

**United States
Department of
Agriculture**

**Natural Resources
Conservation
Service**

**11 Campus Boulevard
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Subject: -- Geophysical Assistance

Date: 3 September 2004

To: Roger A. Hansen
State Conservationist
USDA - NRCS
Parkade Center, Suite 250
601 Business Loop 70 West
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Purpose:

The USDA-ARS Cropping Systems and Water Quality Research Unit in Columbia, Missouri, recently purchased a TerraSIRch Subsurface Interface Radar (SIR) System-3000. Training was provided on the operation of this ground-penetrating radar (GPR) system. In addition an overview was provided on survey procedures and the interpretation and processing of radar data using RADAN for Windows software.

Participants:

Scott Drummond, IT Specialist, USDA-Agricultural Research Service, University of Missouri, Columbia, MO
Jim Doolittle, Research Soil Scientist, USDA-NRCS-NSSC, Newtown Square, PA
Larry Gray, Soil Scientist, USDA-NRCS, Gallatin, MO
Pingping Jiang, UMC-Student, Soil, Environmental and Atmospheric Department, University of Missouri, Columbia, MO
Wonkyo Jung, UMC-Student, Soil, Environmental and Atmospheric Department, University of Missouri, Columbia, MO
Gail Ludwig, Associate Professor and Department Chair, Area, Geography Department, University of Missouri, Columbia, MO
Brent Meyers, Research Specialist, Agronomy Department, University of Missouri, Columbia, MO
Kitchen Newell, Soil Scientist, USDA-Agricultural Research Service, University of Missouri, Columbia, MO
Dennis Potter, State Soil Scientist, USDA-NRCS, Columbia, MO
Melvin Simmons, Supervisory Soil Scientist, USDA-NRCS, Gallatin, MO
Kenneth Sudduth, Agricultural Engineer, USDA-Agricultural Research Service, University of Missouri, Columbia, MO
Cuizhen Wang, Assistant Professor, Geography Department, University of Missouri, Columbia, MO
Dave Wolf, Resource Soil Scientist, USDA-NRCS, Clinton, MO
Kimberly Worth, Soil Scientist, USDA-NRCS, Gallatin, MO
Fred Young, Soil Scientist, USDA-NRCS, Columbia, MO

Activities:

All activities were completed during the period of August 16 thru 20, 2004. An introductory session on the uses of GPR and the interpretation of radar data was provided on Monday morning in the conference room of the State NRCS Office. That afternoon, basic principles of calibrating and operating the radar unit were reviewed on lawns and sidewalks near the Agricultural Engineering Building on the campus of the University of Missouri. A section of a cemetery located in Columbia was surveyed on Tuesday morning and GPR field procedures and interpretations for archaeological investigations were discussed. Later that morning, results of the archaeological survey were processed in the conference room of the Agricultural Engineering Building. On the afternoon of 17 August, a GPR

survey was completed in an area of Haynie loam, 0 to 2 percent slopes, which was located in southern Boone County along the floodplain of the Missouri River. On Wednesday morning, radar surveys were completed in an area of Mexico silty clay loam, 1 to 3 percent slopes, on the Collin Farm, which is located about 1 mile north of Centralia, Boone County, Missouri. Results of this survey were processed in the conference room of the Agricultural Engineering Building that afternoon. Thursday (August 19) was spent conducting archaeological investigations at the Haun's Mill Historic Site, which is located north of Kingston, along Shoal Creek in Caldwell County. Friday morning was spent in the Agricultural Engineering Building processing results of the archaeological investigation at Haun's Mill and discussing the weeks work.

Results:

1. All participants were given the opportunity to operate and complete surveys with the SIR System-3000 radar unit and to process radar data with the RADAN for Windows software.
2. Soils (Blackoar, Kennebec, Keswick, Mexico, and Putnam series) profiled with GPR had both high clay contents and are dominated by 2:1 expanding lattice clay minerals. Though Haynie soils have lower clay contents, they are calcareous and have clay fractions dominated by 2:1 expanding lattice clay minerals. These conditions are highly attenuating to the radar's energy and limit penetration depths to depths of less than 1 meter.
3. Many soils in Missouri are highly attenuating to radar energy and therefore depths of penetration are limited. The USDA-ARS Cropping Systems and Water Quality Research Unit presently plans to use GPR to assess shallow soil features and properties in these soils.
4. The University of Missouri's Geography Department expressed interest in using GPR to support archaeological investigations.
5. It is hoped that this assistance will further strengthen the relationships between NRCS, ARS, and the University of Missouri.

It was my pleasure to work again in Missouri and with members of your fine staff. I deeply enjoyed the opportunity to work once again with my friends at the University of Missouri.

With kind regards,

James A. Doolittle
Research Soil Scientist

cc:

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