Analysis of Plant Remains from the 31GH635 site

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Introduction

Archaeological plant and animal assemblages represent only a small fraction of what was originally used and deposited by humans in open-air settings. Natural and cultural factors can significantly modify organic remains, resulting in recovered assemblages that differ dramatically from the original deposits. As archaeologists, we examine collections that have undergone a series of processes—from the original selection of plants and animals by humans, to food preparation, cooking, discard, animal and insect scavenging, burial, decay, and weathering, to the recovery of food residues by archaeologists. Using standard methodological procedures for sampling, quantification, and analysis allows us to make sense of our assemblages in spite of the deleterious effects of these processes. Here we report on the identification and analysis of the archaeobotanical assemblage from the 31GH635, North Carolina. The site is multicomponent, with occupations from the Middle Woodland period (1 samples) and the Middlee Qualla phase (3 samples).

Recovery and Preservation Bias

The circumstances under which plants preserve best archaeologically involve extreme conditions (e.g., exceptionally wet, dry, or cold environments) that prohibit decomposition of organic matter (Miksicek 1987). Plants can also preserve through exposure to fire, which can transform plant material from organic matter into carbon (Miksicek 1987). The likelihood that a plant will become carbonized varies according to the type of plant, how it is prepared and used, and whether it has a dense or fragile structure (Scarry 1986). Plants that are eaten whole are less likely to produce discarded portions that may find their way into a fire. Plants that require the removal of inedible portions (e.g., hickory nutshell, corn cobs) are more likely to find their way into a fire, and thus into the archaeological record. Inedible plant parts represent intentional discard that is often burned as fuel. Moreover, because inedible portions tend to be dense and fibrous, they are more likely to survive the process of carbonization than the edible parts (e.g., hickory nutshell vs. nutmeats). Physical characteristics are also important for determining whether or not a plant will survive a fire. Thick, dense nutshells are more likely to survive a fire than smaller, more fragile grass seeds. Food preparation activities also affect potential plant carbonization. The simple process of cooking provides the opportunity for carbonization through cooking accidents. Foods that are conventionally eaten raw, however, are less likely to be deposited in fires than cooked foods. Some plants that find their way into the archaeological record in carbonized form were not eaten at all. Wood fuel is the most obvious example. Other non-food plants that become carbonized are incidental inclusions, such as seeds blown by wind dispersal (Miksicek 1987; Minnis 1981; Scarry 1986). Indeed, most secondary invaders are weedy species with lots of seeds (e.g., cheno/am plants) (Minnis 1981).

While we cannot ever hope to know the absolute quantities or importance of different plants in any past subsistence economy, the preservation and recovery biases discussed above do not prohibit quantitative analyses of archaeobotanical assemblages. The most commonly used plant resources in any subsistence economy are more likely to be subject to activities that result in carbonization (e.g., through fuel use and accidental burning) and ultimately, deposition (Scarry 1986; Yarnell 1982). Thus, we can quantitatively examine the relative importance of commonly-used plant resources through time and across space.

Methods of Quantification

Quantitative methods in archaeobotany have developed significantly over the past several decades, and as a result, have been a subject of much critical discussion (Hastorf and Popper

1988). The most common methods for recording and quantifying plant remains are counts and weights. Because of problems with comparability between different types of plant taxa, however, raw (or absolute) counts and weights are not appropriate comparative measures (Scarry 1986). For example, denser taxa yield higher weights than more fragile taxa, and some taxa yield higher seed counts than others (e.g., grasses versus fruits) (Scarry 1986). Thus, using absolute counts or weights to summarize plant data is highly problematic. Most archaeobotanists agree that absolute counts are inadequate for assessing past people-plant interactions in that they do not control for biases related to preservation and sampling error (Kandane 1988; Miller 1988; Popper 1988; Scarry 1986). Absolute counts and weights are simply raw, unstandardized data.

One way to avoid the problems of absolute counts/weights is through the use of ubiquity measures (Godwin 1956; Hubbard 1975, 1976, 1980; Popper 1988, Willcox 1974). This type of analysis is essentially a presence/absence analysis that sidesteps the problems of counts and weights by measuring the frequency of occurrence instead of abundance. In other words, ubiquity analysis measures the number of samples in which a taxon was identified, as opposed to the number of specimens represented by that taxon. The researcher first records the presence of a specific taxon in each sample, and then computes the percentage of all samples in which the taxon is present (Popper 1988). For example, if acorn shell is present in four out of ten samples, then its ubiquity value is 40%. Thus, each taxon is evaluated independently (Hubbard 1980). Because different types of plants are disposed of differently, direct comparisons of ubiquity values between taxa are problematic (Hubbard 1980:53). For example, a 70% ubiquity value for hickory nutshell would not be equivalent to a 70% ubiquity value for beans as these categories have different preservation opportunities—hickory nutshell represents a processing by-product often used as fuel, while beans represent edible portions.

As with any quantitative measure, ubiquity analysis has its disadvantages. A sufficient number of samples is necessary to provide meaningful results as using too few samples creates a high likelihood of sampling error. Hubbard (1976:60) suggests a minimum of 10 samples. Moreover, although ubiquity analysis may mitigate for preservation biases, it is not immune to them (Hubbard 1980:53; Scarry 1986:193). Most importantly, because ubiquity deals with occurrence frequency and not abundance, it can potentially obscure patterns where occurrence frequency does not change but abundance does (Scarry 1986). As Scarry (1986:193) notes: "the frequency with which a resource is used may remain constant, while the quantity used varies." For example, a family may consistently eat corn on a daily basis, but the quantity they consume may vary from day to day. Despite these weaknesses, ubiquity analysis is a good starting point and can provide meaningful results when used alongside other measures.

While ubiquity measures may sidestep the problems inherent in absolute counts, it does not provide a means for calculating relative abundances of different plant taxa. Using comparative ratios is one way of determining the relative abundances of different plants. Essentially, calculating a ratio is a means of standardizing raw measures. In other words, we can deal with the problems of absolute counts and weights by standardizing them in terms of some constant variable (Miller 1988; Scarry 1986). The density measure standardizes data in terms of soil volume—the absolute count or weight of carbonized plant material (for individual taxa or for larger collapsed categories, e.g., corn kernels or corn) is divided by total soil volume for each sample or context. Density measures calculate the abundance of plants per liter of soil, and it is generally assumed that larger volumes of soil will yield more plant remains. However, differences in the context and manner of deposition between soil samples structure the relationship between soil volume and the size of the plant assemblage. For example, a 10 L soil sample from an intact house floor would probably yield a smaller sample of carbonized plant

remains than a 10 L soil sample from a refuse midden, because people tend to keep their houses cleaner than their trash dumps. Thus, density measures are useful in determing feature function.

Standardizing by soil volume, however, does not control for the range of non-plant related activities that contribute to the deposit from which the soil sample derives. In other words, the density measure does not consider plant remains in terms of plant-related activities, but rather in terms of all of the activities that are represented in the deposit. Thus, if the analyst is interested in determining the importance of a specific plant relative to the other plants in a sample or context, then density measures may be inadequate. Rather, standardizing by plant weight might be more appropriate (Scarry 1986). Unlike the density measure, standardizing by plant weight considers the contribution of a specific plant or category of plants solely in terms of plant-related activities. As a result, a plant weight ratio more accurately reflects spatial and temporal differences in plant use. As a quantitative category, plant weight is a sum of weights recorded for all carbonized plant specimens per sample or context. Thus, for each sample, there is a total weight of plant material—this figure is the denominator used to standardize the variable of interest.

Overall, ratios are useful quantitative tools that overcome some of the problems of absolute counts. It is important to understand, however, that ratios reveal only the relative importance of plants within varied depositional contexts, not the absolute dietary contribution of actual resources used in the past (Scarry 1986). For the purposes of the present analysis, we focus on a basic qualitative summary of the data, simply because there are too few samples to perform any meaningful quantitative analysis.

Laboratory Procedures

Flotation samples from the site were collected with variable volumes. Both the light and heavy fractions of the flotation samples were analyzed. Although the materials from the light and heavy fractions were processed and sorted separately, data from the two fractions were combined for analysis. According to standard practice, the light fractions were weighed and then sifted through 2.0 mm, 1.4 mm, and 0.7 mm standard geological sieves. Carbonized plant remains from both fractions were sorted in entirety down to the 2.0 mm sieve size with the aid of a stereoscopic microscope (10–40 X). Residue less than 2.0 mm in size was scanned for seeds, which were removed and counted; in addition, taxa encountered in the 1.4 mm sieve that were not identified from the 2.0 mm sieve were also removed, counted, and weighed. Corn cupules and acorn nutshell were also collected from the 1.4 mm sieve as these tend to fragment into smaller pieces and can be underrepresented in the 2.0 mm sieve.

Botanical materials were identified with reference to the paleoethnobotanical comparative collection at the University of California, Santa Barbara (UCSB) paleoethnobotany lab, various seed identification manuals (Martin and Barkley 1961; Delorit 1970), the USDA pictorial website (http://www.ars-grin.gov/npgs/images/sbml/), and Minnis (2003) which allowed us to identify the range of taxa native to the region. Taxonomic identification was not always possible—some plant specimens lacked diagnostic features altogether or were too highly fragmented. As a result, these specimens were classified as “unidentified” or “unidentified seed.” In other cases, probable identifications were made—for example, if a specimen closely resembled a corn cupule, but a clear taxonomic distinction was not possible (e.g., the specimen was highly fragmented), then the specimen was identified as a probable corn cupule and recorded as “corn cupule cf.”.

Once the plant specimens were sorted and identified, we recorded counts, weights (in grams), portion of plant (e.g., corn kernels versus cupules), and provenience information. Wood was weighed but not counted, and no wood identification was conducted. Generally, most of the

seeds identified in the samples were too small to weigh, and thus only counts were recorded. Hickory nutshell and corn remains were identified only as fragments, and were both counted and weighed. Other than counts and weights, no other measurements were taken on any specimens. In some cases, we sub-sampled selected samples that were extremely large. These samples were weighed and then systematically split using a riffle splitter; some samples were split in half and others in quarters depending on the overall weight of the sample. Counts and weights from the selected subsample were extrapolated using the total sample weight.

Basic Results

This section presents the results of the identification of the carbonized plant remains from the 31GH635. Given the limited number of samples (n=4) from this site, no quantitative analysis was conducted. Plant data from flotation samples are summarized in Tables 1 and 2 (Table 1 = Middle Woodland; Table 2 = Middle Qualla). Raw counts and weights are provided for each taxon; plant weight, wood weight, and soil volume are also provided. A total of 4 flotation samples from this site were sent to UCSB for analysis. Of the 4 samples send to the UCSB paleoethnobotany lab, all samples were sorted, representing a total of 75 liters of soil with a total plant weight of 18.57 grams. Combined, these samples yielded 11 plant taxa (identified to the Genus level), including corn, a variety of nuts and fruits, and various small seeds (Tables 1, 2).

Potential crop plants identified at the site include corn (*Zea mays*), squash/bottle gourd rind (*Cucurbita*/*Lagenaria* sp.). Interestingly, a definitive corn cupule was identified in the Middle Woodland feature. This specimen was sent for direct AMS dating to confirm its chronological placement.

Nutshell recovered from the 31GH635 flotation samples includes acorn (*Quercus* spp.), hickory (*Carya* spp.), and black walnut (*Juglans nigra*). Hickory was the most abundant nut recovered, with low amounts of acorn and walnut. While the nutmeats of walnuts can be easily extracted from the shell, hickory nuts and some acorns require extensive processing before they are rendered palatable (Petruso and Wickens 1984). The hickory kernels are so tightly enmeshed in the interior shell that picking the nutshells from the cracked shell casing is a time-consuming task. Instead, hickory nuts were generally pounded into pieces and boiled to extract the oil (Ulmer and Beck 1951). The process of boiling the pounded hickory nuts separates the pieces of shell, which sink to the bottom of the pot, from the oil, which rises to the top as the nutmeats dissolve and can be skimmed off or decanted. This oil or milk would then be used as an added ingredient in soups and stews, as a condiment for vegetables, or as a general sauce or beverage (Scarry 2003; Talalay et al. 1984).

Acorn processing depends upon whether the nuts derive from white or red oak trees. Nuts from the red oak are high in tannin and are extremely bitter as a result. White oaks, however, yield sweeter nuts; the nutmeats from these acorns can be used for cooking immediately after extraction from the shell (Scarry 2003). The tannin present in the bitter acorns, however, requires an additional processing step. Leaching the tannin from acorns can be accomplished either by soaking them in water, or parching and then boiling them with an alkaline substance such as wood ash. Once processed, acorns were generally ground into a fine meal, which could then be used to make gruel, bake bread, or thicken stews. Less often, acorns were boiled and the oil extracted (Swanton 1944:260, 277).

Fruit taxa recovered from the samples was restricted to a single blackberry/raspberry seed (Rubus spp.) and comes from the Middle Qualla feature. A variety of miscellaneous seeds that produce edible greens and/or seeds were also identified in the assemblage (see Tables 1 & 2). These include panic grass (*Panicum* spp.), Pokeweed (*Phytolacca americana*), purslane (*Portulaca* sp.), and skullcap (*Skutellaria* sp.). Finally, there were specimens from the grass

family that could not be placed within a genus, and numerous unidentifiable small fragments.

Conclusions

Overall, the flotation samples from 31GH635 produced a relatively diverse array of plants for such a small set of samples. These plants mainly represent food plants and herbs. The Middle Woodland assemblage consists mostly of nut fragments, but the corn cupule is highly suggestive of earlier cultivation. Given that recent direct AMS dating of purportedly Middle Woodland-period maize returned much more recent dates (circa AD 900) (Simon 20xx), it will be highly significant if this cupule returns a Middle Woodland date. The Middle Qualla phase assemblage is dominated by corn and hickory, which is consistent with other Qualla-phase plant assemblages. While corn production clearly was important during this period, it is clear that nut collection remained a dominant subsistence activity of the farmer-foragers living at the site.

Table 1. Summary data for Middle Woodland plants identified at 31GH635.

	Sample #	104	
	Feature	195	
	Soil Volume	9	
	Plant Weight	0.42	
	Wood Weight	0.47	
Crops		Count	grams
Maize Cupule	*Zea mays*	1	0
Maize Kernel	*Zea mays*		
Maize kernel cf.	*Zea mays* cf.		
Squash/Gourd rind	*Cucurbita/Lagenaria*		
Squash/Gourd rind cf.	*Cucurbita/Lagenaria* cf.		
Nuts			
Acorn	*Quercus* spp.		
Hickory	*Carya* spp.	5	0.04
Walnut	*Juglans nigra*	1	0.01
Fruits			
Blackberry/Raspberry	*Rubus* spp.		
Other			
Grass Family	Poaceae		
Panic Grass	*Panicum* spp.		
Pokeweed	*Phytolacca americana*		
Purslane	*Portulaca* spp.		
Skullcap	*Skutellaria* spp.		
Unidentifiable		2	0.01

Table 2. Summary data for Middle Qualla plants identified at 31GH635.

	Sample #	86		99		100		Totals	
	Feature	16		16		16		N/A	
	Soil Volume	13		41		12		66	
	Plant Weight	3.29		13.26		1.5		18.05	
	Wood Weight	2.41		12.44		1.42		16.27	
		Count	grams	Count	grams	Count	grams	Count	grams
Crops									
Maize Cupule	*Zea mays*	134	0.6	37	0.48	4	0	175	1.08
Maize Kernel	*Zea mays*	15	0.08	9	0.12			24	0.2
Maize kernel cf.	*Zea mays* cf.			4	0	1	0	5	0
Squash/Gourd rind	*Cucurbita/Lagenaria*	3	0.01	4	0.01	2	0	9	0.02
Squash/Gourd rind cf.	*Cucurbita/Lagenaria* cf.			1	0.05			1	0.05
Nuts									
Acorn	*Quercus* spp.	1	0	4	0	1	0	6	0
Hickory	*Carya* spp.	21	0.17	44	0.48	10	0.08	75	0.73
Walnut	*Juglans nigra*	1	0	2	0.04			3	0.04
Fruits									
Blackberry/Raspberry	*Rubus* spp.					1	0	1	0
Other									
Grass Family	Poaceae	3	0	22	0	1	0	26	0
Panic Grass	*Panicum* spp.			1	0			1	0
Pokeweed	*Phytolacca americana*	3	0	5	0	1	0	9	0
Purslane	*Portulaca* spp.			4	0	6	0	10	0
Skullcap	*Skutellaria* spp.			3	0			3	0
Unidentifiable		10	0.02	32	0.09	7	0	49	0.11

References Cited

Delorit, R. J.
1970 *Illustrated Taxonomy Manual of Weed Seeds*. Wisconsin State University, River Falls.

Godwin, H.
1956 *The History of British Flora*. Cambridge University Press, Cambridge.

Hastorf, Christine A., and Virginia S. Popper (editors)
1988 *Current Paleoethnobotany: Analytical Methods and Cultural Interpretations of Archaeological Plant Remains*. The University of Chicago Press, Chicago and London.

Hubbard, R.N.L.B
1975 Assessing the botanical component of human paleoeconomies. Bulletin of the Institute of
Archaeology 12:197–205.

1976 On the strength of the evidence for prehistoric crop processing activities. *Journal of Archaeological Science* 3:257–265.

1980 Development of Agriculture in Europe and the Near East: Evidence from Quantitative Studies. *Economic Botany* 34:51–67.

Kandane, Joseph B.
1988 Possible Statistical Contributions to Paleoethnobotany. In *Current Paleoethnobotany: Analytical Methods and Cultural Interpretations of Archaeological Plant Remains*, ed. By C. H. Hastorf and V. S. Popper, pp. 206–214. The University of Chicago Press, Chicago and London.

Martin, A. C., and W. D. Barkley
1961 *Seed Identification Manual*. University of California Press, Berkeley.

Miksicek, Charles H.
1987 Formation Processes of the Archaeobotanical Record. In *Advances in Archaeological Method and Theory*, Vol. 10, ed. by M. Schiffer, pp. 211–247. Academic Press, New York.

Miller, Naomi F.
1988 Ratios in Paleoethnobotanical Analysis. In *Current Paleoethnobotany: Analytical Methods and Cultural Interpretations of Archaeological Plant Remains*, ed. by C. H. Hastorf and V. S. Popper, pp. 72–85. The University of Chicago Press, Chicago and London.

Minnis, Paul E.
1981 Seeds in Archaeological Sites: Sources and Some Interpretive Problems. *American Antiquity* 46(1):143–152.

Minnis, Paul E. (editor)
2003 *People and Plants in Eastern North America*. Smithsonian Books, Washington and

London.

Petruso, Karl M., and Jere M. Wickens
1984 The Acorn in Aboriginal Subsistence in eastern North America: A Report on Miscellaneous Experiments. In *Experiments and Observations on Aboriginal Wild Plant Food Utilization in Eastern North America*, edited by P. Munson, 360-378. Indiana Historical Society, Indiana.

Popper, Virginia S.
1988 Selecting Quantitative Measures in Paleoethnobotany. In *Current Paleoethnobotany: Analytical Methods and Cultural Interpretations of Archaeological Plant Remains*, ed. by C. H. Hastorf and V. S. Popper, pp. 53–71. The University of Chicago Press, Chicago and London.

Reid, Fiona A.
1997 *A Field Guide to the Mammals of Central America and Southeast Mexico*. Oxford University Press, New York.

Reitz, Elizabeth J., and Elizabeth S. Wing
1999 *Zooarchaeology*. Cambridge University Press, Cambridge, U. K.

Scarry, C. Margaret
2003 Patterns of wild plant utilization in the prehistoric Eastern Woodlands. In *People and Plants in the ancient eastern North America*, ed. by P. J. Minnis, pp. 50-104. Smithsonian Institution Press, Washington D.C.

1986 Change in Plant Procurement and Production during the Emergence of the Moundville Chiefdom. Unpublished Ph.D. dissertation, Department of Anthropology, University of Michigan, Ann Arbor.

Scarry, C. Margaret, and Vincas P. Steponaitis
1997 Between Farmstead and Center: The Natural and Social Landscape of Moundville. In *People, Plants, and Landscapes: Studies in Paleoethnobotany*, ed. by K. J. Gremillion, pp. 107–122. The University of Alabama Press, Tuscaloosa.

Smartt, J.
1988 Morphological, Physiological, and Biochemical Changes in *Phaseolus* Beans under Domestication. In *Genetic Resources of Phaseolus Beans*, ed. by P. Gepts, pp. 143–162. Kluwer Academic Publishers, Boston.

Smith, Bruce D.
1985 Chenopodium berlandieri ssp. jonesianum: Evidence for a Hopewellian domesticate from
Ash Cave, Ohio. *Southeastern Archaeology* 4(1):107-133.

Sutton, Ann and Myron Sutton
1985 *The Audubon Society Nature Guides: Eastern Forests*. Alfred A. Knopf, Inc., New York.

Swanton, John R.
1944 The Indians of the Southeastern United States. Bureau of American Ethnology Bulletin 137. Government Printing Office, Washington.

Talalay, Laurie, Donald R. Keller, and Patrick J. Munson
1984 Hickory Nuts, Walnuts, Butternuts, and Hazelnuts: Observations and Experiments Relevant to Their Aboriginal Exploitation in Eastern North America. In *Experiments and*

Observations on Aboriginal Wild Plant Utilization in Eastern North America, edited by P. J. Munson, pp. 338-359. Indiana Historical Society, Indianapolis.

Ulmer, Mary and Samuel E. Beck
1951 *Cherokee Cooklore*: *Preparing Cherokee Foods*. Museum of the Cherokee Indian, Cherokee.

Wilkinson, Leland, MaryAnn Jill, Stacey Miceli, Gregory Birkenbeuel, and Erin Vang
1992 *Systat Graphics*. SYSTAT, Inc., Evanston, Illinois.

Willcox, G. H.

1974 A history of deforestation as indicated by charcoal analysis of four sites in Eastern Anatolia. Anatolian Studies *24:117–133.*

Yarnell, Richard A.
1982 Problems of interpretation of archaeological plant remains of the eastern woodlands. *Southeastern Archaeology* 1(1):1–7.