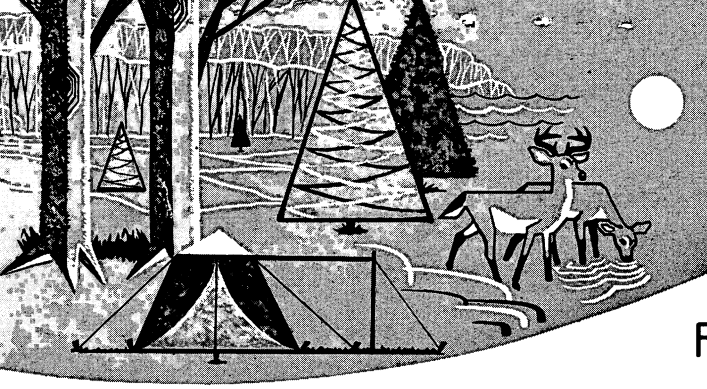

RESEARCH NOTE NC-184

NORTH CENTRAL FOREST EXPERIMENT STATION, FOREST SERVICE—U.S. DEPARTMENT OF AGRICULTURE
Folwell Avenue, St. Paul, Minnesota 55101

1975

ANNUAL CHANGES IN FOREST FLOOR WEIGHTS UNDER A SOUTHEAST MISSOURI OAK STAND

Robert M. Loomis, *Fire Control Scientist*
East Lansing, Michigan
(Office maintained in cooperation with Michigan State University)

ABSTRACT.--Amount of organic matter on the forest floor under a typical southeast Missouri oak stand varies about 2.1 tons/acre from season of greatest to season of least accumulation. This also corresponds to the amount of annual litter fall. Maximum accumulation of 7.5 tons/acre occurred in November after leaf-fall. Summer decomposition is rapid; a minimum of 5.4 tons/acre was present in September before major leaf-fall.

OXFORD: 114.351: 431.5 (778). KEY WORDS: forest fuels, forest fire, biomass.

The quantity of litter and other forest floor components is an important constituent of the National Fire Danger Rating System (Deeming *et al.* 1972). These forest floor fuels are primary fire carriers in hardwood forests.

Fire activity in upland hardwood forests peaks in spring and again in fall (Haines *et al.* in press). Although this pattern has been attributed primarily to climate, phenology of overstory leaf development, and dormancy, the seasonal changes in forest floor fuel may also be influential. In pursuit of this idea, we followed the annual cycle of forest floor loading under a 40-year-old, fully stocked, oak stand in Missouri (fig. 1).

Figure 1.--*The annual cycle of forest floor components weights was studied under a 40-year-old, fully stocked, oak stand in Dent County, Missouri. (Photo taken in January.)*

THE STUDY

Twenty-one samples of forest floor were collected in Dent County on each of five dates: January 2, April 9, June 18, September 1, and November 24, 1964. Each sample consisted of three, 5-inch-diameter,

circular subsamples, separated by L, F, and H-layers.[1] The samples were oven-dried at 100°C. Because of incorporated mineral soil, the H-layer subsamples were incinerated, so the H-layer weights exclude ash.

The stand, on a flat ridge, was fully stocked with trees of all sizes up to and including small sawtimber, with black oak predominating. The forest floor appeared uniform. The soil, a duff mull, is classified as Lebanon and Hobson silt loam (Gilbert 1971).

RESULTS

The maximum loading of 7.5 tons/acre occurred in November after leaf-fall (Table 1). Weights in April, although less than those in November, had not changed significantly. Decomposition during the summer was rapid, leaving a minimum of about 5.4 tons/acre present on September 1, before leaf-fall. There was a significant difference ("t" -0.01) between the November maximum and September minimum L- and F-layer weights, but no significant difference was found between H-layer amounts. No significant difference was found for any layer or combination between November and the previous January.

DISCUSSION

The stand studied is typical of many forests in southeast Missouri and the Central States area. The forest floor did, however, prove to be more similar in weight to that of stands 20 years younger (Crosby and Loomis 1974), because of local site variations. Spring floor weight averages were 8.3 tons/acre for 40-year-old and 6.4 tons/acre for 20-year-old. The amount of forest floor present under approximate equilibrium conditions depends upon such things as vegetation, climate, and soils--factors that influence production and decomposition rates.

The 2.1 tons/acre difference between maximum and minimum total forest floor was also the amount of average annual

Table 1.--*Weight of forest floor components under an oak stand in Dent County, Missouri*

(In tons/acre)

Date (1964)	Forest floor layer					Forest floor L- and F-layer components			
	L	F	H	L and F	L, F, and H	Loose tree foliage[1]	Compacted[2]	Fine[3]	Coarse[4]
January 2	2.2	3.9	1.0	6.1	7.1	1.9	3.2	0.1	0.9
April 9	2.1	3.7	.8	5.8	6.6	2.0	3.2	.1	.5
June 18	1.7	3.2	1.5	4.9	6.4	1.4	2.8	.1	.6
September 1	1.2	3.0	1.2	4.2	5.4	1.0	2.7	.0	.5
November 24	2.3	3.9	1.3	6.2	7.5	2.1	3.6	.0	.5

[1]Loose undecomposed leaves contained in the L-layer.
[2]Compacted decomposing leaves, wood, and other organic materials contained in the F-layer.
[3]Twigs and bark less than 1/8-inch in diameter or thickness.
[4]Twigs, branchwood, and bark from 1/8-inch to 1/2-inch in diameter or thickness, acorn parts, miscellaneous.

[1]*Forest floor components or layers are defined for this study as follows: litter, "L" layer, includes loose surface leaves, twigs, acorns, etc; fermentation, "F" layer, beneath the "L," includes the leaves that are still identifiable but are stuck together and lay flat--mostly the previous 1 or 2 years' fall of leaves; humus, "H" layer, beneath the "F," includes well-decomposed material no longer identifiable as to source, generally mixed with some mineral soil and interlaced with fine roots. Wood larger than 1/2 inch in diameter or thickness was excluded from the sample.*

litter production estimated for three comparable, nearby, black oak stands sampled over a 7-year period, further evidence that the forest floor was in near-equilibrium. Blow (1955) reported a similar situation for an eastern Tennessee upland oak stand. It contained 5.5 tons of floor material/acre in December and 4.2 tons/acre in August; the difference, 1.3 tons/acre, was also the amount of measured litter fall for the stand. This stand had been heavily cut 15 years earlier and contained only 41 square feet basal area of trees larger than 5 inches d.b.h.

The time required for an oak stand forest floor, such as the one observed, to attain equilibrium between annual production and decomposition is approximately 9 and 14 years for 95 and 99 percent equilibrium, respectively, (Jenny *et al.* 1949). This is based on annual production of 2.1 tons/acre.

LITERATURE CITED

Blow, Frank E. 1955. Quality and hydrologic characteristics of litter under upland oak forests in eastern Tennessee. J. For. 53: 190-195.

Crosby, John S., and Robert M. Loomis. 1974. Some forest floor fuelbed characteristics of black oak stands in Southeast Missouri. USDA For. Serv. Res. Note NC-162, 4 p. North Cent. For. Exp. Stn., St. Paul, Minn.

Deeming, John E., James W. Lancaster, Michael A. Fosberg, R. William Furman, and Mark J. Schroeder. 1972. The national fire-danger rating system. USDA For. Serv. Res. Pap. RM-84, 165 p. Rocky Mt. For. and Range Exp. Stn., Fort Collins, Colo.

Gilbert, Frederick L. 1971. Soil Survey of Dent County, Missouri. 68 p. USDA Soil Conserv. Serv. and For. Serv., Washington, D.C.

Haines, Donald A., William A. Main, and Von J. Johnson. Wildfire atlas of Northeastern United States. USDA For. Serv. Gen. Tech. Rep. (In press.)

Jenny, Hans, S. P. Gessel, and F. T. Bingham. 1949. Comparative study of decomposition rates of organic matter in temperate and tropical regions. Soil Sci. 68 (July-December): 419-432.

☆ U. S. GOVERNMENT PRINTING OFFICE: 1975--667892/54 REGION NO. 6