Addressing Survey Bias: Maxent Models and Public Archaeology at the Davy Crockett National Forest

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In February and March of 2018, a Passport-In-Time (PIT) project was conducted to test the first iteration of a suite of novel predictive models designed with the intent of predicting historic and prehistoric archaeological site locations in the Davy Crockett National Forest (DCNF). The PIT project leveraged collections data to produce a suite of niche models for specific time periods based upon the presence of temporally-diagnostic artifacts. Using a series of data layers associated with environmental variables, site locations, and other information, the current suite of models provides a data-driven method that can be continually refined as new data becomes available, and as we continue to generate and test novel hypotheses on the forests. While a valuable addition to the management and protection of these important resources, the model is imperfect. Additional work is needed to test and refine the model through mitigating bias introduced through 30+ years of linear, block, and compartment-level surveys, achieved through shovel-testing a stratified random sample of locations throughout the DCNF. With this, that undertaking begins; however, to fully address survey bias, additional testing—beyond this initial effort—will be required.

Production of the DCNF model follows a recent systematic study of predictive modeling literature that included scientometrics to identify communities of practice in peer reviewed research articles that use geographical applications of predictive modeling or predictive modeling techniques. Similar networks were constructed that are foused on applications of the three R packages used to generate the DCNF models (maxnet, ENMeval, and ENMTools), and are not limited to archaeology. These networks inform the continued development of the DCNF models, and have aided in the iterative refinement of niche models produced through this research program.

Over the past 30+ years, compliance-based archaeological projects conducted on the Davy Crockett National Forest have yielded an impressive contribution to the archaeological record. However, those efforts were limited to specific survey areas based upon specific needs. To begin to address survey bias and the impact that it can have on site predictability models, a stratified random sample of 50 locations was generated for the forest. In early 2018, a public archaeology (Passport-In-Time) project was used to engage interested volunteers who assisted in testing these sample locations. These results, as well as other new data, were added to the maxnet site predictability model in advance of running a second iteration. A second call for volunteers in early 2019 will aid with site relocation and delineation of known resources, as well as an additional test using a new stratified random sample.

The current iteration of the DCNF models holds significant potential beyond the development of a heuristic niche model. Using diagnostic artifacts, the models can be further refined to investigate novel research questions. Might Archai-cal era hunter-gatherer populations, for instance, have preferred a different suite of geographic and landscape-based site selection criteria than the horticulturists and agriculturalists associated with Woodland and Caddo populations? There are also diagnostic artifacts assumed to transcend the hunter-gatherer-to-horticultural or agriculturalist transition in East Texas (Kert and Gary dart points in particular) that are relatively abundant in the NFCT collections.

In addition to the niche models, a geometric morphometric study is underway that asks whether the shape of Gary and Kert dart points differs at those sites where only lithics were recovered (assumed to date to the Archai-cal period) versus those where lithics and ceramics were recovered on the DCNF (assumed to date to the Woodland period), and a hunter-gatherer-to-horticultural and/or agriculturalist niche model affords additional depth to that discussion. Using the ASCII files produced for the machine learning tools, we are beginning to test these hypotheses and others, providing a means of assessing complementary, and in some cases hierarchically-nested, research questions that were previously out of reach.

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