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### Montana Forestry Notes, June 1964

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## Soil Temperatures in the Lubrecht Experimental Forest

By T. J. Nimlos, R. W. Steele, G. M. Blake and R. D. Taber

A need for basic soils data, particularly for many forested soils in the West, has been precipitated by the new soil classification system (Soil Survey Staff, 1960) which stresses the chemical and physical characteristics of a soil in addition to its morphology. For instance, the Altals (7.2) are separated from the Udalf (7.3) partly by mean annual temperature (MAT).

A soil moisture ecology study being conducted on the Lubrecht Experimental Forest will provide some of these data, particularly with reference to soil temperature. As a part of this study, seven sites, called ecounits, are receiving intensive characterization with respect to soil moisture and temperature, climate, and plant and animal ecology. The ecounits are ordinated along a gradient of soil moisture which was estimated from the vegetation on the site. Environmental characteristics of the ecounits are presented in Table 1.

The soil moisture and temperature are measured with stacks of Colman units placed in small openings within the forest stands. One year's data, October 1, 1962, to September 30, 1963, have been collected at five of the seven ecounits; two ecounits (1.5 and 4) were equipped during the summer of 1963. Readings were taken daily during the period of spring recharge and weekly during the remainder of the year. These data are summarized in Table 2.

The thermistor at the 19-inch depth at ecounit 2 is apparently malfunctioning. The temperatures at this ecounit are consistently higher than those at the other ecounits and do not conform to the patterns of the others.

Air temperature, which has a direct bearing on soil temperature, was measured with a hygrothermograph in a standard Weather Bureau shelter located in the center of the Forest. Air temperature data are calculated from daily maximums and minimums (Steele, 1963) and are shown in Table 2.

One year's soil temperature data may be of limited value in view of the normal variability in weather patterns. Air temperatures indicate, however, that the MAT of the air over the period of soil temperature measurement was only one degree above the eight-year mean. Thus the air temperature means at least indicate that the period of measurement was representative of long-range temperatures. Further data must be collected to fully characterize the soil temperature regimes.

**Table 1.** Environmental characteristics of ecounits at which soil temperature data were collected.

	Ecounit Number				
	1	2	3	5	6
Great soil group	Degraded Chernozem	Gray Wooded	Gray Wooded	Brown Podzolic	Humic Glei Planosol
Soil Series	Not named	Lubrecht	Lubrecht	Holloway	Not named
Elevation (ft.)	4100	4100	4100	5900	4100
Aspect	South	South		North	
Slope grad. (%)	32	10	2	15	1

**Table 2.** Mean annual soil temperatures at a number of ecounits in the Lubrecht Experimental Forest and the mean annual air temperature at the Greenough Post Office.

Depth (in.)	Mean annual temperature ( F.)					Air
	Ecounit Number					
	1 <sup>1</sup>	2	3	5	6 <sup>1</sup>	
3	48( 3)	45	40	37	41( 3)	40
10	50(12)	46	40	37	42( 9)	
19		53 <sup>2</sup>	41	36	42(16)	
30		45	42	37	42(24)	
42		45	41	37	42(42)	

<sup>1</sup>Values in parentheses represent the actual depth of thermistor placement for these ecounits. Thermistors could not be installed at standard depths listed in first column due to bedrock or soil boundaries.

<sup>2</sup>Apparently the thermistor is malfunctioning.

The data collected thus far show a temperature gradient in the well drained soils—ecounits 1, 2, 3, and 5—which corresponds to the apparent moisture gradient over the same ecounits. Soil temperatures at ecunit 6 do not correspond to the moisture gradient. The temperatures throughout the profiles are uniform; the total variation in any one profile is less than two degrees.

The MAT of the soil has been estimated by adding 2 F. to the MAT of the air (Soil Survey Staff, 1960). This is approximately correct for ecunit 3, which most closely resembles the site at which the air temperatures were taken. Ecunit 2 is on the same soil series as 3 but is considerably warmer since it is on a gentle south slope. The soil that is saturated

for an appreciable part of the year (ecunit 6) also conforms to this estimate.

The Boralf suborder of the new classification scheme, which includes the Gray Wooded great soil group, is separated from the other Alfisols partly on the basis of a MAT below 47°F. The data reported here indicate this temperature characterizes the Gray Wooded soils in the area sampled.

#### LITERATURE CITED

- Soil Survey Staff, Soil Classification—A Comprehensive System. U. S. Dept. of Agriculture. 1960
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