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FIRST FOREST SOIL SURVEY GIVES SIGNIFICANT RESULTS

By

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The first forest soil survey on national forest lands in the Pacific Northwest was completed last year on the Pringle Falls Experimental Forest when a detailed soil map covering four square miles was made by W. J. Leighty,1/ Assistant Inspector, Bureau of Plant Industry, Soils and Agricultural Engineering. Arrangements for the survey were made by Region 6 of the Forest Service. The purpose of the work was to establish soil, site, and type relationships to aid the reforestation program in the pine region. This is a summary of the findings.

The area studied in detail includes a range of soil conditions considered representative of the Pringle Falls locality, and additional inspection of soils under lodgepole and ponderosa pine forests was made in the surrounding area. The survey revealed that timber type in this area is apparently related to soil drainage, throwing doubt on the theory that fire has been almost entirely responsible for the present distribution of the two species of pine.

Soil Classification

Soils were classified into three series or groups tentatively named Lapine, Wickiup, and Dilman. The Lapine soils were formed from pumice under excessively to moderately well-drained conditions due to a loose, open soil lying on slopes ranging from 2 percent to more than 15 percent. The typical soil consists of a thin covering of organic litter over gray-brown pumice, shading to pale brown or yellow as depth increases.

1/ Leighty, W. J. Classification of sites for reforestation. Office report (typewritten) on file at Region 6, U. S. Forest Service, Portland, Oregon. May 1, 1947.

At about 36 inches a dark brown, gravelly loam, the remains of an old soil buried by pumice, is found. The pumice mantle may range from 2 to 15 feet thick in areas where the soil lies flat or nearly so, but averages about 3 to 4 feet in depth. When this soil is underlain by basalt on the slopes of buttes, the depth of the pumice over the bedrock is seldom more than 24 inches, and the gravelly loam layer is absent. These Lapine soils lie on uplands, outwash plains, and terraces at altitudes ranging from 4,000 to 5,000 feet.

The Wickiup series includes soils formed from pumice under poor or imperfect drainage resulting from a slightly depressed position; the slope never exceeds 1 percent. The soil consists of a very dark gray, thin organic litter layer over light gray pumice, which shades into a white pumice sand at about 36 inches. Below this white layer is a gravelly loam which may be either strongly cemented or compacted. This impervious layer effectively stops downward moisture movement and produces an intermittently high water table. This soil is rather variable due to different degrees of compaction in the subsoil and corresponding differences in drainage. However, it is readily distinguished from the Lapine series by its gray or white leached appearance.

The Dilman series is a heavy textured soil having very poor drainage because of swale, waterway, or swamp position. The typical soil is a gray, silty clay loam shading to lighter gray color at about 12 inches and extending to a depth of 36 to 46 inches. At that point an abrupt change to a very dark gray muck is found. From 50 to 60 inches a fairly dense, silty clay loam layer is encountered. This soil is variable in depth and thickness of the various layers but is easily recognized by its low position and by the fact that only willows, aspen, and some wetland grasses grow upon it. The Dilman series is not extensive in area and is of no value for forestry.

Areas classified as marsh, muck, and rough, stony land were also mapped. Marsh and muck are not considered important for forestry. Rough, stony land varies in productivity according to the depth of soil over rock.

Significant Results

The most significant result of this first forest soil survey is the discovery of an apparent relationship between soil drainage and timber type in the Pringle Falls area. In general, poorly drained soils were found to support lodgepole pine stands but not ponderosa. The well-drained to excessively well-drained soils are occupied by ponderosa pine to the exclusion of lodgepole. This relationship was also observed in surrounding areas eastward to the Fort Rock desert and to the south and west of Pringle Falls. Earlier suspicions of such a relationship were held by Munger[2] and Howell.[3]

2/ Munger, T. T. Western yellow pine in Oregon. U. S. Dept. Agric. Bul. 418, 48 pp., illus. 1917.

3/ Howell, Joseph. Clay pans in the western yellow pine type. Jour. Forestry 29 (6): 962-963. 1931.

Leighty concludes from his work on this area that ponderosa pine does not thrive where there is a fluctuating high or moderately high water table, while lodgepole pine can and does grow well under such conditions due to a higher moisture tolerance or requirement. The possibility of poor air drainage, lower temperatures, more soil freezing, and frost damage affecting species distribution in the poorly drained soil areas is also considered in Leighty's report.

The theory that competition after fire causes the present distribution pattern of the two species is also questioned in the light of this new soil information. In his report, Mr. Leighty says: "In the Pringle Falls Lapine region no certain evidence was observed that would indicate that fires have had a principal influence on the distribution of these two species. If fires have had a material influence, the distribution of the two species should be more haphazard in relation to the soils and topography. Possibly fires may have had an effect on the distribution of the two species in the transitional areas, but it seems likely that the results of the natural competition of the two species in these areas would be uneven."

The soil survey made by Leighty has been extended this year to cover all of the main unit of the Pringle Falls Experimental Forest. Further work in areas outside the pumice zone and at higher altitudes will be carried out to obtain additional information on the occurrence pattern of lodgepole and ponderosa pine.

The following tabulation shows the various soil types, variations within the types, and timber species distribution thereon:

Soil type	Soil depth	Drainage conditions	Timber type
Lapine loamy coarse sand 2-7% slope	33 54 in. to brown stony loam	Very rapid through pumice; moderate through loam. No water table evident.	Nearly pure ponderosa pine; a few scattered lodgepole pine.
Lapine loamy coarse sand 15-25% slope	Bedrock at 24-38 in.	do	Pure ponderosa; some sugar pine on higher north slopes.
Lapine loamy coarse sand 0-2% slope	No obstructions to drainage. Depth unlimited	Very rapid	Pure ponderosa; open pure lodgepole, or more often, a mixture.
Lapine loamy coarse sand 2%+ slope	do	do	Predominantly ponderosa pine.
Lapine loamy coarse sand over compact subsoil 0-2% slope	50-60 in. to hard layers	Variable below pumice. Intermittent water table at 4-5 ft.	Predominantly dense pure lodgepole pine.
Wickiup loamy coarse sand 0-1% slope	Cemented layer at 50 60 in.	Rapid through pumice. Intermittent high water table below pumice.	Dense pure lodgepole.
Wickiup silt loam 0-1% slope	Variable. Generally cemented layer at 60 in. or less.	Poor, due to intermittently high water table. Moderate through silt loam layers.	Dense or very dense pure lodgepole pine.
Dilman silty clay loam 0-1% slope	Heavy silty clay layers at 13-24 in.	Very poor	Not timbered.
Untyped rough stony land 15%+ slope	Shallow to rock outcrop	Very rapid	Pure ponderosa; sugar pine and white fir on high north slopes.
Marsh and muck	Variable. Water table causes constand effect of shallowness	Very poor	Not timbered.