

Effects of Mechanically Generated Slash Particle Size on Prescribed Fire Behavior and Subsequent Vegetation Effects

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Introduction

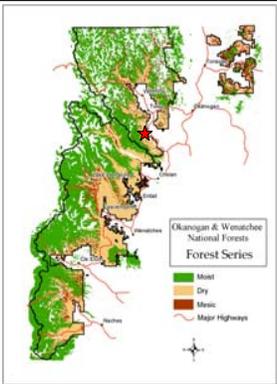
In fire-prone ecosystems of the interior Northwest, resource managers have begun to reduce fuel loadings by manipulating forest structure, thus redirecting the future trajectory of stand development. A fundamental goal of these activities is to restore some of the structural elements, species, and ecosystem processes that characterized these forests prior to widespread suppression of wildland fire. Increasingly, managers are employing thinning and prescribed burning treatments to achieve both short- and long-term changes in stand structure that will lead to reduced future wildland fire severity. Thinning can be costly and time consuming given that current forest structure consists of dense, small trees of limited economic value. Thinning alone without subsequent surface fuels treatment can lead to increased fire hazard. Managers have been experimenting with a variety of methods for thinning small, non-merchantable trees. A recent project funded by the USDA Forest Service, using National Fire Plan funding, evaluated realistic fuels treatment trials in four locations in three states. The Dry Forest Mechanized Fuels Treatment Trials Project (Coulter et al. 2002) was designed to compare costs of various mastication and extractive methods and determine the effectiveness of the various mechanical treatments of reducing fire hazard and effects to soil. One question raised during the trials was the effect of residual slash particle size on prescribed or wildland fire behavior and the subsequent effects on vegetation. National Forest managers found the cost comparisons of the various mechanical treatment methods useful in project planning, but they were uncertain which treatment would best meet resource objectives. *This proposal was developed to design an administrative study for the Okanogan-Wenatchee National Forests that will formally assess mechanical fuels treatment by mastication currently available for use by forest managers.*

The objectives of this study are to test the effectiveness of mastication effort to thin dense fire excluded stands within historically frequent fire environments and to create surface fuels that promote fire behavior characteristics which have positive effects on residual trees, understory vegetation, and soils. Specifically, we ask the following scientific-management questions:

- 1) How does slash particle size and fuel bed depth affect fire intensity and severity?
- 2) How do different mastication efforts and subsequent prescribed fire affect understory and overstory vegetation?
- 3) What are the effects of soil heating from burning different types of slash on the soil nutrient capital?
- 4) What are the effects to soil when slash is not burned?
- 5) Considering production costs, fire effects, soil effects, and vegetative responses, what is the most efficient/appropriate level of mastication effort?

Study Site

The study was established in the Hungry Hunter Ecosystem Restoration Project area located on the Methow Valley Ranger District of the Okanogan-Wenatchee National Forests. The area is dominated by dense dry forest vegetation. The overstory is composed primarily of Douglas-fir and ponderosa pine and understories of grass or grass/shrub mix.



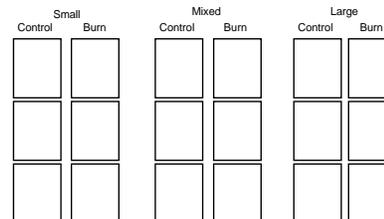
Methods

Treatments

Thinning and burning treatments will be conducted within replicated plots (experimental units). All units will receive the same thinning and burning prescription and result in the nearly same residual stand density. We will use three thinning and burning treatments utilizing one mastication system at three levels of effort to achieve different slash particle sizes: (1) manipulated slash resulting in mostly small fuel pieces (SMALL) – high level of mastication effort, (2) manipulated slash resulting in a mix of small, medium, and large fuel pieces (MIXED) – medium level of mastication effort, and (3) manipulated slash resulting in mostly large fuel pieces (LARGE) – low level of mastication effort. In addition, each of the thinning treatments will be replicated without burning to serve as a control. If possible, a vertical-shaft mastication head mounted on a mid-size or larger excavator (>18,000 kg) will be used.

Replication and Plot Size

Each treatment, including the controls, are replicated three times, using a completely randomized design. The core set of three treatments and three controls thus will be represented in 18 treatment plots (experimental units). Each of the 18 experimental units will consist of a 5-ha measurement plot, within which core variables will be measured, surrounded by a buffer.



Fire and Fuels

Objective 1 - At every unit, a 40 meter sample grid was established, and every other grid point was sampled for woody debris using line intersect and belt transect techniques. Brown's transects were used to sample time lag fuels and belt transects were used to inventory larger fuels.

Vegetation

Objective 2 - Forest vegetation was sampled in four 20 x 50 m plots located at randomly selected grid points. Tree metrics (dbh, status (live, dead), bole scarring, height, height to base of the live crown, and crown condition) and canopy closure were measured on the entire plot. Shrub and herb cover were measured on nested plots.

Soils

Objective 3 and 4 - Soil sampling was done near the reference posts and every other post will be selected as a sample site. Soil organic matter, nutrient capital and N-mineralization at a depth of 0-5cm and 10cm will be determined using the national protocols.

Production Rates and Costs

Objective 5 - Machine production rates will be measured on plots within each of the experimental units. These plots will be of known size and the time to treat each of these plots will be used to estimate production rates and costs of each of the three mastication effort levels.

Pre-Treatment Data Collection

We completed all of the pre-treatment data collection in July of 2005. We established the following sampling plots:

18 treatment units
72 20x50 meter tree plots
216 sample grid points
432 20-meter fuel transects
720 5x10 meter shrub sub-plots
1440 1x1 meter understory vegetation quadrats

We recorded a total of 79 different grass and herb species and 31 shrub species.



Mastication Equipment



Small Slash Particles



Large Slash Particles

Timeline and Deliverables

July 2005 – Pre-treatment data collection
November 2005 – Contract advertised and awarded for mastication work
June 2006 – Mastication work completed
October 2006 – Prescribed burning completed
September 2007 – Post-treatment data collection completed

- Web site located on the Okanogan-Wenatchee NFs intra- and internet web sites
- Scientific publications in journals and PNW research notes describing research results
- A management-oriented guide for developing thinning prescriptions using mastication systems and subsequent prescribed burning