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# DOMINANT PONDEROSA PINES DO RESPOND TO THINNING

by

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In 1953, a study was established in a pole-sized stand of ponderosa pine (Pinus ponderosa) to determine the growth response of dominants released from all lower crown class tree competition.[1/] This research note presents the results measured 6 years after thinning and discusses their significance and application.

Forest trees in a dominant position appear to have much greater access to light, nutrients, and moisture than do associated lower crown class trees. While it seems logical that such dominants in an unthinned stand would grow at near capacity, this study showed that dominant ponderosa pine poles respond markedly to complete removal of all adjacent subordinate trees. Thus, stands having a good distribution of dominant trees need not be bypassed culturally because of the belief that they are growing as rapidly as possible. Such stands may be treated to further accelerate growth of the fastest growing trees to help attain desired size classes at an earlier age.

## EXPERIMENTAL AREA

The study is located on the Pringle Falls Experimental Forest in central Oregon. The stand, situated on a south-facing slope, was 65 years old at the time of plot establishment in 1953. Heights of

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[1/] Establishment of this study and collection of much of the field data was by Walter G. Dahms.

scattered old-growth trees proximate to the study area indicated a site index of 78, although heights of pole-size trees indicated a site index of only 60.[2/] No significant mortality had taken place in the stand for a number of years. Tree density for age 65 was considerably greater than shown in tables for normal stands,[3/] but such overstocked stands are common in central Oregon.

Soil in the study area is the Lapine series, a Regosol developed in dacite pumice from the prehistoric Mount Mazama eruption. The pumice layer, averaging about 33 inches deep, covers a much older, fine-textured, sandy loam residual soil containing cinders and basalt. Average annual precipitation is about 24 inches.

## THE STUDY

Each of the ten 1/10-acre plots, established on a 300-acre segment of the 65-year-old stand, was carefully selected to minimize variation in stand structure. Dominant trees on the 10 plots were number tagged. Treatment consisted of removing all subordinate trees on each of five randomly selected plots, while the remaining five plots were left unthinned to serve as controls.

Measurement data recorded at beginning and end of the 6-year period consisted of diameter, total height, and height to green crown. These measurements were made on all released dominants on the five thinned plots and on comparable tagged dominants on the five unthinned plots. Cubic-foot volume of tagged trees was computed, using a formula derived from stem measurements made on standing trees. This approach to volume computation gave more confidence to volume increment comparisons between treatments than use of a standard volume table.

## STAND FEATURES

Before treatment, both thinned and unthinned stands were similar in cubic volume, basal area, and height, although some difference in average diameter and number of trees existed (table 1).

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[2/] Meyer, Walter H. Yield of even-aged stands of ponderosa pine. U. S. Dept. Agr. Tech. Bul. 630, 60 pp., illus. 1938.

[3/] See footnote 2.

Very little ground vegetation was evident at the time of thinning (fig. 1). An occasional plant of antelope bitterbrush (Purshia tridentata), snowbrush ceanothus (Ceanothus velutinus), and pine manzanita (Arctostaphylos parryana var. pinetorum) was found.

Dominant trees constituted only about 9 percent of the number before treatment but accounted for approximately one-third of the total stand basal area (table 1). On the average, cubic-foot volume of dominant trees was about 10 percent greater on the unthinned plots than on the thinned plots. Spacing between dominant trees averaged 17 feet. Treatment contrast is readily seen in figures 1, 2, and 3.

Table 1.--Average characteristics of thinned and unthinned stands at age 65 and 6 years later (per acre)[1/]

| Stand | Stand age | Number of trees | Average d.b.h. | Average height | Basal area | Volume[2/] |
|---|---|---|---|---|---|---|
| | Years | | Inches | Feet | Sq.ft. | Cu.ft. |
| Thinned: | | | | | | |
| Total stand (before thinning) | 65 | 1,874 | 4.12 | 32 | 173.2 | 2,537 |
| Dominant trees (residual stand) | 65 | 156 | 7.57 | 42 | 48.1 | 774 |
| Dominant trees | 71 | 156 | 8.57 | 47 | 61.6 | 1,079 |
| Unthinned: | | | | | | |
| Total stand | 65 | 1,504 | 4.54 | 33 | 169.1 | 2,434 |
| Total stand | 71 | 1,408 | 5.09 | -- | -- | -- |
| Dominant trees | 65 | 154 | 7.93 | 43 | 52.8 | 855 |
| Dominant trees | 71 | 154 | 8.45 | 48 | 60.0 | 1,056 |

1/ Average of five thinned and five unthinned plots, each one-tenth acre in size

2/ Volume of entire stem, inside bark.

Figure 1.--Typical stand condition before thinning. Plot supported 172 square feet of basal area per acre.

Figure 2.--Same stand (fig. 1) immediately after thinning. Plot has 44 square feet of basal area. Dead limbs have been pruned from all remaining trees.

Figure 3.--Same stand (figs. 1 and 2) 6 years after thinning, showing the decomposition of thinning slash.

## GROWTH RESPONSE

### Diameter

Dominant tree diameter increment in the thinned stand was twice that of comparable trees in the unthinned stand for the 6-year period (fig. 4). On the average, response was essentially the same for all diameters observed. In terms of yearly increment, thinned trees grew 0.165 inch compared with 0.087 inch for unreleased trees. Increment cores from released trees indicate that a very small portion of the response to thinning occurred during the first 2 years. Most of this rather surprising increment, therefore, occurred during the latter part of the observation period. Future increments could be substantially greater than for the period reported here.

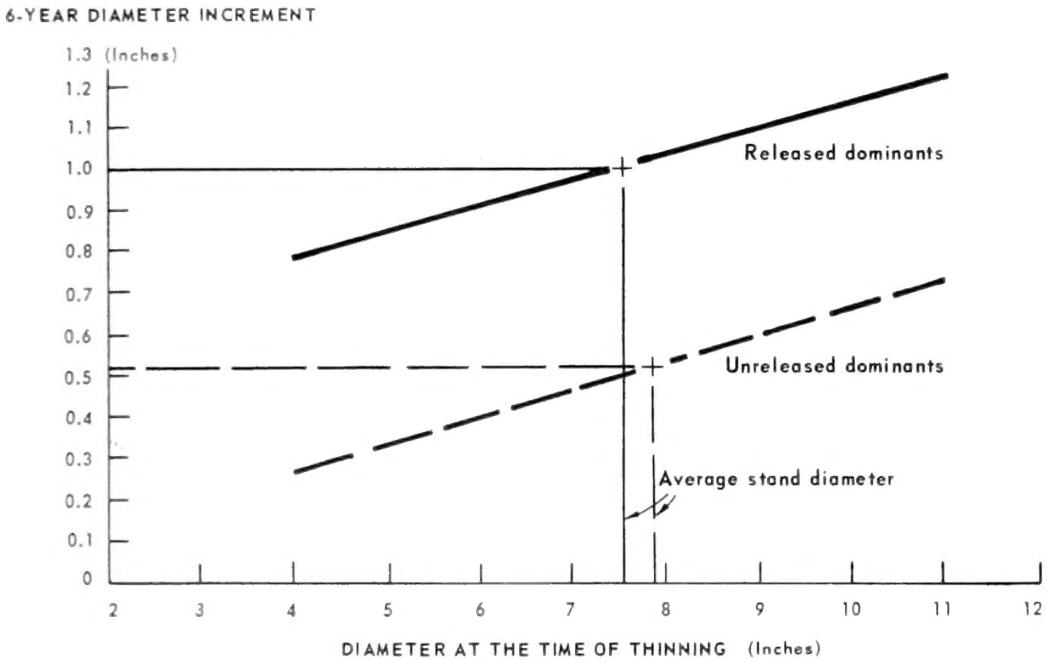


Figure 4.--Average 6-year diameter growth of dominant ponderosa pine in relation to initial diameter.

The growth-retarding influence of lower crown class trees on diameter of dominants can be substantiated further by measurements taken in an adjacent comparable, thinned stand.[4/] Diameter growth of dominant trees of the adjacent stand averaged 0.123 inch annually in contrast to 0.165 inch for the dominant trees of the study reported here. This growth comparison was made using equal numbers of trees from each stand. However, the adjacent stand had sufficient numbers of subordinate crown class trees to constitute an overall spacing of 9 by 9 feet compared with the 17- by 17-foot spacing of the dominant trees of the study plots where all subordinate crown class trees were removed. This indicates that even the moderate numbers of subordinate trees of the 9- by 9-foot spacing reduced growth of dominant trees.

A similar response has been recognized in dominant Douglas-fir poles where only two or three adjacent competing trees are removed.[5/]

## Height

Height growth was not significantly affected by thinning during the 6 years of observation. Growth ranged from a plot average height of 1.15 feet per year per released dominant to a low of 0.68 foot on a control plot. Average height growth between thinned and unthinned stands differed only by 0.07 foot. Past thinning experience in this species has shown this lack of response in height growth to be expected in the early years after thinning. In adjacent plots thinned to 9- by 9-foot spacing, height growth response did not become evident until the end of the second 5-year period of observation.[6/]

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[4/] Barrett, J. W. and Mowat, E. L. Fourth progress report on ponderosa pine thinned plots 14-18, Pringle Falls Experimental Forest. Unpublished typewritten report. Pac. NW. Forest & Range Expt. Sta.

[5/] Reukema, Donald L. Response of individual Douglas-fir trees to release. U. S. Forest Serv. Pac. NW. Forest & Range Expt. Sta. Res. Note 208, 4 pp., illus. 1961.

[6/] See footnote 4.

## Volume

Volume increment of the five thinned plots averaged 50.7 cubic feet per acre per year. Dominant trees in the unthinned stand produced only an average of 33.5 cubic feet per acre per year. The difference of 17.2 cubic feet between thinned and unthinned stands is significant at the 5-percent level of probability. The yearly production rate of 50.7 cubic feet per acre in the thinned stand has already reached 65 percent of full production as determined from adjacent fully stocked stands.

Regression showing individual tree volume increment (fig. 5) indicates that even the very largest trees of superior dominance are capable of response.

## CROWN CHANGE

Very few of the lowest limbs on released trees died, but more than 2.5 feet (measured along the bole) of lower crown died on

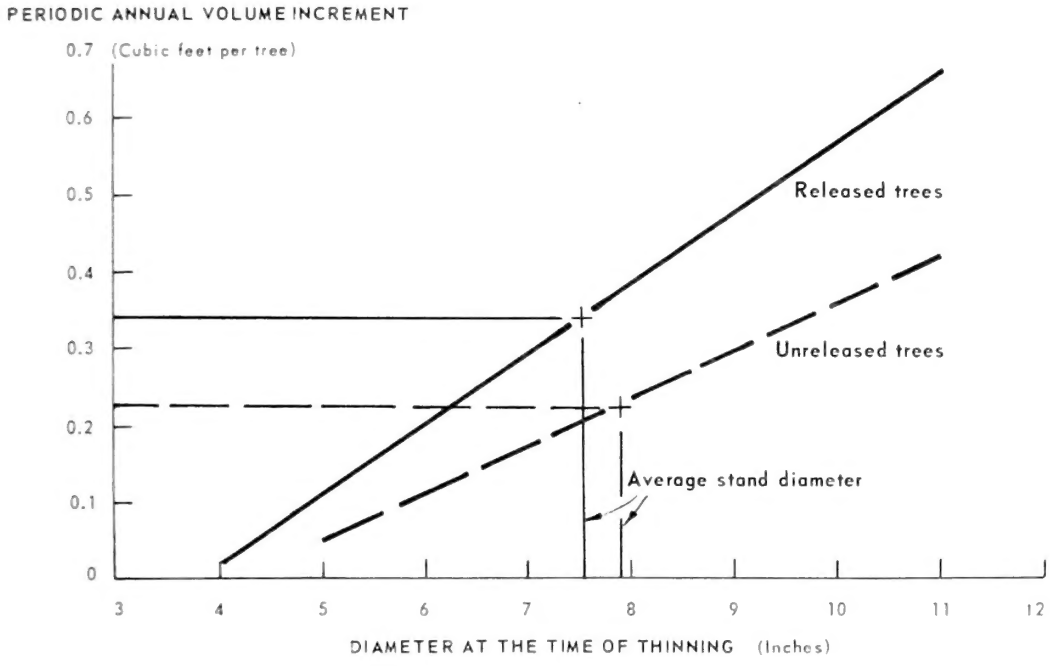


Figure 5.--Average annual cubic-foot volume increment per dominant tree in relation to initial diameter.

unreleased dominants. Height to green limbs on dominants of the unthinned stand increased from 19.2 to 21.8 feet in 6 years. On released trees height to green limbs increased only 0.3 foot.

Lumber grade recovery might be significantly affected by this trend. During the early commercial harvests, the quality advantage might be in favor of the thinned stand because tight, green knots are preferred to loose, dead knots. Later, however, as trees approach maturity, persistence of green limbs could reduce accretion of high-quality, clear wood. Artificial pruning of lower limbs, dead or alive, would minimize the problem.

## CONCLUSIONS

In this experiment dominant ponderosa pine poles responded to thinning. During the first 6 years after thinning, dominant tree response to release was in diameter increment with no clear-cut stimulus to height growth. Response to release based on width of growth rings was about the same for all size classes from 4 to 12 inches d.b.h. Cubic volume, of course, accumulated at a greater rate on released trees.

Lower crown on released trees remained live longer than on dominant trees in the natural, unthinned stands. Without pruning, this trend could lead to significant lumber grade differences between thinned and unthinned stands.

Release of dominant trees to wide spacing may help to maintain or stimulate the flow of wood to market by accelerating attainment of tree size classes which might be lacking in the existing stand structure.