Title of Project:
Rethinking Logistic Regression for Predictive Archaeological Modeling: Improving Predictive Accuracy Using the Generalized Additive Model (GAM).
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Description of Research and GIS Applications

The Center for Environmental Management of Military Lands (CEMML), Colorado State University, has developed a series of predictive archaeological models of prehistoric and historic period site locations for a study area on Department of Defense lands in the western United States. While research efforts began by applying traditional archaeological approaches to predictive modeling using parametric logistic regression analysis, additional analytical steps have been explored using non-traditional types of logistic regression models, such as the general linear model (GLM), the generalized additive model (GAM), and the local regression model (LOESS), more commonly applied in ecology and epidemiology.

We demonstrate that non-parametric analysis produces a better fit with the independent biophysical variables of interest to archaeologists, rather than the traditional parametric analytical approach used in earlier predictive modeling efforts. More specifically, we demonstrate that the non-parametric GAM model, while computationally more complex for purposes of spatial modeling, is more appropriate for predictive archaeological modeling, producing more accurate predictions of archaeological site-presence and site-absence. The implications of these results are then discussed with respect to land-management decision-making on military lands. Our results not only increase predictive accuracy over a GLM-based model, but also effectively reduce the acreage falling within the high- and medium-probability areas predicted by the models. This is illustrated by comparing the results of a 1987 "archaeological sensitivity map" (extrapolated from localized discriminant function analysis and other information), our own GLM-based predictive model, and the final GAM-based predictive model.