Logging Precommercial Douglas Fir

By **Alan B. Berg**

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Forest Management Research

FOREST RESEARCH LABORATORY
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FOREST RESEARCH LABORATORY

The Forest Research Laboratory, Oregon State University, is part of the Forest Research Division of the Agricultural Experiment Station. The industry-supported program of the Laboratory is aimed at improving and expanding values from timberlands of the State.

A team of forest scientists is investigating problems of growing and protecting the timberland crop, while wood scientists endeavor to make the most of the material produced.

The current report stems from studies of forest management.

PURPOSE . . .

Develop the full potential of Oregon's timber resource by:

increasing productiveness of forest lands with improved practices.

improving timber quality through intensified management and selection of superior trees.

reducing losses from fire, insects, and diseases--thus saving timber for products and jobs.

Keep development of the forest resource in harmony with development of other Oregon resources.

PROGRAM . . .

REGENERATION through studies of producing, collecting, extracting, cleaning, storing, and germinating seed, and growing, establishing, and protecting seedlings for new forests.

YOUNG-GROWTH MANAGEMENT through studies of growth and development of trees, quality of growth, relationship of soils to growth, methods of thinning, and ways of harvesting to grow improved trees.

FOREST PROTECTION through studies of weather and forest fire behavior to prevent fires, of diseases and insects to save trees, and of animals to control damage to regrowth.

TREE IMPROVEMENT through studies of variation, selection, inheritance, and breeding.

CONTENTS

SUMMARY

An intermediate cutting in the form of a selection thinning in a 25-year-old precommercial stand of Douglas fir at Burnt Woods, Oregon, resulted in returns about equal to expenses. Two men with a power saw and a horse for equipment removed pulpwood and small saw logs. A total of 8.71 man-hours was required for each 1000 board feet of saw logs at the landing. An additional amount of 3.53 man-hours was required to produce, during the same operation, each cord of pulpwood.

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Cecil Brill, experienced horse logger, did the logging.

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INTRODUCTION

As intensive management of Douglas fir in Oregon increases, intermediate cuttings will be applied to young age classes to hasten the stand to an economic size and to assist in realizing the full potential harvest for the site.

Intermediate cutting should begin as soon as practicable so that the stand can be moulded to the form desired. In some areas, precommercial thinning might be undertaken with return less than cost, in expectation that the improved stand will give increased yields in advanced commercial cuttings.

The test at Burnt Woods was an attempt to make a commercial cut in a precommercial stand with returns at least equal to costs. The procedure followed allowed costs and returns to be analyzed for removal of saw logs only, and for concurrent removal of saw logs plus pulpwood from trees already cut.

Thinning was by the selection method in which large trees were removed. This method is particularly applicable to young stands because it increases the likelihood of returns to match expense, because it can be applied early in the life of the stand, and because the best-formed trees are favored for later cropping (1,2,3,4).*

The work reported was the initial phase of a larger study in managing young Douglas fir stands. Eight plots, each of one-tenth acre, have been established as two replications of three treatments and con-

*References cited.

trol. Silviculturally, the project was planned to test the effect of levels of growing stock on production of wood.

All six plots to be cut were to be treated alike initially; treatments were to be varied for future cuttings.

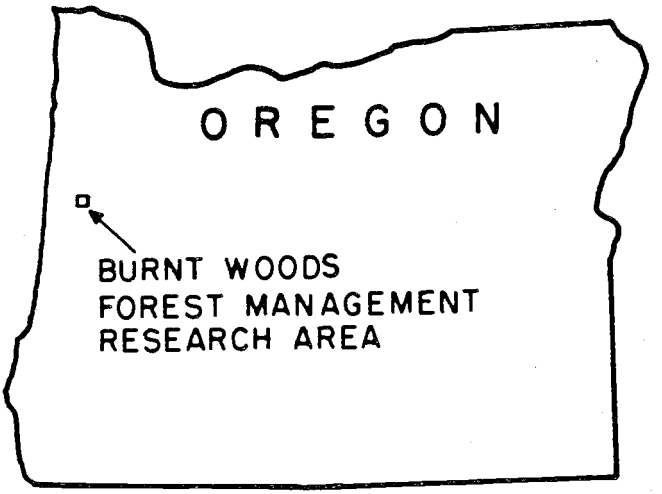

Figure 1. The area thinned was west of Corvallis, Oregon, in Lincoln County.

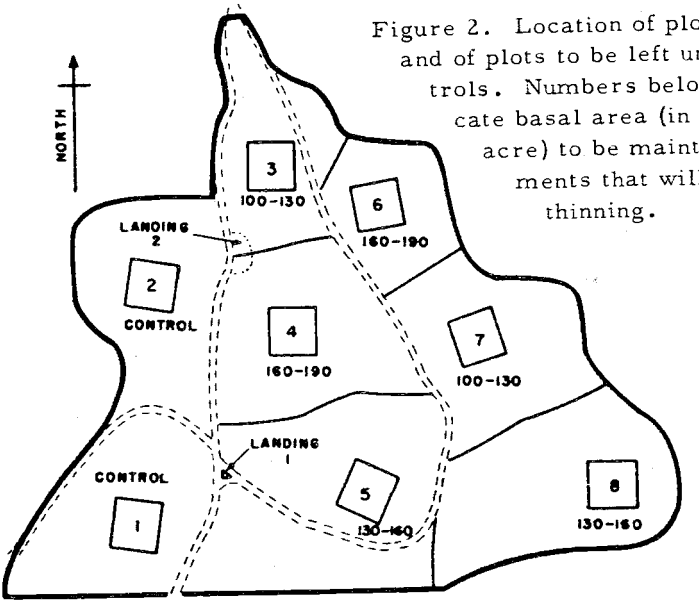

Figure 2. Location of plots to be treated, and of plots to be left untreated as controls. Numbers below each plot indicate basal area (in square feet to an acre) to be maintained in treatments that will follow the first thinning.

EXPERIMENTAL PROCEDURE

The Burnt Woods Forest Management Area is located in Lincoln County, west of Corvallis, Oregon (Figure 1). The area, of about 9.6 acres, supported a 25-year-old stand of high site II Douglas fir. Dominants reached 69 feet in height. Slopes were gentle, and little or no underbrush or debris was on the ground. A dirt road passed through the area.

This, the first thinning in the experimental area, removed only merchantable defective and wolf-type trees in the upper crown classes and was, therefore, an effort to release trees of good quality by removing trees of low quality.

The same general treatment was given to plots 3 through 6, and to the buffer zones around each plot, as shown in Figure 2. Plots 1 and 2 were left untreated to serve as controls for comparison.

Treatment of the stand

Trees marked for removal ranged from 6-inch diameter, breast high, to 17-inch diameter. Volume of trees marked was estimated from local Scribner tables developed for 8-foot logs following standards of the U. S. Forest Service. Every marked tree contained at least one merchantable saw log.

Volumes marked varied considerably for the six plots. Minimum volume in a plot was 1100 board feet an acre, and maximum was 2850 board feet an acre. Average was 1940 board feet. Trees marked included about 21 per cent of the board-foot volume and 12 per cent of the basal area of the stand, but only 5.6 per cent of the number of trees. Appearance of the stand in plot 4 before thinning is shown in Figure 3; after thinning, in Figure 4.

Statistics for the stand on thinned plots only are listed in Table 1.

Figure 3. Plot 4 before thinning.

Figure 4. Plot 4 after thinning.

Table 1. Averaged Data for Thinned Plots, Based on an Acre.

Measurement	1959; Original stand	Thinned	Mortality	*Growth	1960; Thinned stand
Trees, no.	1240	70	110	--	1060
Diameter, inches	5.8	8.6	3.1	--	5.9
Basal area, sq ft	218	27	6	12	197
Gross vol, fbm	9120	1940	--	1100	8280

*Growth was during slightly more than one year, as measurements in 1959 were taken in the late part of June, but in 1960, were after the growing season.

Logging methods

Both pulpwood and saw logs were removed. Saw logs had minimum diameter of 6 inches inside bark at the small end, and minimum length of 10 feet. The remainder of each tree to a top diameter of three inches inside the bark, and logs too crooked or deformed to make saw logs, were removed as pulpwood.

Trees were felled with a light-weight chain saw. Aim was to drop the trees in a direction to facilitate yarding out the logs, but the stand was so dense that each tree usually had to be felled as determined by openings in the canopy. Frequently, the trees would not fall after cutting, but would be held up by adjacent trees. Sometimes the cut tree could be loosened by rotating it with a peavy; at other times, a pull with the horse was necessary.

Limbs were cut off felled trees to a top diameter of three inches. Care was taken to remove stubs to avoid damage to standing trees when yarding.

All logs were bucked to some extent in the woods. Their lengths ranged from 10 to 24 feet, with the most frequent length being 16 feet.

Skid trails were planned so yarding was usually downhill. Abrupt

turns were avoided; trails were as short as possible; the longest distance for yarding to a road was 330 feet, and the longest distance to a landing was 630 feet (Figure 5).

As many as four logs were brought out on each turn. The horse, which weighed about 1600 pounds, could have yarded heavier loads, but density of the stand prevented.

The logs were loaded aboard a truck by means of an A-frame, with the horse as motive power. Saw logs were hauled to Philomath for sale, a distance of about 22 miles. Since there was no market for pulpwood within an economical distance, loading time and hauling costs were estimated.

Roads shown in Figure 2 were adequate for the experimental logging, so no new roads were built.

RESULTS

All phases of the operation proceeded without difficulty. No damage to the stand was obvious; only occasional abrasion of the bark on roots from yarding was noticed.

In all, 281 trees with gross volume of 9050 board feet and average diameter, breast high, of 8.7 inches were removed from the six plots and the surrounding buffer zones. Average gross volume was 32 board feet to a tree. The largest tree cut was 17 inches in diameter, breast high (Figure 6).

Trees cut produced 315 saw logs with a net volume of 7095 board feet, Scribner rule, as scaled by Columbia River Bureau standards. The average saw log contained 22.5 board feet. In addition, 14.38 cords of pulpwood were produced.

Material cut amounted to five truck loads of saw logs and an estimated two loads of pulpwood (Figure 7). Each load required an estimated three man-hours at the landing. An additional nine hours were needed for raising and lowering the A-frame.

Time required for the various operations in logging is shown in Table 2. The data were arranged to show time to each tree to remove only saw logs, then time needed for each tree if both saw logs and pulpwood were removed. Time for saw timber only is shown also for each log.

Table 3 reflects the costs in terms of time required to produce saw logs only, and the additional costs required to remove pulpwood at the same time, based on volume removed in board feet and cords. For pulpwood, time shown is amount needed in excess of that for saw logs only.

On the basis of these figures, rate of production for this operation was 384 board feet of saw logs and 0.80 cord of pulpwood in 8 man-

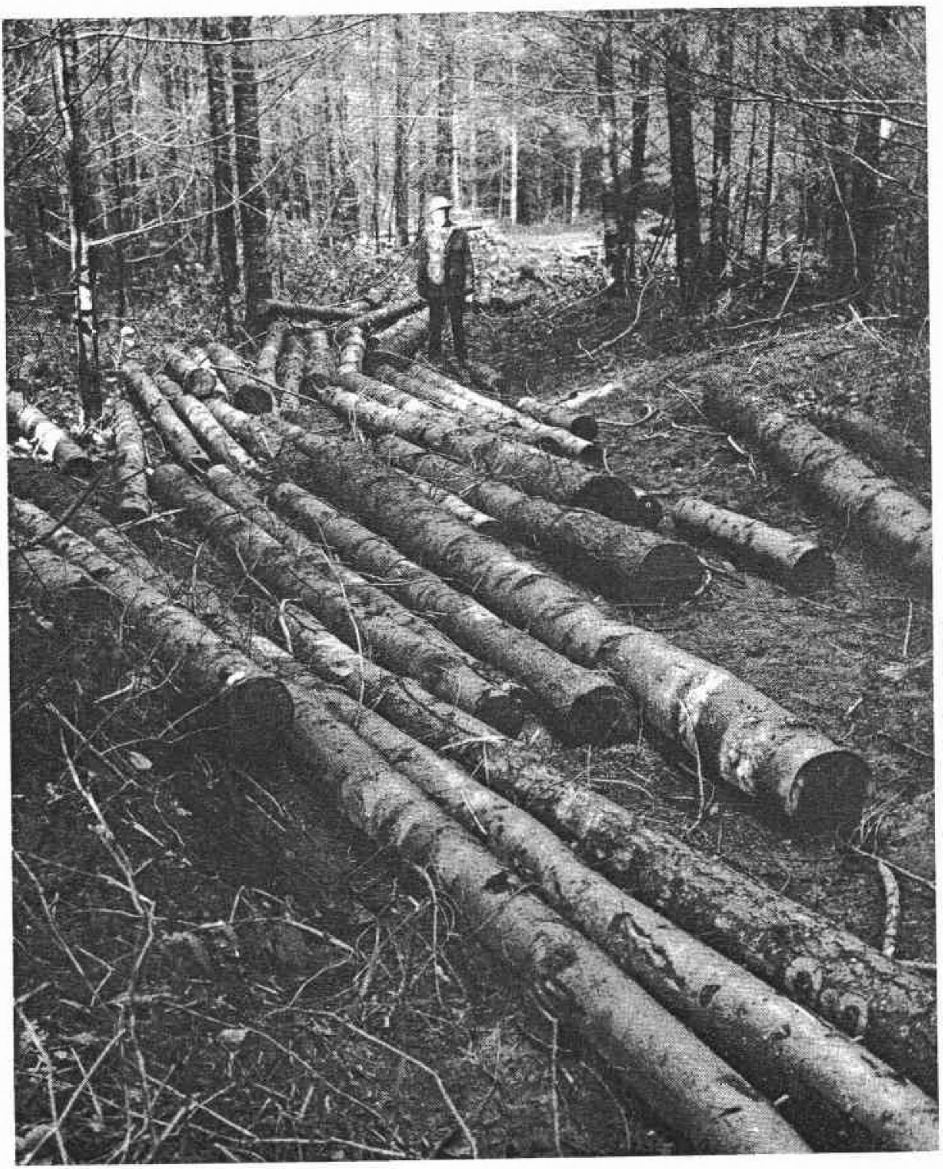

Figure 5. Small saw logs in skid trail above the landing at Burnt Woods.

Figure 6. Log on right was largest removed in first intermediate cutting at Burnt Woods in 1960.

hours. To remove saw logs only, rate of production was 632 board feet in 8 man-hours.

Saw logs down to a six-inch top could be sold readily to mills in the Willamette Valley. At the time of the study the actual price at mills in the Philomath area for material of the size removed was $50.00 for a thousand board feet.

No market for pulpwood within an economic hauling distance existed. However, the prevailing price in localities where pulpwood was purchased was $16.00 a cord.

Using these market prices, the value of the products harvested would be as in Table 4.

Table 2. Man-Minutes Required for Logging Operations.

Operation	For each tree		For each saw log
	Saw logs, pulpwood	Saw logs	
Falling	4.41	4.41	3.93
Limbing	7.22	2.60	2.31
Bucking	4.38	2.19	1.95
Yarding	8.04	4.02	3.58
Subtotal	24.05	13.22	11.77
Constructing landings [1,2]	0.89	0.89	0.79
Raising, lowering A-frame [1,2]	1.92	1.92	1.71
Loading [2]	4.48	3.20	2.86
Total	31.34	19.23	17.13

[1]These times would be lowered materially as operation increased in size.

[2]This time could be reduced in a larger operation that justified more efficient loading equipment, such as a mobile crane, a fork loader, or a tractor that could operate along the road.

Costs of logging and delivering the saw logs to the mill were as shown in Table 5. Additional costs for removing pulpwood when taken with saw logs are estimated in Table 6. If labor is charged at the rate of $2.75 an hour, a slight net gain from the saw logs is reduced by a slight loss from the pulpwood. Result is, the initial thinning just about paid its way.

No costs for building roads were included, because none were incurred.

Table 3. Man-Hour Requirements in Logging.

Operation	Saw logs, M fbm	Pulpwood,[1] cord
To landing		
Falling	2.91	--[2]
Limbing	1.71	1.51
Bucking	1.44	0.71
Yarding	2.65	1.31
Subtotal	8.71	3.53
At landing		
Construction	0.59	--[3]
Raising, lowering A-frame	1.27	--[2]
Loading	2.11	0.42[4]
Total	12.68	3.95

[1]Time noted is for pulpwood when cut with saw logs.

[2]No additional time required for production of pulpwood.

[3]A cost applicable to future thinnings also.

[4]Loading costs are estimated from other operations with similar material.

Table 4. Value of Products Harvested.

Product	Volume	Value / unit	Total value
Saw logs	7095 fbm	$50 /M fbm[1]	$354.75
Pulpwood	14.38 cords	16 /cord[2]	230.08
			$584.83

[1]Value of saw logs based upon actual prices in Philomath area for size of material removed.

[2]Values of pulpwood based upon prevailing prices in localities where pulpwood was purchased at time of study.

Table 5. Cost of Logging 7095 Board Feet of Saw Logs.

Item	Unit	Amount	Rate	Cost
Stumpage	M fbm	7.095	$3.00	$21.28
Power saw	Hour	31	0.50	15.50
Horse	Day	6	1.50	9.00
Insurance	Day	6	0.72	4.32
Hauling	M fbm	7.095	6.00	42.57
Administration	M fbm	7.095	1.00	7.10
Labor	Hour	90	2.75	247.50
Total				$347.27
Selling price				354.75
Net return				$7.48

Table 6. Additional Cost of Logging 14.38 Cords of Pulpwood when Removed with Saw Logs.

Item	Unit	Amount	Rate	Cost
Stumpage	Cord	14.38	$1.00	$14.38
Power saw[1]	Hour	10	0.50	5.00
Horse	Day	3	1.50	4.50
Insurance	Day	3	0.72	2.16
Hauling	Cord	14.38	3.00	43.14
Administration	Cord	14.38	0.50	7.19
Labor	Hour	57	2.75	156.75
Total				$232.74
Estimated selling price	Cord	14.38	16.00	230.08
Net loss				$2.66

[1]Represents the additional use of the saw to produce pulpwood. Does not include falling.

Figure 7. Some small logs and pulpwood at landing

DISCUSSION

Use of inexpensive equipment that is both light and maneuverable is vital to success in thinning young stands. In the hands of an experienced operator, such equipment secures minimal damage to the stand and provides maximal efficiency in handling small material (1, 2, 3, 4).

Falling, yarding

Falling can be accomplished by any light power saw. Dense stands may prevent severed trees from falling. A peavy is desirable to roll down such trees. In difficult situations, equipment used in yarding may be necessary.

Limbs and, particularly, stubs should be removed from the bole before yarding to prevent gouging trees in the residual stand. Bucking can be to any desired length consistent with the product desired, safety of the stand, and ease of removal.

In dense stands, the horse has definite advantage in skidding (4). As it is able to maneuver more easily than mechanical equipment, the horse is more efficient and causes less damage to the residual stand. A light horse about 1500 pounds in weight is efficient in very young stands.

Investment and upkeep for a horse are considerably smaller than for mechanical equipment. A horse and equipment may be purchased for $200 or less and can be used for eight years or more. Costs kept at Black Rock for eight years have shown that upkeep, including depreciation, will not exceed $1.50 a day.

Skid trails for horse logging ought to be determined in advance of skidding, ought to be straight, and be located so as to do the least damage to the remaining trees (Figure 7).

Small tractors, either rubber tired or crawler, are satisfactory

also. The best procedure is to construct narrow skid trails through the stand and to yard out the logs from the stand to the skid trail by cable and winch. The tractor then can proceed to the landing with a turn of logs. Landings should be located permanently for ease of loading and to facilitate downhill yarding wherever possible.

For loading small material, the fork-lift loader is the most efficient, but for small operations, the cost of such equipment may be prohibitive (2,4). The operator then must use a rollway or A-frame. Rollways can be constructed easily in a short time and are the most satisfactory where conditions permit. The logs can be loaded by hand, rolling the logs from the rollway on to the truck. An A-frame also is erected easily with a minimum of expense. The horse can be the source of power in loading logs by this means.

Roads

Construction of roads might reduce returns from an operation such as this to equal costs, or even to a loss. However, cost of roads should be distributed over the entire cost of management and not to a single thinning (4).

To lower immediate costs, roads may be developed stepwise by pushing in a pioneer road for the first thinning and then improving the road by ditching, installing culverts, and grading as successive intermediate cuts are made.

Roads should be permanent, as straight as possible with gentle grades, and as narrow as consistent with ease in removing products. High-speed roads are not necessary.

Markets

At the time of test, small saw logs and pulpwood were the only products that could be relied on consistently as outlets for material re-

moved in management of young stands. Saw logs down to six-inch diameter could be sold readily to mills in the Willamette Valley. The market for pulpwood was weak. Trends indicated that the market would improve and will assist materially the economic phase of forest management.

Other products, such as fuelwood, fence posts, car stakes, hop poles, and corral poles could be sold locally in limited amounts but, in general, programs of intermediate cutting cannot be built around removal of only these products (2, 3).

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