SWS-01-07

Soil and Water Science
Research Brief

University of Florida Institute of Food and Agricultural Sciences

Using Ground-Penetrating Radar

M.E. Collins, J. Schultz, and M.A. Tischler

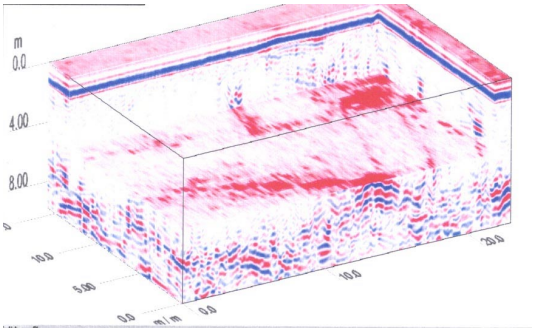
Ground-penetrating radar (GPR) is a geophysical method that has been applied to investigate subsurface features and layers in soils for over 20 years. This technique, also lesser known as ground-probing radar, georadar, or subsurface radar, was first used in Austria in 1929 to determine the depth of a glacier. Its development was

continued by the military in the 1950's and in the 1960's GPR was used for the Viet Nam conflict. Subsequently in the 1970's, NASA was involved in improving the equipment and used it to investigate the subsurface of the moon during the Apollo 17 mission.

From the early 1980's GPR has been routinely used in the National Cooperative Soil Survey Program. Principal uses have been to estimate the variability and taxonomic composition of soils, chart the lateral extent, and estimate the depth and thickness of soil horizons and geologic layers, and to map and interpret soils.

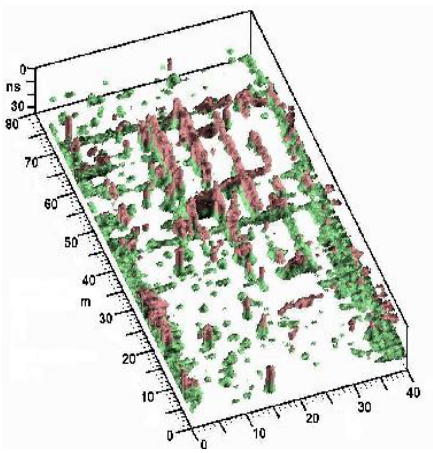
All soils are not equally suited to GPR techniques. Soil maps and taxonomic descriptions contained in published soil survey reports can be used to assess the suitability of soils and sites for GPR applications. In addition, the criteria used to define and classify the soil can be used to aid interpretations of radar imagery.

In some soils, the use of GPR is inappropriate. In these soils and for some types of shallow investigations, other geophysical techniques are available which can provide more reliable and less ambiguous data. Knowledge of the chemical, physical, and mineralogical properties of soils and their distribution can facilitate the assessment of sites for GPR applications. In the United States, this information is contained in published soil surveys reports and information systems.



Systematic GPR surveying and computer graphic techniques have been used to enhance the understanding of soils and the landscapes on which they occur. Systematic profiling with GPR along parallel grid lines quickly provides the copious data needed to produce detailed computer-generated two-dimensional isoline plots and three-dimensional surface net diagrams of subsurface features.

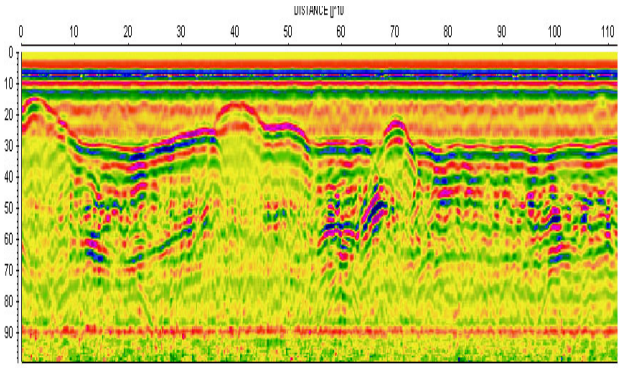
Advantages of GPR systems are speed of operation and capacity to produce large quantities of continuous, high resolution subsurface data. Compared with conventional methods of observing soils, GPR techniques are faster, more economical, less likely to overlook subsurface features, and are nondestructive.



GPR transmits radar signals that can detect objects/features in Florida as deep as ~100 feet, and as shallow as 1 foot, under optimum ground conditions and with the appropriate antenna. The depth of penetration depends upon the electromagnetic properties (principally conductivity) of soils and the antenna frequency used.

Low frequency antennae (e.g. 80 MHz) provide information at great depths while high frequency antennae (e.g. 1000 MHz) are used to discriminate features at shallow depths. The antenna can be towed by hand, or by a vehicle at speeds from ~2 to 5 mph.

Disciplines using GPR technology include pedology, archaeology, forensic anthropology, geology, hydrology, law enforcement, and the military.



Authors

M.E. Collins
Soil and Water Science Department
P.O. Box 110290, University of Florida
Gainesville, FL 32611
mec@gnv.ifas.ufl.edu

J. Schultz
Anthropology Department
P.O. Box 117305, University of Florida
Gainesville, FL 32611
schultzj@ufl.edu

M.A. Tischler
Soil and Water Science Department
P.O. Box 110290, University of Florida
Gainesville, FL 32611
mollic@ufl.edu