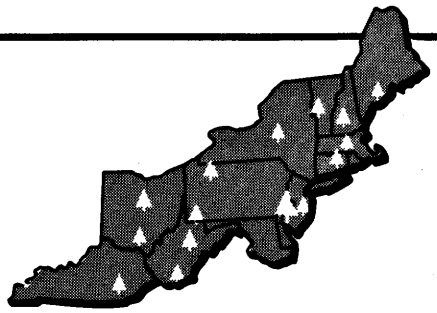
USDA FOREST SERVICE RESEARCH NOTE NE-215
1975

Northeastern Forest Experiment Station



FOREST SERVICE, U.S. DEPT. OF AGRICULTURE, 6816 MARKET STREET, UPPER DARBY, PA. 19082

A TEST OF POINT-SAMPLING IN NORTHERN HARDWOODS

—DALE S. SOLOMON
Research Forester
USDA Forest Service
Northeastern Forest Experiment Station
Orono, Maine

Abstract.—Plot- and point-sampling were compared with a complete inventory of two different stands of northern hardwoods. Prisms with basal-area factors of 5, 10, 20, 30, and 40 and a ¼-acre plot were used. Only the 5-factor prism gave a significantly different estimate. Therefore, a prism factor of 10 or greater is suggested for use in northern hardwoods.

Point sampling with a wedge prism is an effective means of estimating basal area per acre in forest stands. The theory and field use of the prism have been thoroughly described and many trials have been conducted (Husch 1955, Grosenbaugh and Stover, 1957). Prism cruising is applicable to most forest stands, but the efficiency of the cruise depends on the prism factor selected, the stand conditions, and the average size of the trees in the stand. The accuracy of cruises with different prism factors can be compared by standard statistical procedures.

Because of the lack of published information on prism cruising of northern hardwoods in New England, I conducted a study on the Bartlett Experimental Forest in the White Mountain National Forest of New Hampshire to compare the estimation of basal area per acre with five common prism factors and a circular ¼-acre plot with a 100-percent tally of the stand being sampled. The prism factors tested were 5, 10, 20, 30, and 40. These cover the range of the factors most commonly used for cruising forest stands in the East. The circular plot of ¼ acre (58.9 feet radius) was selected because it represents the area on which most trees would be sampled with the 10-factor prism. Almost all of the trees sampled by the 20-, 30-, and 40-factor prisms would be within the ¼-acre circular plot and only the larger trees counted by the 5- and 10-factor prisms could be outside the circular plot.

The two kinds of northern hardwood stands studied were: young sawtimber (60- to 80-year-old even-aged timber; Compartments 1 and 14), and sawtimber (over 80-year-old uneven-aged timber; Compartments 21 and

Table 1.—Estimates of basal area per acre obtained with five prisms and with ¼-acre plots, compared with measured basal area

Compartment	Acres	No. of sample points	Prism factor 40		30		20		10		5		¼-acre plot		Actual
			Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	B.A./acre
1	34.5	42	105.8	70.6	103.6	60.9	107.6	47.3	103.1	33.1	97.1	29.2	98.1	27.9	100.6
14	68.8	52	119.2	59.8	125.2	58.4	124.6	41.8	117.9	35.3	107.3**	20.2	118.9	17.3	119.2
21	39.6	50	116.0	70.7	120.4	63.4	112.0	50.2	106.6	29.7	94.8**	29.0	113.6	29.7	115.2
27	64.3	86	101.4	60.3	111.3	57.5	111.6	43.6	100.6	36.2	84.4**	24.1	100.0	26.0	102.6

** Significant at .01 simultaneous probability level by t test.

27). These stands provided a range of size classes and proportions of saplings and other undergrowth.

A base line was selected along one side of each compartment. Then cruise lines running north and south were laid out at randomly selected distances 2, 3, or 4 chains apart along the base line. Sampling points were placed at randomly selected intervals of 2, 3, or 4 chains along each cruise line. All five prisms were used at each point and a ¼-acre plot was centered on it. Points were taken wherever they occurred on the ground, except when they were closer than 58.9 feet (radius of the ¼-acre circular plot) to the compartment boundary; then the point was moved back so all of the ¼-acre plot was within the compartment. Point edge effect bias was handled as suggested by Grosenbaugh (1958), and the horizontal distance and dbh of questionable trees were measured to determine whether they should be counted.

Estimates of basal area per acre made with the five prisms and from the ¼-acre plot were compared with each other and with the actual basal area determined from the 100-percent tally. Simultaneous test procedures showed that only the differences between the tally and the estimates made with the 5 factor prism were significant (table 1).

The choice of prism depends upon the variability of the stand and the number of points that can be sampled economically. Prisms with lower factors produce lower standard deviations (s), but they require counting more trees at each point and therefore require more time.

The number of sample points per acre necessary to achieve a confidence interval of half-width d at the .95 confidence level is approximated by

$$n = 4\, s^2/d^2$$

where s^2 is the sample variance.

Literature Cited

Grosenbaugh, L. R., and W. D. Stover.
1957. POINT-SAMPLING COMPARED WITH PLOT-SAMPLING IN SOUTHEAST TEXAS. For. Sci. 3:2-14.

Grosenbaugh, L. R.
1958. POINT-SAMPLING AND LINE-SAMPLING: PROBABILITY THEORY, GEOMETRIC IMPLICATIONS, SYNTHESIS. USDA For. Serv. South. For. Exp. Stn. Occ. Pap. 160.

Husch, B.
1955. RESULTS OF AN INVESTIGATION OF THE VARIABLE PLOT METHOD OF CRUISING. J. For. 53:570-574.