Hazard Abatement by Prescribed Underburning in West-Side Douglas-Fir

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THE build-up of natural fuels beneath our coastal stands of Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco) constitutes a significant forest management problem in the Pacific Northwest. The tangle of downed branchwood and frequent snags impedes access by the forest visitor hampers movement of wildlife through the area, and is aesthetically displeasing to view. Thick, dense mats of organic material carpeting the forest floor inhibit successful seeding and hinder tree planting operations following timber harvests. But the most unacceptable aspect of this problem may well be the serious fire hazard that these fuel accumulations represent. Ironically, this grave fire potential is a result of our own successful efforts to keep wildfire out of the forest environment.

Is there a solution to this problem short of allowing wildfire to return? It appears as though there is; and the remedy may be just what the doctor ordered. Like all strong medicines it requires a prescription and a knowledgeable person to administer it. Prescribed understory burning could be the answer.

Underburning by prescription for fire hazard reduction is a well established tool for the management of many fire-related conifer species (Fahnestock, 1973). Only recently, however, has it been considered as a potentially useful technique for reducing fuel accumulations in west-side Douglas-fir. In 1972, the U. S. Forest Service conducted three successful burns on the Willamette National Forest, Oregon. Nevertheless, doubt remained as to whether prescribed underburning could be employed in the wetter forest regimes farther north.

STUDY DESIGN

To examine the practicability of using controlled fire in second-growth stands of Douglas-fir in the Puget Sound Region, and to test its safety and effectiveness as a hazard abatement technique, a study was conducted in the summer of 1973, on the University of Washington's experimental forest near Mt. Rainier. Five treatment plots representing different slopes, aspects, and fuel conditions were established beneath mixed and pure undisturbed stands of 50 to 60 year-old Douglas-fir.

A survey based on Brown's (1971) planar intersect method for fuel sampling was conducted to determine preburn fuel loading. The results of this inventory (Table 1) compared well with other Douglas-fir forest floor biomass studies conducted in the past (Heilman, 1961, Grier and McColl, 1971; Gessel and Balci, 1963; Youngberg, 1966).

Plots were treated with strip-head fires between mid-July and mid-September, 1973, under varied weather and fuel moisture conditions. Flames spread with little difficulty, and at no time did the fire threaten loss of control. Shortly after each burn, post-fire fuel measurements were taken, again using the sampling technique developed by Brown (1971).

TABLE 1. Average fuel loading and reduction on prescribed underburning study plots in west-side Douglas-fir.

Fuel size class (in.)	Fuel loading (tons/acre) Preburn	Fuel loading (tons/acre) Reduction	Percentage Reduction
0.00–0.25	1.6	1.4	82a
0.26–0.99	2.3	1.4	67a
1.00–3.00	5.0	1.8	41b
Greater than 3.00	36.0	13.3	31
Duff	39.6	25.9	71a

a Statistically different at .01 level of significance
b Statistically different at .05 level of significance

EXPERIMENTAL RESULTS

The results are quite impressive (Table 1). Differences between preburn and postburn fuel loadings were statistically significant at the .05 level for all but the heavy fuels greater than 3 inches in diameter. By greatly reducing the fuels less than .5 inches in diameter, the trial burns largely eliminated the wildfire problem (Brown, 1972; Countryman, 1969). Duff reduction, too, was outstanding. Though mineral soil was occasionally exposed (most frequently at the base of the trees where fine debris had accumulated in greater quantities) a layer of humus, .2 to .5 inches thick, remained following the burns.

LONG TERM EFFECTS

It is too early to know the long term results and possible negative features of this underburning experiment. It may be surmised, however, that the detrimental effects are few, if existent at all. The moist protective layer of humus remaining after the fire undoubtedly prevented excessive heat penetration to the mineral soil below (Davis, 1959). Therefore, soil quality probably did not suffer and may even be improved by the burning (Hare, 1961).

From reports by several workers, Hare (1961) concludes that the amount of crown scorch resulting from a fire is perhaps the best predictor of tree injury by heat. Crop tree crown scorch was rare on the plots studied in this experiment. Observations made 1 year later revealed only a few unhealthy crowns. Cambial injury, too, was probably negligible, since the thick bark of Douglas-fir makes the tree highly resistant to damage by fire. Consequently, high mortality and growth retardation among crop trees is not anticipated.

The burns provided a noticeable thinning of suppressed and undesirable conifers. Cedar trees in the understory, with their thin bark and lower crowns, were generally killed. Crown scorch examinations shortly after the fire substantiated this speculation, and an informal survey 1 year later confirmed the expected high mortality.

The minor understory vegetation, consisting principally of salal (*Gaultheria shallon* Pursh) and Oregon grape (*Berberis aquifolium*

Pursh), was largely consumed. The following winter, some salal had resprouted. Oregon grape was noted returning 1 year after the fire.

A POTENTIAL TOOL

The results of this study indicate that prescribed underburning is a safe, effective tool for abating wildfire hazard in second-growth stands of west-side Douglas-fir. Significant reductions in fuel loading were achieved with fires which were easily controlled. Much work remains, however, to verify the long term effects and economic feasibility of this management technique. Additional investigation is also warranted to evaluate its potential as an aid to silviculture and other aspects of forest management.

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