SOUTHERN FOREST EXPERIMENT STATION

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FOREST FLOOR IN LOBLOLLY PINE PLANTATIONS AS RELATED TO STAND CHARACTERISTICS

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SOUTHERN FOREST EXPERIMENT STATION

At ages 8 to 16 years, erosion-control plantings in north Mississippi had floors whose ovendry weights averaged 7.3 tons per acre. $W = 1.38 + 0.246$ *(age)* $+$ *0.0218 (basal area).*

Because it produces a mantle of soil-stabilizing litter, loblolly pine is widely planted on eroding sites in the South. This paper reports a study in which the forest floor under established plantations was measured and analyzed in relation to several stand characteristics. The study was made in north Mississippi, where large acreages of erosion-control plantings have been made by the Yazoo-Little Tallahatchie Flood Prevention Project of the U.S. Department of Agriculture.

The analysis produced two equations by which weights of the forest floor can be roughly estimated from stand data or from measurements of floor depth. Satisfactory sampling techniques for obtaining the weight of the floor were also worked out.

METHODS

The forest floor was sampled on 108 plots in 10 loblolly plantations ranging in age from 8 to 16 years. Each plot consisted of at least 25 planting squares. Sixty-three plots were in plantations that had been established on abandoned fields with a broomsedge cover, and 45 were in stands on dry ridges formerly occupied by sparse stands of hardwoods. Plots were unthinned, and at least 50 percent stocked. The trees had never been overtopped.

One completely stocked planting square was selected at random within each plot, and three samples of the floor were randomly taken within each square and composited.

An angle-iron frame 0.96-foot square was used in sampling. The L- and F-layers were collected by cutting along the inside of the frame with a knife. The H-layer was not found. Depth of the floor was measured to the nearest 0.1 inch at the midpoint of each side of the frame. Living grass was excluded; dead grass and hardwood leaves were included where found, but formed a small part of the floor in stands above 8 years of age. Twigs, bark, and miscellaneous debris less than 0.25 inch in diameter were included.

On 82 percent of the plots in stands 10 years and older, a mull type A_1 had begun to form, and there was ample evidence of earthworm

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activity. Some of the mull formation can be attributed to the decomposition of grass on the old fields and of hardwood leaves in conversion plantings. There was, however, evidence that the pine needles themselves were contributing in many of the stands.

Twenty-five floor-depth measurements to the nearest 0.1 inch were made at 1-foot intervals on a transect starting at the northeast corner of each plot and running diagonally towards the southwest corner. These were taken to determine if the point at which the floor was sampled was representative.

The four trees making up the planting squares sampled were measured to the nearest 0.1 foot of height and the nearest 0.1 inch of d.b.h. Age was determined from planting records. The presence or absence of an A_1 horizon was noted. Stand characteristics were based on the tree measurements in the planting square.

In the laboratory the soil and fine organic matter were screened from the samples. This material and the bulk of the sample were ovendried at 105° C. and weighed separately. The fines were burned in a muffle furnace and reweighed to determine loss on ignition. Weights of the fine organic matter and of the rest of the floor were then summed in grams, multiplied by 100 to obtain pounds per acre, and converted to tons.

The average weight of the floor in all the plantations sampled was 7.31 tons per acre. The means and ranges of the stand characteristics measured are given in table 1. It should be remembered that the values were derived from measurements on a perfectly stocked planting square.

All possible combinations of five independent variables—age of trees, number per acre, height, basal area per acre, and depth of forest floor—were tested in regression analyses.

Table 1.—*Stand characteristics*

Item	Means	Range
Age (years)	12.2	8-16
Trees per acre (number)	1,637	589-5,556
Spacing (feet)	5.1x5.2	2.8-8.6
Tree height (feet)	28	16-46
Basal area per acre (sq. ft.)	134	36-307
Forest floor depth (inches)	.8	.1-2.7
Weight of floor per acre (tons, ovendry)	7.3	2.4-14.7

RESULTS

The most suitable regression equation for estimating weight of the forest floor (W, tons per acre) from stand characteristics included tree age (A) and basal area (BA) as independent variables. It was:

$$W = 1.38 + 0.246\ A + 0.0218\ BA \quad R = .70$$

Weight-estimating curves computed from the equation are shown in figure 1. The equation explained 49 percent of the variation, and the addition of height or number of trees per acre, or both, did not significantly improve it.

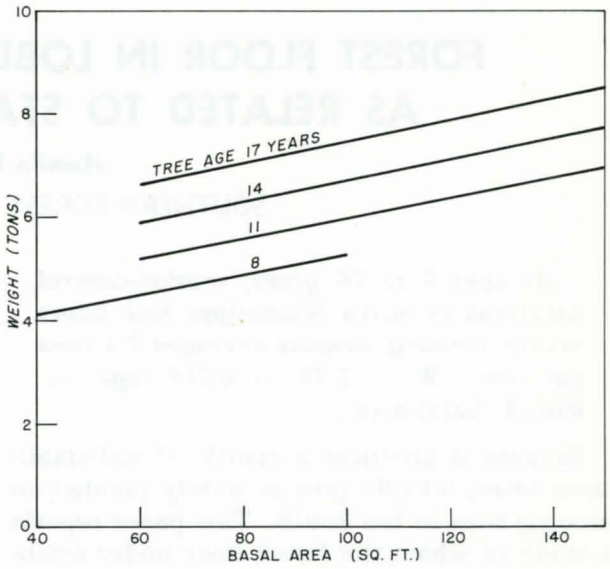

Figure 1.—*Ovendry weight of forest floor per acre in loblolly pine plantations.*

The best one-variable regression, that of basal area, explained 43 percent of the variation. In other one-variable regressions tree height accounted for 31 percent of the variation, age for 28 percent, and trees per acre for 0.2 percent.

To determine whether use of the planting square data biased the results, a t-test was made to compare the average of the 12 floor depths on the border of the litter samples with the average of the 25 depths measured across the gross plot. There proved to be no significant difference between the sample depths and plot depths. It is probable that needles do not fall vertically but are distributed by air currents. Average floor depth was 0.79 inch.

Depth alone accounted for 58 percent of the total variation and for 87 percent of the variation that could be explained by all five independent variables combined. If depth (D) is measured in inches, weight of floor can be roughly estimated from:

$$W = 3.28 + 5.07\ D \qquad R = .77$$

It would be convenient if age and spacing (number of trees per acre) were proportional to the weight of the forest floor. This relationship is explored in figure 2. Only the narrow spacings resulted in any great difference in floor weight. Litter from all of the spacings measured was adequately protecting the site from erosion. Among the more common spacings litter production varied hardly at all, probably because increased crown volume and needle size compensated for decreases in density. For these reasons also, judicious thinnings probably would not jeopardize the litter-producing capacity of a stand.

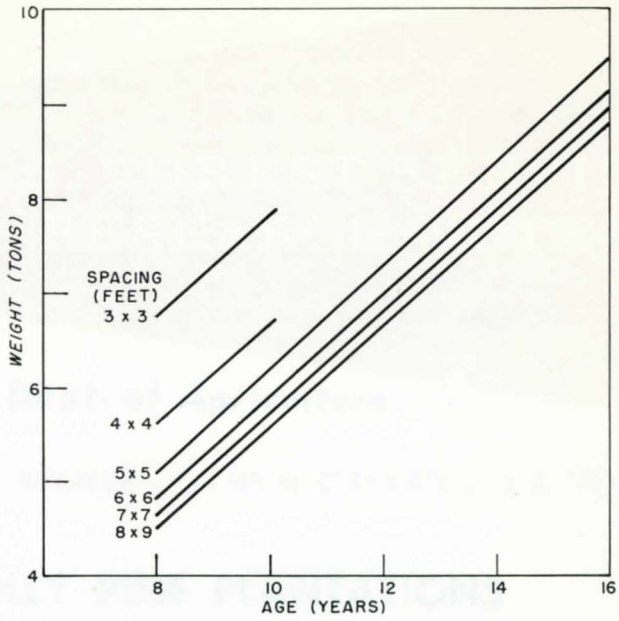

Figure 2.—*Forest floor weight per acre (ovendry) as related to age and spacing.*