RESEARCH NOTE NC-115

NORTH CENTRAL FOREST EXPERIMENT STATION, FOREST SERVICE—U.S. DEPARTMENT OF AGRICULTURE

Folwell Avenue, St. Paul, Minnesota 55101

WHITE PINE PRODUCTION BEST AT HIGH STOCKING

ABSTRACT. — Basal-area growth, board-foot growth, and total board-foot production increase with residual stand densities ranging from 80 to 140 square feet per acre.

OXFORD: 561.25:562.2:228.1:174.7 *Pinus strobus* **(776). KEY WORDS: basal-area growth, board-foot growth, board-foot volume.**

Eastern white pine (*Pinus strobus* L.), once the major conifer in the Lake States, now forms stands on only 134,000 acres in Minnesota, of which two-thirds is classified as poor site.[1] However, if relatively insect and disease free, these stands can have high growth rates.[2]

A high growth rate has been maintained for 15 years in a white pine density study installed in 1954 when the stand was 80 years old. The stand, located in north-central Minnesota, was released from overstory aspen in 1934. It is not known how early height growth was affected by this overstory; apparent site index of the area is 57 feet (age 50). Before thinning in 1954, the basal area averaged 156 square feet per acre and volume averaged 22,330 board feet.

Four density levels are being tested in this study — 80, 100, 120, and 140 square feet per acre. Each treatment covers approximately 6 acres. Although the study is not replicated, each density contains six to eight 1/5-acre measurement plots. The stand was thinned to assigned basal areas in 1954, 1959, and 1964. Each thinning favored the bigger or healthier trees.

Although basal area growth decreased sharply in the last 5 years, the average annual basal-area growth during the 15-year period ranged from 2.56 square feet per acre at a density of 80 square feet to 3.15 square feet per acre at 140 square feet (table 1).

Board-foot growth rates were high for the first 10 years, but like basal area growth, they decreased in the last 5 years. The most notable reduction was in the 140-square-foot treatment. This reduction was due to the loss of several large trees on each of three 1/5-acre plots, causing an even greater decrease in net growth. However, average annual board-foot growth values for the 15-year period ranged from 605 board feet per acre at a density of 80 square feet to 835 board feet per acre at 140 square feet. Although growth differences between adjacent density levels were not significant (95-percent level), the differences between the 80-square-foot level and the 120- and 140-square-foot levels were significant, thus indicating that volume growth increased with increasing stand density.

Total net production since the initial thinning also was related to stocking density (table 2). The 140-square-foot density level produced an average of

[1] *Stone, Robert N. A third look at Minnesota's timber. USDA Forest Serv. Resource Bull. NC-1, 64 p., illus. N. Cent. Forest Exp. Sta., St. Paul, Minn. 1966.*

[2] *Buckman, Robert E., and Zasada, Z. A. Five-year results of a growing stock density study in 85-year-old white pine. USDA Forest Serv., Lake States Forest Exp. Sta. Tech. Note 589, 2 p. 1960.*

Table 1. — *Effect of stand density on net annual growth per acre of white pine*

BASAL AREA GROWTH-SQUARE FEET

Residual basal area stocking (in sq.ft.)	Stand age (years)			
	80-85	85-90	90-95	80-95
80	2.88	2.86	1.90	2.56
100	3.48	3.20	2.16	2.95
120	3.30	3.44	2.46	3.07
140	3.78	4.08	1.60	3.15
BOARD-FOOT GROWTH[1/]				
80	666	684	466	605
100	804	838	480	707
120	822	938	618	793
140	942	1,102	460	835

1/ Scribner rule to 6-inch top d.i.b.

Table 2. — *Effect of stand density on periodic yield and total net production per acre of white pine*

BASAL AREA YIELD-SQUARE FEET

Residual basal area stocking (in sq.ft.)	Stand age (years)						Total net production since installation
	80	85	90	80-90	95 Stand	95 Stand + thinnings	
80	66.0	16.7	11.6	94.3	89.9	184.2	38.2
100	60.0	16.8	15.9	92.7	109.3	202.0	42.0
120	37.0	16.9	19.0	72.9	131.3	204.2	47.2
140	20.0	18.3	19.2	57.5	147.9	205.4	45.4
BOARD-FOOT YIELD[1/]							
80	7,600	2,890	2,120	12,610	17,240	29,850	9,080
100	5,870	2,900	2,670	11,440	20,940	32,380	10,610
120	2,820	2,930	3,530	9,280	25,160	34,440	11,890
140	1,780	3,170	3,450	8,400	28,350	36,750	12,520

1/ Scribner rule to 6-inch top d.i.b.

3,440 board feet per acre more than the 80-square-foot density. It is therefore concluded that maturing stands of eastern white pine will produce more board-foot volume with higher stocking densities, up to 140 square feet of basal area per acre.

BRYCE E. SCHLAEGEL
Associate Mensurationist
Northern Conifers Laboratory
Grand Rapids, Minnesota

1971

☆ U.S. GOVERNMENT PRINTING OFFICE: 1971—760-106/10 Region No. 6