Characterizing the Archaic Period along the Flint and Chattahoochee River Valleys

Vanessa N. Hanvey
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RESEARCH

Located within the Chickasawhatchee Creek watershed and Ichauway-Nochaway Creek drainage of the Lower Flint River, the Chickasawhatchee Archaeological Survey (CAS) targeted a variety of ecological areas with the purpose of understanding land use in upland environments throughout prehistory (Waggoner 2009). James Waggoner Jr. identified archaeological site types based on the distribution of lithic artifacts collected from this survey in his dissertation, which investigated landscape use and maintenance during the Late Archaic period (3000-1000 BCE) (Figure 1). The North and South survey areas contained different types of archaeological sites, but it could not be determined if these difference reflect a broad subsistence pattern or two distinct cultural groups.

To test Waggoner's conclusion concerning land use patterns and cultural groups, I will focus on his diagnostic hafted biface assemblage. I will utilize exploratory statistics associated with ecological communities to identify and the concept of technological systems to characterize patterned variation (Stark 1998). I hypothesize that certain attributes of hafted bifaces are less subject to technical choice than others and thus may be more closely associated with subsistence or land use practices.

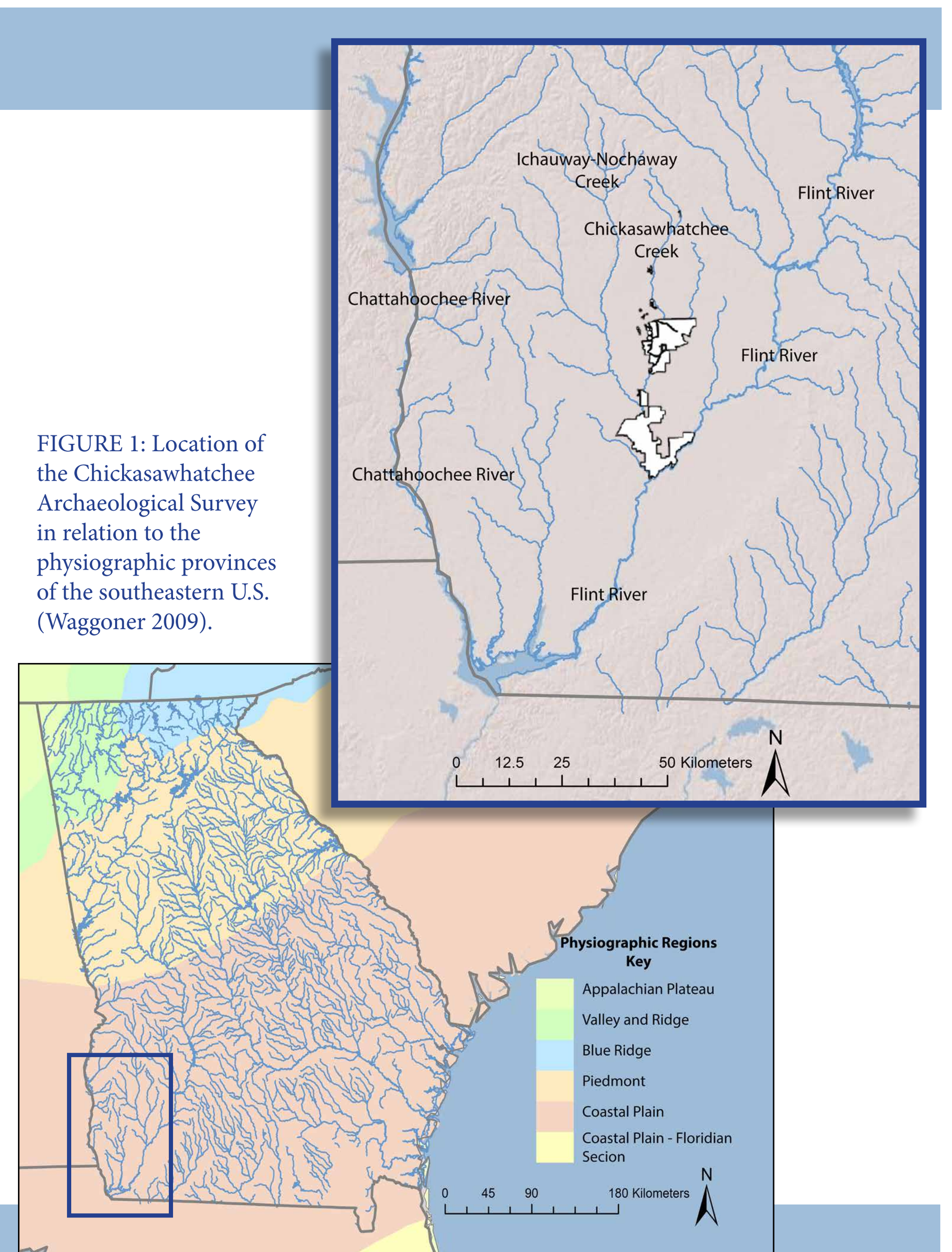

FIGURE 1: Location of the Chickasawhatchee Archaeological Survey in relation to the physiographic provinces of the southeastern U.S. (Waggoner 2009).

DATASET

The dataset utilized in this research is composed of stemmed hafted bifaces (n=478) that date to the Late Archaic period (Figure 2). Collected during the Chickasawhatchee Archaeological Survey (CAS) directed by John F. Chamblee and James Waggoner Jr. from 2003-2006, each artifact corresponds to a section of either the North or South survey area (Figure 3). Waggoner analyzed the hafted bifaces for the purpose of assigning time periods to sites identified during the survey. Qualitative attributes related to the haft and blade portions of the bifaces were recorded (Chart 1). Additionally, relative completeness of the tool, raw material type, and presence of heat treating were recorded.

To maintain comparability with Waggoner's results, his original analytical categories are used to explore the structure of this dataset. Specific attributes were chosen based on relative heterogeneity of responses, and the total amount of hafted bifaces or sample units was chosen based on the presence of responses (n=206).

To test the conclusion that distinctions in the North and South survey areas are attributable to one subsistence strategy, I compare the patterned variation of three sets of hafted biface attributes. These attributes are grouped based on their relationship with the stone tool manufacturing process and postulated influence of technical choice; more potential influence by technical choice may be indicative of something other than land use.

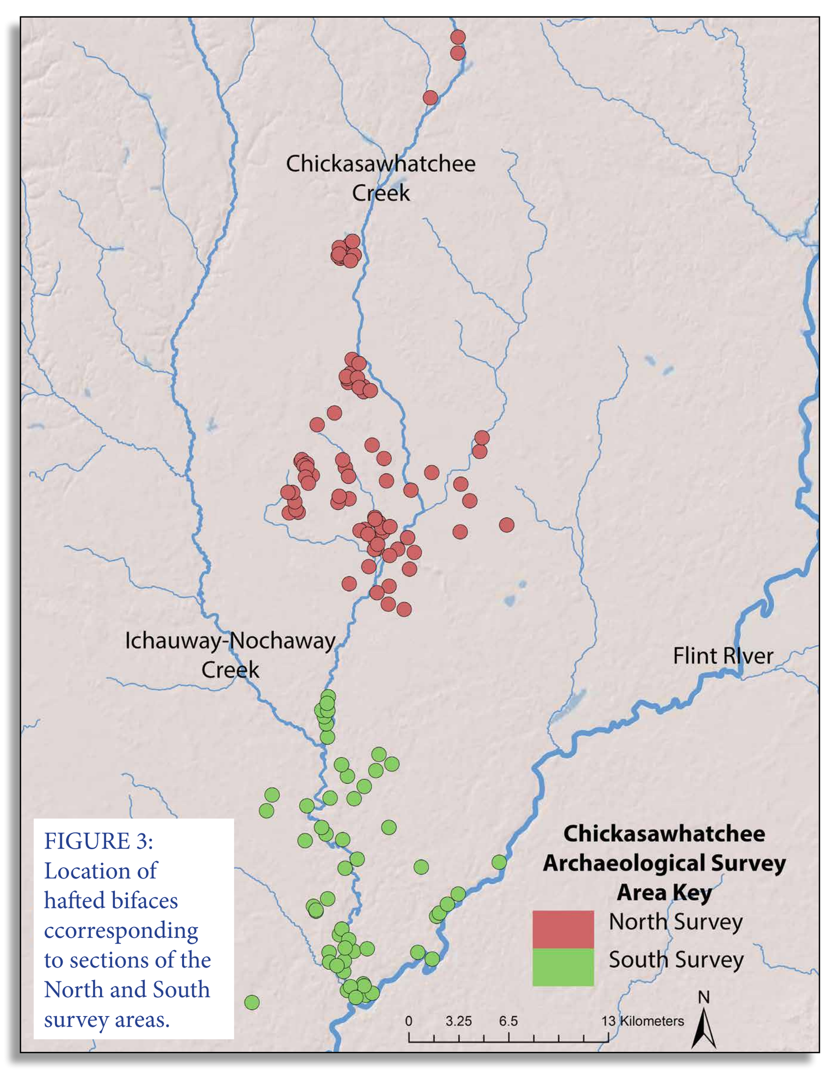

FIGURE 3: Location of hafted bifaces ccorresponding to sections of the North and South survey areas.

Blade Attributes	
Shoulder	**Yes**
Horizontal	
Inversely Tapered	
Round	
Broad	
Excurvate	
Not Available	
Barb	**No**
Simple	
Expanded	
Not Available	
Blade Shape	**Yes**
Straight	
Excurvate	
Incurvate	
Parallel	
Excurvate/Incurvate	
Not Available	
Blade Edge	**Yes**
Serrated	
One Edge Beveled	
Two Edges Beveled	
Not Available	
Distal End	**No**
Acute	
Obtuse	
Broad	
Not Available	

Haft Element Attributes	
Haft Area Types	**Yes**
Contracted Pointed	
Straight Stemmed	
Excurvate Stemmed	
Contracted Stemmed	
Rounded Stemmed	
Pointed Stemmed	
Not Available	
Stem Side Shape	**Yes**
Straight	
Incurvate	
Excurvate	
Not Available	
Stem Base Shape	**Yes**
Straight	
Incurvate	
Excurvate	
Bifurcated	
Auriculate	
Not Available	

Heat Treatment	
Yes-Cooked	**Yes**
No-Raw	**Yes**

Completeness	
100%	**Yes**
75%	**Yes**
50%	**Yes**
≤25%	**Yes**

CHART 1: Late Archaic stemmed hafted biface attributes analyzed for by Waggoner (2009) as well as those used in this study (indicated by "yes" or "no").

Those attributes associated with the blade and haft elements of the hafted bifaces are subject to technical choice for the duration of use life through the processes of tool maintenance and repurposing. Thus, I would expect:

- The patterned variation associated with the blade and haft elements to be highly subject to technical choice and potentially reflect 'communities of culture' or 'social fields' (Stark 1998:10).

The patterned variation of other attributes such as relative completeness and heat treatment would be less reflective of technical choice as it is associated with only the initial stages of the manufacturing process and resource availability.

- The relative completeness of the hafted biface is likely reflective of subsistence or land use patterns as it is directly correlated with activity.

RESEARCH OBJECTIVES

- Test the use of ecological community exploratory multivariate statistics in archaeological contexts.
- Describe the patterned variation among the Late Archaic hafted bifaces recovered during the CAS.
- Explore the relationship between subsistence patterns and social boundaries within the CAS areas.
- Test the hypothesis that certain attributes of hafted bifaces are more likely to depict patterns of variation associated with technical choice.
- Conduct a preliminary analysis of Gulf-draining river basins (Figure 4).

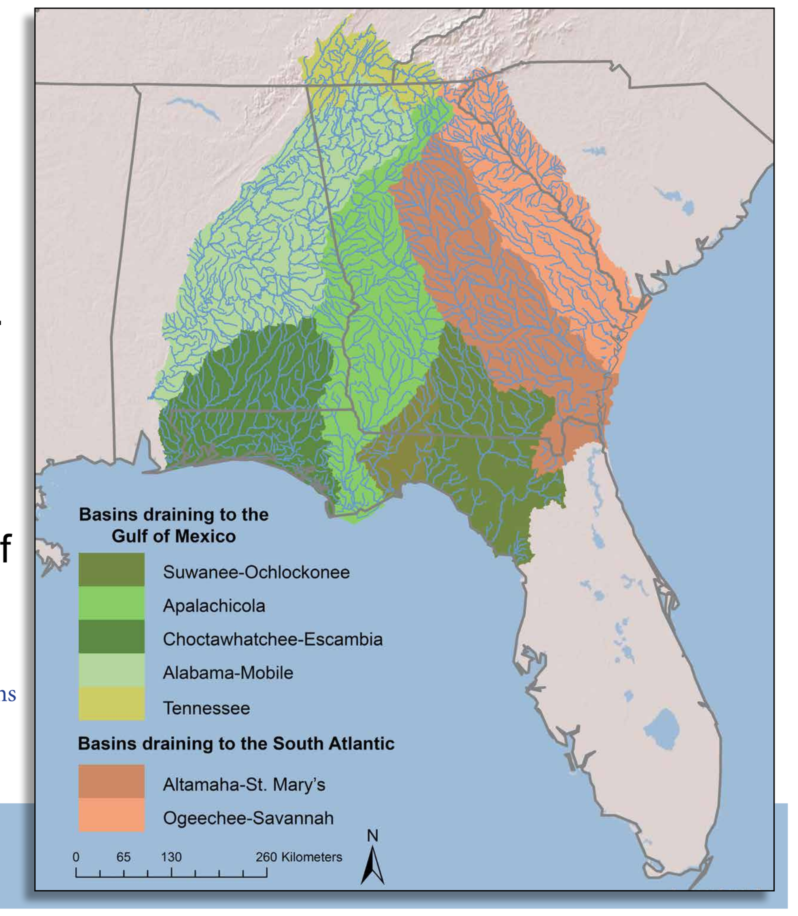

FIGURE 4: River basins draining to the Gulf of Mexico and South Atlantic.

METHODOLOGY

The benefit of interpreting archaeological data within an ecological community framework is that emphasis is placed on the interdependence of species or characteristics with each other. Analyses are highly contextualized and often exploratory, making the methodology extremely applicable to archaeological datasets from which patterns are sought. My methodology is based on the analysis of ecological communities for these reasons, and I use the computer program PC-ORD to generate all subsequent statistics (McCune, Grace, and Urban 2002; Peck 2010).

I utilize two forms of multivariate analysis to characterize the relationships among "species" or artifact attributes and sample units or hafted bifaces: Indicator Species Analysis (ISA) and Nonmetric Multidimensional Scaling (NMS). I use the Sørensen (Bray-Curtis) distance measure because the resulting gradient of covariation between sample units and attributes is proportional to the number of attributes.

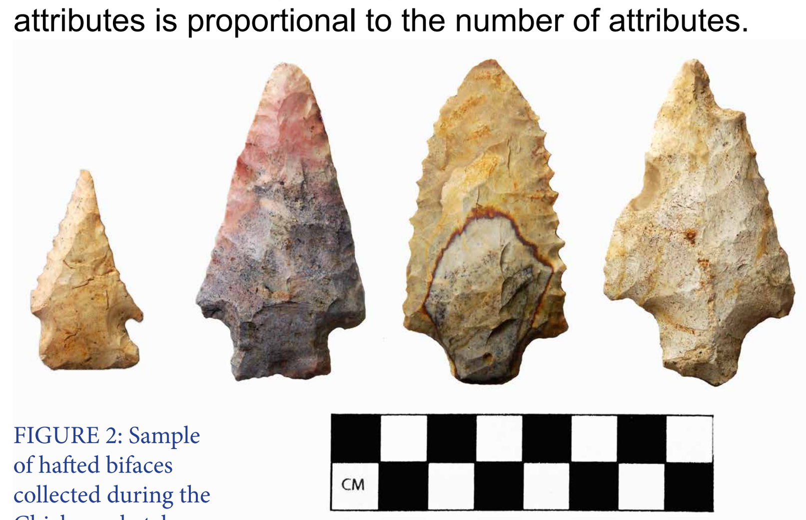

FIGURE 2: Sample of hafted bifaces collected during the Chickasawhatchee Archaeological Survey.

ISA is used to define the differences between pre-existing groups of sample units by describing how well attributes separate into groups. Utilizing the Dufrêne and Legendre's (1997) method for binary data, the concentration or abundance and frequency of attributes is used to describe the indicator value of different groups of sample units (McCune, Grace, and Urban 2002).

NMS is used to summarize the relationship between these targeted attributes and sample units. There is a lack of assumptions of linear relationships because NMS utilizes ranked distances to order "sample units such that their interpoint distances reflect the redundant pattern of covariation observed in… original response data" (Peck 2010:84).

CONCLUSION & FUTURE WORK

- ISA results suggest that the abundance of certain attributes indicates the North and South survey areas.
- NMS results suggest that the North and South survey areas are not wholly responsible for the differences between attributes.
- Application of exploratory statistics was useful because of its ability to handle complex, multivariate datasets.

The results of this research are preliminary and additional application of statistics is needed before concrete conclusions may be drawn. It is intriguing that relative completeness of the hafted bifaces as well as heat treatment of the raw material seem to correlate with the North and South survey areas. Waggoner hypothesized that differences in surface water between the two survey areas may be correlated with distinctions in site types. Consideration of hydrologic and topographic features may prove more useful in explaining the patterned variation identified in this dataset, specifically that associated with blade and haft element attributes (Figure 11).

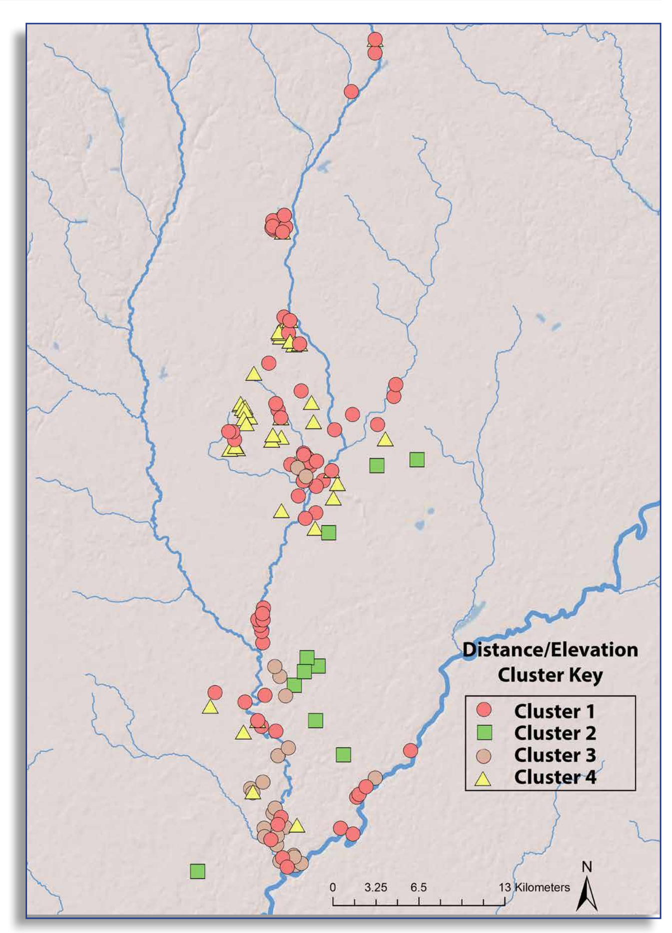

FIGURE 11: Location of hafted bifaces ccorresponding to clusters associated with distance to the nearest water source and elevation.

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RESULTS

INDICATOR SPECIES ANALYSIS

ISA analysis identified descriptive variables associated with the North and South survey areas (Chart 2). Indicator Values and significance scores were both assessed, and final decisions pertaining to descriptive attributes were made based on the relationship between these statistics.

For the haft element, a straight haft shape along with straight and excurvate stem sides are considered descriptive attributes. For the blade, rounded, horizontal, and inversely tapered shoulders are considered descriptive variables. A relative completeness of 100%, 75%, and 50% as well as the presence/absence of heat treatment are considered descriptive variables.

Haft	Indicator Value	p^*
HAFT_ST	44.4	0.5845
HAFT_EX	4.1	0.1486
HAFT_CT	4.7	1.0000
HAFT_RD	0.9	1.0000
HAFT_PT	0.4	1.0000
STSID_ST	47.8	0.1494
STSID_IN	6.1	0.2557
STSID_EX	3.6	0.0644
STBS_ST	26.0	0.6283
STBS_IN	15.6	0.5135
STBS_EX	13.0	0.6723
STBS_BIF	0.4	1.0000
STBS_AUR	0.4	1.0000

Blade	Indicator Value	p^*
SHLD_HZ	34.7	0.1692
SHLD_IT	13.0	**0.0328**
SHLD_TP	11.9	0.8780
SHLD_RD	3.1	**0.0492**
SHLD_BR	0.9	0.4485
SHLD_EX	1.1	0.5579
BLDSH_ST	41.0	1.0000
BLDSH_EX	9.6	0.1484
BLDSH_IN	3.3	0.3141
BLDSH_PL	1.7	1.0000
BLDSH_EI	0.8	1.0000
EDG_SR	1.9	0.3427
EDG_B1	0.4	1.0000

Other	Indicator Value	p^*
COMP_100	40.8	**0.0002**
COMP_75	14.9	**0.0328**
COMP_50	50.8	**0.0002**
COMP_25	2.6	0.7630
HT_RAW	28.0	0.0728
HT_COOK	36.8	0.1560

Monte Carlo Test, 4999 randomizations.
**p-value <0.05 are bolded.*

CHART 2: Indicator species analysis results comparing North and South survey areas. Descriptive attributes chosen for NMS based on the Indicator Value and p-value are highlighted.

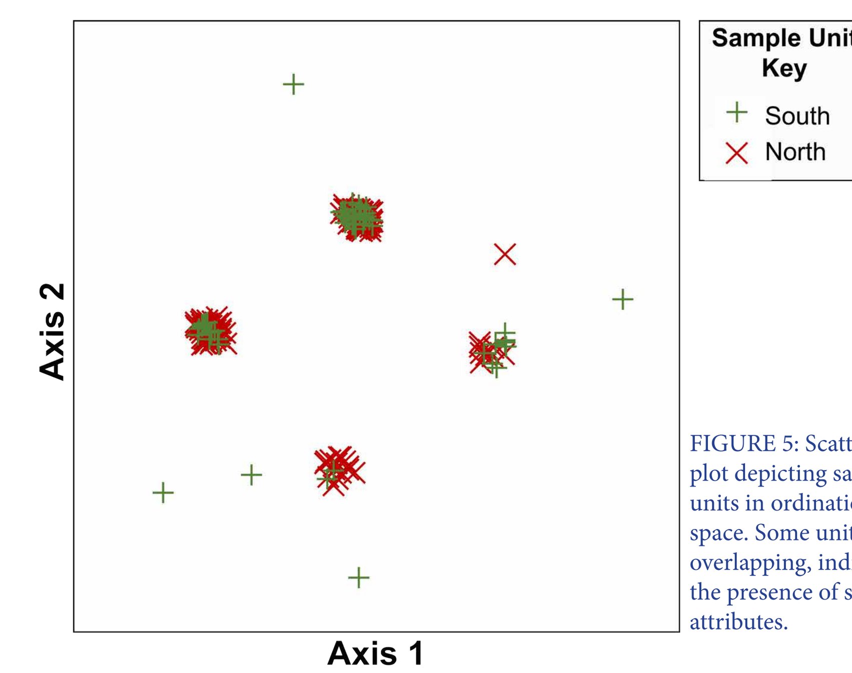

FIGURE 5: Scatter plot depicting sample units in ordination space. Some units are overlapping, indicating the presence of similar attributes.

NONMETRIC MULTIDIMENSIONAL SCALING

The NMS ordination of these eleven attributes stabilized after 250 iterations with a final stress of 3.407, a final instability of 0.00000, and an optimal dimensionality of two axes. A scatter plot depicting sample units in ordination space is provided (Figure 5), where distance between points is "proportional to the underlying distance measure" (Peck 2010: 104). A varimax rotation is applied to the ordination results to improve interpretation by highlighting groups of corresponding sample units and attributes.

A joint plot is generated to depict the relationship between attributes and ordination space using vectors, where the angle and length is indicative of the strength of the relationship (Figures 6 and 7). Heat treatment has a strong relationship (responsible for 80% of the structure with a coefficient of determination of 0.80).

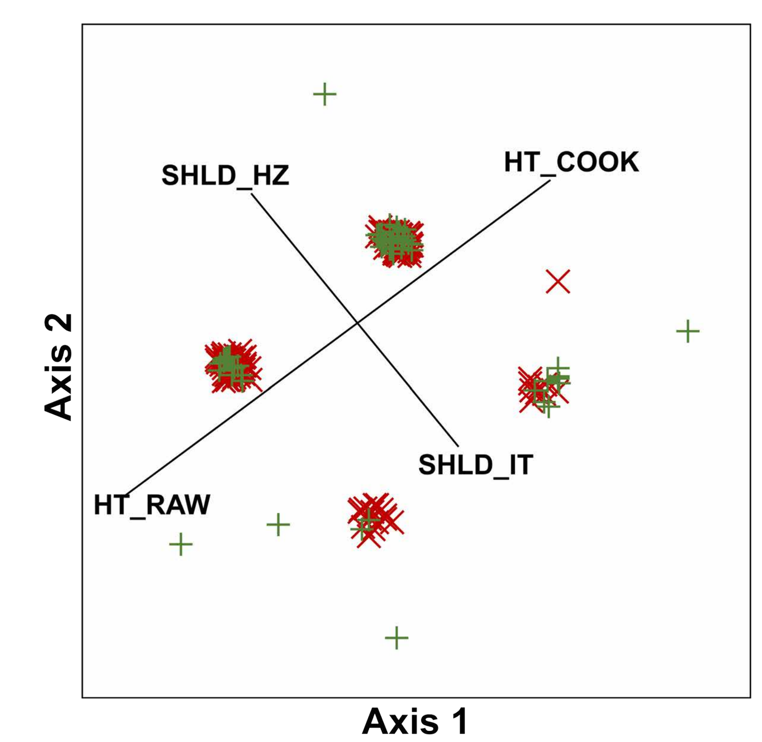

FIGURE 6 (left) Joint plot depicted at a coefficient of determination (r-squared) of 0.50.

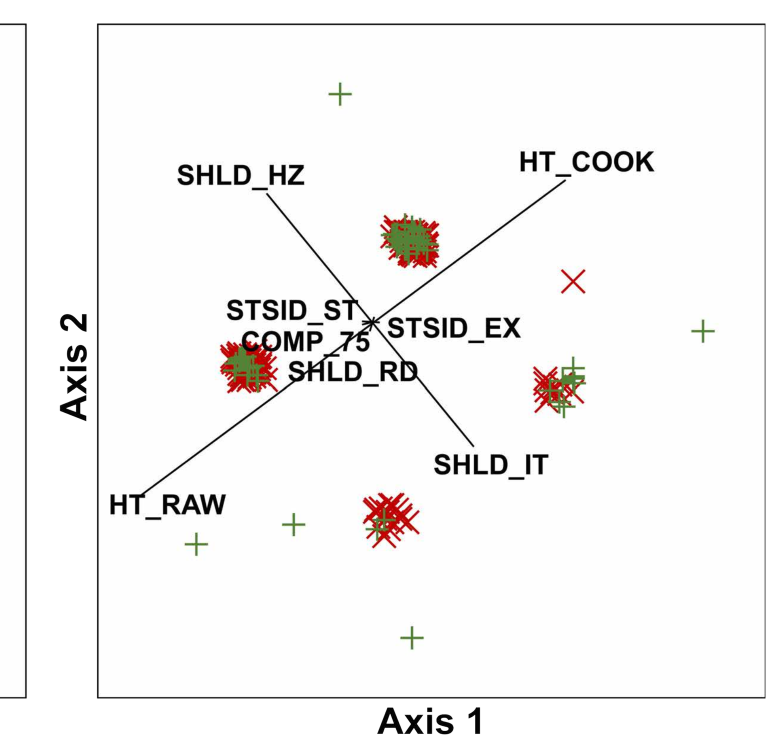

FIGURE 7 (right) Joint plot depicted at a coefficient of determination (r-squared) of 0.02.

Species abundance or concentration is overlain and symbolized by the relative size of the symbol in overlay scatter plots (Figures 8-10). The Kendall's tau-b correlation coefficient is provided with the overlay scatterplots which represents the rank relationship between the ordination score and individual attributes. A positive coefficient indicates similarity of variables and a negative coefficient indicates dissimilarity of variables with each ordination axis.

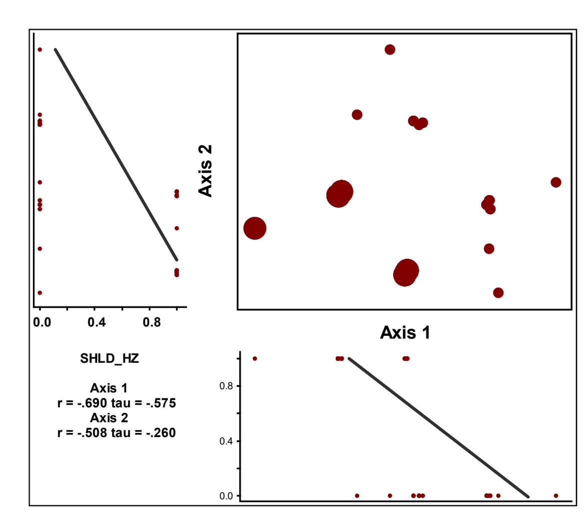

FIGURE 8: This is an overlay showing the abundance of the attribute Horizontal Shoulders depicted as size of sample unit symbol.

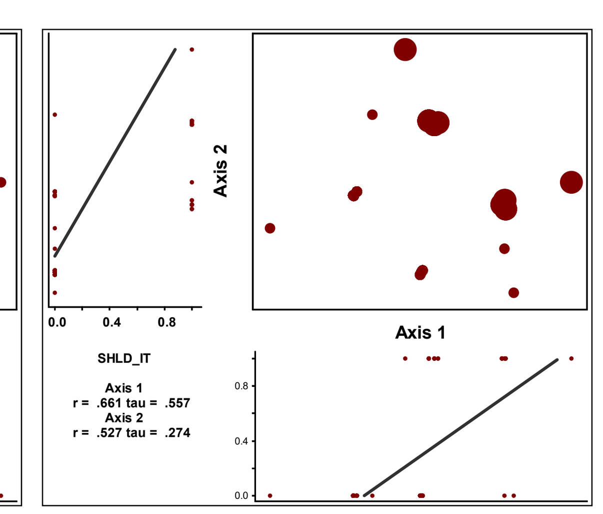

FIGURE 9: This is an overlay showing the abundance of the attribute Inversely Tapered Shoulders depicted as size of sample unit symbol.

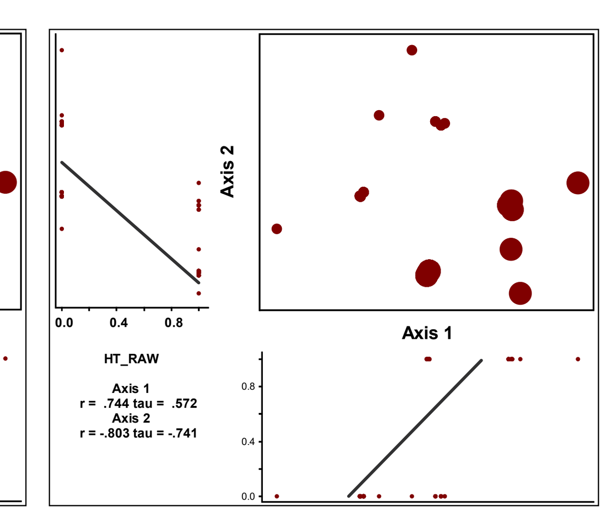

FIGURE 10: This is an overlay showing the abundance of the attribute no Heat Treatment (Raw) depicted as size of sample unit symbol.