SOUTHERN FOREST EXPERIMENT STATION

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LITTER IN LONGLEAF PINE STANDS THINNED TO PRESCRIBED DENSITIES

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This note reports the effects of longleaf pine (*Pinus palustris* Mill.) stand density on the composition, deposition, and accumulation of litter on the forest floor.

The study was conducted from July 1960 through June 1963 in even-aged second-growth longleaf stands on the Escambia Experimental Forest in southeastern Alabama. Two blocks, each with five square 2.5-acre plots, were established in March 1957, and plots in each block were cut to randomly assigned densities of 9, 18, 27, 36, and 45 square feet of basal area per acre. All overstory hardwoods were destroyed at that time. When the stands were remeasured in February 1962, basal areas ranged from 10.4 to 49.5 square feet per acre, and average d.b.h. ranged from 13.7 to 14.8 inches. In one stand, tree age averaged 54 years, and site index, 76 feet; in the other, tree age averaged 59 years, and site index, 70 feet. Neither stand had been burned since 1954.

Falling litter was caught in nine ¼-milacre paperboard seed traps systematically located within a 1-chain square at the center of each plot. Once a month all material caught in the traps was collected and oven-dried to constant weight at 100° C. After oven-dry weight of litter in each trap was obtained, the contents of two different traps each month from each plot were allowed to come to moisture equilibrium in air, sorted into needles, leaves, miscellaneous coarse material, and miscellaneous fine material, and reweighed. Miscellaneous coarse material included cones, twigs more than ¼ inch in diameter, and other material more than ½ inch wide and 1/16 inch thick with one surface larger than 1 square inch. Miscellaneous fine included all remaining small material except needles and leaves. Relative amounts of the four litter components were calculated annually.

In February or March of each year the accumulated litter on the forest floor was collected from five 0.96-square-foot samples taken at random on undisturbed portions of each plot. These samples were oven-dried, weighed, sorted into needles, leaves, grass (including herbage), brush (up to 1-foot in height), wood, and miscellaneous partly decayed material, and reweighed.

LITTER DEPOSITION

Pine needles made up 70 percent of the trapped litter; leaves, 5 percent; miscellaneous coarse material, 7 percent; and miscellaneous fine material, 18 percent. Annual deposition of all litter increased from an average of 918 pounds (dry weight) per acre under the stand of lowest density to 3,004 pounds per acre under the highest. The weight of pine needles alone ranged from 618 to 2,102 pounds per acre. This annual deposition is somewhat less than the 2,307 to 3,168 pounds of needle litter per acre reported by Heyward and Barnette (*3*) in dense second-growth stands of longleaf pine. The weight of both miscellaneous fractions, as well as of needles, increased with increasing basal area. Thus, the pine overstory was the principal contributor to these categories. Litter fall differed little between blocks; one block accounted for 50.8 percent of the total catch; the other, 49.2 percent.

The relation of litter weight to stand basal area was exponential, and the logarithm of total litter weight bore a significant linear relation (0.05 level) to basal area. The regression for weight of needles alone was also significant; the curve is similar to but 30 percent lower than that for all litter (fig. 1).

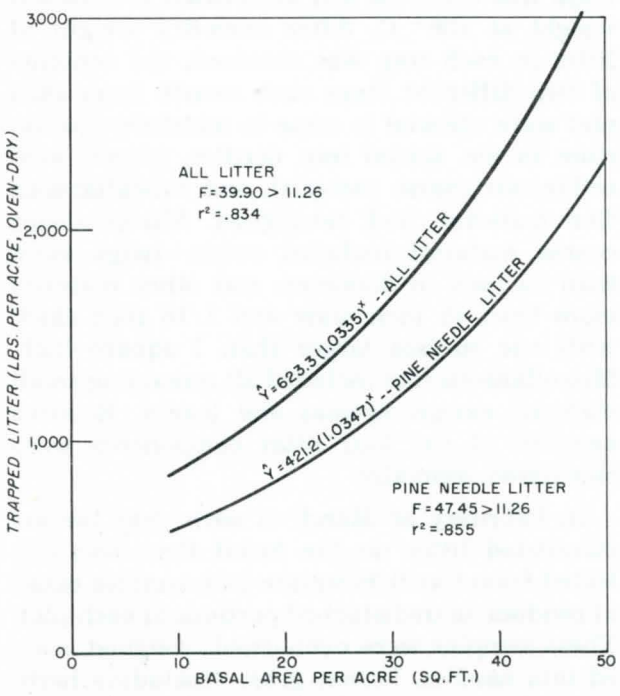

Figure 1.—*Annual litter deposition in relation to basal area of overstory.*

Total litter fall in the 3 successive years of the study was 1,930, 1,854, and 1,727 pounds per acre. This variation is small. Others have observed that the weight of needles deposited in 1 year may be two to three times that in another (*1, 4*).

Litter deposition followed a predictable seasonal pattern. Forty-six to 48 percent of the yearly total fell in September, October, and November. During each of the remaining 9 months, deposition averaged very close to 6 percent.

LITTER ACCUMULATION

The average weight of material on the forest floor, excluding the miscellaneous partly decayed material, ranged from 2,587 pounds per acre under the lowest to 4,256 pounds per acre under the highest stand density. Pine needle litter plus grass and herbage accounted for 70 percent of this material.

Apparently, deposition and decay of needles had reached an equilibrium on the study area. The average weights of needles under all stands in the 3 years were 1,674, 1,697, and 1,548 pounds per acre. The total needle accumulation did not reach as much as 2 years' deposition under any of the stands.

Hardwood leaves and brush constituted only a small fraction of the material on the forest floor. Average weight of leaves per plot collected annually from the forest floor was more than twice that caught in traps (206 pounds vs. 96 pounds). Most of the leaves probably came from hardwood sprouts and brush below the level of the trap surface.

Wood on the forest floor averaged 804 pounds per acre, slightly more than six times the annual collection of miscellaneous coarse material from litter traps. The quantity of wood declined from 1,123 to 919 to 370 pounds per acre in the 3 years. In an undisturbed stand, wood on the forest floor should remain essentially constant. In this study, the quantity probably was high initially because of the recent thinning.

The weight of accumulated needles on the forest floor increased rapidly with stand density from a low of 460 pounds per acre under the thinnest stands to 2,903 pounds under the densest. As with needle deposition, the relation was curvilinear (fig. 2). The regression was con-

siderably steeper than that for trapped needles, beginning at about 150 pounds (20 percent) below the latter, crossing it at a basal area of 23 square feet, and ending about 1,000 pounds (50 percent) above it.

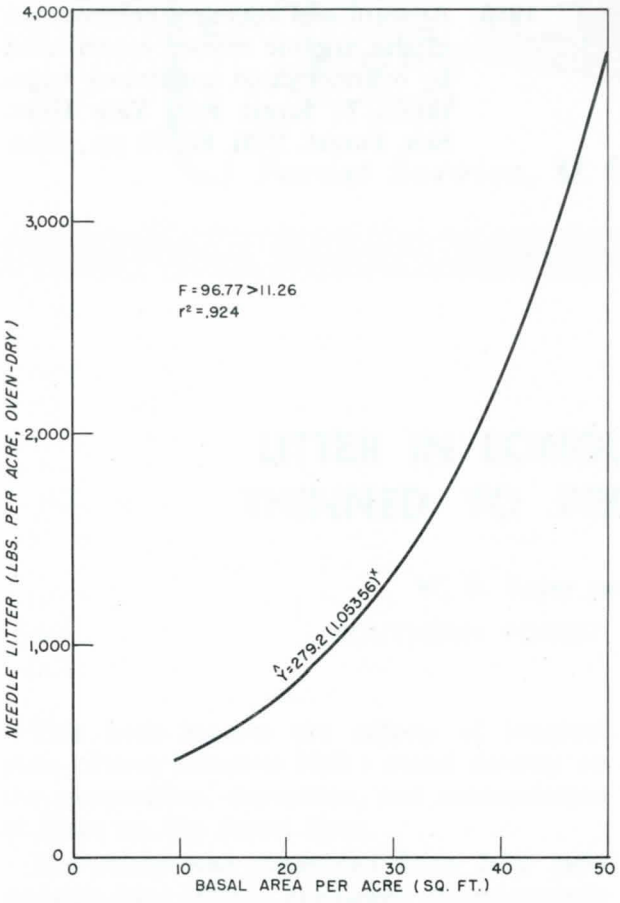

Figure 2.—*Accumulation of pine needle litter on the forest floor.*

The grass rough decreased from more than 1,100 pounds per acre under stands with 9 to 18 square feet of basal area to little more than 500 pounds on those with 36 to 45 square feet. The decline was curvilinear, and the relation of grass weight to stand density was significant (fig. 3). Others have found a similar, but less steep, downward trend in grass production with increase in basal area (2).

The combined weight of grass plus pine needles increased from 1,607 pounds per acre (71 percent grass) under the lowest to 3,481 pounds per acre (83 percent pine needles) under the highest density class. The total weight of these flash fuels had a linear relation to stand density (fig. 4).

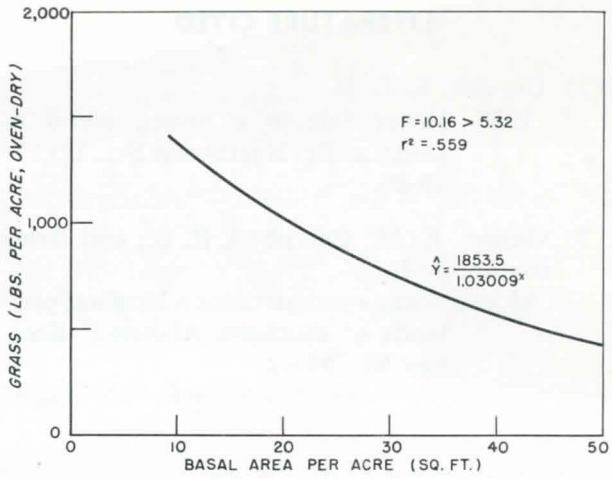

Figure 3.—*Grass rough on forest floor.*

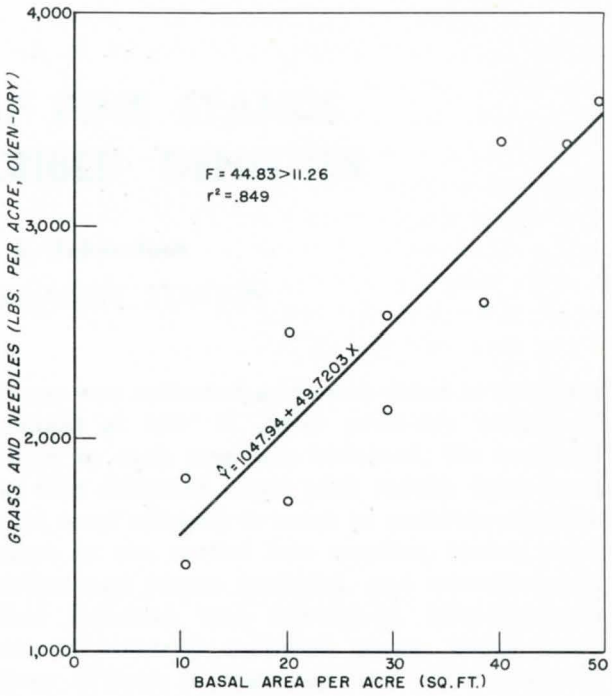

Figure 4.—*Combined accumulation of grass and needle litter rough.*

The amount of flash fuel built up rapidly as basal area increased, but total weight of these two components did not become great enough, under stands up to 50 square feet per acre, to either support a high intensity fire or equal 2 years' deposition of needles. Therefore, in the absence of significant quantities of flammable brush, prescribed burning for hazard reduction alone does not seem to be warranted in such light stands. Prescribed burning for other purposes could be accomplished biennially just as well as at longer intervals.

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