

## Reduction in the Number of Trees in Maturing Pine Forest

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There are relatively little quantitative data on the annual or period reduction in the number of trees in developing forest. It is well known, of course, that many trees die, succumbing to the effects of competition, during the time of forest maturation. In the case of tree species which bear many viable seeds and produce many seedlings, the number of trees which come to maturity may be an exceedingly small percentage of the original number of young trees in a given area. This paper summarizes the results of an investigation of this question in relation to a single species, the southern shortleaf pine.

Competition among individuals within a species is well illustrated by the southern shortleaf pine, *Pinus echinata* Miller. Throughout Arkansas, exclusive of the river overflow areas, pure stands of various ages of this tree may be found. Most of these pure pine forests are doubtless on areas that were once cleared, for agriculture, in lumbering operations, or on sites in which the original (usually mixed pine-deciduous) forest was destroyed by tornadoes. Such stands are essentially even-aged. It is a characteristic of both shortleaf and loblolly pine to invade and pre-empt bare areas quickly. Such areas are stocked with seedlings, in numbers permitted by the factors of the sites, in from one to five years.

**Method of study.**—In this investigation, counts were made of trees in twenty-three unmolested stands of shortleaf pine of various ages. All plots of trees 35 years of age, or older, were  $\frac{1}{4}$  acre in area; younger trees were counted on  $\frac{1}{16}$ -acre plots. Average height, diameter, and age of dominant and co-dominant trees was secured with the usual instruments. All plots were on Hanceville sandy loam with a slope of approximately 20 per cent. The character of the soil is significant since the rate of growth is materially influenced by soil features, and possibly the number of trees per unit area at any given age would also be influenced by this factor. Hanceville sandy loam, with slope around 20 per cent, affords a relatively poor pine growing site, having a site index of about 50, or an average height growth of about a foot a year during the first 50 years. Superior sites for this species afford a growth rate of about two feet a year.

**Results.**—The following table shows the relationship of age of the shortleaf pine stands to the number of trees per acre, and to the average height and diameter, of dominant and co-dominant trees:

TABLE I.—THE RELATIONSHIP OF AGE OF STAND TO THE HEIGHT, DIAMETER, AND NUMBER OF TREES PER UNIT AREA OF SHORTLEAF PINE ON HANCEVILLE SOIL

| Number of stands from which averages were determined | Average age of trees | Diameter* breast height | Height of trees | Number trees per acre | Per cent annual reduction of trees during periods |
|--|----------------------|-------------------------|-----------------|-----------------------|---|
| 1.....   | 9 yrs.               | 1.9"                    | 6.0'            | 19,008                | .....   |
| 2.....   | 16 yrs.              | 2.8"                    | 14.0'           | 8,783                 | 8.0   |
| 2.....   | 35 yrs.              | 6.0"                    | 40.0'           | 1,638                 | 2.0   |
| 4.....   | 40 yrs.              | 8.5"                    | 44.0'           | 744                   | 0.9   |
| 5.....   | 60 yrs.              | 9.6"                    | 60.0'           | 415                   | 0.08  |
| 3.....   | 70 yrs.              | 12.0"                   | 66.5'           | 180                   | 0.12  |
| 5.....   | 116 yrs.             | 14.3"                   | 78.0'           | 120                   | 0.07  |
| 1.....   | 152 yrs.             | 17.0"                   | 85.0'           | 80                    | 0.058   |

\* Diameter and height averages are of dominant and co-dominant trees.

As would be expected the greatest mortality of trees occurs in the early years of the life of the stand. The period of seven years, from the ninth to the sixteenth, brought about a reduction of 54 per cent of the number in the nine-year-old stand, or an average annual diminution of 8.0 per cent. The next 19 years show an average annual loss of 2 per cent of the nine-year-old stand, and the next five years an average annual loss of 0.9 per cent. From the age of 35 years on to the time of maturity the average annual losses were small, compared to those of the early stages, being only 0.058 per cent per year, during the period between the 116 and 152 years. The number of individuals in the 152-year-old forest was 0.42 per cent of the number in the nine-year-old stand.