Forest Research Notes

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FOREST SERVICE, U.S. DEPT. OF AGRICULTURE, 102 MOTORS AVENUE, UPPER DARBY, PA.

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HUMUS DEPTHS UNDER CUT AND UNCUT NORTHERN HARDWOOD FORESTS

Harvesting timber on lands devoted primarily to watershed management may alter, for better or worse, many features of a forested watershed. One such feature is forest humus. The beneficial role of forest humus in watershed management is widely recognized. A protective mantle of humus serves to cushion the impact of rain, to impede surface runoff, to restrict soil freezing, to favor infiltration, and to store certain amounts of rainfall.

In general, the effects of timber harvesting upon humus depths are extremely variable, depending in part upon timber type, climate, and degree of cutting. Theoretically, humus should be shallower under heavily-cut stands than under uncut stands, at least for the first several years. Opening the canopy would reduce the leaf supply; and exposing the humus to direct solar radiation would speed decomposition.

Sartz and Huttinger *(4)* found less humus under stands with fair stocking than under stands with good stocking. Curves developed by Morey *(3)* of humus depth over stand age in temporary hardwoods and long-lived hardwood forest types in the Connecticut River Valley show that humus depth reaches a minimum 20 to 30 years after clearcutting. Then humus begins to build up, and reaches its original depth 70 to 80 years after clearcutting. Carmean *(1)* reported that 4 years after clearcutting the weight of humus on the clearcut and uncut plots was not significantly different; this was a study on poor oak sites with thin mor humus in Ohio.

Study Area And Method

There were two reasons for making this study: (1) To obtain some information on humus depths in northern hardwood stands in the White Mountain region of New Hampshire. Such information is virtually non-existent. (2) To compare humus depths under uncut stands with humus under stands that were partially cut and clearcut 20 to 25 years ago.

Humus measurements were made on six plots at the U.S. Forest Service's Bartlett Experimental Forest at Bartlett, New Hampshire. The plots were situated on two areas about ½ mile apart. Site quality of the level lower area was greater than that of the steeper upper area.

The upper area had been partially logged about 1875. An uneven-aged stand of beech, sugar maple, and yellow birch (about 75, 10, and 5 percent, respectively) occupied this area in 1934 when the experimental cuttings were made. The soil is Hermon very stony sandy loam, a well-drained podzol.

The lower area, which is more accessible, had been clearcut about 1875, and an even-aged second-growth stand developed. In 1937 this area had a 60-year stand of red maple, paper birch, and white ash (30, 15, and 15 percent, respectively). The soil is Waumbek stony fine sandy loam, a moderately well-drained podzol.

A clearcut plot, an individual-tree-selection plot, and an uncut control plot were established in the upper and lower areas during the period 1934 to 1939. Cutting practices employed are described in table 1. Each plot was 10 acres in size.

To determine the effects of these treatments on humus depth, humus was measured in 1959 on a sampling grid covering 1 acre in the center of each plot. In each acre-grid a cut of humus down to the mineral soil was extracted at 60 points, a sufficient number of observations to render a difference in humus depth between cutting practices of 0.5 inch significant at the 5 percent level. This cut was examined and the L, F, H, and A_1 layers, if present were measured to the nearest 1/10 inch. The humus type was classified according to Hoover and Lunt *(2)*.

Results

Mor-type humus predominated on the plots. Only a few mulls and duff mulls were found, and they did not appear to have been influenced in their development by the churning action of soil organisms commonly associated with mull formation. More likely, the presence of mull-like humus was due to mixing by windthrow or past logging operations. The scarcity of mull types and the uncertainty as to whether they were true mulls led to excluding them from this report.

Table 1.--Average humus depths on clearcut, partially cut, and uncut plots at the Bartlett Experimental Forest, Bartlett, New Hampshire, 1959

Plot No.	Plot character	F layer	H layer
	LOWER AREA		
	This area clearcut about 1875. Soil type is Waumbek, a moderately well-drained stony fine sandy loam. Slope 3-8 percent.		
		Inches	Inches
1.	Clearcut in 1939.	0.50	*2.35
2.	Thinning cut in 1937, removing 40 percent of volume.	.44	2.95
3.	Uncut.	.41	3.37
	UPPER AREA		
	This area partly cut about 1875. Soil type is Hermon, a well-drained very stony sandy loam. Slope 25-35 percent.		
4.	Clearcut in 1935.	*0.51	2.05
5.	Cut in 1934 by individual-tree-selection method. 30 percent of volume removed.	.80	2.27
6.	Uncut.	.72	2.33

*Plots that have significant differences in F or H layers are joined by lines. These differences are significant at the 1-percent level.

Average depths of the F- and H-layers of the mors are given in table 1. Clearcutting reduced the depths of the H-layers in the lower plots. The H-layer in Plot 1, which was clearcut in 1939, averaged 2.35 inches, while on the uncut Plot 3 it was 3.37 inches. The 1.02-inch difference was significant at the 1-percent level. A similar comparison between the clearcut and uncut plots (4 and 6) of the upper area gave a difference of 0.28 inches, which was not significant.

Partly cut plots had intermediate depths, and differences between them and the more heavily cut and uncut plots were not significant. On both sites an orderly trend of a decreasing H-layer with increasingly heavy cuts is apparent.

The wide range of depths of the F-layers between plots of the upper area proved to be highly significant. The greater depth of this layer in the partly cut plot may be attributable to the more vigorous crowns and dense understory of the forest cover. Thinner F-layers on the lower set of plots may be due to conditions more favorable to rapid decomposition.

Literature Cited

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--GEORGE HART
Research Forester
Northeastern Forest Experiment Station
Forest Service, U.S. Dept. Agriculture
Laconia, N.H.

AGRICULTURE-FOREST SERVICE-UPPER DARBY