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DOUGLAS-FIR THINNING VALUES SENSITIVE TO PRICE-DIAMETER RELATIONSHIPS

by

Robert M. Randall, *Economist*

and

David R. Darr, *Economist*

ABSTRACT

This paper examines the impact of four alternative price-diameter relationships on the present net worths obtained from an evaluation of commercial and precommercial thinning in Douglas-fir stands varying by age and site class. Of special interest was how different relationships affected the magnitudes of projected returns and how rankings were affected. It was found that alternative assumptions could produce large differences in present net worth values in some cases, changing the financial desirability of thinning among stands of Douglas-fir. Analysis showed that large differences persisted over a wide range of interest rates.

Keywords: Stumpage prices, stand development, stand diameter (mean), thinning -) economic evaluation.

BACKGROUND

If an analyst attempts to project returns expected from managing a stand of timber, one of his tasks is to select stumpage prices for evaluation of intermediate and final harvests. Because these harvest yields occur at different stages of stand development, they represent various average tree diameter situations. The analyst must identify or assume a relationship between stumpage price and stand diameter.

In previous studies, when a price-diameter relationship has been considered in investment analysis, generally only one relationship has been used and the potential sensitivity of study results to stumpage price variation has not been fully examined. For example, Teeguarden[1/] calculated stumpage prices for stands averaging 10-inch d.b.h. at one-half the assumed price for a 19-inch d.b.h. and then assumed that prices for intermediate diameters would follow a linear relationship. In the "Douglas-fir Supply Study,"[2/] analyses were based on the assumption that prices for thinnings, salvage of dead trees, and smaller trees removed in prelogging equaled 75 percent of final harvest prices. Exceptions were Lundgren,[3/] Rose,[4/] and Chambers and Pierson,[5/] who examined some investment effects of alternative price-diameter relationships.

This paper shows how present net worth values, derived for the financial evaluation of commercial and precommercial thinning opportunities in Douglas-fir, can be influenced by any one of four alternative assumptions about price-diameter relationships. The paper also shows how these assumptions can influence expected returns and decisions associated with thinning Douglas-fir.

[1/] Dennis E. Teeguarden. Economics of replacing young-growth ponderosa pine stands...a case study. USDA Forest Service Research Paper PSW-47, 16 p. Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif., 1968.

[2/] USDA Forest Service. Douglas-fir supply study. 53 p., illus. USDA Forest Service, Regions 5 and 6 and Pacific Northwest Forest and Range Experiment Station, Portland, Oreg., 1969.

[3/] Allen L. Lundgren. Thinning red pine for high investment returns. USDA Forest Service Research Paper LS-18, 20 p., illus. Lake States Forest Experiment Station, St. Paul, Minn., 1965.

[4/] Dietmar W. Rose. Stumpage dimensions and stumpage value. The Forestry Chronicle 49: 226-227, 1973.

[5/] Charles J. Chambers and Richard N. Pierson. Does commercial thinning pay under sustainable harvest? Oregon State University. Short course on management of young Douglas-fir and western hemlock, June 13, 1973. Proceedings in press.

FRAMEWORK FOR ANALYSIS

Evaluations of the contribution to present net worth of commercial and precommercial thinning in several Douglas-fir stands varying by age and site class provided the basis for testing four assumed price-diameter relationships.[6/] The four price-diameter relationships tested are as follows:

1. The average value per thousand board feet, Scribner scale, for all stumpage harvested in thinning operations equals 75 percent of the average value of final harvest stumpage of $30 per thousand board feet (based on 1970-71 prices).

2. The average value of stumpage from thinnings equals the average value of stumpage from final harvest operations and is equal to $30 per thousand board feet.

3. The average value of 8-inch-d.b.h. trees is equal to 75 percent of the average value of trees 20 inches and over, and the stumpage increases in value proportionate to increases in diameter breast high up to 20 inches which has an average value of $30 per thousand board feet.

4. Stumpage price is equal to a function of the logarithm of average stand diameter.

$$P = a + b \log (D)$$

where

P = stumpage price

a and b are constants

D = average stand diameter

We used these assumptions to derive four sets of present net worth values which were then analyzed to determine what effects, if any, varying assumptions might have on the values and the decisions based on them. Because local market conditions vary and can change over time, our list of price-diameter relationships is by no means exhaustive. The validity of any one of our four or other possible relationships will depend on local market conditions, which can change over time. For example, adoption of small log technology by mills in an area may increase the value of small-diameter timber relative to larger timber.

[6/] Additional details concerning the procedures and data base used in calculating present net worth of commercial and precommercial thinning in Douglas-fir are contained in an office report and may be obtained upon request from the authors.

RESULTS

Figure 1 shows the contribution to present net worth of commercial thinning in Douglas-fir stands classified by site class and stand age. Four assumptions are shown for each age-site combination. The numbers correspond to the numbered assumptions outlined in the preceding section. For any assumption, the relative benefits of thinning in stands varying by age and site class can be determined and compared. For example, using assumption 2, one can determine that thinning begun in a site I stand at age 50 is valued at $406 and thinning begun in a 30-year-old stand on the same site is valued at $258. Managers could use such information, with information on budget and manpower ceilings and limitations on cutting of volume and acreage, to derive rankings which could be used to determine the order of cutting.

Figure 1 also shows that different assumptions about the price-diameter relationship can influence the relative ordinal ranking of stands based on the level of present net worth. For example, assumption 1 gives a higher value for a 45-year-old site II stand than it does to a 55-year-old site II stand. Assumptions 2, 3, and 4, however, give the 55-year-old stand a higher value.

Figure 1 can also be used to derive the difference in present net worth between the assumption producing the highest value and the assumption producing the lowest value for each site-class, stand-age combination. Thus, figure 1 also gives a measure of the magnitude of differences in present net worth values that can result from changing assumptions. For example, the 45-year-old site II stand has over four times the value with assumption 2 than when assumption 4 is used. If for planning purposes, management wants reasonably close estimates of cash flows from commercial thinning, then the assumption used can make a substantial difference. Figure 2 shows that varying interest rates do not change the results shown in figure 1. We use as an example the same site-II, age-45 stand described above. The values generated by the different assumptions tend to maintain their position even though interest rate varies from 3 to 10 percent.

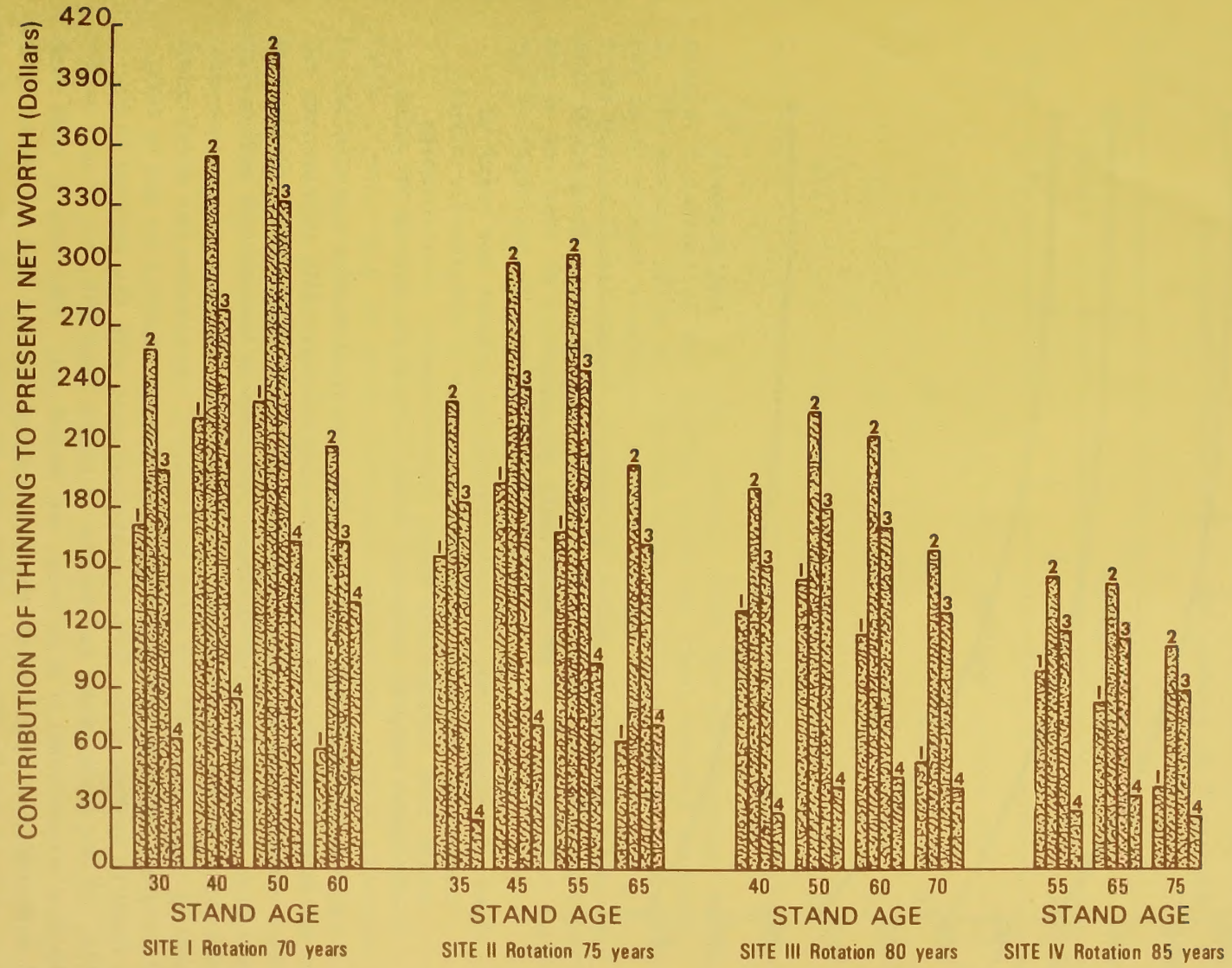

Figure 1.--Comparison of contribution to present net worth of commercial thinning in Douglas-fir stands varying by age and site class under each of four assumptions about price-diameter relationships. Discount rate is 5 percent.

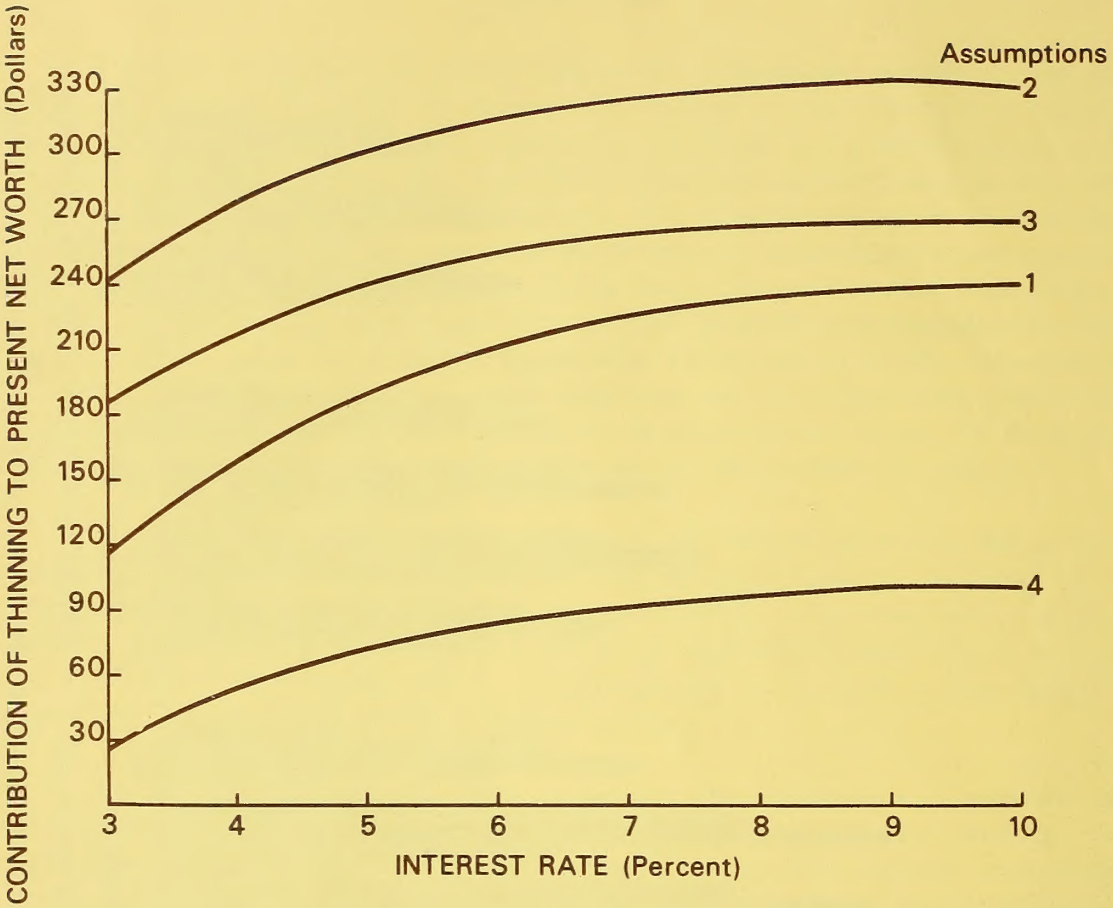

Figure 2.--Comparison of contribution to present net worth of commercial thinning in an age-45, site-II Douglas-fir stand under four assumptions about price-diameter relationships and under varying interest rates. Rotation age is 75 years.

The price-diameter relationship assumed can be especially crucial to the decision of whether to precommercially thin or not. Unlike commercial thinning where costs are recovered in the current operation, precommercial thinning involves an investment with returns deferred to some future time. To illustrate, assume precommercial thinning costs are $60 per acre and table 1 represents the discounted net returns from future harvests. To decide whether or not to thin, we need to compare the $60-investment cost with the entries in the table. If the discounted net return is more than $60, we would undertake the investment; if it is less, we would not. For site I, note that all assumptions would allow the investment but for site III, none of the assumptions would allow it. With site II, however, the decision depends upon the assumption made. Assumptions 2 and 3 show benefits exceeding the cost, but assumptions 1 and 4 show the cost to exceed discounted returns.

Table 1.--*Net returns in dollars per acre from harvests expected after precommercial thinning at age 15 in Douglas-fir. Net returns discounted to the present at 7 percent*

Site	Assumptions[1/]			
	1	2	3	4
	Dollars			
I	65	88	80	65
II	53	71	64	54
III	36	48	43	34

[1/] Assumptions: 1. The average value for all thinning stumpage equals 75 percent of the average value for final harvest stumpage. 2. The average value of thinning stumpage equals the average value for final harvest stumpage. 3. The average value of 8-inch-d.b.h. trees equals 75 percent of the average value of trees 20 inches and over. Stumpage between 8 and 20 inches increases in value proportionate to increase in diameter. 4. Stumpage price is equal to a function of the logarithm of average stand diameter.

In conclusion, this study demonstrates that care should be taken in selecting the price-diameter assumption used to evaluate forest management activities. The results show that not only can the assumption influence the priority of projects selected and the estimates of benefits expected, but that it can be decisive in influencing the project's financial feasibility.

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Mailing address: Pacific Northwest Forest and Range Experiment Station
P.O. Box 3141
Portland, Oregon 97208