Derby Mesa Fuels Specialist Report

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Background:

The Derby Mesa Landscape represents a unique and valuable ecosystem on the White River National Forest, and more specifically on the Eagle Holy Cross Ranger District. The landscape contains ponderosa pine (*Pinus ponderosa*), Douglas-fir (*Pseudotsuga menziesii*), and aspen (*Populus tremuloides*), with a Gambel oak (*Quercus gambelii*) and mixed mountain shrub understory, which is a habitat type more commonly found in Southwest Colorado.

Historically, conditions in ponderosa pine/Douglas-fir stands included an understory that consisted mainly of needle litter, bunchgrasses, and shrubs. The overstory consisted of ponderosa pine and codominant or subdominant Douglas-fir. Frequent (3 –20-year average fire return interval) low to moderate intensity wildfires maintained ponderosa pine as the dominant species by maintaining open stand conditions favorable to the growth and establishment of this species. Frequent fires were usually a result of lightning or burning by Native Americans. Following over a century of fire suppression Douglas-fir is becoming the dominant species in some areas due to lack of frequent disturbance and it's higher shade tolerance. The concept of Historical Range of Variability[1](or variation) HRV can be used to describe the range of common ecosystem conditions in the past, and provide us with a baseline to describe current landscape conditions.

Within the sage and bunchgrass cover type, conifer encroachment is gradually altering fire regimes. Conifer encroachment increases the probability of high severity wildfire.

Fire Regime and Disturbance History:

Fire regimes within the Derby Mesa Landscape fall under Fire Regime Group I, Fire Regime Group III, and Fire Regime Group IV[2] (Table 1).

For ponderosa pine, frequent, non-lethal surface fires were the primary disturbance, occurring every 3 to 30 years (Arno and Petersen 1993, Arno 1976, Fischer and Bradley 1987). Three-year fire return intervals were likely very localized and associated with Native American burning. More median fire return intervals were likely about 15 years. Mixed-severity fires likely occurred about every 50 years, depending on fuel conditions, climate, and ignitions.

Recent fire history in this landscape consists of multiple small fires (approx. 1 per year based on Upper Colorado River Interagency Fire Management Unit) and two larger Fires (Emerald Lake Fire 1980 and Red Dirt Fire 1975). Both Emerald Lake and Red Dirt Fires started on the drier east side of the Red Dirt Creek drainage in a pinyon/juniper fuel type and burned aggressively onto Derby Mesa from the west. Both fires were of mixed to high severity and quickly escaped initial attack efforts. Smaller fires

[1] The Historical Range of Variation or Variability (HRV) is a description of the change over time and space in the ecological condition of potential natural vegetation types and the ecological processes that shape those types.

[2] See Attached Fire Regime Group Table

were actively suppressed and remained less than 50 acres. In the absence of fire suppression, a few of these fires would have likely helped maintain lower fuel loading within the assessment area.

Table 1 – Fire Regime Group Descriptions

Group	Frequency	Severity	Severity Description
I	0 – 35 years	Low/ mixed	Generally low-severity fires replacing less than 25% of the dominant overstory vegetation; can include mixed-severity fires that replace up to 75% of the overstory
II	0 – 35 years	Replacement	High-severity fires replacing greater than 75% of the dominant overstory vegetation
III	35 – 200 years	Mixed / low	Generally mixed-severity; can also include low-severity fires
IV	35 – 200 years	Replacement	High-severity fires
V	200+ years	Replacement / any severity	Generally replacement-severity; can include any severity type in this frequency range

*Fire regime groups used in the current LANDFIRE data bases. These groups have been modified from earlier versions (Hardy et al. 2001, Schmidt et al. 2002) to include low-severity fires in Fire Regime III and fires of any severity in Fire Regime V. Adapted from FRCC Guidebook, Version 1.2.1 (Anon. 2010).

In the early 2000s (2003 – 2005), silvicultural activities were implemented in portions of the Derby Mesa landscape and were successful at creating open growing conditions for ponderosa pine, with reduced crown density and fuel loading, consistent with Fire Group I. Prescribed burning was utilized along with hand and mechanical treatments and timber removal.

Grazing activities has likely occurred in the area uninterrupted since settlement. Grazing has contributed to the reduction of herbaceous surface fuel continuity. Reduced surface fuel continuity can have both positive and negative effects. The reduction of fuels can result in a reduction of fire spread rates, which can reduce fire size and severity in the short term. Within the Wildland Urban Interface, this potential reduction in fire spread could be beneficial. However, in Fire Regime Group 1 areas, the loss of low intensity fire enables stand density and fuels to depart from historic conditions, resulting in potentially higher severity fires(including active and passive crown fire) when they do occur.

Current Conditions in the Proposed Area:

Within the Derby Mesa landscape, ponderosa pine stand conditions vary. Some stands are within the Historical Range of Variability (HRV) and have an overstory in which ponderosa pine is still the dominant species, stand densities are relatively low and not capable of carrying crown fires, and bunchgrasses and mixed mountain shrub communities compose the understory. Based on LANDFIRE Data from 2014, most these stands would be considered to have a low departure from historic conditions. These are stands that have been mechanically treated and are currently within the normal HRV. Many of these stands are trending toward the moderate departure category and planning for treatment with those stands to maintain them within the HRV would add a valuable resource benefit.

Canopy Bulk Density[3] in these stands are generally low enough to limit the probability of active crown fire spreading between trees if torching were to occur. Canopy Base Height[4] (CBH) is generally higher (1.5-3m)[5]. Within these stands surface fire[6] is most likely due to lack of ladder fuels and canopy continuity. Under these conditions, overstory mortality would likely be low.

Fire Regime Condition Class Descriptions*

Condition Class	Descriptions
FRCC1	Fire regimes are within the historical range and the risk of losing key ecosystem components is low. Vegetation attributes (species composition and structure) are intact and functioning within their historical range.
FRCC2	Fire regimes have been moderately altered from their historical range. The risk of losing key ecosystem components is moderate. Fire frequencies have departed from historical frequencies by one or more return intervals (either increased or decreased). This may result in moderate changes to one or more of the following: fire size, intensity, severity, and landscape patterns. Vegetation attributes have been moderately altered from their historical range.
FRCC3	Fire regimes have been significantly altered from their historical range. The risk of losing key ecosystem components is high. Fire frequencies have departed from historical frequencies by multiple return intervals. This may result in dramatic changes to one or more of the following: fire size, intensity, severity, and landscape patterns. Vegetation attributes have been significantly altered from their historical range.

* Fire Regime Condition Class1 (FRCC) is a standardized interagency tool that utilizes the concept of HRV to assess a current landscape's departure from historical (natural) conditions (Hann et al. 2003). Fire regimes are typically described by fire frequency, intensity, size, and vegetation type (Heinselman 1981; Sando 1978)

In other stands within the proposed area Douglas-fir has become the seral dominate species as a later successional stage has developed. Conditions within these stands are moderately to severely departed from historical conditions. Additionally, understory fuels within these stands have significantly higher fuel loading that could be characterized as fuel model TU5, Very High Load, Dry Climate Timber-Shrub (Burgan, 2005). Canopy Base Height within these stands is also significantly lower (0-0.5m) to the ground and intermingles with the shrub understory. Canopy Bulk densities are increased as well. Based on experience and fire behavior modeling[6] we can expect to see hotter fireline intensities, higher flame lengths (11ft-25ft+), faster rates of spread, and frequent passive and active crown fire. From a fire suppression standpoint, the flame length threshold for direct fire attack with ground crews is 4 feet[7] and for aerial firefighting effectiveness that threshold is 8 feet (Crystal S Stonesifer, 2016). Based on the modeling information fire suppression efforts in these stands would likely prove ineffective and result in uncontrolled fire spread and mixed to high severity primary fire effects including considerable overstory tree mortality.

[3] Forest Canopy Bulk Density (CBD) describes the density of available canopy fuel in a stand. It is defined as the mass of available canopy fuel per canopy volume unit. CBD unit measurements are kg m-3 * 100. CBD estimates are used to determine the threshold spread rate, or surface wind speed, used to determine the likelihood of active crown fire.

[4] The forest Canopy Base Height (CBH) describes the average height from the ground to a forest stand's canopy bottom. Specifically, it is the lowest height in a stand at which there is a sufficient amount of forest canopy fuel to propagate fire vertically into the canopy.

[5] Using LANDFIRE Data within the Interagency Fuel Treatment Decision Support System(IFTDSS)

[6] IFTDSS Modeling under 97th Percentile Fire Conditions

[7] NWCG Fireline Handbook, Appendix B, Fire Behavior Hauling Chart p. B-57

Fire and Fuels Effects of Proposed Actions:

Fire Regime Condition Class 2 and 3:

Hand and mechanical treatments in stands that are currently outside of their historical range of variability are an effective pretreatment prior to utilization of fire in that landscape. Mechanized treatments are used as a method to accomplish desired changes in forest structure and composition and to reduce fire intensity prior to implementing prescribed fire (M.E. Hunter, 2007). Through retention of existing ponderosa pine trees and removal of other conifers species, potential ladder fuels would be reduced resulting in a reduction of the potential for high severity fire events. Ponderosa pine regeneration and retention will help restore this area to a more historical condition that is in line with FRCC Condition Class 1. Open canopy conditions post-cut would likely add to herbaceous surface fuel establishment and growth, which will increase opportunities to reintroduce frequent low intensity fire. By utilizing tree removal, Canopy Bulk Density and Canopy Base Heights would be reduced prior to any use of fire within the stands. These structural changes should reduce the potential for high severity fire and tree mortality once fire is reintroduced. All harvesting activities would likely improve surface fuel continuity and quality. Care should be taken to limit the depth of these fuel beds and avoid heavy concentrations of slash.

Fire Regime Condition Class 1:

In areas that a currently considered within HRV and areas that are returned to a more moderately departed condition, broadcast burning would be conducted to maintain fire regime condition class 1. In stands with smaller trees (generally <5”DBH) in the understory and heavy accumulations of brush, preparing the stand with whip felling and hand thinning would improve fuel bed continuity and reduce potential for canopy scorch. It is recommended that fire continue to be utilized (every 5-15 years) to maintain the stands in fire regime condition class 1 and planning should include long term(30+ Years) prescribed and natural fire management options in order to maintain ecosystem health.

Fire and Fuels Summary:

The proposed action is expected to have an overall positive effect from the fuels and fire standpoint. Returning the area to a Condition Class 1 state would have the benefit of allowing the area to be maintained within its historic fire regime and return interval in the future. After treatment, planned and unplanned fire would be expected to be of low severity and the risk of loss of key ecosystem components would be reduced. Firefighter and public safety would be increased if wildfires were to occur in the area. Fire management options would be broadened and suppression actions would be more likely to be successful with the lower severity fire

References

Burgan, J. H. (2005). *Standard Fire Behavior Fuel Models: A Comprehensive Set for Rothermal's Surface Fire Spread Model.* Ft. Collins, CO: USDA, US Forest Service, Rocky Mountain Research Station.

Crystal S Stonesifer, e. a. (2016). *Fighting fire in the heat of the day: an analysis of operational and environmental conditions of use for large airtankers in United States fre suppression.* International Journal of Wildland Fire.

M.E. Hunter, W. S. (2007). *A Comprehensive Guide to Fuels Treatment Practices for Ponderosa Pine in the Black Hills, Colorado Front Range, and Southwest.* Ft. Collins, CO: USDA Forest Service, Rocky Mountain Research Station.

Morelan, M. T. (2005). *LANDFIRE Rapid Assessmnet Reference Condition Model: Ponderosa Pine Northern and Central Rockies.* LANDFIRE.