United States Department of Agriculture
Soil Conservation Service
Northeast NTC
160 E. 7th Street
Chester, PA 19013

Subject: SOI - Trip Report - GPR Field Studies, Giles and Montgomery Counties, Virginia; April 27-29, 1987.

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To: George C. Morris
State Conservationist
Soil Conservation Service
Richmond, Virginia

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**Purpose:**

To assist the state soil survey staff and faculty of the Agronomy Department, Virginia Polytechnic Institute and State University evaluate soil-stratigraphic relationships along alluvial terraces of the New River, and to assess the potential of using GPR techniques within the Great Valley of Virginia.

**Participants:**

Dr. James C. Baker, Soil Survey Coordinator, VPI, Blacksburg, VA
Steve Cromer, Soil Scientist, VPI, Lovingston, VA
Marc H. Crouch, Soil Specialist, SCS, Richmond, VA
James Doolittle, Soil Specialist (GPR), SCS, Chester, PA
Dr. William Edmonds, Field Coordinator, VPI, Blacksburg, VA
Bruce Legge, Soil Scientist, VPI, Lovingston, VA
Max McCord, Lab Tech., VPI, Blacksburg, VA
Dean Rector, Soil Specialist, SCS, Richmond, VA
Pam Thomas, Grad. Student, VPI, Blacksburg, VA
Steve Thomas, Party Leader, VPI, Lovingston, VA

**Activities:**

The time was spent conducting transects with the ground penetrating radar (GPR) at the Giles Agronomy Research Farm near Pearisburg and at the Agronomy Research Farm near Blacksburg. Soils were examined by auger borings. Depths to soil horizon were determined by auger borings and correlated with images on the radar's graphic profiles. Images of soil horizons were identified on the graphic profiles and were correlated with detailed field sketches and data

collected by Dr. Edmonds. Soil features and horizons were identified by their unique signatures on graphic profiles.

Discussion:

Graphic profiles collected with the GPR at the Giles Agronomy Research Farm can be used to trace the lateral extent and variation of soil strata. The radar provided detailed and comprehensive imagery of soil horizons to depths of about 2.5 meters at this site. On this terrace, augering, due to the occurrence of coarse fragments, is often difficult. In fifty-seven percent of Dr. Edmonds' observation sites, augering was restricted by coarse fragments to depths of less than 1.8 meters. While dependent upon ground truth observations, the GPR was used to extend the accuracy and range of our interpretations and to fill in the information voids which exists between the observation sites.

Sixteen soil families had been identified on this study site. Based on auger boring observations and laboratory data, the distribution of soils within the study site is highly complex and difficult to delineate on soil maps. Cross sectional radar profiles of the terrace (from transects conducted perpendicular to river) display a greater degree of complexity and variation than longitudinal profiles of the terrace (from transects conducted parallel with the river).

In cross-section, while strata appearing on graphic profiles are variable (depth and expression) over short distances, distinct zones can be identified and are associated with patterns of channel filling and cutting. These pattern zones and features appear to correspond with Dr. Edmonds'data. Strata are more continuous and appear to be less variable along the longitudinal profile.

While some strata appeared to be more extensive and uniform than others, lateral variations in textures were observed. Abrupt vertical changes in soil texture from sandy clay loams to sandy loams, or from sands or loamy sands to sandy loams were observed with the radar. However, gradual lateral or vertical changes in soil properties are usually not discerned with the radar.

The inability of the radar to discern subtle lateral changes in soil textures helps to explain a noteworthy disparity with the data collected by Dr. Edmonds. The profiles developed by Dr. Edmonds depicted many discontinuous layers with rather abrupt vertical boundaries. These strata are segmented between auger boring sites in areas where no data are available. However, the radar profiles depict many of these layers as being continuous rather than segmented between the observation sites. While the strata appear to be continuous on the radar profiles, gradual lateral variations in texture would not be discerned and would account for the abrupt breaks in texture and stratification which appears on Dr. Edmonds' profiles.

As a result of the complexity of soil patterns and the variations in soil properties occurring at the Giles Agronomy Research Farm site, and based on the limited number of auger borings made during the radar survey, not all strata could be identified on the graphic profiles. These strata may be identified after the imagery is compared with Dr. Edmonds' detailed observations of the study site. The GPR imagery should supplement data collected by Dr. Edmonds and assist site evaluation and mapping.

Extensive areas of Fredrick (clayey, mixed, mesic Typic Paleudults) and Timberville (clayey, mixed, mesic Fluventic Dystrochrepts) soils occur in the Great Valley. The high clay content of these soils limits the probing depth of the radar to the upper boundary of the fine textured sediments or to depths of 0.5 to 1.0 meters. Consequently the potential for deep profiling with the GPR in the Great Valley is very poor.

The GPR distinguished area of Fredrick, Marbie (fine-loamy, siliceous, mesic Typic Fragiudults), and Timberville within the same landscape. Fragipans, argillic horizons, alluvial layers, and bedrock were distinguished on the radar's graphic profiles by their unique signatures. While limited in probing depth, the GPR can be successfully applied to near surface investigations and soil map unit composition studies in the Great Valley.

Annotated copies of all graphic profiles have been returned to Dean Rector for review.

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cc:
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