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IN A 70 YEAR-OLD MIXED OAK STAND

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GROWTH INCREASE AFTER MODERATE THINNING IN A 70 YEAR-OLD MIXED OAK STAND

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ABSTRACT

The effect of a moderate intensity crown thinning on a mixed oak stand in the Hudson Highlands was monitored for 13 years. The results show: 1) a significant increase in total basal area, cubic footage, and board footage on the thinned area compared to the control area; 2) a highly significant increase in mean basal area increment for Northern Red Oak and White Oak on the thinned area; and 3) a significant lower mortality rate on the thinned area.

Introduction

Thinning, although an accepted tool of the forest manager, is often neglected in practice because of limitations on time and money or because it is felt that it would produce no real response in a particular situation. Some studies show that Northern Red Oak (*Quercus rubra*) and White Oak (*Quercus alba*) respond well to release (U.S.D.A., 1965). Roach and Gingrich (1962) found that, on medium sites, oak stands could be thinned successfully up to an age of 60 to 70 years. In contrast to this, Carvell (1971) found no significant increase in diameter growth after thinning stands of Northern Red Oak and White Oak older than 40 years.

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TABLE 1. STAND COMPOSITION PRIOR TO CUTTING (1960)

DBH Class	Stems Per Acre by Species							Total
	NRO	WO	BO	CO	SM	RM	Other*	
4	-	1	-	13	12	3	13	42
6	10	5	-	5	8	1	7	36
8	10	3	-	1	5	-	3	22
10	23	-	-	5	3	3	-	34
12	17	3	1	3	-	-	-	24
14	8	3	5	-	-	-	-	16
16	5	1	3	1	-	-	1	11
18	1	-	-	-	-	-	-	1
Total	74	16	9	28	28	7	24	186
BA/Acre	49.07	10.08	11.57	12.71	5.76	2.15	4.38	95.72
BA %	57	11	12	13	6	2	5	100

*Other includes: ash, dogwood, black gum, hemlock, hickory, black birch, and poplar

TABLE 2. STAND GROWTH IN BASAL AREA AND VOLUME PER ACRE*

	Year		Change	Percent increase†
	1960	1973		
Basal Area Feet	95.7 [63.5]	97.5 [83.0]	1.8 [19.5]	1.8 [30.7]
Board Feet	6372 [4887]	8663 [7112]	2291 [2225]	36.0 [45.5]
Cubic Feet	2545 [1657]	2648 [2102]	103 [445]	4.1 [26.8]
Standard Cords	31.8 [20.8]	33.1 [26.3]	1.3 [5.5]	4.1 [26.4]

*Numbers not in brackets represent Control Plots, numbers in brackets represent Thinned Plots.

†The increase in B.A., B.D. and Cu. Ft. volume are significantly greater on the Thinned Plots than on the Control Plots ($\alpha = .05$).

This paper presents the results of a 13 year thinning study in a mixed oak forest. The data support the statement by Roach and Gingrich (1962) that thinning may achieve worthwhile results in previously unthinned oak stands even though they are past the usual top thinning age of 60 or 70 years.

THE STUDY AREA

The thinning study was started in 1960 in a mixed hardwood stand on the Harvard Black Rock Forest, Cornwall, New York. The study area had no history of agricultural clearing. Prior to the thinning the most recent silvicultural treatment of the stand was the removal of dead, dying and diseased trees for cordwood in 1933. Then very few healthy or suppressed trees were cut in order to maintain "the local climate as far as possible" (Tryon, 1933). In 1960, the stand was predominantly oak with Northern Red Oak comprising about 50 percent of the basal area in the stand before thinning. White Oak, Black Oak (*Q. velutina*), and Chestnut Oak (*Q. prinus*) together contained 36 percent of the basal area. Red Maple (*Acer rubrum*), Sugar Maple (*A. saccharum*), White Ash (*Fraxinus americana*), Flowering Dogwood (*Cornus florida*), Black Gum (*Nyssa sylvatica*), Hemlock (*Tsuga canadensis*), Black Birch (*Betula lenta*), and Poplar (*Populus* spp.) were represented in smaller numbers (Table 1).

The study area, with an average elevation of 500 feet, was located on thick glacial till overlaid by clay loam (Denny, 1938). In 1973, the Site Index was calculated to be 55 (Schnur, 1937) with heights of dominant trees ranging from 56 to 75 feet and ages from 65 to 95 years. The area had excellent stocking with trees of better than average form. Six one-fifth-acre plots were set up, three in the area to be thinned and three outside the area to serve as controls. All trees 3.5 inches and larger in diameter were numbered and measured. The mean diameter was 9.4 inches with the range from 3.5 to 17.0 inches.

THE THINNING

In 1960, the stand was given a moderate crown thinning which removed approximately one-third of the basal area on 9.3 acres (Table 2). The trees to be logged were marked, bucked into lengths for fuelwood, and removed from the area with a wagon and horses in order to minimize logging damage. Eleven cords per acre were cut; 20.8 cords of timber were left standing with space for individual tree development. No attempt was made to favor trees on the basis of species, hence the stand composition was not changed significantly by the logging operation.

TABLE 3. STAND COMPOSITION IN POOLED PLOTS AFTER 13 YEARS OF GROWTH*

DBH Class	Stems Per Acre By Species										TOTAL
	NRO	WO	BO	CO	SM	RM	ASH	OTHER†			
4	-	1 [-]	-	1 [7]	5 [5]	10 [-]	- [-]	17 [8]			34 [20]
6	3 [-]	1 [-]	-	1 [1]	7 [10]	5 [-]	- [1]	15 [10]			32 [22]
8	5 [1]	1 [-]	-	- [-]	8 [-]	- [-]	- [7]	1 [3]			15 [11]
10	8 [7]	-	-	1 [1]	- [3]	3 [-]	- [3]	1 [-]			13 [15]
12	15 [12]	-	-	1 [-]	5 [-]	- [-]	- [5]	1 [1]			21 [26]
14	10 [3]	3 [-]	5 [1]	1 [-]	- [-]	- [-]	- [-]	- [1]			19 [5]
16	8 [12]	1 [3]	3 [1]	- [-]	- [-]	- [-]	- [-]	- [-]			12 [16]
18	5 [7]	1 [-]	-	1 [-]	- [-]	- [-]	- [-]	1 [-]			8 [7]
Total	54 [42]	8 [9]	8 [5]	6 [9]	25 [18]	18 [0]	0 [16]	35 [23]			154 [122]
B.A./Acre	49.38 [46.09]	9.52 [9.49]	10.31 [6.83]	7.35 [1.22]	8.41 [3.52]	3.20 [-]	- [8.19]	9.30 [7.99]			97.47 [83.33]
Square Feet											
B.A. %	50 [56]	10 [11]	11 [8]	8 [2]	9 [4]	3 [0]	[9]	9 [10]			100 [100]

*Numbers not in brackets represent Control Plots, numbers in brackets represent Thinned Plots.

†OTHER includes: red maple, black gum, black birch, hemlock, dogwood, basswood and sassafras.

RESULTS

Total basal area, cubic footage, and board footage were calculated for the thinned and control plots (Table 2). Statistical comparison of the 13-year growth results showed the thinned plots with significantly greater performance in all categories (Z test $\alpha = .05$). The mean basal area increment was calculated by species and compared by treatment using the t test. For all species, this increment was greater on the thinned plots than on the control plots. The differences were highly significant ($\alpha = .01$) for Northern Red Oak and White Oak. These species together comprised about 65 percent of the basal area in the stand.

An interim measurement was made in 1965. By that time, 15 trees had died, 14 on the control plots and one on the thinned plots. When the final measurement was made in 1973 an additional 19 trees had succumbed, 18 on the control plots and one on the thinned plots. The mortality rate was 27.3 percent on the control area and 2.9 percent on the thinned area. This differential mortality was statistically significant (Z test $\alpha = .01$).

Ingrowth (3.5 inches plus in diameter) was measured in 1965 and 1973. Four trees were added to the tally in 1965, 23 more in 1973, all in the control areas. The 27 trees represent nine species and added about 2.2 basal area feet per acre to the total figure.

The thinning opened up the canopy enough to produce luxuriant undergrowth. Most of the undergrowth is shrub and tree reproduction, with Red Maple, Dogwood, Alder (*Alnus incana*), Black Birch, and Oak sprouts having definite lead. The thinning did not result in epicormic branching, ice damage or windthrow.

The 1973 Stand Table (Table 3) shows that the distribution of species by diameter class and basal area is quite similar on the two areas.

CONCLUSIONS

Since this study was relatively small and limited to one locality, any conclusions drawn from the data must be considered tentative. However, for stands of similar age and species composition, located on comparable sites, the data support the following observations:

1. Crown thinning produced a significant increase in basal area, board feet and cubic feet production.
2. Crown thinning promoted highly significant growth increment increases on Northern Red Oak and White Oak.

3. Moderate crown thinning reduced oak mortality in these well-stocked stands.
4. Although growth in board feet was almost unchanged, cordwood and cubic feet growth was over four times greater in the thinned area.

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