Early Results from the Piedmont Settlement Ecology Project

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Project Goals

The Piedmont Settlement Ecology Project is an NSF-funded (BCS-1430945), multi-year investigation of the factors that influenced the settlement patterns of hierarchical Mississippian and egalitarian Piedmont Village Tradition (PVT) communities in the Piedmont Southeast and adjoining areas. The primary goals of this research are 1) to describe and explain the ecology of communities of varying sociopolitical complexity through a multiscalar GIS-based spatial analysis of site locations and cultural and natural landscapes and 2) to offer explanations for their geographic patterning that incorporate environment, landscape, demography, and social, political, and economic interactions.

This poster details early results from the second stage of this research. The first stage created a comprehensive description and explanation of PVT settlement patterns (Jones and Ellis in press). Here, I focus primarily on Missippian settlements in western North Carolina and how they compare to the PVT settlements. I also examine a sample of Mississippian settlement sites from Virginia and Georgia to contextualize the results within the Southeast. I do this by collecting landscape data at sites and within their catchments and comparing them to random distributions to determine spatial correlations. I also compare Mississippian and PVT settlements directly to one another. The settlement sites examined in this work are shown in Figure 1.

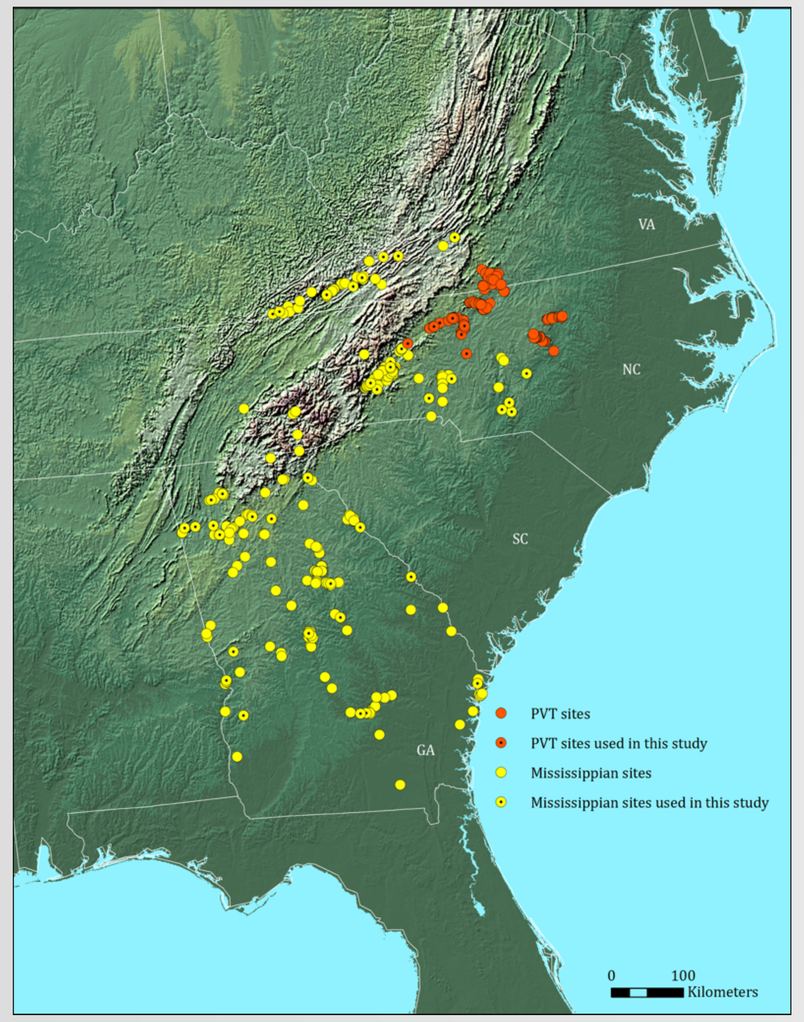


Figure 1: map showing the Piedmont topographic formation in the Southeast and the sites being analyzed.

Background

Settlement ecology is the study of human interaction with surrounding natural and cultural landscapes and how these relationships influence settlement patterns and processes. The basic assumption is that human settlement is a behavioral reaction to our surroundings. That is, we place ourselves on the landscape strategically with respect to particular resources, places, and other people. Thus, if we can establish significant spatial correlations between past settlements and various features of the surrounding environment and landscape, we can formulate *explanations* for past human behaviors that created the observed patterns.

Previous research has examined Mississippian settlement ecology qualitatively (Beck and Moore 2002; Meyers 1995; Milner 1998; Pauketat 2004). Most of the quantitative settlement ecology research has focused on non-Mississippian groups in eastern North America (Allen 1996; Hasenstab 1996; Jones 2006, 2010; Jones and Wood 2012). Similar research has been done for PVT groups already as well (Jones et al. 2012; Jones and Ellis in press). All of these works have begun to provide information about how people interacted each other, their natural environment, and their cultural landscapes

In North Carolina, PVT and Mississippian communities occupied adjacent spaces in the Piedmont and surrounding areas. PVT communities occupied floodplains along the upper Yadkin River, Dan River, Eno River, and Haw River. Hierarchically organized communities and polities with Mississippian characteristics appear in the lower Yadkin/Pee Dee River valley and tributaries around 1100 CE (Oliver 1992; Coe 1995; Boudreaux 2007). Similar Lamar Mississippian communities and polities appear in the western Piedmont and Appalachian uplands to the north and west of the upper Yadkin Valley around 1400 CE (Moore 2002). Woodall (1999, 2009) showed evidence of interaction between PVT and Lamar communities and polities after 1400 CE.

Methods

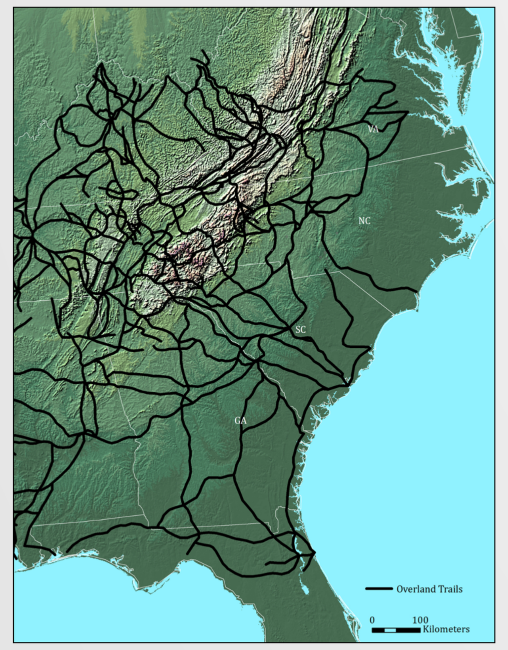
With the help of several undergraduate assistants, I created a geodatabase of all PVT and Mississippian sites from 1000-1600 CE across the Piedmont Southeast (less South Carolina). Those sites are shown in Figure 1. All of these sites will eventually be analyzed over the next two years of this project, but I selected a sample by targeting well-known sites and randomly selected sites for a 15% sample: 15 sites in NC (out of 119), 10 in VA (out of 30), and 23 in GA (out of 154). In North Carolina, sites cluster in five areas, Mississippians in the upper Yadkin River Valley (UYRV), upper Catawba River Valley (UCRV), the lower Catawba River Valley (LCRV), and the Pee Dee River Valley (PDRV), and PVT in the upper Yadkin River Valley (UYRV) distinctly downstream from the Mississippian settlements.

I obtained topographic (DEM), sedimentary, and hydrographic data from the USGS. I digitized historic trail locations from Mouzon (1775) and Myer (1971).

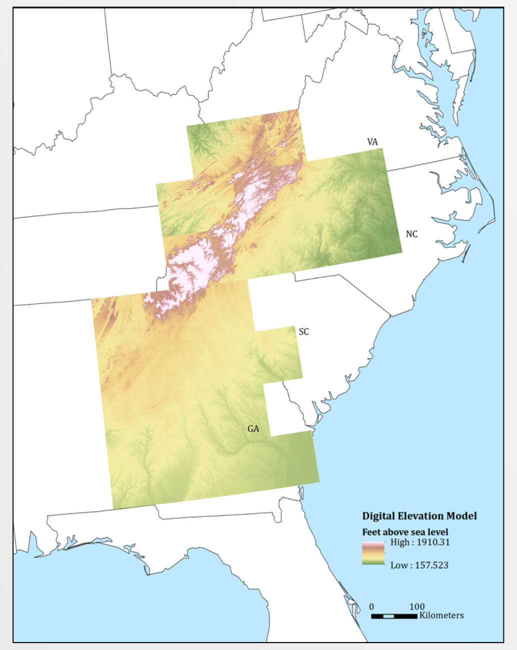
I then recorded 19 characteristics of the site locations and 2km catchments around each (Table 1 and Figures 2-4). I recorded the same data for an equal number of random locations in each state. I previouslly recorded the PVT data used here during the first stage of this project (Jones and Ellis in press).

Variable	Measurement	Influence Measured
Distance to overland trail	Straight line distance based on Mouzon (1775) and Meyer (1971)	Transportation/defensibility/communication
Distance to trail node	Straight line distance based on Mouzon (1775) and Meyer (1971)	Transportation/defensibility/communication
Viewshed area	Binary viewshed size	Defensibility/territoriality
Number of wetlands within catchment	Count based on NWI data from mid-20th century	Wild food resources
Number of forested wetlands within catchment	Count based on NWI data from mid-20th century	Wild food resources; preferred deer habitats
Largest wetland within catchment	Size based on NWI data from mid-20th century	Wild food resources
Total wetland area within catchment	Area based on NWI data from mid-20th century	Wild food resources
Aspect at site	Based on 10m DEM	Building/settlement preference
Slope at site	Based on 10m DEM	Building/settlement preference
Average aspect within catchment	Based on 10m DEM	Agricultural and wild resource productivity
Slope within catchment	Based on 10m DEM	Agricultural and wild resource productivity
Area of loam sediments within catchment	USGS soil maps from early 20th century	Agricultural and wild resource productivity
Average solar radiation within catchment	Yearly average from AD 1400	Agricultural productivity: length of growing season
Area of well drained sediment within catchment	Based on NRCS classifications	Agricultural productivity
Floodplain size	Based on orthographic maps and DEMs	Agricultural productivity: amount of arable land
Area of good hardwood growth sediment in catchment	Based on NRCS classifications	Availability of building materials
Area of good conifer growth sediment in catchment	Based on NRCS classifications	Availability of building materials
Number of tributaries within catchment	Based on NHD dataset	Water availability
Distance to tributary	Straightline distance	Water availability

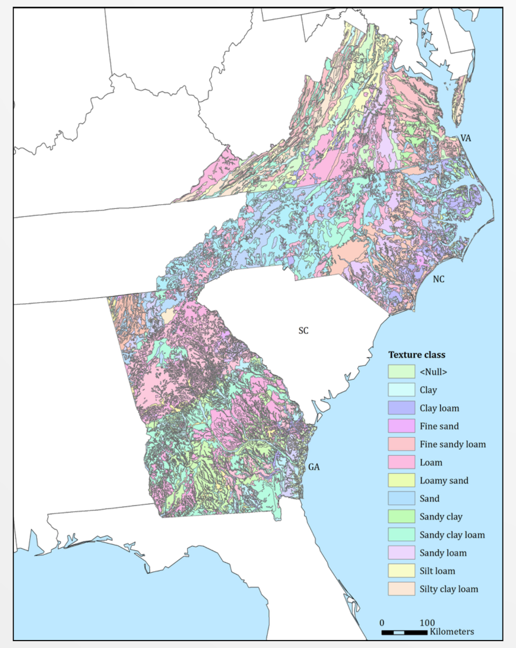
Table 1: landscape and environmental variables measured for each site and random location, how they were measured, and to which part of the settlement location decision process they were likely related.



Figures 2: map of overland trails in the Southeast. Digitized from Mouzon (1775) and Myer (1971).



Figures 3: map of digital elevation models used for measuring flooplains and calculating slope, aspect, solar radiation, and viewsheds.



Figures 4: map of NRCS soil maps, showing texture. I also used these data to measure sediment drainage properties and growth potential for tree types.

I next compared the settlements to the random locations using discriminant function analysis (DFA). This is similar to multivariate regression analysis and compares two datasets based on their characteristics, determines whether they are statistically different, and if so which of the characteristics most differentiates them. This method is ideally suited to settlement ecology research because not only does it test for autcorrelation, it provides a ranking of variables that approximates the mental balance sheet (Stone 1996) used to prioritize potential settlement locations.

Results

Tables 2 and 3 show that Mississippian settlements in North Carolina were most distinguished from PVT settlements by having more solar radiation, being farther from trail nodes, having larger wetlands within their catchment, and having larger viewsheds. Similar to previous results (Jones 2015), they also have better tree growth land, less loam, and less well drained sediments. Solar radiation was removed from Table 2 because it was singularly distinguishing in the first result. I will need to reanalyze this variable to be sure that discrepancies in DEM quality or resolution is not impacting this result.

Variable	Value
Average solar radiation within catchment	0.317
Distance to trail node	0.025
Area of good conifer growth within catchment	0.024
Largest wetland within catchment	0.023
Viewshed size	0.020
Number of tributaries within catchment	-0.019
Area of good hardwood growth within catchment	0.018
Area of loam within catchment	-0.017
Area of well drained sediment within catchment	-0.017
Distance to tributary	0.016
Total wetland area within catchment	0.016
Distance to overland trail	0.015
Number of forested wetlands within catchment	0.010
Floodplain area	0.006
Average slope within catchment	0.006
Number of wetlands within catchment	-0.002
Aspect at site	0.001
Slope at site	0.000

Table 2: DFA results from comparison of Mississippian and PVT settlements in NC. A positive value indicates that Mississippian settlements had larger values; a negative that PVT settlements did. 100% of original group cases were classified correctly.

Variable	Value
Distance to trail node	0.161
Area of good conifer growth within catchment	0.152
Largest wetland within catchment	0.143
Viewshed size	0.124
Number of tributaries within catchment	-0.118
Area of good hardwood growth within catchment	0.116
Area of loam within catchment	-0.109
Area of well drained sediment within catchment	-0.105
Distance to tributary	0.104
Total wetland area within catchment	0.103
Distance to overland trail	0.096
Number of forested wetlands within catchment	0.061
Floodplain area	0.038
Average slope within catchment	0.037
Number of wetlands within catchment	-0.012
Aspect at site	0.005
Slope at site	-0.001
Distance to trail node	0.161

Table 3: DFA results from comparison of Mississippian and PVT settlements in NC with solar radiation removed. 100% of original group cases were classified correctly.

Table 4 shows that Mississippian communities in North Carolina, when compared to a random distribution, were selecting locations with larger floodplains, larger wetlands, larger viewsheds, and less well drained sediment. Table 5 shows that in the mountains of Virginia, Mississippian communities were selecting locations with more tributaries, lower slope, smaller floodplains, and less well drained sediment. Table 6 shows that in the Georgia Piedmont, communities were selection locations with larger floodplains, larger and more wetlands, more western facing slopes, less well drained sediment, less slope, and closer to trails.

Variable	Value
Floodplain area	0.209
Largest wetland within catchment	0.203
Viewshed size	0.156
Total wetland area within catchment	0.153
Area of well drained sediment within catchment	-0.122
Area of loam within catchment	-0.098
Slope at site	-0.087
Average solar radiation within catchment	-0.071
Distance to trail node	0.067
Number of wetlands within catchment	0.065
Area of good hardwood growth within catchment	-0.051
Area of good conifer growth within catchment	-0.035
Distance to tributary	0.025
Average aspect within catchment	0.013
Number of forested wetlands within catchment	-0.011
Distance to overland trail	0.010
Number of tributaries within catchment	-0.005
Average slope within catchment	-0.004
Aspect at site	0.001
Floodplain area	0.209

Table 4: DFA results from comparison of Mississippian settlements in NC to random locations. 100% of original group cases were classified correctly.

Variable	Value
Number of tributaries within catchment	0.347
Slope at site	-0.130
Floodplain area	-0.111
Area of well drained sediment in catchment	-0.104
Aspect at site	0.092
Average slope within catchment	-0.076
Area of loam within catchment	0.069
Distance to tributary	-0.054
Distance to trail node	0.050
Largest wetland within catchment	-0.048
Total wetland area in catchment	-0.045
Viewshed size	0.034
Distance to trail	0.030
Number of wetlands within catchment	0.024
Average aspect within catchment	0.016
Average solar radition within catchment	0.009
Area of good conifer growth within catchment	-0.007
Forest wetlands within catchment	0.003
Area good hardwood growth within catchment	-0.001

Table 5: DFA results from comparison of Mississippian settlements in VA to random locations. 100% of original group cases were classified correctly.

Variable	Value
Floodplain area	0.356
Largest wetland 2km (sq m)	0.318
Total wetland area in catchment (sq m)	0.305
Aspect at site	0.294
Area of well drained sediment in catchment	-0.225
Average slope within catchment	-0.145
Slope at site	-0.140
Distance to trail (m)	-0.120
Average aspect in catchment	0.104
Forest wetlands within 2km	0.102
Tributaries within catchment	0.065
Area of loam in catchment (sq m)	-0.045
Wetlands 2km	0.033
Distance to tributary (m)	0.032
Viewshed size (sq m)	0.024
Distance to trail node (m)	0.011
Area good conifer growth w/in catchment	-0.010
Area good hardwood growth w/in catchment	-0.002

Table 6: DFA results from comparison of Mississippian settlements in GA to random locations. 90.2% of original group cases were classified correctly.

Discussion

In general, the Mississippian settlements in the Piedmont (NC and GA) spatially correlate with similar features. This suggests that these communities either formed in or selected locations in larger floodplains with mixtures of soil drainage types and that had wetlands nearby. Those in the Virginia mountains had similar preferences. This supports previous hypotheses not just about Mississippians in the Southeast, but for those across the Eastern Woodlands, that productive agricultural lands, wetland resources, and ecological diversity were important (Milner 1996; Pauketat 200. As Beck and Moore (2002) noted, building on Smith (1978), perhaps locations that allowed larger and more permanent settlement were the locations where sociopolitical complexity formed and persisted. Aspiring elites could maintain large and sedentary groups of followers, allowing them to extract more resources and use surplus to trade for exotic goods. A recent pilot study (Jones 2015) showed that these types of locations in the North Carolina Piedmont may have only been prevelant in the UCRV, and were not found in the UYRV. Thus, sociopolitical and socioeconomic hierarchies using the above strategy may not have been sustainable in the latter.

Perhaps the most unexpected result was that Mississippian settlements in NC were farther from trail nodes compared to their PVT neighbors. Several researchers, including myself, have noted both the proximity of UCRV Mississippian settlements to trails and the distance from them by PVT communities (Beck and Moore 2002; Jones and Ellis in press). The data need to be examined more closely, but there is legitimacy to this finding. The raw data show the LCRV and PDRV Mississippian sites are on average 45,800m from trail nodes while UCRV and UYRV Mississippian sites are 22,116m and 17600m, respectively (Figure 5). In addition, the Mississippian sites are slightly farther from trails compared to a random distribution. The average distance from trail nodes for the random locations is 22,147m, and it is 12,688m for just those random locations in the UCRV. The PVT settlements are on average 10,736m from a trail node. However, this is farther than expected given a random pattern. Mississippians may not have been prioritizing locations near trail nodes. Perhaps the draw of areas allowing for more persistence (as described above) was stronger.

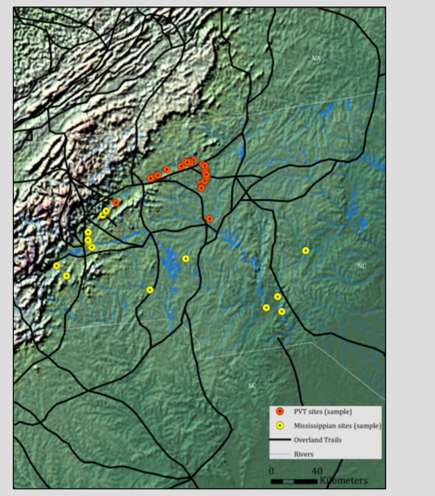


Figure 5: map showing the location of overland trails in relation to the sampled sites used in this study.

Future Work

Over the next two years, I will analyze (with undergraduate research assistants) the remaining sites in North Carolina and larger samples of sites in Georgia, South Carolina, and Virginia using these same methods. These will be combined with what we know from excavations at both Mississippian and PVT sites from across the Piedmont Southeast to create a multiscalar description and explanation for the distribution of settlements. If these results continue to be supported, this work should help us to explain why sociopolitical complexity appeared and persisted where it did in the Southeast and what impact that had on environments, landscapes, and interaction patterns.

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