Effects of lop and scatter slash treatment on potential fire behavior and soil erosion following a selection harvest in a coast redwood forest

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INTRODUCTION

Even though harvesting timber is one method of reducing fuel continuity and subsequent potential fire behavior, the residual slash can greatly increase the surface fuel loading and subsequent risk of wildfire on harvested sites. Fire behavior following silvicultural treatments to a stand can vary greatly, with both depth and loading playing a significant role (Nives 1989). Surface fuels and subsequent potential fire behavior has been shown to increase in the first year after harvest in coast redwood forests (*Sequoia sempervirens* (D. Don) Endl.) (Dicus 2003), which threatens not only natural resources but also structures in an ever-increasing wildland-urban interface.

Alternatively, logging slash may serve to hold post-harvest soil in place, thereby decreasing soil erosion and stream sedimentation, which may be of greater importance than fire risk in some areas. Logging operations, particularly roads, can significantly increase erosion rates in coastal forests (Amaranthus et al., 1985). Slash may reduce the detrimental effects of harvesting impacts by decreasing raindrop impact and subsequent soil movement.

This research examined surface fuel loading, potential fire behavior, and soil erosion following a single-tree selection harvest and subsequent lop and scatter slash treatment in coast redwood stands near Aptos, California. The specific objectives were to (1) quantify fuel loading and potential fire behavior before and for three years after a selective harvest, and (2) determine if residual slash affected surface soil erosion.

METHODS

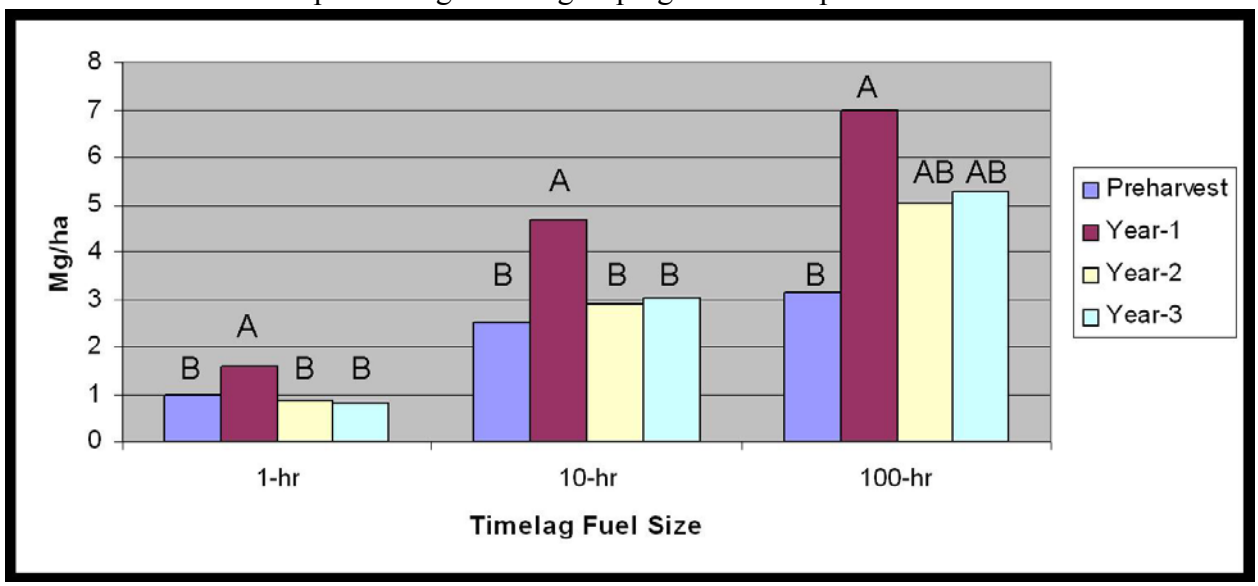
Data were obtained near Aptos, California from the 600-acre Valencia tract of the Swanton Pacific Ranch, which is managed by the faculty in the Natural Resources Management Department of the California Polytechnic State University. Valencia is a second growth redwood forest that originated after the site was clearcut for rebuilding efforts following the 1906 San Francisco earthquake. Valencia was selectively harvested in 2002 by tractor or cable skidding with the objective of creating un-even aged stands (Piirto et al. 1997).

Fuel loading was recorded at 40 continuous forest inventory plots for one year prior and three years following harvest by a modified point transect method (Brown et al. 1982). Post-harvest slash had been dispersed using a lop and scatter treatment.

Soil erosion data were collected in 9 plots that were selected to be most representative of the topography, vegetation and soil types in the area. Five troughs were installed at each plot perpendicular to the slope in a row with approximately 1.5 feet between each trough. Soil was collected in the troughs after major rain events in the second year following harvest, dried at 105^{o}C for 24 hours, and weighed to 0.01g.

RESULTS AND DISCUSSION

Figure 1. Results from a General Linear Model of timelag fuel class at Valenica Forest for years 2002-2005. A and B represent significant groupings with an alpha-=0.10.



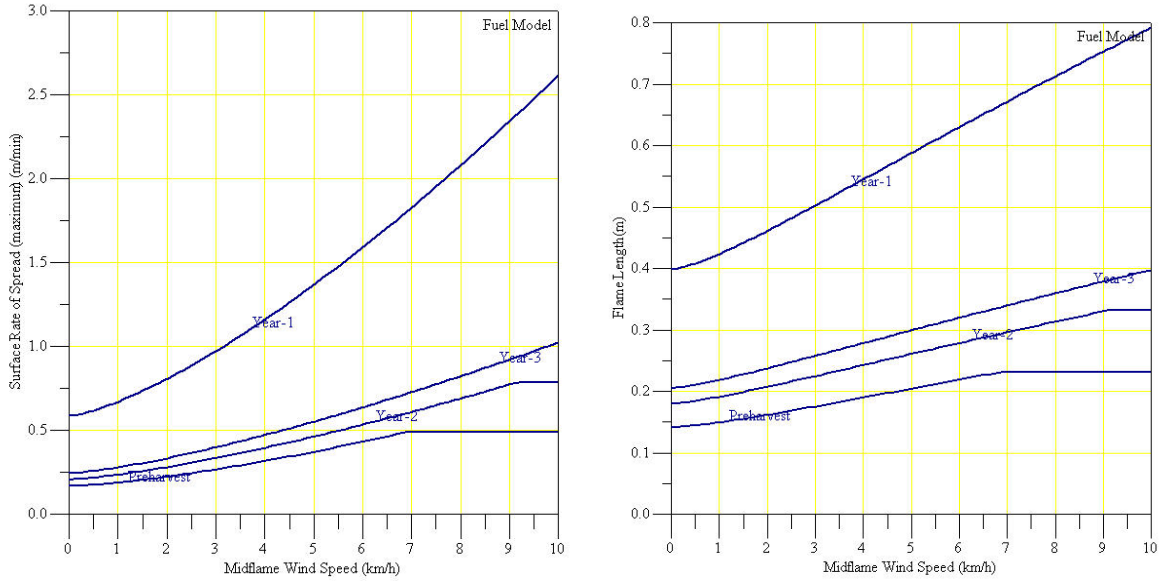


Figure 2. Preliminary results from Behave Plus fire behavior prediction runs. Years 1-3 indicate the three post-harvest years.

Following a selection harvest at Valencia Forest, preliminary results indicate that fuel loading in 1,10,100 hour timelag classes significantly increases for the period of one year. By the second year following harvest there are no significant differences in fuel loading between post-harvest years and pre-harvest (Fig. 1). This could be due to the highly variable decomposition rates of understory fuels (Lahio et al., 2004). These rates are dependent upon several factors including temperature, soil moisture, insect activity and material size (Lahio et al., 2004). The lop and scatter treatment that took place at Valencia, effectively increased the surface area exposed on dead and downed fuels as well as keeping fuels on the ground.

Results indicated that total fuel loading and calculated fireline intensity was significantly increased for one year after harvest, but returned to pre-harvest conditions by the second year. Both surface rate of spread and flame length are elevated for one year following harvest. These parameters for years 2 and 3 are only slightly higher than pre-harvest levels (Fig. 2).

Preliminary GLM procedures of soil erosion produced a P value of 0.99 for fuel loading and 0.69 for slope. Post-harvest soil erosion may be more related to skidding method than fuel loading, which appears to be largely a product of slope.

The length of elevated fire risk appears to last only a year at Valencia Forest, possibly due to the cool moist climate that facilitates decay. Analysis of fuels will continue to be conducted, with additional years of sampling it becomes possible to hypothesize a decay rate at the forest.

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