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The Resources Agency
California Department of Forestry & Fire Protection

P.O. Box 944246
Sacramento, CA 94244-2460
Phone: 916-653-7209
Web: www.fire.ca.gov

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COMMERCIAL THINNING TO REDUCE FOREST FUELS

David Dulitz, José Medina, and Joseph Naya[1]

Timber harvesting projects with traditional slash treatment such as lopping often do little to reduce the fire hazard in an area. Although live fuels are reduced by removing a portion of the forest canopy, dead and down fuels increase if logging slash is not treated or removed. The slow deterioration rate for large logging slash means that dead and down fuels can remain for many years. The project sought to demonstrate that commercial thinning with intensive slash treatment could be a viable method of meeting the goals of timber management for the landowner while, at the same time, reducing the fire hazard.

Description of Area and Stand: The 112-acre project area is located at the 5600' elevation in Tulare County within the California Department of Forestry and Fire Protection (CDF) Mt. Home Demonstration State Forest. The timber stand is a mixed conifer forest with the following tree species; ponderosa pine (*Pinus ponderosa*), sugar pine (*Pinus lambertiana*), incense cedar (*Calacedres decurrens*), white fir (*Abies concolor*), and black oak (*Quercus kelloggii*). A description of the stand before harvest is as follows:

Basal area/acre	223 square feet
# Trees/acre	255
Board Foot Volume/acre	34,350 Board Feet
Average DBH (all trees)	6 inches
Average DBH (overstory)	18 inches

(DBH-Diameter at breast height)

Slopes within the project area average 30%. This stand lies at the top of a continuous south facing slope that contains oak grassland at the bottom, running into dense chaparral, and finally into timber within the project area. Figure 1 illustrates how this stand appeared before operations.

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1 Respectively, Manager, Assistant Manager, and Forestry Assistant at Mountain Home Demonstration State Forest, Springville, California.

The stand was logged in 1962 when a majority of the old-growth overstory was removed. The stand was also salvage logged several times during the last 10 years to remove drought-induced mortality. Logging slash had been treated by lopping and scattering. Dead fuels on the ground consisted of heavy accumulations of logs, limbs, duff, and old logging slash. Dead and down fuels averaged 46 tons per acre.

No fires have occurred in the project area since 1946. Fire history information is not available for the period prior to 1946. The absence of fire scars on all but the oldest trees in the stand indicate an absence of fire in this area for at least the last 100 years. High public use in the surrounding area increases the risk of a potential wildfire ignition. A fire has the potential of starting downslope from the project area threatening the timber stands of the State Forest

Figure 1. A typical stand before treatment.

The Project: A Timber Harvesting Plan was prepared for the project area in 1996. The planned objectives of the harvest were to thin the timber stand using the commercial thinning silvicultural method and reduce fuel loading by treating the logging slash and old down fuels. The thinning would reduce the ladder fuels by removing a portion of the understory. It would also reduce the continuous nature of the tree canopy by widening the spacing of overstory trees. Slash treatment after harvesting would reduce the amount of dead fuels.

The timber stand was marked for harvest in the summer of 1996 with the silvicultural objective to remove a portion of the suppressed, intermediate and co-

dominant trees in the stand, releasing the larger overstory. Minimum merchantable size for cut trees was 10 inches DBH. A total timber volume of 272,610 board feet was marked for harvest. A total of 2,076 trees, or 24 trees per acre, were marked. Basal area of the leave stand was 140 square feet per acre. Average DBH of the cut trees was 14 inches. Some snags were marked for harvest, but for wildlife considerations, an average of 3 snags per acre were left.

Two archaeological sites, three watercourse protection zones, and several steep areas exist within the project area where equipment was excluded and no tree removal or slash piling was done. These excluded areas totaled 25 acres leaving 87 acres to be harvested.

Dead fuels on approximately 20 acres of the project area were hand piled and burned before harvest using inmate labor from the Mt. Home Conservation Camp. In this area, dead fuels were reduced from 46 tons per acre to 5 tons per acre. The objective of the hand piling was to contrast the timber harvesting and slash treatment in an area with relatively low existing fuel concentrations to one where old logging slash was abundant on the ground before harvest.

The timber was sold to Witten Logging Company of Weldon, California. The project area was logged in early summer of 1997. Logging was accomplished with ground skidding equipment; D7 Cat and rubber tired skidder. Some additional timber was marked during the course of the sale to remove damaged trees. The dense nature of the stand led to some skidding damage of merchantable trees. Trees were also damaged during the slash piling operations and these were required to be removed. The final volume removed from the project was 304,040 board feet with a total stumpage value of $33,237.

Contract specifications required the timber operator to pile, by machine or hand, dead and down fuels after harvest. A portion of the duff layer was left undisturbed and the three largest down logs per acre were left for soil erosion and wildlife habitat considerations. Machine piling was accomplished with a D7 Cat equipped with a brush rake. Hand piling of slash was done in areas that could not be piled by machine because of steep slopes, rockiness, or dense timber. The timber operator made approximately 680 machine and hand piles. The piles were covered with heavy craft paper to provide for a dry ignition point and were burned in the fall of 1997.

Costs: Costs for this project are summarized in Table 1. All costs are per thousand board feet (MBF). Logging costs on other projects would vary with site-specific factors such as volume per acre, tree size, type of logging equipment, slope, road construction and road maintenance. This project required 800 feet of new road construction along with watering and grading of approximately 2 miles of timber access road. Hauling costs were based on the actual haul for this sale and would vary by sale location. Administration costs include advertising and selling the timber and Timber Sale Contract administration. Timber Harvesting Plan

preparation costs and administration would be reduced on a per thousand basis as the size of the project was increased or conversely increased for smaller projects.

Costs for hand piling dead and down fuels before harvest are not shown in Table 1. These costs are not shown because of the difficulty in calculating real costs based on work accomplished with inmate labor. Slash piling costs shown in Table 1 reflect the cost to the timber operator to pile slash and down fuels after harvest.

Table 1. Project costs in 1997 dollars.

Timber Harvest Plan Preparation	$23.00/MBF
Timber Marking	$12.00/MBF
Administration	$15.00/MBF
Falling and Bucking	$47.00/MBF
Logging (Stump to Truck)	$76.00/MBF
Hauling	$54.00/MBF
Road Const., Maintenance and Erosion Control	$12.00/MBF
Slash Piling (Machine and Hand)	$18.00/MBF
Covering and Burning Slash Piles	$12.00/MBF
Timber Tax	$ 9.00/MBF
Total	$278.00/MBF

Fuel Loading: A fuels inventory was conducted on a portion of the project area after log skidding but before slash disposal to determine the amount of additional fuel generated from the fresh logging slash. An average of 29 tons per acre of new logging slash was present. Adding this to the pre-harvest level of 46 tons per acre brought the total dead and down fuel loading after harvest to 75 tons per acre.

A fuels inventory taken after the slash piling and burning operation indicated an average of 19 tons per acre of dead and down fuels. This represents a 59% reduction from the pre-harvest fuel loading and a 75% reduction from the amount of fuels that would be present after harvest with no slash treatment. A sub-sample of fuels inventory plots in the area that had been hand piled before harvest showed a dead and down fuel loading after harvesting and slash disposal of 14 tons per acre.

Conclusions: The results of this project indicate that post-harvest fuel loading after commercial thinning in a mixed conifer stand can be reduced to less than 20 tons per acre. Reductions in fuel loading to levels significantly less than that reported here may not be desirable or economically obtainable. Complete slash cleanup is not desirable from a soil erosion or wildlife habitat perspective.

Slash left for wildlife habitat and control of soil erosion will result in a certain amount of dead and down material left on the site. For example, three large down logs per acre will result in a fuel loading of 3-8 tons per acre of fuel depending on diameter and length. Significant amounts of fuel will also be present within watercourse protection zones and other protection areas where equipment is excluded. With careful planning and operation, protection for wildlife and soil erosion can be

achieved while still providing for an increased level of fire protection for the timber stand.

Figure 2. A typical stand after treatment.

Cost to the landowner for the increased level of slash treatment in this project was $30/MBF or $106/acre. Assuming a delivered log price of over $278/MBF, there was enough value in the timber to pay for the additional slash disposal costs and still have a positive cash flow to the landowner.

Covering slash piles with a waterproof covering was found to be very beneficial. The piles could be burned after significant amounts of precipitation had occurred with a low probability for burn pile escapes. The extra cost associated with covering the piles was offset by the lower costs of igniting and tending the piles.

Hand piling that was accomplished on a portion of the sale area before harvest helped in reducing stand damage during logging and in a reduction of the amount of fuels to be piled by the timber operator after harvest. The smaller piles within these areas could also be burned with less danger of scorching the crowns of leave trees. The final fuel loading in areas that had been hand piled prior to harvest was not appreciably less than areas that had not been hand piled. The extra cost associated with this pre-treatment of slash may not be justified unless an inexpensive labor source is available.

This project demonstrates that commercial timber harvesting can be used as a

cost-effective tool to reduce fuels in young mixed conifer forests. Significant reductions in fuel loads after harvest can occur using the techniques demonstrated in this paper.

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Gray Davis
Governor
State of California

Mary D. Nichols
Secretary for Resources
The Resources Agency

Andrea E. Tuttle
Director
California Department of Forestry and Fire Protection

California Department of Forestry &
Fire Protection
P.O. Box 944246
Sacramento, CA 94244-2460