SPARC Project Short Report

Project Name:

Five Lands Geospatial Project

PI(s) and Institution(s):

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I.   Summary of work undertaken in collaboration with SPARC

A model was hypothesized based on epigraphic and archaeological evidence in which ancient Maya sites in the Dolores-Poptun region of the western Maya Mountains of Guatemala were situated on the landscape in such a way as to (1) monitor and profit from natural travel routes through the mountains and (2) establish territorial control through mutual visibility among friendly sites, such that each of several political territories ruled by different kings would correspond to a cluster of intervisible sites. To test (1), SPARC, in collaboration with colleagues at Oak Ridge National Laboratory, used a digital elevation model produced from 30 m resolution Shuttle Radar Topopgraphic Mission data to create six least-cost pathway maps of the entire Maya region, using different criteria for "cost" and different methods of calculating it. These maps were overlaid on a map of site location throughout the May area and on a local map of site location in the Dolores-Poptun area that included smaller centers of a kind not always included in the larger-scale one. For the Dolores-Poptun region, the distances between sites of various sizes and social functions and the least-cost pathways were tabulated. To test (2), sites were modeled as points on the DEM, and the viewshed from each point was determined. We then asked whether any site in our model was directly visible from any other, and what percentage of each site's viewshed was visible from each other site.

II.   Summary of Results (500 words)

For question (1) above, a statistically significant correlation between the locations of sites and that of least-cost pathways was established at the level of the entire Maya region. At the level of the Dolores-Poptun region, as defined in the study, the correlation was not statistically significant. Nevertheless, almost every site in the local study region was located within 1 km of a least-cost pathway as defined by caloric expenditure or the Langmuir cost function; the statistical insignificance of this result was likely an artifact of the density of least-cost paths within this small study region. For question (2), an initial round of viewshed analysis showed that almost no site point in the DEM was directly visible from any other (there were two exceptions: one pair of sites were directly intervisible, and two other sites were each intervisible with a third but not with one another). Clusters of intervisible sites, which had been expected to correspond roughly to political territories suggested by the epigraphic record, thus did not exist. However, the viewsheds of many proximate sites did overlap substantially. When clusters of sites were

defined by 5% overlap in their viewsheds, a single "mega-cluster" emerged which covered nearly the entire study region; when clusters were defined by 15% overlap, they were too small and isolated to match well with the epigraphic record. On the other hand, clusters of sites with 10% overlapping viewsheds did correspond well to the territories suggested by the epigraphic data, raising the possibility of a novel method of territorial control in a region characterized by cockpit karst and geographically unlike other areas (e.g., Yaxchilan and Minanha) where direct intervisibility has been shown to have been important.

III.   Presentations and Publications Completed

Carter, Nicholas P., Lauren Santini, Adam Barnes, Rachel Opitz, Devin White, Kristin Safi, Bryce Davenport, Clifford Brown, and Walter Witschey. 2019. "Country Roads: Trade, Visibility, and Late Classic Settlement in the Southern Maya Mountains." *Journal of Field Archaeology* 44(2):84–108.

Carter, Nicholas P., Dorothy Carter, Nathan Carter, Rachel Opitz, and Adam Barnes. 2018. "Cash Crops and Snake Kings: Integrating Archaeology, Epigraphy, and Network Analysis in the Southern Maya Mountains." The Connected Past, University of Oxford, Oxford, December 7, 2018.

IV.   Presentations and Publications In Press / Planned

As Lauren Santini and I have discussed with Rachel Opitz and Adam Barnes, a logical extension of our previous work would be getting the gang back together to collaborate with Christina Halperin, who works at Ucanal, Guatemala, to expand our research north into the Ucanal region. Dr. Halperin is interested in the project, and we will be able to proceed once we have more accurate site location date for the Ucanal region.