

DIAMETER GROWTH OF TREES IN AN UNEVEN-AGED OAK FOREST
IN THE MISSOURI OZARKS

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Abstract: We tested the efficacy of even-aged stand tables for predicting diameter growth of trees in uneven-aged oak stands. The study was based on the age- and diameter-structure of the Pioneer Forest, a 156,000-acre, privately owned oak forest in the Ozark Highlands of Missouri. The forest has been managed by single-tree selection since 1954.

Observed diameter distributions were drawn from a random sample of 60 oaks ≥ 1.6 -inches dbh on each of 10 1-acre plots. The plots were randomly located across one square mile of the forest. Dbh and the age of each tree at a height of 1 foot above groundline were determined. We compared the observed diameter distributions with those predicted by Schnur's even-aged stand tables for upland oaks. Predicted diameter distributions were derived by aggregating the age distribution of the observed sample into 10-year age classes and projecting the growth of each age class based on the stand tables. The resulting even-aged distributions were then combined to form a predicted uneven-aged diameter distribution for a single stand. Chi-square and Kolmogorov-Smirnov (KS) one-sample tests were used to test the null hypothesis of no difference between observed and predicted distributions.

Separate comparisons were made for red oak and white oak species groups. Statistical tests were applied to the composite distribution and to each 1-acre plot. Results were the same for chi-square and KS tests. In general, even-aged stand tables did not accurately describe the diameter growth of individual cohorts within an uneven-age stand. The range of observed diameters was greater in the uneven-aged stand than would be expected had the trees grown in even-aged stands at 100% ("normal") stocking. Observed composite distributions for the red oak (n=180) and white oak (n=398) species groups differed from the predicted distribution ($p < 0.001$). Of the 20 comparisons at a scale of one-acre, 15 did not differ significantly. However, at the smaller scale, the paucity of statistically different comparisons may have been the result of the reduced power of tests associated with small populations. The lack of agreement between observed and predicted distributions may largely be related to differences in growth and mortality of trees on the Pioneer Forest and those expected in normally stocked even-aged stands. Because the Pioneer Forest is managed at a relatively low density (average stocking is 67% for trees ≥ 1.6 inches dbh), we might expect density-dependent mortality rates of trees to be relatively low and growth rates to be relatively high. In turn, this may explain the larger-than-expected number of small trees and the extended distribution of large trees in the observed distributions. The discrepancy between observed and predicted was greatest for small-diameter white oaks. The substantially greater-than-expected numbers of white oaks in the 2- and 3-inch dbh classes emphasizes the inadequacy of the even-aged stand tables to express the shift to a negative exponential diameter distribution at reduced stand density (Figure 1).

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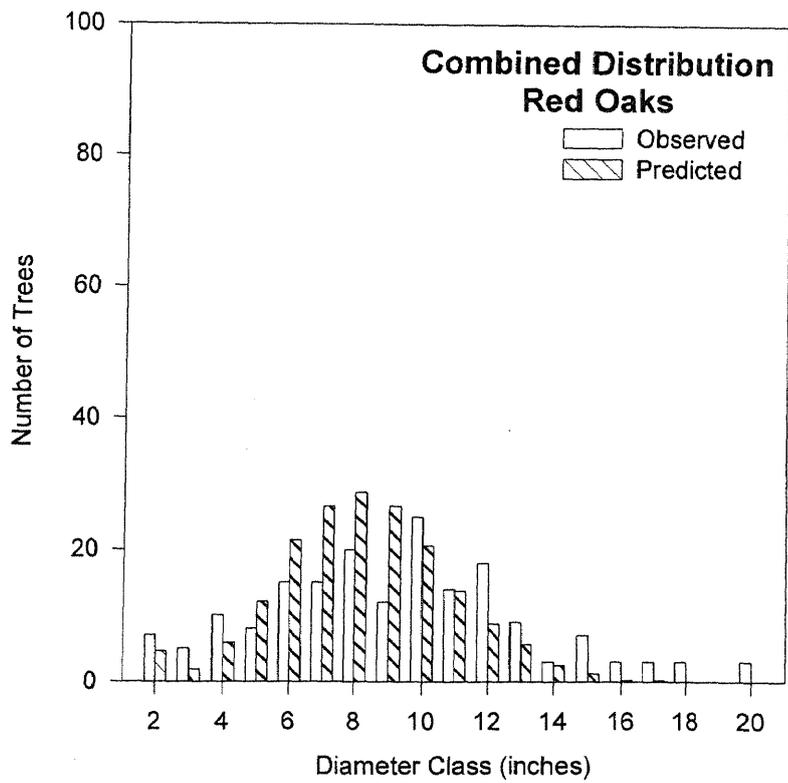
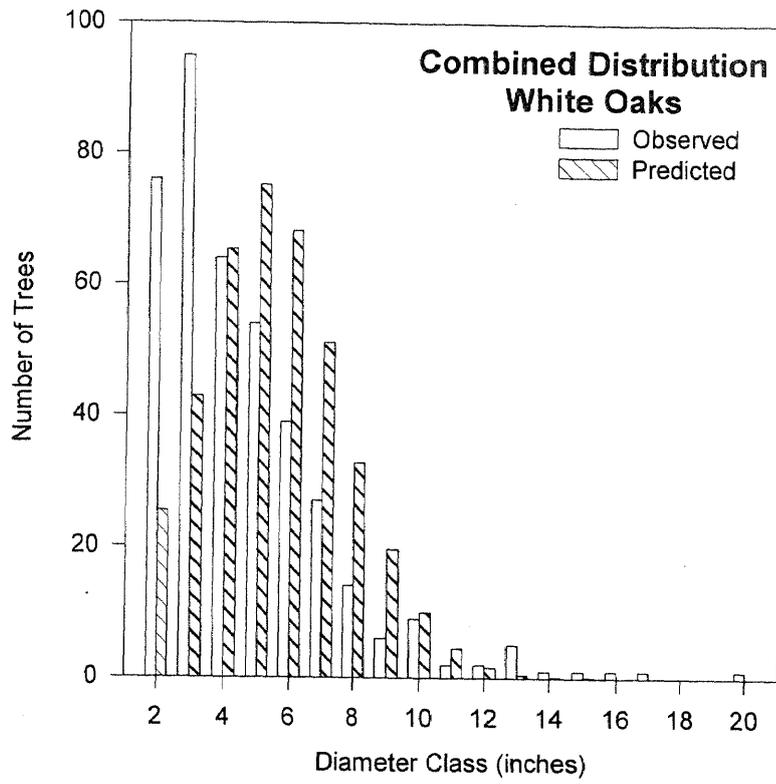


Figure 1. Observed and predicted diameter distributions by oak species group.