Jocko Lakes Salvage

Fire and Fuels Report

Prepared by:
Ellen C. Bogardus-Szymaniak
Fuels Specialist
TEAMS Enterprise Unit

for:
Seeley Ranger District
Lolo National Forest

September 9, 2008

Table of Contents

List of Tables

Introduction

During August of 2007, the Jocko Lakes wildfire burned 11,881 acres of National Forest System Lands (NFS) on the Seeley Lake Ranger District (RD) of the Lolo National Forest. The Seeley Lake RD is proposing salvage harvest on approximately 15 percent of NFS land burned by the wildfire (1,648 acres). Other NFS lands within the fire perimeter (approximately 36,000 acres) would remain in their current post-fire condition. The Jocko Lakes Fire Salvage (JLFS) project area is located in northwestern Montana approximately three miles west of the community of Seeley Lake.

This report analyzes impacts to the fire and fuels resource from federal activities proposed in the JLFS Environmental Assessment (EA) and discloses the potential effects of the alternatives on the fire and fuels resource for consideration in determining whether or not to prepare an Environmental Impact Statement.

The report begins by outlining the regulatory direction, which guides the development of management activities and the issues addressed. The report discusses the methodology of analysis, summarizes the existing and desired fuel conditions and describes effects of those treatments by alternative. Direct and indirect effects will be considered for each alternative. Cumulative effects are those effects from other activities, past, present, and future, that adds to or subtract from the effects of this project.

Regulatory Frame Work

National Fire Plan Direction

Federal direction includes the National Fire Plan (Managing the Impact of Wildfires on Communities and the Environment, A Report to the President; USDI and USDA 2000) and the Federal Wildland Fire Policy (USDI et al. 1995 with updates in 2001-2006).

Forest Plan Direction

The following summarizes the Management Areas (MA) in the analysis area along with the standards relevant to fire and fuels management.

Management Area Direction

Management Area 16 – (suitable for timber management)

77 percent of the project area

Standard 9 - Wildfires will be confined, contained, or controlled as provided for by criteria and guidelines for each fire management unit in the Fire Management plan.

To achieve management goals and objectives, prescribed burning may be planned and executed to maintain or restore the composition and structure of plant communities, or for hazard reduction purposes.

Standard 25 - Prescribed burning will be used to accomplish slash disposal, site preparation, silvicultural, ecological, wildlife and range objectives. In habitat groups where fire is not a useful tool, logging/scattering trampling, isolation of separate cutting units, fuel break construction, and fuel-wood utilization will be used to reduce fuel accumulations, reduce hazards and prepare sites for regeneration. Slash disposal will be complete enough to provide for free movement of deer and elk or in the case of isolated units, small enough to avoid impacting major elk/deer through paths. Prescribed burning for natural vegetation enhancement will be prescribed by a certified silviculturist. Use of prescribed fire for hazard reduction and site preparation will be based on an economic analysis. Utilize the most cost effective alternative that will meet the required resource objective.

Management Area 17 – (steep lands similar to MA 16)

1 percent of the project area

Standard 10 - Wildfires will be confined, contained, or controlled as provided for by criteria and guidelines for each fire management unit in the Fire Management Plan.

Standard 31 - Prescribed burning will be used to accomplish slash disposal, site preparation, silvicultural, ecological, wildfire, and range objectives. In habitat groups where fire is not a useful tool, logging/scattering trampling, isolation of separate cutting units, fuel break construction, and fuelwood utilization will be used to reduce fuel accumulations, reduce hazards, and prepare sites for regeneration. Slash disposal will be complete enough to provide for free movement of deer and elk or in the case of isolated units, small enough to avoid impacting major elk/deer through paths. Prescribed burning for natural vegetation enhancement will be prescribed by a certified silviculturist. Planning for use of prescribed fire to reduce hazards and prepare regeneration sites should be based on a cost effective analysis of an alternative that also meets other required resource objectives.

Management Area 23 – (timbered lands with medium visual sensitivity)

Less than 1 percent of the project area

Standard 9 - Wildfires will be confined, contained, or controlled as provided for by criteria and guidelines for each fire management unit in the Fire Management plan.

To achieve management goals and objectives, prescribed burning may be planned and executed to maintain or restore the composition and structure of plant communities, or for hazard reduction purposes.

Management Area 25 – (lands with a medium degree of visual sensitivity)

22 percent of the project area

Standard 7 - Wildfires will be confined, contained, or controlled as provided for by criteria and guidelines for each fire management unit in the Fire Management plan.

To achieve management goals and objectives, prescribed burning may be planned and executed to maintain or restore the composition and structure of plant communities, or for hazard reduction purposes.

Criteria Used for Analysis

Effects on Potential Fire Behavior

Fireline intensity expressed as flame length in feet associated with fire hazard. Flame lengths generally less than 4 feet are desired allowing for safe direct attack by handcrews. Flame lengths greater than 4 feet generally require equipment to be employed such as dozers and aircraft; beyond 8 feet torching, crowning and spotting can occur (Rothermel 1983).

- **Measure**: flame length in feet

Effects on Average Fuel Loading of Down Woody Debris (DWD)

The average amount of DWD as expressed in tons per acre. Fire hazard and resistance-to control reach high ratings when large woody fuels exceed 25 to 30 tons per acre combined with small woody fuels of five or more tons per acre. Accumulations of large woody fuels can hold a smoldering fire on a site for extended periods. Potential for spotting and crown fires is greater where large woody fuels have accumulated (Brown et al. 2003) (Lolo NF 2006).

- **Measure**: tons per acre

Methodology for Analysis

Fuel models as defined by Scott and Burgan (Scott and Burgan 2005) were used as a measure to display general changes in fuel profiles by vegetative cover type. Models were adapted using best professional judgment after site visits in order to most accurately represent fuels for the project area. Fuel models were then processed through a fire behavior model (BEHAVEPlus3.0.2) to determine fire behavior characteristics for the project area (reference Appendix A).

Estimates of fire severity were obtained by using the Rapid Assessment of Vegetation Condition after Wildfire (RAVG) remote sensing technique. The fire severity information was then used in the Forest Vegetation Simulator (FVS) model to estimate average loadings of DWD (reference Appendix A).

Assumptions and Variables Used In the Models:

For potential fire behavior modeling, weather parameters used in the models represent the 90th percentile weather conditions for the area. These values were derived from the Seeley Remote Automated Weather Station site located near the analysis area over a 53-year period from July1 through August 31 which represents the period when most wildfire ignitions occur. The fuel moisture values used were as follows: 0- to 0.24-inch (1hour) dead twigs = 3 percent; 0.25- to 0.99-inch (10 hour) dead twigs = 4 percent; 1.0- to 2.99-inch (100 hour) dead twigs = 11 percent; 3+-inch (1000 hour) =13 percent, herbaceous fuels 75 percent and live woody fuels = 94 percent. Ninetieth percentile eye level wind speed for the area is approximately 3 miles per hour.

For fuel loading of DWD, the Rapid Assessment of Vegetation Condition after Wildfire (RAVG) severity categories of mixed (category 4 or 5), high (category 6), and very high (category 7) were used. The “no burn” and “low” categories were not simulated as little change was expected in these categories.

The fire severity information was then used in the Forest Vegetation Simulator (FVS) model to estimate average loadings of DWD over time.

Fire behavior characteristics and DWD average loadings were estimated for current condition (2008), post harvest (2012), and 14 years after the fire (2022).

Affected Environment

Existing Condition

Historical reports dating back to 1901 describe the Seeley Lake area as being subject to periodic low intensity fires (Arno 2000). These fires were effective in reducing establishing regeneration, maintaining openings in the forest and maintaining fire resistant tree species. In the absence of these periodic maintenance fires, forest successional processes have changed these open forests into multi-storied stands that create fuel ladders into the crowns of the mature overstory trees. Without fire, the potential for stand replacement fires increases over time (Arno et al 1997).

The current structure of these forests, due in large part to over eighty years of effective fire suppression, has shifted to dense, multi-storied forests with a higher probability for intense, stand replacement type fires. This situation existed prior to the Jocko Lakes fire on the Seeley Lake RD.

Fire history records indicate that approximately 38 percent of the Seeley Lake RD has burned (123,289 acres) from 1980 to 2006.

The Jocko Lakes fire started on August 3, 2007 and burned 11,881 acres - a mosaic of unburned to very high severity burned areas. Inside the proposed treatment units, the breakdown of severity is as follows:

Unburned	0%
Low	28%
Mixed	18%
High	6%
Very high	48%

Outside of the proposed treatment units, the breakdown of severity on NFS land is:

Unburned	5%
Low	16%
Mixed	13%
High	3%
Very high	24%

The balance (39 percent) is state or private land

Existing Potential Fire Behavior

Fireline intensity is widely used as a means to relate visible fire characteristics and interpret general suppression strategies. There are several ways of expressing fireline intensity. A visual indicator of fireline intensity is flame length (Rothermel 1983, NWCG Fireline Handbook Appendix B 2006). Table 1 compares fireline intensity, flame length, and fire suppression difficulty interpretations.

Table 1. Fireline intetensity interpretations

Fireline Intensity	Flame length	BTU/ft/sec	Interpretations
Low	<4 feet	Less than 100	Direct attack at head and flanks with hand crews, handlines should stop spread of fire
Low-Moderate	4-8 feet	100-500	Employment of engines, dozers, and aircraft needed for direct attack, too intense for persons with hand tools
Moderate	8-11 feet	500-1000	Control problems, torching, crowning, spotting; control efforts at the head are likely ineffective. This would require indirection attack methods.
High	> 11 feet	Greater than 1000	Control problems, torching, crowning, spotting; control efforts at the head are ineffective. This would require indirection attack methods.

Table Based on Rothermel (1983)

Fire modeling was conducted to evaluate the existing potential for flame length of the proposed project area under high fire danger (90th percentile) weather conditions.

Under the current condition, modeling suggests that about 46 percent of the project analysis area representing the high and very high severity burned areas would only generate flame lengths of less than 1 foot. The mixed severity burned areas (about 21 percent) would generate flame lengths of about 2 feet and the flame lengths in the unburned and low severity burn areas could reach about 8 feet (about 34 percent of the area) (Table 2). Under the current condition the project analysis area predominately is considered to have low (67 percent of the area) or low-moderate (33 percent) potential fireline intensity.

Existing Average Fuel Loading of DWD

Fire hazard and resistance-to control reach high ratings when large woody fuels exceed 25 to 30 tons per acre. Modeling was conducted to evaluate the existing average fuel loadings for DWD.

Under the current condition, modeling shows the range of DWD average fuel loadings are from 4 tons per acre to 10 tons per acre – well within the Lolo NF DWD Guidelines.

Desired Condition

Research (Arno et al 1997) indicates that historically, many of the stands within this project area were thinned by frequently occurring fires. These fires generally eliminated much of the understory component while maintaining a more open forest character under the overstory trees. As a result, the forests tended to be single-storied, more fire tolerant, and less susceptible to widespread mortality from intense fires and extreme fire behavior.

An attempt to create or maintain fire behavior characteristics that range from low to moderate and DWD average loadings that will not create undue fire hazard is desirable in these western Montana habitat types.

Dead and down woody material has long been considered a fire hazard. However, to manage all residue on all sites as potentially dangerous because it can threaten resource values and fails to consider the complete range of factors contributing to risk definitions (Lolo 2006 DWD Guide).

The Lolo NF Land Management Plan provides some guidance on the desired condition of the forest. The following are standards that are applicable for the Management Areas in Jocko Lakes project area:

- Wildfires will be confined, contained, or controlled as provided for by criteria and guidelines for each fire management unit in the Fire Management Plan.
- Prescribed burning will be used to accomplish slash disposal, site preparation, silvicultural, ecological, wildfire, and range objectives. In habitat groups where fire is not a useful tool, logging/scattering trampling, isolation of separate cutting units, fuel break construction, and fuelwood utilization will be used to reduce fuel accumulations, reduce hazards, and prepare sites for regeneration.

Environmental Consequences

Spatial and Temporal Context for Effects Analysis

The Jocko Lakes project area, totaling 11,881 acres was used to analyze the direct, indirect and cumulative effects of the salvage on fire and fuels. References to a larger area are used when helpful to give context. This analysis area was chosen because it is where activities related to the salvage will occur and consists of National Forest, State of Montana, and private industrial lands and is of a sufficient size to project potential impacts to fuels and fire behavior of the proposed actions.

The temporal bound of the proposed activities is 14 years (2022) based on the modeling of Downed Woody Debris requirements for the Wildlife resource. The fourteen years are subdivided into current condition (2008), post harvest condition (2012) and future condition (2022) to illustrate potential fire behavior and average DWD fuel loadings.

Alternative 1 – No Action

Under the No Action Alternative, no removal of fire-killed trees would occur. Therefore surface, ladder, and crown fuels would continue to develop over time. Wildfires would continue to be suppressed in order to protect life, property, and resources.

Direct and Indirect Effects

Effects on Potential Fire Behavior

Under the no action alternative the current potential fire behavior is low over 67 percent of the project area and low-moderate of the remaining area as described under the existing condition. In time fuels will accumulate from dead trees falling and growth of new vegetation, however fire behavior was modeled based on estimated fuel loading, anticipated stand composition and structure to evaluate potential fireline intensity (flame length) for the project analysis area 14 years in the future. Under the no action alternative, modeling suggests that fireline intensity would not change within this time frame (Table 2).

Effects on Average Fuel Loading of Down Woody Debris

Under the no action alternative, the average DWD fuel loading is approximately 4 to 9 tons per acre in the current condition; well within the desired loadings. As time progresses, the average DWD loadings increase to 11 to 29 tons per acre in 2022. On 200 acres of the drier sites (VRU2), the average DWD loading exceeds 20 tons per acre which is not desirable. The rest of the project area is well within the desired loadings.

Alternative 3 – Modified Proposed Action

This modified proposed action will salvage harvest timber on approximately 15 percent of NFS land burned by the Jocko Lakes wildfire. This treatment is desirable as it promotes lower fire behavior (flame lengths) in the long term. The treatments lower the average DWD fuel loadings by removing wood that would otherwise contribute to higher fuel loadings. Wildfires would continue to be suppressed in order to protect life, property, and resources.

Direct and Indirect Effects

Effects on Potential Fire Behavior

Under the proposed action alternative, modeling suggests treated areas would have no meaningful difference in overall flame lengths as compared with the No Action Alternative immediately after treatments, or 14 years after the salvaging is complete. Flame lengths would be between 1 and 3 feet across 67 percent of the project area. Therefore, direct suppression strategies with hand crews could be employed for the area as described in Table 1. Direct suppression strategies using equipment could be used on the remaining 33 percent of the project area.

A small amount of residual material (<3 inches) would be left behind after salvage treatments. However, the slight increase in material is not enough to change modeled fireline intensities. This material will diminish over time due to crushing from snow load and decomposition. There is no Wildland Urban Interface in project area and the surrounding area fuel loading has been decreased greatly due to the Jocko Lakes wildfire.

Table 2. Comparison of Short-term and Long-term Flame Length and Fireline Intensity by Alternative

		High / Very High Severity	**Mixed Severity**	**Unburned / Low Severity**
Percent of project area		46%	21%	33%
Alt. 5	Flame length	<1foot	<2 feet	<8 feet
	Short-term fireline intensity	low	low	low / moderate
	Long-term fireline intensity	low	low	low / moderate
Alt. 3	Acres salvaged*	890 ac. (89% of treatments)	300 ac. (18% of treatments)	460 ac. (28% of treatments)
	Short-term flame length	<1foot	<2 feet	<8 feet
	Short-term fireline intensity	low	low	low / moderate
	Long-term flame length	<2 feet	2-3 feet	<8 feet
	Long-term fireline intensity	low	low	low / moderate

* Acres are from FVS runs by Silviculturist; FI = Fireline intensity; FL = Flame Length in feet; Short-term =2-3 years; Long-term = 14 years.

Effects on Average Fuel Loading of Down Woody Debris

In areas treated with salvage harvesting, the average DWD fuel loading ranges from 4 to 10 tons per acre in the current condition to 9 to 23 tons per acre in 2022 which is well within the desired fuel loading range.

The salvage harvesting would remove fuel loadings now that would decrease the fuel loading now, resulting in potentially less severe fires in the future.

Cumulative Effects

The Jocko Lakes project area, totaling 11,881 acres was used to analyze the cumulative effects of the salvage on the fire and fuels resource. This area was chosen because it is where activities related to the salvage will occur and consists of National Forest, State of Montana, and private industrial lands and is of a sufficient size to project potential impacts to fuels and fire behavior of the proposed actions.

Recent past, current and proposed treatment projects within the analysis area include both timber harvest and salvage activities by various land management entities that reduce surface, ladder and crown fuels (thus reducing potential fire behavior) by mechanical thinning, hand thinning, pile burning, and removal. For more specific information, refer to the Fire and Fuels resource Cumulative Effects Worksheet.

The Jocko Lake wildfire burned a significant portion of the analysis area. Prior to the Jocko Lakes wildfire, fire suppression over the past 80 years reduced naturally occurring fire events and limited beneficial fire effects (such as reducing stand densities) and overall size of fires. The accumulated fuels, due to fire suppression may have influence the intensity and size of the Jocko fire. It is reasonable to assume that fire suppression will continue.

No cumulative beneficial effects would occur with the selection of the No Action Alternative. This alternative would not contribute to the reduction in potential fire behavior.

Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

Fire management activities considered in the action alternative is consistent with direction in the Lolo National Forest Plan (1986) Chapter 2 Forest-Wide Management Direction, Management Area Standards as described below. Fire Management activities considered in the action alternative is consistent with the Lolo National Forest Fire Management Plan (2007), an annual addendum to the Lolo National Forest Plan (1986).

References Cited

Andrews, Patricia L.1986. BEHAVE: fire behavior prediction and fuel modeling system-BURN subsystem, Part 1. Gen. Tech. Rep. INT-194. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 130 p.

Arno, S. F. 2000. The 100-year crusade against fire: Its effect on western forest landscapes. Society of American Foresters, Proceedings. 1999 National Convention.

Arno, S. F., Smith H. Y., Krebs, M. A. 1997. Old Growth Ponderosa Pine And Western Larch Stand Structures: Influences Of Pre-1900 Fires And Fire Exclusion. Res. Pap. Int-Rp-495. USDA Forest Service, Intermountain Res. Sta. 20 Pp.

Brown, James K.; Reinhardt, Elizabeth D.; Kramer, Kylie A. 2003. Coarse woody debris: managing benefits and fire hazard in the recovering forest. Gen. Tech. Rep. RMRSGTR- 105. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 16 p.

Dixon, Gary E. 2008. Essential FVS: A User's Guide to the Forest Vegetation Simulator. Internal Rep. Fort Collins, CO: U. S. Department of Agriculture, Forest Service, Forest Management Service Center. 193p.

National Wildfire Coordinating Group, 2006. Fireline Handbook Appendix B. NFES 2165. 124p.

Rothermel, Richard C. 1983. How to predict the spread and intensity of forest and range fires, Gen Tech Rep. INT-143, USDA, FS, Intermountain Range and Experiment Station, Ogden, UT, 161 p.

Scott, J.H., and R.E. Burgan. 2005. Standard fire behavior fuel models: A comprehensive set for use with Rothermel's surface fire spread model. General Technical Report RMRS-GTR-153. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fort Collins, CO.

USDA, Forest Service, Lolo National Forest. 1986. Lolo National Forest Plan.

USDA, Forest Service, Lolo National Forest. 2006. Down Woody Material Guide

USDI and USDA .2000. Managing the Impacts of Wildland Fires on Communities and the Environment - A Report to the President (aka National Fire Plan) http://www.forestsandrangelands.gov/

USDI and USDA 2002. A Collaborative Approach for Reducing Wildland Fire Risk to Communities and the Environment: 10-Year Comprehensive Strategy: Implementation Plan Available at: http://www.forestsandrangelands.gov/

USDI et al. (USDI/ USDA/ DOE/ DOF/DOC/EPA/FEMA/NAOSF).1995. Federal Wildland Fire Policy. http://www.nifc.gov/fire_policy/index.htm and for 2001 updates http://www.nifc.gov/fire_policy/history/index.htm

Appendix A

Methodology for Analysis

Historic fire occurrence data was retrieved from the Forest GIS data base.

Fire behavior fuel models as defined by Scott and Burgan 2005, were applied to most accurately represent fuel conditions for the project area now and in the future and processed through BEHAVEPlus3.0.2 to determine fire behavior characteristics, such as flame length, for the analysis area. It is assumed that fuel loading data may under-represent what the smaller (less than 3 inch diameter) fuel loading might be in 14 years. It is expected that large diameter fuels, resulting from breakage when falling and decay, will resulting greater amounts of smaller fuels. However, this is difficult to measure at this time. Because the smaller diameter fuels drive fire behavior models, fire predictions may be over or under-represented. Local knowledge and best professional judgment were considered as fire fuel models were applied and predictions made. Fire fuel models and modeled fire behavior used in the analysis are located in the process records.

Estimates of fire severity were obtained by using information from the Rapid Assessment of Vegetation Condition after Wildfire (RAVG) remote sensing technique. This technique is a post-fire damage assessment and spatially represents and categorizes forested vs. deforested areas. The severity categories of mixed (category 4 or 5), high (category 6), and very high (category 7) were used as inputs into FVS (see below). The “no burn” and “low” categories were not simulated as little change was expected in these categories.

The fire severity information was then used in the Forest Vegetation Simulator (FVS) model to estimate average loadings of DWD over time. The Forest Vegetation Simulator (FVS) is an individual-tree, distance-independent growth and yield model (Dixon 2008). It has been calibrated for specific geographic areas (variants) of the United States. FVS can simulate a wide range of silvicultural treatments for most major forest tree species, forest types, and stand conditions.

Fire behavior characteristics and DWD average loadings were estimated for current condition (2008), post harvest (2012), and 14 years after the fire (2022).

Assumptions and variables used in the model

For potential fire behavior modeling, weather parameters used in the models represent the 90th percentile weather conditions for the area. These values were derived from the Seeley Remote Automated Weather Station site located near the analysis area over a 53-year period from July1 through August 31 which represents the period when most wildfire ignitions occur. The fuel moisture values used were as follows:

- 0- to 0.24-inch (1hour) dead twigs = 3 percent
- 0.25- to 0.99-inch (10 hour) dead twigs = 4 percent
- 1.0- to 2.99-inch (100 hour) dead twigs = 11 percent
- 3+-inch (1000 hour) =13 percent
- Herbaceous fuels 75 percent

- Live woody fuels = 94 percent
- Ninetieth percentile 20 foot wind speed for the area is 9 miles per hour.
- Ninetieth percentile eye level wind speed for the area is approximately 3 miles per hour – used wind reduction factor of 0.3.
- Model runs were standardized utilizing 40 percent slope.

Limitations of the Models

"A model is a simplification or approximation of reality and hence will not reflect all of reality" (Stratton 2006). Given the uncertainty of any modeling exercise, the results are best used to compare the relative effects of the alternatives, rather than as an indicator of absolute effects. Professional judgment and experience were applied.