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Thinning Young Oak Stands On Poor Sites In Southern New Jersey Does Not Pay

Between 1933 and 1940 the Civilian Conservation Corps undertook many cultural operations in the state forests of southern New Jersey; one of the most common was thinnings in predominantly oak stands on upland sites. The thinnings varied from very light--removing only trees that would soon die--to very heavy. They were usually justified on the prevalent notion that growth of the residual stems would be stimulated.

This same justification is still being used to some extent today for thinning oak stands on poor sites in the Northeast. But is the growth of residual stems markedly stimulated? Let's look at the results from a thinning study started in the Lebanon Experimental Forest near New Lisbon, N. J., in 1935.

Experimental Methods

The site selected for the study was typical of many upland soils in the Pine Region of southern New Jersey. It had a well-drained Evesboro soil. Moore states that in this section the oaks are generally 40 to 50 feet tall when 40 to 50 years old,[1] thus indicating a site index of about 50 feet.

The stand selected was also typical in many ways. It had about 1,950 stems per acre larger than 0.5 inch in diameter (breast high), all but 28 of which were oaks. The hardwoods were chiefly black, white, and chestnut oaks, with a few scarlet and post oaks. All were sprouts, usually from large stools; and most of them had started after a wildfire

[1] Moore, E. B. Forest management in New Jersey. N.J. Dept. Conserv. and Devlpmnt. 55 pp., illus. 1939.

13 years before. Thus the majority of oaks were less than 3.5 inches d.b.h. and less than 25 feet tall when the study started. The largest oak in the study area was 6 inches in diameter, 32 feet tall, and had lived through the last wildfire. A few shortleaf and pitch pines of various sizes were scattered through the stand.

A 4-acre block of plots was established for this study--sixteen 1/16-acre plots, each of which was surrounded by a 3/16-acre isolation strip that received the same treatment. These plots were arranged in a Latin Square.

Three thinning treatments and an untreated control were used, each in 4 plots. The light, medium, and heavy thinnings removed 13, 29, and 46 percent respectively of the original basal area; or 33, 52, and 72 percent of the original number of stems.

D.b.h. of all stems, both those cut and those left, and total height of each stem left were measured in 1935. Individual trees were tagged, and individual-tree records were kept. In 1955 the diameters of all trees were again measured to the nearest 1/10 inch. And total heights were measured on a sample of 5 oaks, if available, in each of the following 1935 diameter classes in each plot: 1.1-1.5 inches, 1.6-2.0 inches, 2.1-2.5 inches, and 2.6 inches or more.

Results

Thinning greatly reduced the mortality of oaks during the 20-year period. In the unthinned controls 54 percent of the oaks died during that interval. Where light thinning was used, 35 percent died; medium thinning 19 percent; and heavy thinning 4 percent.

This mortality and the initial effect of the thinning on the number and size of oaks, of course, make the results confusing. For example, if we consider the 20-year change in basal area of all oaks in the stand, there's an appreciable difference in results between figuring this on the basis of trees living in 1935 and using only those living in 1955 (table 1). Thinning increased net growth in basal area, but the basal-area growth per acre of all oaks living in 1955 was greatest in the unthinned and lightly thinned plots. Since thinning greatly reduced the initial basal area, as well as losses through mortality, it greatly increased growth percent: the difference between heavy and no thinning is 5.9 percent for net annual growth in basal area, 2.3 percent when based on trees living in 1955.

Thinning from below of course changed the average diameter of the oaks in these plots in 1935--from 1.7 inches in the controls to 2.3 inches in the heavily thinned areas. But by 1955 natural dying had also eliminated most of the smaller stems in the lightly thinned or unthinned areas. For example, in the unthinned controls 85 percent of the oaks that were 1 inch in diameter in 1935 had died. Thus the average diameters in 1935 of the oaks living in 1955 differed only slightly among the treatments (table 1).

Table 1.--20-year effects of thinning on the changes in basal area and diameter of oaks

Treatment	20-year increase in basal area per acre[1]		Average diameter (b.h.)		
			1935		1955
	All oaks	Oaks living in 1955	All oaks	Oaks living in 1955	
	Sq.ft.	Sq.ft.	Inches	Inches	Inches
Heavy thinning	34.8	35.1	2.3	2.3	4.2
Medium thinning	34.9	36.9	2.1	2.2	3.8
Light thinning	33.9	39.6	2.0	2.2	3.6
No thinning	31.2	39.6	1.7	2.1	3.5

[1]First-column values are less than those in the second because they are net values, having been reduced by the basal area in trees that died since 1935.

Some of the data in table 1 might be interpreted as showing that thinning did affect the diameter growth of all oaks living in 1955. Those in the heavily thinned plots grew 1.9 inches in the 20 years, compared to 1.6 or 1.4 inches in the other treatments. And the difference between heavy thinning and the other treatments was statistically significant.

But remember that in 1955 the thinnings still have a great effect on the number of oaks per acre. In the controls there are 916 oak stems per acre, in the lightly thinned plots 868, medium thinning 688, and heavy thinning 512. Perhaps the slow growth of the smaller stems dragged down the values for all living oaks in the more lightly thinned or unthinned areas.

Consequently the growth in basal area of the 20 fastest growing oaks per plot was summarized and analyzed. Expressed in terms of d.b.h., this amounted to 2.2 inches per tree in the heavily thinned plots, 2.1 under medium thinning and in the controls, and 2.0 in the lightly thinned plots. The analysis of the basal-area data from which those diameter values were obtained indicated that the treatments produced no statistically significant differences.

Height growth was also unaffected by the thinning treatments, although it was affected by size class. Of the stems measured, those 1.1-1.5 inches in diameter in 1935 grew 6 feet in height (average) in the 20-year period; those 1.6-2.0 inches, 9 feet; those 2.1-2.5 inches, 13 feet; and those larger, 14 feet. Only among stems larger than 2.0 inches were there no significant differences between size classes.

By 1955 the largest oaks in all plots were between 5 and 8 inches in diameter, and between 35 and 52 feet tall.

Evidently the noncommercial thinnings of small oaks tested in this study did not appreciably stimulate the growth of the residual stand, and thus produced no practical benefits. Similar results should probably be expected elsewhere from thinning similar sprout stands of oaks growing on relatively poor sites.

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