United States Department of Agriculture

Soil Conservation Service

Northeast NTC
160 E. 7th Street
Chester, PA 19013

Subject: SOI - Ground-Penetrating Radar (GPR) Field Studies in Oregon; August 17-19, 1986

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To: Jack Kanalz
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PURPOSE

To demonstrate, explore, and assess the potential of using ground-penetrating radar techniques in the Pumice Zone of Central Oregon.

PARTICIPANTS

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Thor Thorson, Correlator, SCS, Portland, OR

EQUIPMENT

The equipment used during this field study was the SIR System-8 with the ADTEK SR 8004H graphic recorder and the ADTEK DT-6000 tape recorder. The 120 MH_z antenna with the 705DA transceiver produced the most optimal balance of penetration and resolution of subsurface features. The radar unit operated well in the field with no observed malfunctions.

ACTIVITIES

The GPR unit arrived in Bend, Oregon, on the afternoon of August 17, 1986. The GPR system was used on a variety of soils and soil landscapes near the towns of Bend and Redmond. The unit departed Washington on August 20.

DISCUSSION

The Pumice Zone of Central Oregon represents a most favorable environment for GPR operations. Thick deposits of dacitic, pumiceous ash and cinders, low clay content, and relatively dry soil conditions contributed to the deep probing with the GPR.

The GPR was used as a quality control tool to rapidly assess and record the presence of, depth to, and lateral extent of buried loamy sediments and basalt bedrock in areas of Lapine (cindery Typic Cryorthents) and Shanahan (ashy over loamy, mixed, nonacid Typic Cryorthents) soils. Also, the GPR discerned the thickness of cinder deposits, differences related to grain sizes or bulk densities within these deposits, and stratigraphic relationships. These features are critical for soil classification decisions and map unit interpretations. The depth to bedrock is variable within each of the selected study sites and ranged from 4 to 16 feet.

In areas of the proposed Plainview soil (coarse-loamy, mixed, mesic Aridic Haploxerolls), the GPR determined the thickness of loamy sediments, the depth to and thickness of underlying fragmental materials, and the depth to tuff. The thickness of alluvial sediments and the depth to tuff was variable at the study site and ranged from 6 to 12 feet. This information was of immediate benefit to the mining operator who had allowed us access to his land and was interested in our work and results.

Several transects were completed in areas of Deschutes (coarse-loamy, mixed, mesic Aridic Haploxerolls) and Stukel (loamy, mixed, mesic Lithic Haploxerolls) soils. The depth to basalt bedrock is difficult to determine with conventional surveying tools due to the large number of coarse fragments in these soils. With the GPR, the depth to bedrock was easily and quickly charted along the entire length to the transect. The bedrock was charted at relatively shallow (averaged 21 inches) and uniform (ranged from 18.1 to 25 inches) depths. Based on radar data, the composition of the study area averaged 59 percent Deschutes and 41 percent Stukel soils.

The GPR was used to characterize geomorphic surfaces and to determine the occurrence and distribution of duripans on the soilscape. Generally, the duripans were found to occur principally on the higher-lying, more stable terrace levels.

RESULTS

This study represents the first opportunity for SCS to work with ground-penetrating radar in Oregon and to investigate the potential of using GPR techniques on soils derived from volcanic ash, cinder, and pumice. Results from this investigation are most encouraging. The potential for using GPR techniques on similar soils in the Northwest is high.

The radar probe to depths as great as 16 feet in soils within the study areas. The quality of the graphic images was high and comparable with results obtained in Florida, a state recognized as being highly suited to GPR operations. In the Pumice Zone of Central Oregon, the GPR can be used effectively as a quality control, reconnaissance, or investigatory tool.

This field study has provided an opportunity for field and staff specialists to observe and evaluate the performance of the GPR on selected soils within Oregon. These impressions, both pros and cons are beneficial for the proper evaluation and direction of GPR techniques within SCS.

An annotated record of the graphic profiles has been returned to Gerald Latshaw, State Soil Scientist, under a separate cover letter. I hope that you will have the opportunity to review these graphic records.

A special thanks is extended to Thor Thorson for his preparation for and leadership of this field study.

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