

DEVELOPMENT OF UNDERSTORY TREE VEGETATION AFTER THINNING NATURALLY OCCURRING SHORTLEAF PINE FORESTS

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During the 25 years since establishment of more than 200 growth study plots in even-aged, naturally regenerated shortleaf pine (*Pinus echinata* Mill.) forests, there has been considerable development of hardwood understory trees, shrubs, and some shortleaf pine regeneration. During the period from 1985-1987, even-aged shortleaf pine growth-study plots were established on the Ozark and Ouachita National Forests in western Arkansas and eastern Oklahoma. Plots were established in combinations of four levels of site index (50, 60, 70, and 80 feet at base age 50 years), four levels of age (20, 40, 60, and 80 years), and thinned to four levels of basal area per acre (30, 60, 90, and 120 square feet per acre). At plot establishment, hardwoods were controlled by application of chemical herbicide by stem injection or equivalent method. In subsequent years, hardwood regrowth has occurred, and some plots contain shortleaf pine regeneration.

At the second remeasurement, 10 years after plot establishment, understory tree development was measured by establishing two 5-milacre plots within each 0.2-acre shortleaf pine growth-study plot. At the third and subsequent

remeasurement, 15 years after plot establishment, four 5-milacre plots were established within each 0.2-acre shortleaf pine growth-study plot to assess understory tree development. The statistical analysis has shown that red maple (*Acer rubrum* L.), flowering dogwood (*Cornus florida* L.), winged elm (*Ulmus alata* Michx.), northern red oak (*Quercus rubra* L.), black oak (*Q. velutina* Lam.) and shortleaf pine are the most dominating understory species. An annual total understory basal area growth model shows that the understory vegetation basal area growth is negatively affected by the upper story basal area and upper story plot age and positively affected by the site index (p -value < 0.05). The proportion of total shortleaf pine understory basal area to understory hardwood basal area has decreased with time elapsed from initial thinning treatments. However, there are relatively good numbers of shortleaf regeneration stems in the understory on some plots. The study results have clearly shown that the growth and development of understory hardwood and shortleaf pine regeneration depend on the actual condition and density of upper-story shortleaf trees in the stand of interest.

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