ESTIMATING CONE YIELD OF SHORTLEAF PINE

KENNETH W. SEIDEL [1]

The cone production of shortleaf pine *(Pinus echinata* Mill.) varies from year to year. It is often desirable to estimate cone yield so that timber sales can be scheduled to coincide with cone maturity, or to decide which trees in a seed-production area have enough cones to make collecting worth while. The results of a study in a shortleaf pine seed-production area in the Missouri Ozarks showed that there were actually about three times as many cones on a tree as indicated by a binocular count.

The data were obtained from a 40-year-old natural stand of shortleaf pine on the Centerville Ranger District, Clark National Forest, in Reynolds County, Mo. (fig. 1). It has been managed as a seed-production area since 1954 when the first thinning was made.

In the fall of 1965, the mature cones on 90 trees were counted with binoculars by two observers. Each observer counted cones on 45 trees. The binocular estimate of each tree was obtained by counting all

[1] Formerly Associate Silviculturist, U.S. Department of Agriculture, Forest Service, North Central Forest Exp. Sta., Columbia, Mo., field office maintained in cooperation with the University of Missouri Agricultural Experimental Station; now with Pacific Northwest Forest and Range Experiment Station, Bend, Oreg.

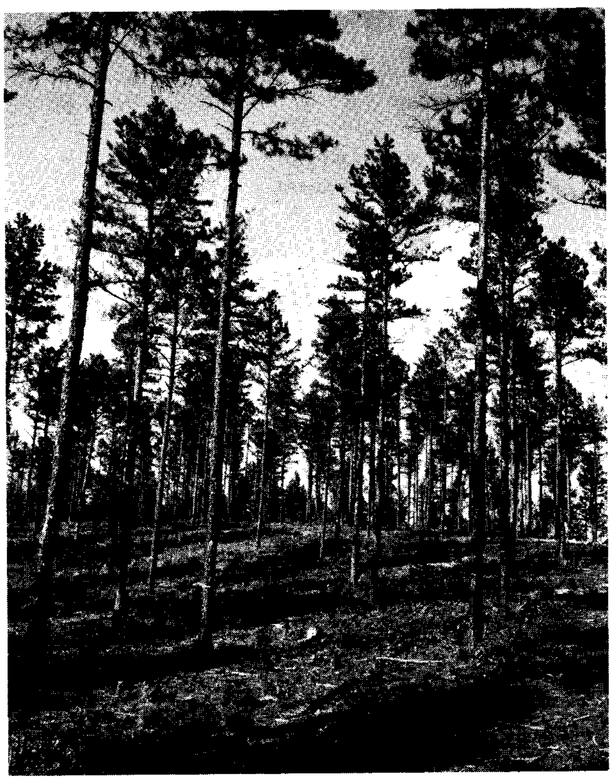

Figure 1.—Thinned shortleaf pine seed-production area. Understory hardwoods have been controlled.

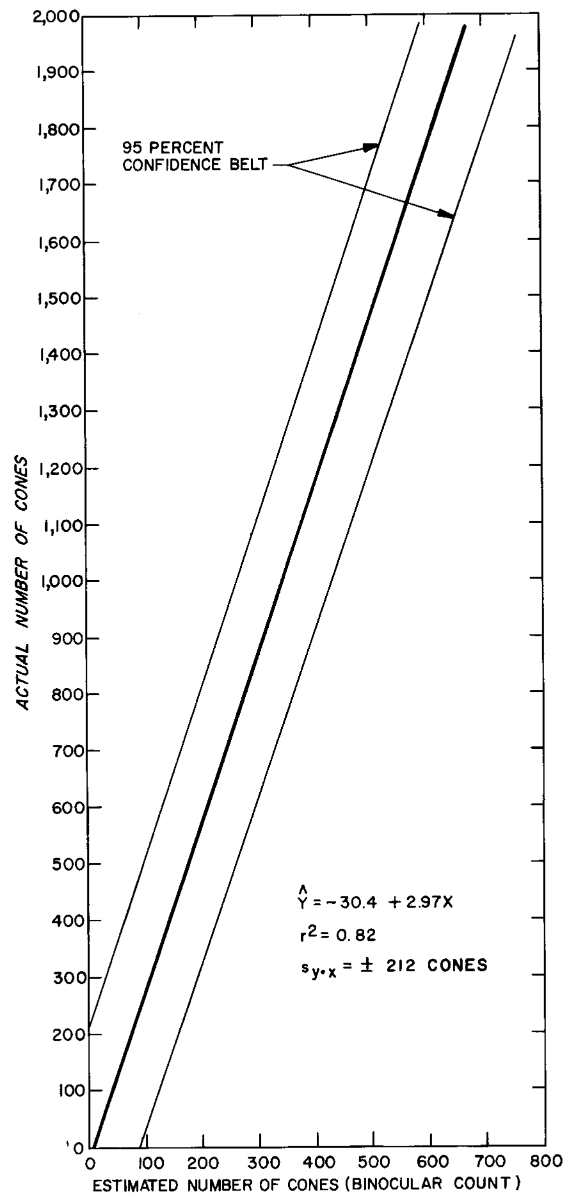

Figure 2.—Relation between actual number and estimated number of cones per tree. Basis: 90 X and Y values.

cones visible from one side of the tree, then counting all cones visible from the opposite side (180° from the first) and adding the two counts together. After binocular counts were completed, the cones from each tree were harvested with the aid of a hydraulic truck-mounted boom or "cherrypicker."

The relationship between the actual and binocular cone count per tree was calculated for each observer. The two regressions were not significantly different, and data from both observers were combined into a single regression (fig. 2). The relationship can be expressed by the equation $Y = -30.4 + 2.97X$, where Y = actual number of cones per tree and X = binocular cone count.

This equation can be used to correct binocular cone counts to account for hidden cones, or the actual number of cones can be read directly from figure 2. However, the easiest way to adjust the cone count is to simply multiply the binocular count by three.

When using figure 2, it should be recognized that the "actual" number of cones does not represent an exact value because of the sampling variation associated with the regression. For example, if 300 cones are counted with binoculars, then the corrected estimate (fig. 2) is 860. But the true number of cones per tree may range from 600 to 1,100, as indicated by the width of the confidence bands about the regression.

Estimating cone crops in standing shortleaf pine is a difficult and uncertain job at best, and cone yields are usually greatly underestimated. A three-fold increase of the binocular estimate resulted in a more realistic estimate of the true number of cones in the trees studied, and should be applicable to trees in similar stands.