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# SOIL MOISTURE DEPLETION IN THREE LODGEPOLE PINE STANDS IN NORTHEASTERN OREGON



by
Daniel M. Bishop

A 1-year study in the Blue Mountains of northeastern Oregon indicates that substantial amounts of soil moisture are consumed during the growing season in lodgepole pine stands. Dual purposes of the study were to estimate the quantities of water that can be stored in basalt-pumice soils typical of the Blue Mountains, and to determine the rate and amount of moisture depletion during the summer growing season. These are the first steps of an investigation to learn if cutting dense lodgepole stands will influence the amount of water available for streamflow.

## THE STUDY

The study was located on a long flat-topped ridge (elevation, 5,000 feet) near the Starkey Experimental Forest and Range. Three areas were selected; each is covered by a nearly pure stand of 90-year-old lodgepole pine.

Soil in the study areas is a permeable pumicite (depth, 16 to 20 inches) lying over residual material of variable thickness derived from basalt. Depth to basalt bedrock ranges from 34 to 44 inches. The $A_0$ horizon is composed of pine needles and other organic matter in various states of decomposition. This upper zone of the soil profile is usually matted with the roots and runners of lesser vegetation: grouse whortleberry, shinyleaf spirea, pinemat manzanita, strawberry, sedges, and pinegrass. In the better illuminated parts of the understory are numerous seedlings of lodgepole pine, Douglas-fir, grand fir, and western larch.

In each study area, two 50-foot-square plots were established. At biweekly intervals from May 1 through October 1, 1959, soil moisture was sampled at four randomly selected locations in each plot. New random locations were selected for each biweekly sampling period. Three depth strata were sampled at each location: A (0 to 12 inches), B (12 to 24 inches), and C (24 inches to bedrock).

Stratum A, composed of pumicite, was sampled with an open-sided Veimeyer tube, and a 2-inch can-type auger was used for sampling strata B and C. Stratum B included both pumicite and residual soils; samples in stratum C were composed of residual soils.

All soil samples were weighed before and after drying with an accuracy of ±0.1 gram, and soil moisture was recorded as percent of the samples' ovendry weight. Bulk densities were determined so that percent soil moisture could be expressed in terms of equivalent inches depth.

## RESULTS

Soil moisture began its annual decline about May 15 in strata A and B, and 2 weeks later in stratum C (fig. 1). Between May 15 and September 17, average total soil moisture content was reduced from 15.9 inches depth to 4.5 inches depth. Average contribution from stratum A was 4.4 inches; from stratum B, 4.2 inches; and from stratum C, 2.8 inches.

During this same period, an average of 2.3 inches of rain fell on the surface of the plots. Added moisture supplied by this net rainfall (rain intercepted by tree crowns is excluded) had little apparent effect on the trend in soil moisture depletion (fig. 1). However, it is assumed that moisture added by rainfall must be taken into account in measuring total moisture depletion. Total indicated disposition of moisture, therefore, was 13.7 inches during the period May 15 to September 17.

Disposal of this soil moisture can be attributed to evaporation, transpiration by vegetation, and seepage into the basalt bedrock. Combined effects of evaporation and transpiration appear to account for a major part of the moisture depletion, indicating that substantial amounts of water in basalt-pumice soil in the Blue Mountains could be influenced by cutting lodgepole pine.

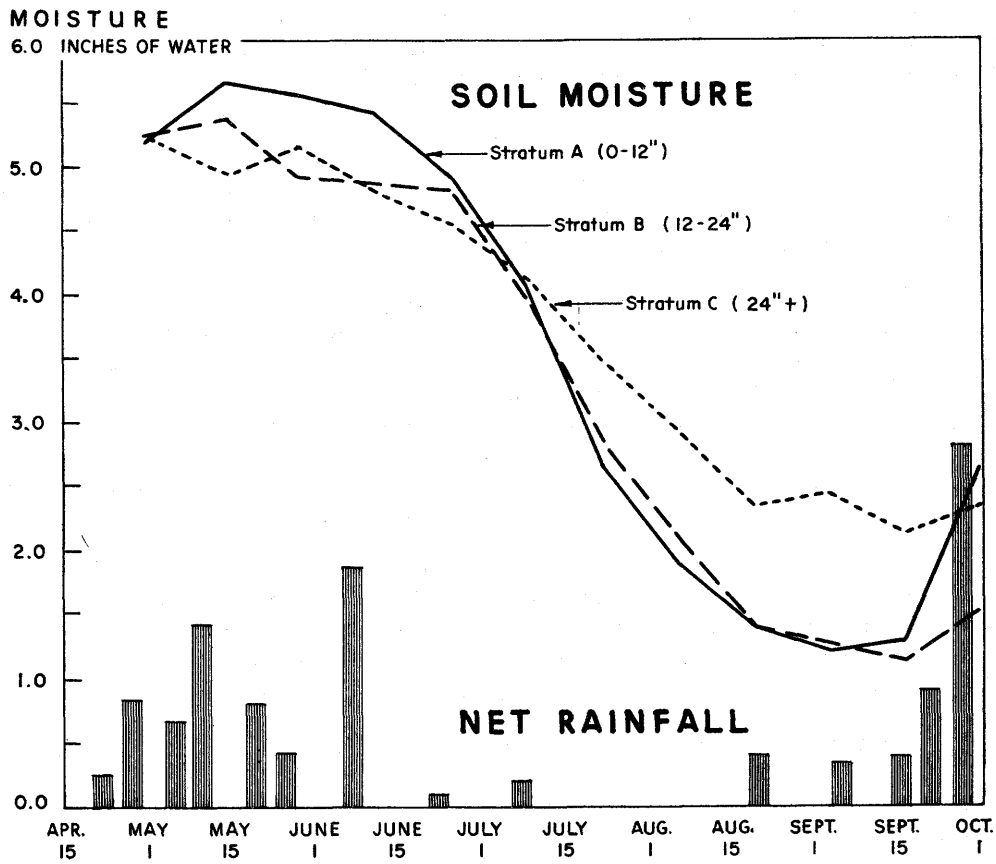


Figure 1.--Distribution of net rainfall and soil water in three lodgepole pine stands--1959.