Prearchaic Land Use in Grass Valley, Nevada: A Novel Statistical Implementation of Optimal Distribution Modeling

THE UNIVERSITY OF UTAH ARCHAEOLOGICAL CENTER

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Introduction

Using Prearchaic (PA) sites in Grass Valley, NV (Fig. 1), this project investigates (i) environmental factors driving variation in PA settlement and (ii) geomorphological factors driving variation in PA surface visibility. Building on previous research [1,2], we evaluate variables using Ideal Free Distribution [3] and Maximum Entropy (MaxEnt) [4].

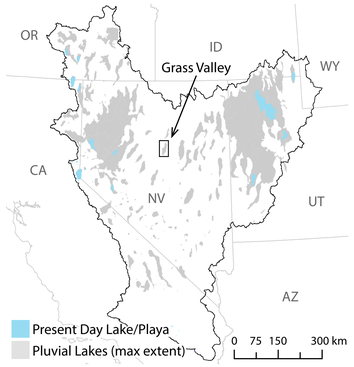
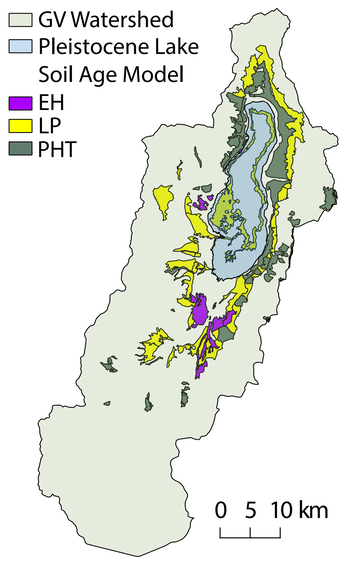


Figure 1: GV Overview

Methods and Data

We fit a predictive model to the data using a Maximum Entropy approach. For comparison, we also fit a generalized additive model (GAM) using Maximum Likelihood.

Figure 2: GV Reference



Response Variables

- Prearchaic sites (n=18)

Predictor Variables

- DEM: Digital Elevation
- Slope (from DEM)
- MI: Moisture Index
- NPP: Primary Productivity
- Soil age model (Fig. 2)
  - LP: Late Pleistocene
  - EH: Early Holocene
  - PHT: P-H Transition
- Tobler cost distance to:
  - P. lake shoreline
  - Springs

Predictions

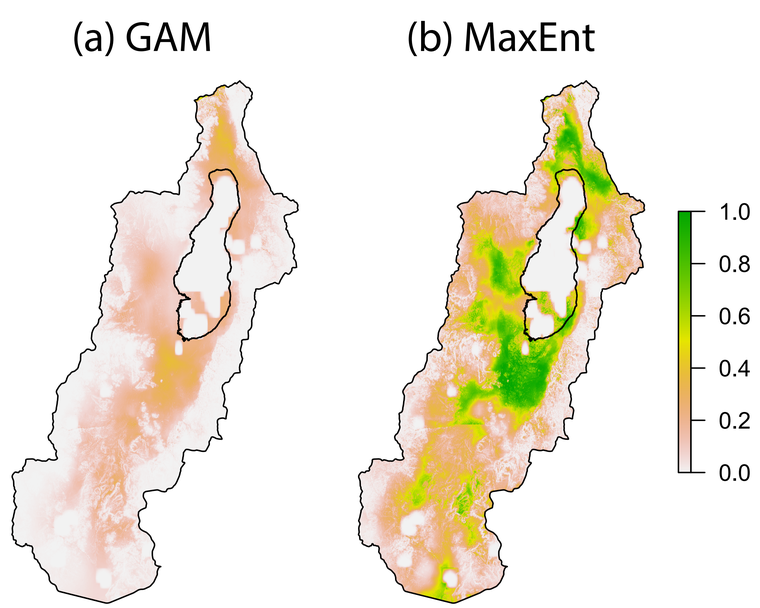


Figure 3: Grass Valley Prediction Rasters

Performance

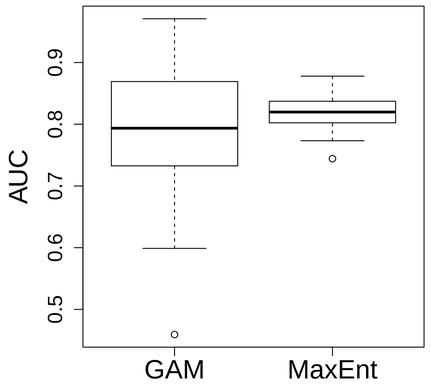


Figure 4: AUC Distribution

We bootstrap both the GA and MaxEnt models through 100 iterations to evaluate the predictive power (AUC median) and robustness (AUC dispersion) of each.

Predictors

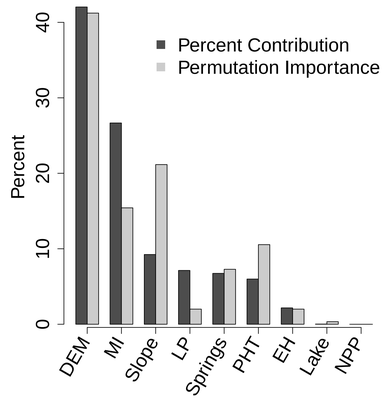


Figure 5: MaxEnt

For the model fitted by MaxEnt, elevation (DEM), moisture (MI), slope, and Late Pleistocene (LP) soil age contribute most to the model's predictive power. These we interpret in terms of habitat suitability and surface visibility.

Discussion

Our results show that:

1. Elevation and MI contribute the most to PA habitat suitability.
2. Contemporaneous soil age layers predict PA surface visibility.
3. MaxEnt is more powerful and robust with small training sets.

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Selected References

[1] Codding, B. F. *et al* (2016). "Prearchaic Adaptations in the Central Great Basin: Preliminary findings from a stratified open-air site in Grass Valley, Nevada." Great Basin Anthropological Conference, Reno, Nevada, 2016. URL: https://collections.lib.utah.edu/details?id=1202780.

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