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SOME ECONOMIC CONSIDERATIONS IN THINNING DOUGLAS-FIR

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Many thousands of acres of young Douglas-fir stands in western Washington are ready for commercial thinning. This is true even after liberal allowance is made for premerchantable and understocked stands, unfavorable topography, and lack of markets. However, with but few exceptions, regular systematic thinning is not being practiced even in favorably located, operable stands.

What is the reason for this reluctance to thin Douglas-fir? The answer to this question lies largely, it is believed, in landowners' uncertainty about thinning costs and financial returns. Far too many feel thinning is an expensive indulgence that cannot stand cold cost accounting. They base their belief on three contentions:

1. Light, frequent cuts, necessary for complete mortality salvage, are not financially feasible because logging costs will be excessive.

2. Construction of the necessary road system will make initial expense per unit of product removed prohibitive.

3. Thinning will simply reduce the final cut; the same total volume could be more economically harvested all at once at the end of the rotation.

This paper demonstrates that such objections are not always valid and that in many cases thinning is not only profitable but more so over the rotation period than not thinning. Cost records of light and frequent thinnings, gathered by the Puget Sound Research Center over an 8-year period at the McCleary Experimental Forest,[1/] have been analyzed. This experience, together with certain assumptions regarding increment and future thinning plans, is the basis for the following analysis of (1) logging costs and efficiency, (2) road costs, and (3) financial comparison of thinning versus not thinning.

Description of Thinning

A 25-year thinning experiment was started in 1949 on the McCleary Experimental Forest. The stands (Site II) are chiefly Douglas-fir, 45 to 55 years old in 1949, with some mixtures of red alder, western hemlock, and western redcedar. Average initial volume per acre was 27,000 board-feet,[2/] which is approximately full stocking for this age and site. About 40 acres have been thinned each year. The fifth thinning, in 1953, completed the first-cycle cut of the 200 acres in the experiment. The second cycle, begun in 1954, is now in its third year, making a total of eight thinnings completed through 1956. Five cycles (25 annual cuts) are planned before the harvest cut, tentatively scheduled at age 80 years.

The first 4 thinnings removed 15 to 22 percent of the stand in a few large dominants and many smaller trees of lower crown classes. Experience of three representative years (1950-52) is averaged in table 1. The next four thinnings (one in the first cycle, three in the second) were much lighter, averaging 10 to 12 percent, and were almost exclusively low thinnings. Average figures for three thinnings of this type (1953-55) are also given in table 1.

All conifer thinnings to date, including dead and down salvage, have been milled at the same nearby sawmill. Alder timber included in the sales since 1951 has been resold by the purchaser for pulpwood and sawlogs.

1/ Maintained jointly by the Simpson Logging Company and the U. S. Forest Service in Grays Harbor County, Wash.

2/ Scribner rule for all trees 11.0 inches d.b.h. and larger to an 8-inch top.

Table 1.--Average costs and production for two 3-year periods in thinning Douglas-fir, McCleary Experimental Forest, Wash.

Item	Production/man-day		Cost/M b.m.	
	1950-52	1953-55	1950-52	1953-55
	bd.-ft.		dollars	
Felling and bucking	4,832	5,456	4.57	4.34
Skidding	4,248	4,392	6.64	8.21
Loading	7,744	9,592	3.97	2.91
Trucking	8,488	9,352	4.35	2.97
Moving and road maintenance	7,843	27,736	1.77	1.18
Administration	9,856	14,408	1.29	1.53
Taxes	-	-	1.56	1.83
Total operation	1,089	1,396	24.15	22.97

All skidding has been done by crawler tractors of varying sizes. Several loading devices have been used. Crew size varied from 2 to 9 men.

Logging Costs and Efficiency

Logging in the 1950-52 period removed 810 M b.m., Scribner rule, and cost $24.15 per M b.m. for an average cut of 5,603 bd.-ft. per acre. The lighter average cut of 3,098 bd.-ft. per acre in the years 1953-55 cost an average of $22.97 per M b.m. (table 1). A total of 416 M b.m. was harvested in this period.

Costs include prevailing wages, payroll taxes, bookkeeping, administrative expense, and adequate allowance for machines and equipment, but do not include allowance for access-road construction.

Although logging methods were generally similar over the years, variations in type of equipment, job planning, and labor efficiency affected costs more than did cut per acre. The significant fact is that light cuts, whether they be 3,000 or 5,000 bd.-ft., can be made at reasonable rates. Skidding cost was higher in the second period because the 1955 operator had to relog his area to pick up overlooked trees. Loading and trucking in the second period were improved by a more efficient crew and better equipment.

Labor in the second period was much more efficient than in the first: 1,396 bd.-ft. per man-day as against 1,089. Improvement was made by reducing crew size from 5-9 to 2-3 men. Another improvement was skidding to cold decks at roadside for later loading, which resulted in less time loss than in the more intricate operation where all jobs were carried on simultaneously by large crews.

Dead and down salvage material made up 15 to 20 percent of the annual cut in both 3-year periods.[3/] Average d.b.h. of trees cut was slightly lower in the 1953-55 period than in the earlier period; 15.6 inches and 16.8 inches, respectively.

Those familiar with logging costs and labor efficiency will recognize the McCleary experience figures as both reasonable and satisfactory.

3/ Worthington, Norman P. Mortality can be salvaged. The Lumberman 82 (5):59-60, illus. 1955.

Road Costs

Thinning requires construction of a road system prior to the final cut, thus differing from clear cutting, where road construction is coincident with the single harvest. Hence, thinning must absorb the extra cost of earlier road construction. Such extra cost should include only (1) interest charge on construction cost, and (2) road repair and maintenance costs. Original cost of the road should be charged against the final crop at the end of the rotation. There are other methods of accounting for these costs, but the one used here has the merits of simplicity and logic.

The McCleary experience may be used to illustrate the economics of road construction in a thinning operation (table 2). At a cost of $9,420, 1.95 miles of surfaced road, adequate for both thinning and final cut, was built 25 years prior to anticipated final harvest. This road will serve 280 acres and allow light and frequent thinnings, including salvage of mortality, over a planned period of 25 years. The annual removal per acre will be 625 board-feet; 500, live timber and 125, dead and down salvage material.

Interest charges and road maintenance costs, which must be paid for out of thinnings, amount to $3.80 per M b.m. for the proposed annual cut. This represents direct logging expense and is a logical deduction from gross stumpage price before net stumpage is determined for tax or other financial purposes.

Financial Comparison of Thinning vs. Not Thinning

Table 2 also gives the data for comparison discussed in this section.

If thinning is not done, it is assumed that in 1974 the stand will contain 48,250 bd.-ft. per acre. This represents a net growth of 850 bd.-ft. per acre per year for 25 years, added to the initial volume of 27,000 bd.-ft.

Experience at the McCleary Experimental Forest has shown that 3,125 bd.-ft. can be thinned every 5 years from a 55-year-old stand, or at the rate of 625 bd.-ft. per acre per year. Thinnings would be made up of 500 bd.-ft. from growing stock and 125 bd.-ft. of dead trees (lost in the unthinned stand). To forecast future increment, it is assumed that this cut from growing stock will reduce the normal increment (850 bd.-ft. per acre) by a percentage equal to one-half of the percentage reduction in growing stock at

Table 2.--Financial advantages of thinning over not thinning for the period 1949-74, McCleary Experimental Forest, Wash.

Item	Unit	Quantity
General data and assumptions:		
Cost of road system, 1.95 miles at $4,831	dollars	9,420
Area served by system	acres	280
Average initial stand per acre	bd.-ft.	27,000
Final harvest (1974)	years	25
Interest rate	percent	5
Clearcutting example:		
Annual increment per acre	bd.-ft.	850
Stand volume per acre, 1974	bd.-ft.	48,250
Road cost per M b.m. (9,420/48.25 x 280)	dollars	0.70
Stumpage price per M b.m. ($17.00 less 0.70)	dollars	16.30
Value per acre of stand, 1974	dollars	786.48
Thinning example:		
Annual increment per acre	bd.-ft.	756
Annual salvage per acre	bd.-ft.	125
Annual cut per acre (500 live + 125 salvage)	bd.-ft.	625
Annual road charge per M b.m. thinned $\frac{(9,420 \times .05 + \$100 \text{ per mile maintenance})}{280 \times .625}$	dollars	3.80
Stumpage price per M b.m., live thinnings (15.00 - 3.80)	dollars	11.20
Stumpage price per M b.m., salvage (12.50 - 3.80)	dollars	8.70
Value per acre, annual thinnings (.5 M b.m. x $11.20 + .125 M b.m. x $8.70)	dollars	6.69
Value per acre, annual thinnings at 5 percent, 1974	dollars	319.29
Volume per acre, thinned stand, 1974	bd.-ft.	33,404
Road cost per M b.m. ($9,420/33.404 x 280)	dollars	1.01
Stumpage value per M b.m., thinned stand (17.50 - 1.01)	dollars	16.49
Value per acre, thinned stand, 1974	dollars	550.83
Comparison of two methods:		
Total value per acre under thinning, 1974	dollars	870.12
Value per acre, clear-cut stand, 1974	dollars	786.48
Advantage per acre in favor of thinning, 1974	dollars	83.64
Annual advantage per acre of thinning	dollars	1.75

each thinning. Therefore, increment over the 25-year period would average 756 bd.-ft. per acre per year.[4] Of this, 256 bd.-ft. is allowed to remain in the stand as an addition to growing stock, a total of 6,400 bd.-ft. in the 25-year period. The stand at harvest thus contains 33,404 bd.-ft., and total yield is 49,029 bd.-ft. (33,404 + (25 x 625).

With no thinning the stand at harvest age would be worth $786.48 per acre (48.25 M b.m. x $16.30).

In the thinned stand the stumpage value of an annual thinning made prior to harvest, estimated on the basis of current sales, is $6.69 per acre after allowance for road costs, as explained earlier. The accumulated value of this series of 25 annual incomes is $319.29 at 5 percent interest. The value of the residual stand at harvest age is $550.83 (33,404 M b.m. x $16.49).[5] Thus, the total value from the thinned stand is $870.12.

Comparison of values for the two stands, $870.12 per acre for the thinned stand and $786.48 for the unthinned, shows an advantage of $83.64 per acre for thinning. This is equal to a series of 25 annual incomes of $1.75 at 5 percent interest, which may be called a per-acre per-year added income from thinning. Since the annual cut of live trees is 500 bd.-ft., this amounts to $3.50 per M b.m. of thinned timber cut. This income, which is net after all road costs are included, is lost if thinning is not practiced.

The extra value in thinning in this case is from two sources, namely, (1) salvage of 125 bd.-ft. of mortality annually, and (2) income prior to final cut without substantial reduction in increment. These two financial advantages are well grounded on experimental evidence and in accord with sound silvicultural and practical

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4/ For example, the first cut of 500 bd.-ft would reduce the growing stock of 27,000 bd.-ft. by 1.85 percent. Increment in the first year after is assumed to be 850 bd.-ft. less .925 percent, or 842 bd.-ft. At the beginning of the second year the stand would have 27,000 - 500 + 842 = 27,342 bd.-ft. The second cut would reduce this growing stock by 1.83 percent and the 842 bd.-ft. increment by .915 percent. In the 25th year increment would be 702 bd.-ft., and the 25-year average 756 bd.-ft.

5/ An advantage in stumpage value of $0.50 per M b.m. (table 2) over the smaller and rougher average tree in the unthinned stand has been allowed.

management policies. Considerable acreage of young forest stands in western Washington can be thinned in a similar manner. The common policy of ignoring young-growth stands as an immediate timber source in computing allowable sustained-yield cut may need restudy.

Summary

The thinning of Douglas-fir in western Washington is often neglected by forest owners due to lack of knowledge of its long-term economic benefits. A current experiment in 55-year-old Douglas-fir on the McCleary Experimental Forest is demonstrating that light, frequent thinnings are both possible and profitable. An 8-year annual record has shown that cuts as light as 3,100 bd.-ft. per acre can be made for $23-$24 per M b.m., plus a road cost of $3.80 per M b.m. A labor efficiency of 1,100-1,400 bd.-ft. per man-hour was obtained. Financial comparison of the McCleary experience with a policy of not thinning has indicated a substantial financial gain ($3.54 per M b.m.) for thinning. This gain is due to the annual income received from the thinnings and the salvage of annual mortality prior to final harvest, without appreciable reduction of increment. Failure to thin, or postponement of thinning, may result in a substantial financial loss to the forest owner.