WHAT ABOUT SIZE OF THE SAMPLE PLOT?

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The size of the sample has long been the subject for discussion among foresters as well as forester-photogrammetrists. Although the subject is not strictly photogrammetric in thought, it will concern photogrammetrists who must design inventory procedures and supervise the field investigation of the forest cover.

The size of the sample to be taken in the field for inventory purposes has an important effect upon the variation between plot volumes and the economy of the sample system. Statisticians will quickly realize that if the coefficient of variation can be substantially reduced, the number of samples required to meet a stipulated sampling error can in turn be reduced. At the same time it is important to keep in mind that the smaller the sample, the greater the number, the better the distribution, and the better the answer. There is a point of diminishing return on this theory, however, and we must examine further the economy of such thinking.

FIGURE 1. Size of Plot and Coefficient of Variation.

The shape of the sample will further influence the variation between plot volumes. Holes in the forest canopy tend to be more round in formation than square or rectangular, and it is quite possible, if taking a small circular plot, to find absolutely no trees growing on the plot. At the same time, a few chains farther on in the same stand a small circular plot might easily include four or five large volume trees. Larger plots tend to reduce the variation by the fact that even though they may include the same circular hole in the forest canopy,

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the plot will still have some volume recorded and the variance from the average will not be to such an extreme.

To study these variables one hundred plots in different shapes and sizes were taken in the same stand of average coastal stand variance. The plots were circular, triangular and rectangular in shape in sizes 1/100, 1/50, 1/20, 1/10, 1/5, 1/4, 1/3, 1/2, and 1 acre. At randomly selected points all sizes in each shape were taken recording the plot volumes. Each set of plots of a given size and shape was analyzed statistically to determine the limits of error, standard error of the mean, and coefficient of variation.

The effect of coefficient of variation on sample number was compared in the Girard formula as follows:

$$n = \frac{N \cdot x \cdot (t^2 c^2)}{N e + (t^2 c^2)}$$

where

n = number of plots to be taken

N = total number of possible plots (area to be sampled times number of plots per acre)

t = standard deviation

c = coefficient of variation (as a decimal)

e = allowable sampling error (as a decimal)

Sampling error using the same formula:

$$e = \sqrt{\frac{t^2 c^2 (N-n)}{nN}}$$

e = sampling error

Coefficient of variation is equal to the standard deviation divided by the arithmetic mean:

$$CV\% = \frac{Sx}{\bar{x}} (100)$$

The 1/2-acre rectangular plot, one chain by five chains, was determined to be the most efficient for old growth timber. See Figure 1, Curve "A". The 1/2-acre circular plot is shown in Curve "B" of Figure 1. The 1/10-acre rectangular plot, Curve "C" of Figure 1, was the most efficient for small non-merchantable stands in the six- to twelve-inch diameter group. The latter size drop was accounted for in the homogenous structure of the younger stands. Plots of greater size did not materially affect the coefficient of variation, while plots of other shapes did significantly increase the coefficient of variation. The 1/2-acre circular plot, although not displaying a significant increase in coefficient of variation at the 1/2-acre size, was found to be more time consuming and more susceptible to plot limit error than the 1/2-acre rectangular plot. The 1/3-acre rectangular plot could be used since it resembles the CV of the 1/2-acre rectangular, but the inconvenient computations in extensions by thirds ruled out this consideration. The decision to use the 1/2-acre rectangular plot was reached on the basis of the lower coefficient of variation and the fact that travel conditions in the area are often extremely difficult due to brush and down timber. Therefore, considerable time is saved by taking a fewer number of large plots over taking a greater number of smaller plots.