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United States  
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Agriculture

Soil  
Conservation  
Service

Northeast NTC  
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Subject: SOI - Trip Summary - Cornell University,  
Ithaca, New York; May 20-24, 1985

Date: June 11, 1985

To: Dr. Ray B. Bryant  
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Ithaca, NY 14853

File Code: 430-5

PURPOSE

To field test the ground-penetrating radar (GPR) on soils developed from high lime till and fine-textured glaciolacustrine sediments in central New York.

PARTICIPANTS

Ray Bryant, Assistant Professor of Soil Science, Cornell University, Ithaca, NY  
James Doolittle, Soil Specialist (GPR), SCS, NENTC, Chester, PA  
Jamil Macedo, Graduate Assistant (Brazil), Cornell University, Ithaca, NY  
Dan Miller, Research Associate, Cornell University, Ithaca, NY  
Frankie Ramos, Research Technician, Cornell University, Ithaca, NY  
Victor Snyder, Assistant Professor of Soil Science, Cornell University, Ithaca, NY  
Keith Wheeler, Soil Scientist (Inter.), SCS, Syracuse, NY

EQUIPMENT

The equipment used during this field trip was the SIR System 8 with micro-processor, the ADTEK SR-8004H graphic recorder, and the ADTEK DT-6000 tape recorder. Although the 80, 120, and 300 MHz antennas were used, the 120 MHz antenna appears to be the most suitable for field investigations within the study areas. Wire connections within the terminals of the trigger cable for the model 765 HP transmitter repeatedly parted under tension and required field repairs. No other equipment malfunctions were observed.

ACTIVITIES

Prior to the arrival of the GPR, sites were selected in fields of the Aurora, Game, Mount Pleasant, and Savage Farms. A field of Bath (coarse-loamy, mixed, mesic Typic Fragiochrepts), Mardin (coarse-loamy, mixed, mesic Typic Fragiochrepts), and Volusia (fine-loamy, mixed, mesic Aeric Fragiaquepts) soils was transected with GPR on 20 May. Multiple GPR



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experiments and traverses were conducted in an area of Honeoye (fine-loamy, mixed, mesic Glossoboric Hapludalfs) and Lima (fine-loamy, mixed, mesic Glossoboric Hapludalfs) at the Aurora Farm on 21 and 22 May. Areas of Hudson (fine, illitic, mesic Glossaquic Hapludalfs) and Rhinebeck (fine, illitic, mesic Aeric Ochraqualfs) soils were transected at the Game and Savage Farms on 23 May.

### CONCLUSIONS

The probing depth and the effectiveness of the GPR as an investigatory tool was limited by relatively high electrical conductivities of the studied soils. Soils with high electrical conductivities rapidly dissipate energy and restrict the probing depth of the GPR. The principal factors that influence the electrical conductivity of soils and limit the probing depth of the GPR are water content, the amount of salts in solution, and the amount and type of clays. The performance of the GPR appears to be restricted in most areas (such as the Allegheny Plateau) having moderately fine or fine textured soils weathered from shale or siltstone.

Probing depths of 1.0-1.5 meters were attained in the loamy Bath, Mardin, and Volusia soils; 0.5-1.0 meters in the high lime, loamy Honeoye and Lima soils; and less than 0.5 meters in the clayey Hudson and Rhinebeck soils. These ranges represent depths of consistent and interpretable radar imagery of soil features and do not represent the infrequent exception or necessarily the maximum depth of penetration.

Although the probing depth was severely restricted in the study areas, the GPR appears to be an effective tool for detecting the presence, depth, and variability of some soil features. The radar provided imagery of the cambic horizon in Mardin soil, and the argillic horizon in Honeoye, Hudson (see enclosed figure), Lima, and Rhinebeck soils. Semi-variograms can be constructed for these horizons based on profile data. Generally, fragipans and dense basal till were not uniformly expressed nor apparent across graphic profiles.

Comments and observations have been made on a complete record of the graphic profiles and returned under a separate cover.

Thanks once again for the opportunity to work with you and Mr. Ramos in the field. The trip was both enjoyable and rewarding.

  
James A. Doolittle  
Soil Specialist (GPR)

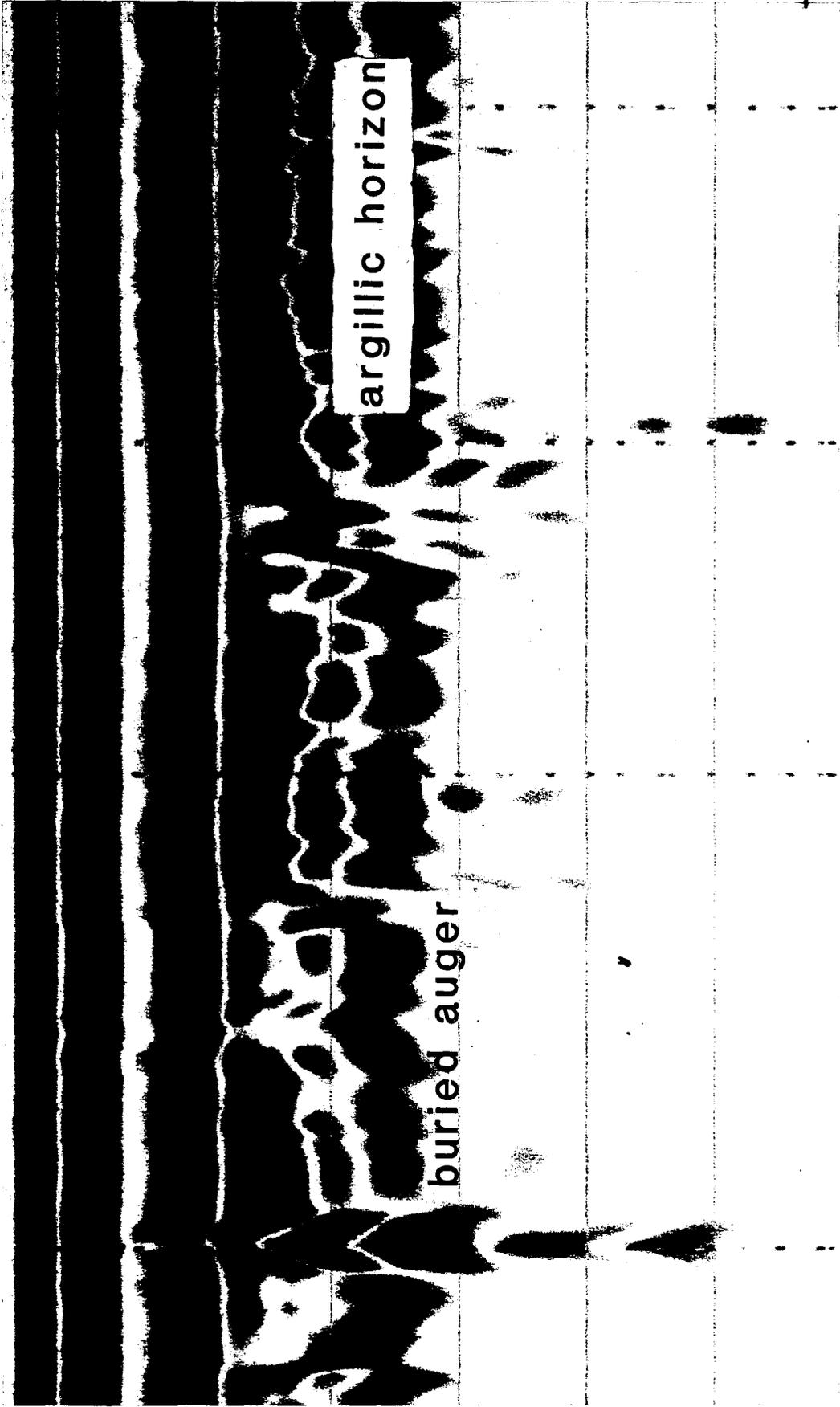
Enclosure

cc:

A. Holland  
T. Miller  
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DEPTH IN METERS

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**GPR PROFILE OF HUDSON SOIL**  
**FINE, ILLITIC, MESIC GLOSSAQUIC HAPLUDALFS**