

Automated Detection of Prehistoric Conical Burial Mounds
From LIDAR Bare-Earth Digital Elevation Models

Abstract

The Iowa Department of Natural Resources (IDNR) and partnering agencies are conducting a statewide LiDAR data collection project. A 1 m shaded relief image from an early collection clearly displayed a recorded, prehistoric mound group on IDNR property, except for a set of three mounds overshadowed from a nearby hill. Prehistoric burial mounds are protected from disturbance through several federal and state laws. Unfortunately, the State Archaeologist and State Historic Preservation Offices do not have the resources to conduct mound surveys throughout the state for the sake of knowing what areas should be protected from future development. LiDAR introduces the possibility that large-area mound prospection is feasible.

There are challenges to image interpretation that can make such a task time-consuming with potentially mixed results. Conical mounds visible on shaded relief images are as small as 5 m diameter and 30 cm high. Interpretation over large areas can become tedious and may affect the quality and consistency of the interpretation over time. The interpreter's experience and ability to detect subtle changes in shading also impact interpretation quality. The early relief image demonstrated that more than one image with different settings will be necessary to interpret areas that are overshadowed.

A conical mound detection model was developed in the ArcGIS 9.2 ModelBuilder environment using Spatial Analyst tools. The model works as an interpretation aid by marking features that fit the metrics of the most common mound type. ArcGIS is the prevalent GIS software used by archaeologist in the state and the model, stored as a .tbx file, is easily distributable. The base of the model relies on three variables derived from the BE DEM – height, slope and aspect variety. An additional segment of the model is for clean-up and conversion from the raster data model to vector.

The model was tested in five areas representing three physiographic regions; it detected 90% of mounds that were interpretable from shaded relief images and have been recently field-verified, including other mound types. The model reduced the area to be checked to 0.15% - 0.4% of the area of interest. Natural and man-made features that triggered false positives were consistent; future work will be directed towards reducing the occurrences.

The model can expedite prospection of counties with high mound densities to the point where the time required for such a project would fit a modest budget. The results of the interpretation can be disseminated through an Internet Map Service (IMS) already established for professional archaeologists. County planners and local governments could get the results to the quarter section through an IMS currently in development, giving them warning that a potential prehistoric burial may be in a planned project area.