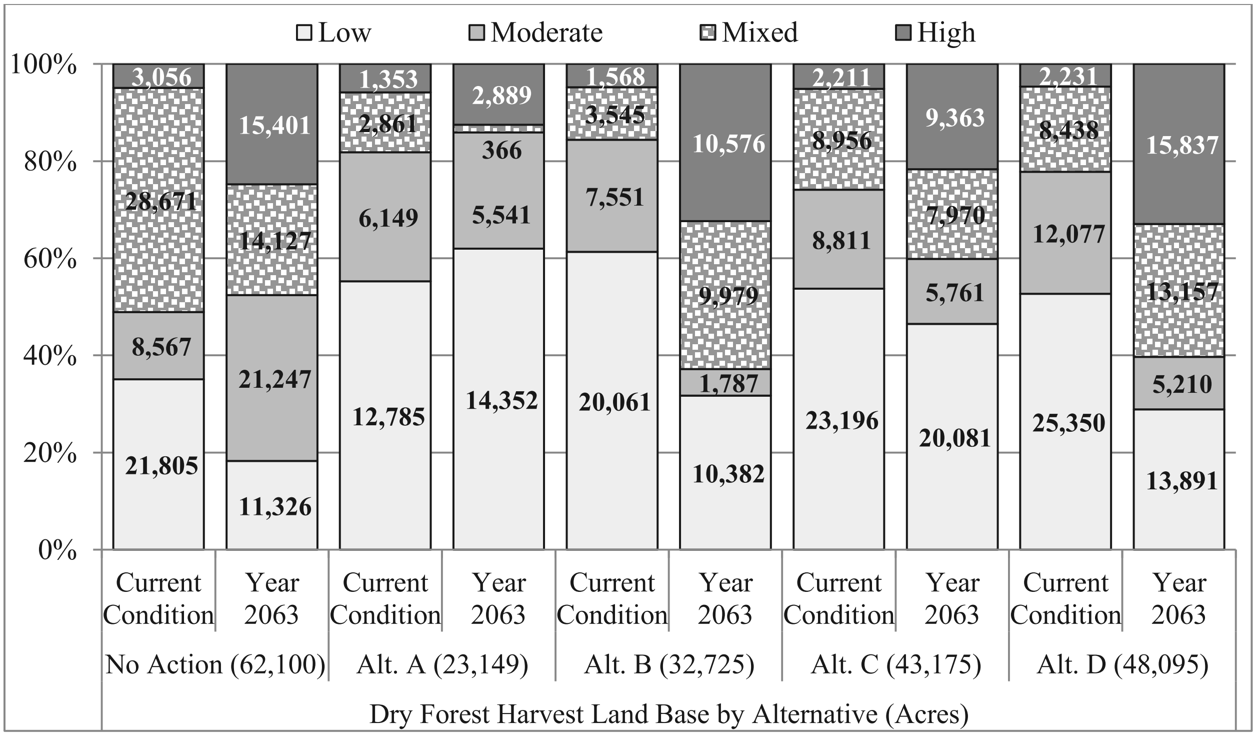

Figure H-10. Stand-level fire resistance categories in the Harvest Land Base in the dry forest on the Roseburg District for the current condition and each alternative in 50 years.

Issue 3 - Stand-Level Fire Hazard Within Wildland Developed Areas by District

Stand-level fire hazard within close proximity to developed areas – All BLM lands by District

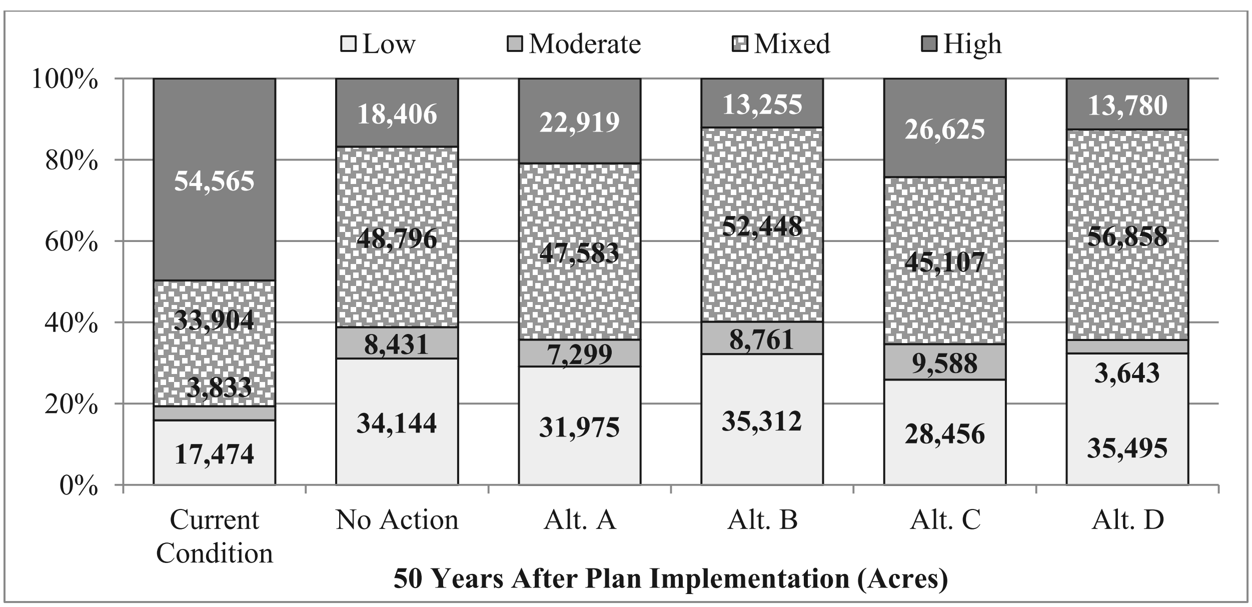

Figure H-11. Stand-level fire hazard for all BLM-administered lands on the Coos Bay District within the WDA, current condition and by alternative in 2063.

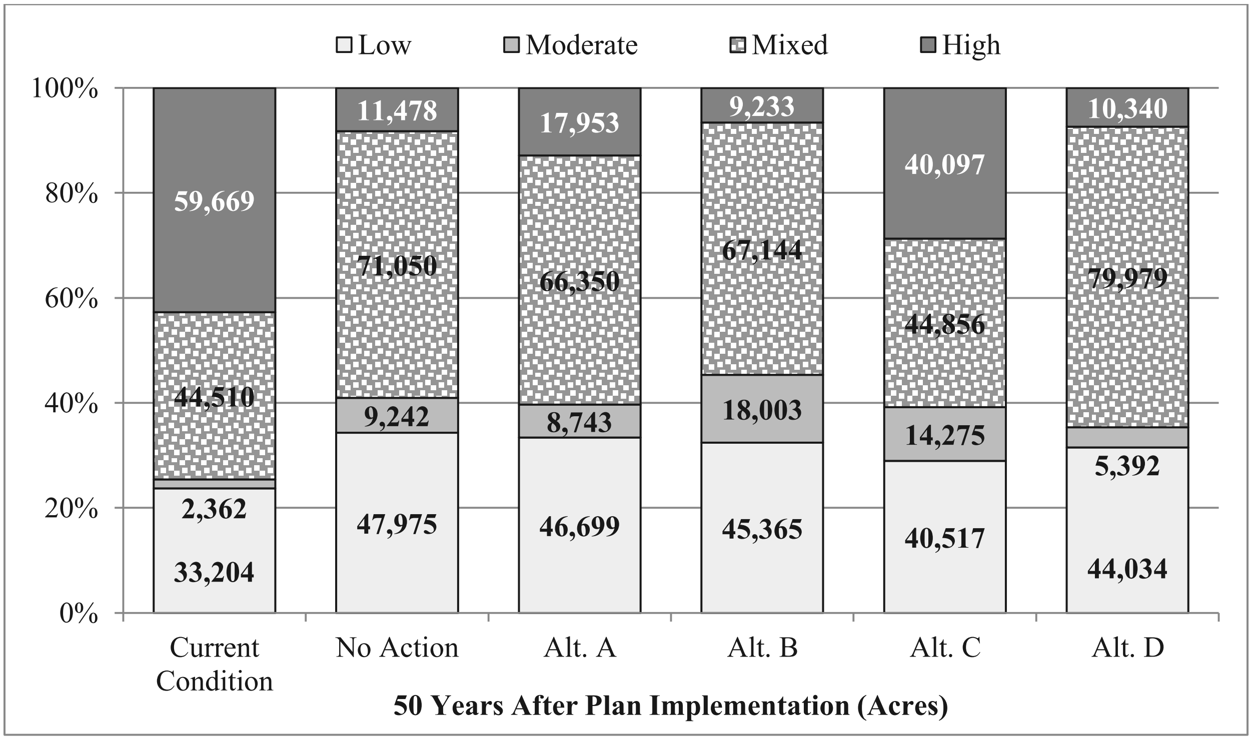

Figure H-12. Stand-level fire hazard for all BLM-administered lands on the Eugene District within the WDA, current condition and by alternative in 2063.

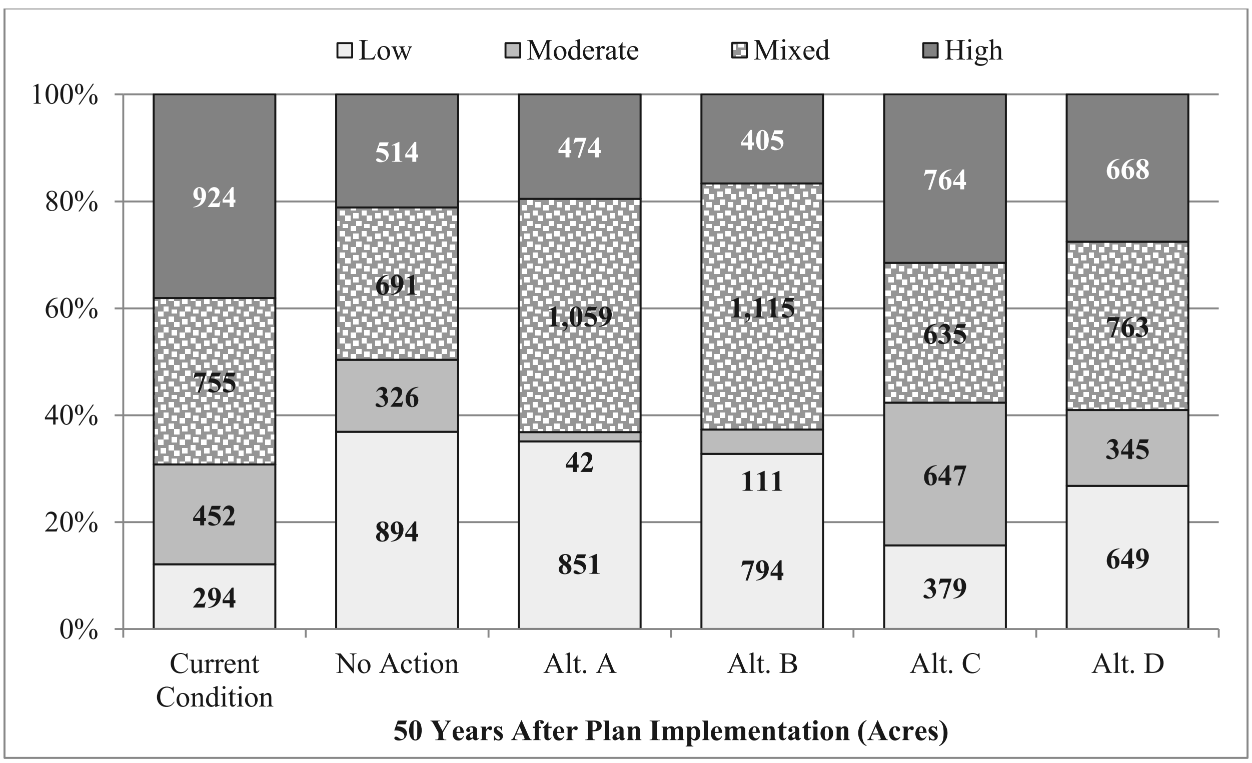

Figure H-13. Stand-level fire hazard for all BLM-administered lands on the Klamath Falls Field Office within the WDA, current condition and by alternative in 2063.

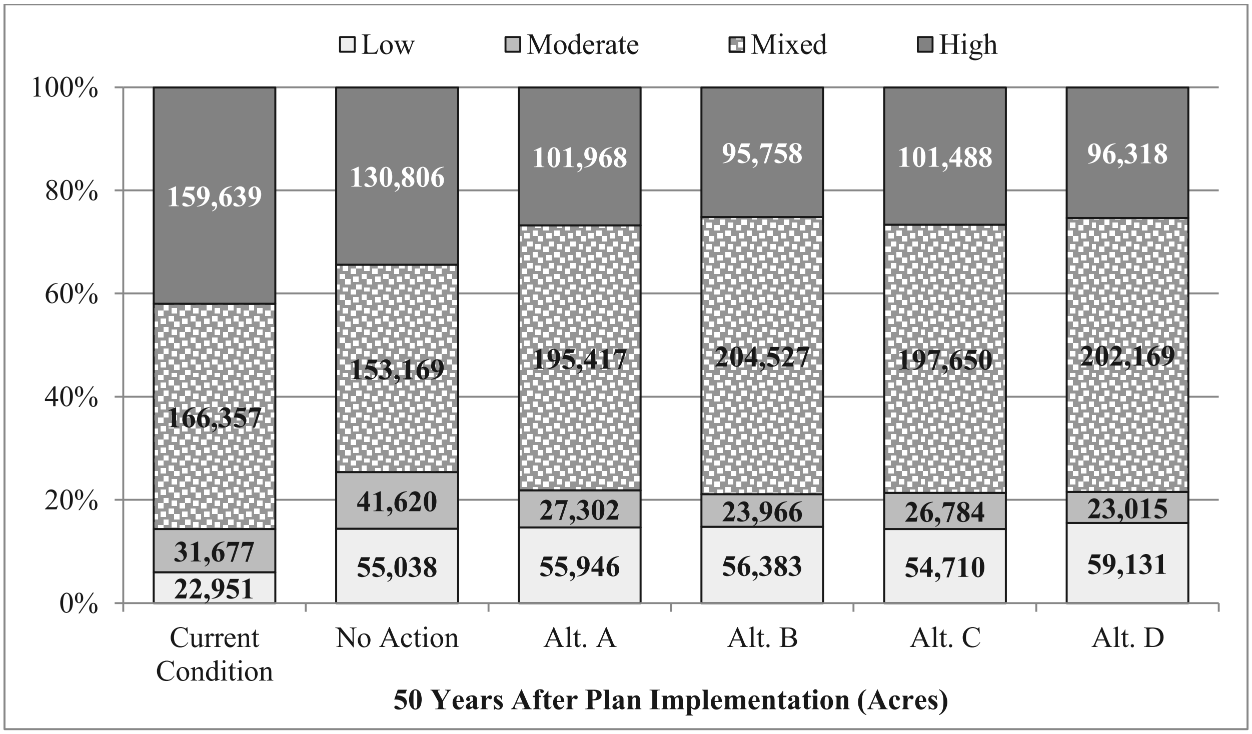

Figure H-14. Stand-level fire hazard for all BLM-administered lands on the Medford District within the WDA, current condition and by alternative in 2063.

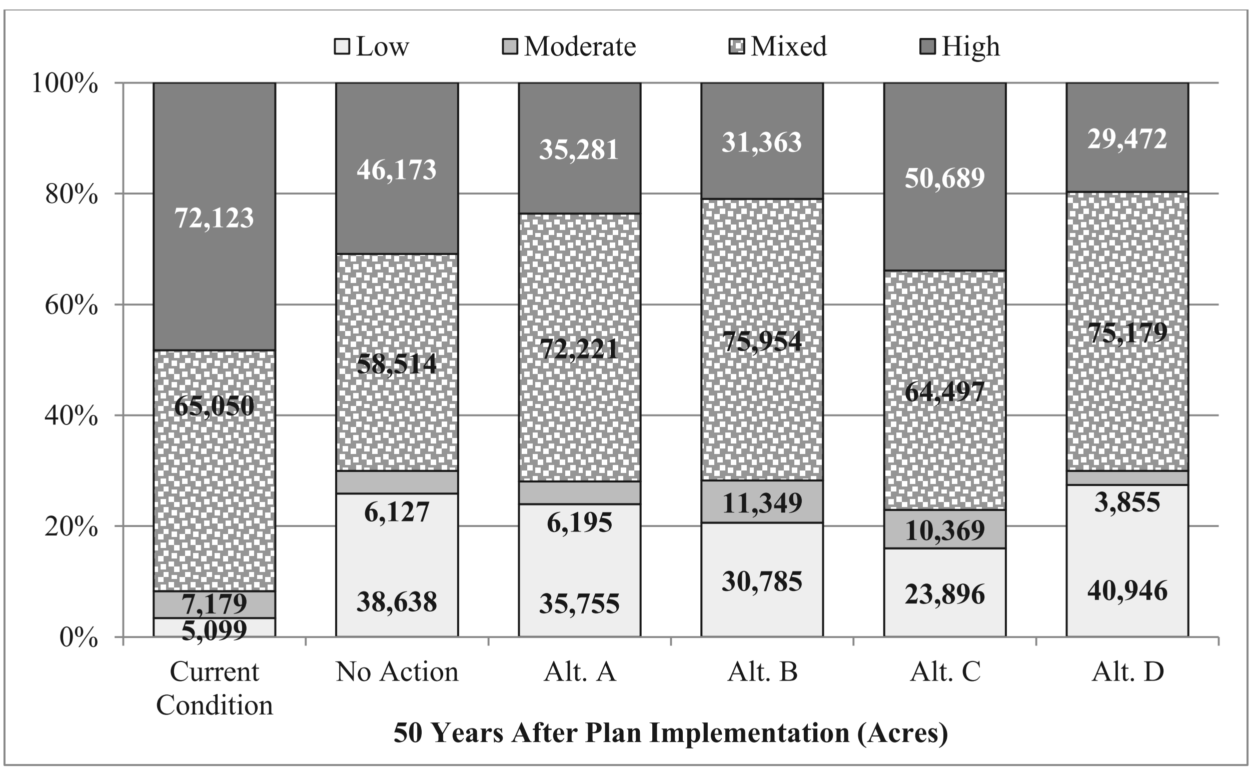

Figure H-15. Stand-level fire hazard for all BLM-administered lands on the Roseburg District within the WDA, current condition and by alternative in 2063.

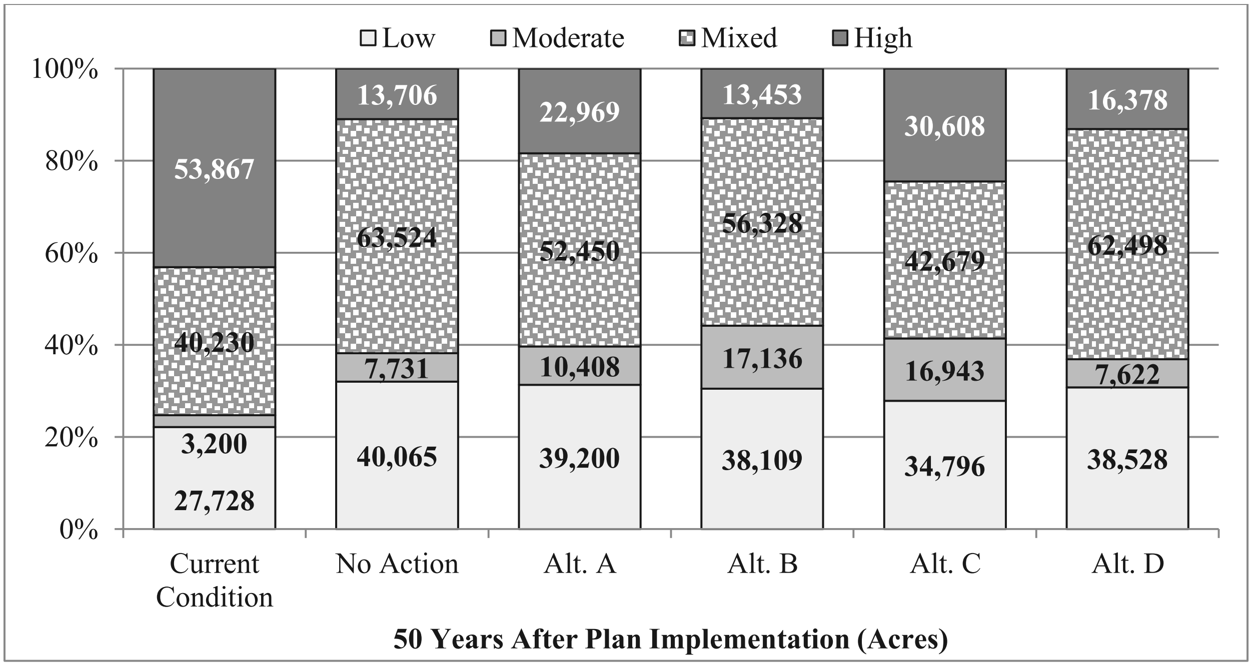

Figure H-16. Stand-level fire hazard for all BLM-administered lands on the Salem District within the WDA, current condition and by alternative in 2063.

Issue 3 - Stand-Level Fire Hazard for Late-Successional Reserves Within Wildland Developed Areas by Planning Area Region

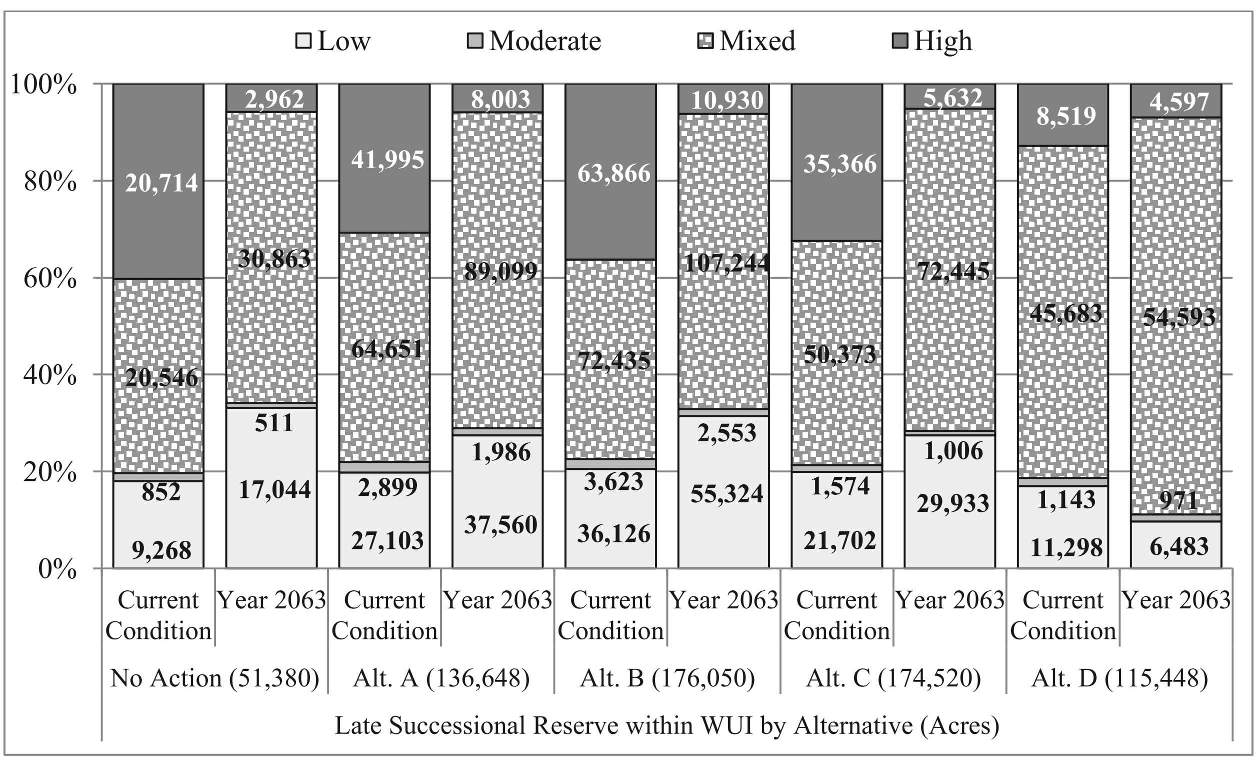

Figure H-17. Stand-level fire hazard in the Late-Successional Reserves in the dry forest in the coastal/north for the current condition and each alternative in 50 years.

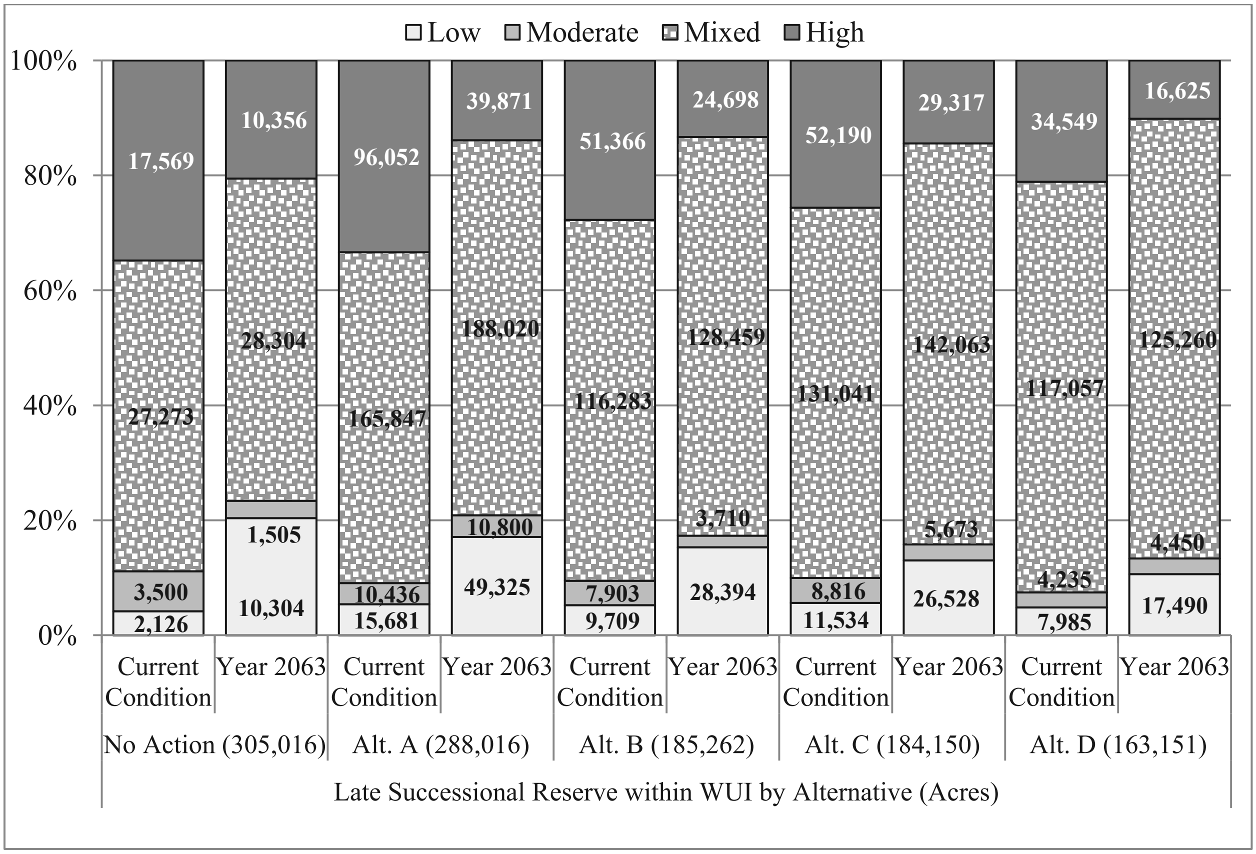

Figure H-18. Stand-level fire hazard in the Late-Successional Reserves in the dry forest in the interior/south for the current condition and each alternative in 50 years.

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