STABILITY OF DIAMETER DISTRIBUTIONS

IN A MANAGED UNEVEN-AGED OAK FOREST IN THE OZARK HIGHLANDS

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Abstract: We studied a privately owned 156,00-acre oak-dominated forest in the Ozark Highlands of southern Missouri. The forest has been managed by the single-tree selection method since 1952. Using 40 years of continuous forest inventory records, we analyzed the stability of the shape of tree diameter distributions at the forest-wide scale. Results show that for trees ≥5-inches dbh, diameter frequency distributions closely conform to the negative exponential function for the three species groups and three stand density classes compared. Values of the slope coefficient for the negative exponential model, and thus the ratio of number of trees in successive dbh classes (*q*), were stable at the highest stand density class (>57% stocking) but tended to be unstable at lower stocking levels (<40% and 40-57%) for the three species groups considered (all species, red oaks, and white oaks). Among species groups, white oaks were least stable and the all-species group most stable. For any given 15- or 30-year interval, *q* (for 1-inch dbh classes) ranged from 1.18 to 1.44 (1.4 to 2.1 for 2-inch classes). When trees from 1.6 to 4.9 inches were included, the power function fit the observed distributions better than the negative exponential function. However, when observed distributions were fit separately to the range of diameters above and below 9 inches (near the minimum cutting diameter), the negative exponential model in most cases fit both segments of the distribution better than the power function. Statistical tests of the equality of the two parameters of the negative exponential model indicated there is significant discontinuity between dbh distributions above and below the minimum cutting diameter. The overall instability of diameter distributions appears to be related to self-limiting oscillations in slope shape and discontinuities that, within a cutting cycle, pivot or "seesaw" about the minimum cutting dbh of 10 inches. Such instability would not appear to adversely affect sustaining a negative exponential diameter distribution and thus the silvicultural system.

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