

AERIAL AND ON-THE-GROUND GEOPHYSICAL METHODS FOR DETECTING SUBSURFACE ANOMALIES OF ANTHROPOGENIC ORIGIN

Larisa Golovko, Landviser LLC, TX and Landviser s.r.o., Prague, Czech Republic

Iurii Manshtein, Landviser s.r.o., Prague, Czech Republic

Aleksei Trubin, Czech University of Life Sciences, Prague, Czech Republic

Detecting subsurface anomalies is a challenging task for any single geophysical method. Several geophysical methods have been developed to measure soil electrical properties, which in many applications help accurately map and identify anomalous zones of buried materials distinct from naturally occurring variability of the soils. In archaeology, the search for man-made foundations and constructions using geophysical methods involves not only detecting resistivity anomalies but also searching for signature geometrical patterns indicative of the underlying structure of anthropogenic origin. Remote sensing data, such as airborne medium-resolution color-infrared (CIR) imagery and high-resolution Light Detection and Ranging (LiDAR) data can be very useful during the initial phase of site selection for further on-the-ground geophysical measurements. In 2021-2022 we conducted field geophysical surveys near Montrose, IA, and Nauvoo, IL to study the remaining earthen constructs (mounds, berms, sandy foundations of the places of worship) possibly attributable to Hopewell culture as well as a site of the first European settlers on the west bank of the Mississippi River. Seven sites (fallow agricultural fields, wooded areas, and a residential yard) that were identified as areas of interest were surveyed with multiple geophysical instruments to clarify historical construction layouts. We used electrical geophysical methods of direct current (DC) four-electrode probe and electromagnetic induction (EMI) mapping, electrical resistivity 2D/3D tomography (ERT), and vertical electrical sounding (VES) methods, which were carried out with the instruments by Landviser and SiberGeo: LandMapper, SibER48K12, Geovizer, and AEMP-14. The field electrical properties data were combined with the previously collected magnetometry, CIR, and LiDAR data into comprehensive GIS to study and detect patterns confirming previous usage and modification of the land that can be attributed to human activities at different archaeological periods. Based on the GIS analysis, we verified the correctness of the initial selection of sites by detecting elevation, color, magnetic, and electrical properties anomalies. We found clear geometrical patterns at several sites by mapping the data anomalies from the field measurements and airborne imagery. Caution should be exercised when applying geophysical methods to distinguish between the anomalies of the ancient and modern origin or human and natural origin, therefore, a combination of methods is needed to enhance the funding and draw correct conclusions.