# Analysis of Plant Remains from the 31BN976 site

prepared by:
Matthew E. Biwer and
Amber M. VanDerwarker

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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 taphonomic processes 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 collection of plants and animals by humans from the natural environment, to food preparation, cooking, discard, animal and insect scavenging, burial, decay, and weathering, to the eventual recovery of food residues by archaeologists. As a result, these food remains cannot be interpreted at face value. Instead, standard methodological procedures for sampling, quantification, and analysis allows us to make sense of botanical assemblages. Here I report on the identification and analysis of the archaeobotanical assemblage from the 31BN976, North Carolina with occupations likely dating to the Late Woodland period (4 samples).

Recovery and Preservation Bias

Formation processes, or the ways in which an artifact or feature entered the archaeological record, are an important consideration in archaeobotanical analysis. In general, seeds may enter the archaeological record: 1) through gathering, cooking, or other processing activities; 2) by being incidentally brought to the site alongside a comestible and thrown away; 3) having been gathered for non-food purposes and discarded as waste; 4) as an inclusion in dung used for building material or fuel; 5) or blown in or accidentally brought back as a rider (see Hubbard 1976). These scenarios provide cultural and environmental context for the entry of plants into the archaeological record. The mode in which a plant is collected, transported, processed, used, and discarded will influence its entry and abundance in the archaeological record (see Dennel 1976; Miksicek 1987; Minnis 1981).

We must also consider how the botanic remains were preserved, as preservation impacts the composition of the archaeobotanical record. Macrobotanical remains in exposed environments will decompose rapidly due to biological, chemical, and weathering processes. However, archaeological plant remains may be preserved at an archaeological site: 1) in an extremely dry environment; 2) in an extremely wet (anaerobic) environment; or 3) through carbonization (Pearsall 1988). Dry preservation (desiccation) occurs in areas where the continual absence of moisture inhibits the development and growth of bacteria, fungi, and other microorganisms that assist in decomposition. Recovering desiccated remains from archaeological excavations is rare, but when encountered they often provide a more complete inventory of plants than the carbonized assemblage. In wet environments, water saturation (waterlogging) will create conditions that inhibit the growth of microorganisms and thus slow decomposition, resulting in remarkably preserved botanical remains; in extremely dry or wet environments, the favorable conditions for preservation often create unique challenges, such as the recovery of a preponderance of dense materials from a site. Finally, preservation through carbonization, in which organic material is converted into an inorganic matter, is the most commonly encountered vector of plant preservation worldwide (e.g., Hastorf and Popper 1988; Wright 2010).

The type or portion of plant that is recovered is also relevant to a discussion of preservation and formation processes of botanic remains in archaeological sites. Comestibles and other food-related items that have non-edible parts (e.g., maize cobs, nutshell) are often discarded into the fire as fuel (see Minnis 1981) or used as a tool. The discarded inedible

portions may survive into the archaeological record depending on their density. For example, nutshell, which tends to be denser than the edible parts (e.g., nutshell, dense seeds), has a higher likelihood of surviving the process of carbonization and thus being preserved in the archaeological record than a maize cob because they are more fragile than nutshell. On the other hand, edible portions of plants that are often consumed whole (e.g., beans, maize kernels) or raw (e.g., fruits), are less likely to enter into the archaeological record, though accidents do occur and are patterned (see Yarnell 1982). In this situation, coprolites may provide the only direct evidence of a consumable/consumed taxon.

Methods of Quantification

Quantitative methods in archaeobotany have developed significantly over the past several decades (see Hastorf and Popper 1988; VanDerwarker 2010). The most common methods used by archaeobotanists for recording and quantifying plant remains are raw (absolute) counts and weights. Absolute counts and weights are unstandardized data and may reflect differential preservation, sampling, local environmental conditions, or other factors. These measures are a useful way to display original data as it was collected by the archaeobotanist and may be used by other researchers for comparative analysis. However, raw counts and weights are not appropriate for direct evaluation due to problems of comparability between plant taxa because they do not control for preservation biases and sampling error (see Miller 1988; Popper 1988).

One way to avoid the problems of absolute counts and weights is by using the ubiquity measure (Pearsall 2000:212-16; Popper 1988:60-64). This method of standardization calculates the percentage of samples in which a taxon is present relative to the total number of samples. The taxon is considered present whether there are 1 or 1,000 specimens, and the same frequency score is given no matter the count. For example, if maize is present in 6 of 10 samples, it receives a ubiquity score of 60%. This is an excellent means for dealing with differential preservation, as plants that may be overrepresent or underrepresented due to taphonomic processes have the same influence when present. Ubiquity is also useful for investigating spatial and temporal patterns of plant use within similar contexts, though the results but may be less meaningful when comparing contexts of differential deposition or use.

Density is another useful standardizing measure that uses a constant variable, such as soil volume, to create a comparative ratio to assess the relative abundance of plants at the site (Miller 1988; Scarry 1986). To calculate density, the absolute count of plant taxa (numerator) is divided by the total soil volume collected from a sample, context, or site (denominator). Standardizing botanic data using density controls for differences in soil volume between samples and allows for the direct comparison of samples of unequal size. A basic assumption in using this measure is that the larger soil volume sampled, the greater likelihood that (rare) plant remains that will be recovered (Miller 1988:73).

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 (standardized count) 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 tools that overcome some of the problems of absolute counts. However, it is important to note that ratios reveal only the *relative importance* of plants within depositional contexts, not the contribution of resources to ancient diet (see Scarry 1986). For example, the recovery of 100 nutshells and 10 maize kernels does not necessarily represent evidence that nuts were more important than maize to the diet of residents of a given site; preservation and sampling biases prohibit paleoethnobotanists from making definitive determinations on whether certain taxa were more common or important than others. For the purposes of the present analysis, I focus on a basic qualitative summary of the data, using ubiquity, standardized counts, and relative percent contribution of the taxon to the total botanic assemblage simply because there are too few samples to perform any meaningful quantitative analysis.

Laboratory Procedures

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. Acorn nutshell was 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 (Delorit 1970; Martin and Barkley 1961; Medsger 1966), 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." In other cases, probable identifications were made. For example, if a specimen closely resembled a bedstraw (*Galium* sp.), 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 "bedstraw cf.".

Once the plant specimens were sorted and identified, I recorded counts, weights (in grams) 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 and acorn nutshell 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.

Basic Results

This section presents the results of the identification of the carbonized plant remains

from 31BN976. Given the limited number of samples (n=4) from this site, no quantitative analysis was conducted. Plant data from flotation samples are summarized in Table 1. Raw counts and weights are provided for each taxon; plant weight and wood weight are also provided. A total of 4 flotation samples from this site were sent to UCSB for analysis. All samples were sorted, representing a total plant weight of 35.34 grams and a total wood weight of 19.06 grams. Combined, these samples yielded 10 plant taxa (all were identified at least to the Family level, but most were identified to the Genus level), including nuts, fruits, and a number of seeds/leafy greens (Table 1). No crop taxa, such as maize (*Zea mays*), were identified. Ubiquity, standardized count, and relative percent measures are provided in Table 2.

Nutshell recovered from the 31BN976 flotation samples includes acorn (*Quercus* spp.) and hickory (*Carya* spp.). Hickory was the most abundant nut recovered with low amounts of acorn also being present. Hickory nuts and some acorns require extensive processing before they are rendered palatable (Petruso and Wickens 1984). The hickory nutmeat is 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/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 (see Scarry 2003; Talalay et al. 1984). In addition, four hickory nutshell fragments (x1 from each sample) were selected for AMS dating (Table 3).

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 wax myrtle seed (*Myrica* sp.). A variety of miscellaneous seeds that produce edible greens and/or seeds were also identified in the assemblage (Tables 1 & 2). These include bedstraw (*Galium* sp.), copperleaf (*Acalypha* sp.), spurge (*Euphorbia* sp.), panic grass (*Panicum* spp.), and purslane (*Portulaca* sp.). Finally, there were specimens from the grass (Poaceae) and aster (Asteraceae) families that could not be placed within a genus. Numerous unidentifiable small carbonized fragments were also recovered.

## Conclusions

Overall, the flotation samples from 31BN976 produced a relatively diverse array of plants for such a small set of samples. These plants mainly represent food plants, greens, and herbs. The lack of cultivated species in the assemblage suggests that the site residents did not practice horticulture or agriculture subsistence strategies at this local. Instead, forgers at this site gathered or tended nut trees and gathered fruits and wild seeds/greens from the surrounding area.

Table 1. Counts and Weights of Plant Taxa by Sample

| Site: 31BN976 | Feature | 1 | | | | 1 | | | |
|---|---|---|---|---|---|---|---|---|---|
| | T.U. | 3 | | 1 | | 4 | | 1 | |
| | Level | 2 | | 6 | | 3 | | 7 | |
| | Depth | 50-56 cmbs | | 87-95 cmbs | | 40-56 cmbs | | 98-108 cmbs | |
| | Plant Weight (g) | 2.5 | | 6.29 | | 3.18 | | 23.37 | |
| | Wood Weight (g) | 2.5 | | 5.52 | | 2.84 | | 8.2 | |
| **Common Name** | **Taxonomic ID** | **Count** | **grams** | **Count** | **grams** | **Count** | **grams** | **Count** | **grams** |
| **Nuts** | | | | | | | | | |
| Acorn | *Quercus* sp. | | | 17 | 0.05 | | | 7 | 0.04 |
| Hickory | *Carya* sp. | 3 | 0.01 | 65 | 0.69 | 10 | 0.25 | 32 | 0.75 |
| | | | | | | | | | |
| **Fruits** | | | | | | | | | |
| Wax Myrtle | *Myrica* sp. | | | | | | | 1 | 0 |
| | | | | | | | | | |
| **Other** | | | | | | | | | |
| Aster Family | Asteraceae | | | | | | | 1 | 0 |
| Bedstraw | *Galium* sp. | | | | | 1 | 0 | | |
| Copperleaf | *Acalypha* sp. | | | | | 1 | 0 | | |
| Spurge | *Euphorbia* sp. | | | | | 1 | 0 | | |
| Grass Family | Poaceae | | | | | 1 | 0 | | |
| Panic Grass | *Panicum* sp. | | | 1 | 0 | | | | |
| Purslane | *Portulaca* sp. | | | | | 1 | 0 | 1 | 0 |
| Unidentifiable | | 4 | 0 | 4 | 0.03 | 19 | 0 | 6 | 0.01 |

Table 2. Ubiquity Values, Standardized Counts, and Relative Percentages of Plants from 31BN976.

| | | Count | Weight | Ubiquity | Relative % | Standardized Count |
|---|---|---|---|---|---|---|
| **Nuts** | | | | | | |
| Acorn | *Quercus* sp. | 24 | 0.09 | 50% | 13.64 | 0.679 |
| Hickory | *Carya* sp. | 110 | 1.7 | 100% | 62.50 | 3.113 |
| **Fruits** | | | | | | |
| Wax Myrtle | *Myrica* sp. | 1 | 0 | 25% | 0.57 | 0.028 |
| **Miscellaneous** | | | | | | |
| Aster Family | Asteraceae | 1 | 0 | 25% | 0.57 | 0.028 |
| Bedstraw | *Galium* sp. | 1 | 0 | 25% | 0.57 | 0.028 |
| Copperleaf | Acalypha sp. | 1 | 0 | 25% | 0.57 | 0.028 |
| Grass Family | Poaceae | 1 | 0 | 25% | 0.57 | 0.028 |
| Panic Grass | *Panicum* sp. | 1 | 0 | 25% | 0.57 | 0.028 |
| Purslane | *Portulaca* sp. | 2 | 0 | 50% | 1.14 | 0.057 |
| Spurge | *Euphorbia* sp. | 1 | 0 | 25% | 0.57 | 0.028 |
| **Unidentified** | | | | | | |
| Unidentifiable | | 33 | 0.04 | 100% | 18.75 | 0.934 |

Table 3. AMS Dating Sample Info

| Sample # | Site | Feature | T.U. | Level | Depth | Taxon | Weight (g) |
|---|---|---|---|---|---|---|---|
| Sample 1 | 31BN976 | | 1 | 6 | 87-95 cmbs | Hickory Nutshell | 0.05 |
| Sample 2 | 31BN978 | | 1 | 7 | 98-108 cmbs | Hickory Nutshell | 0.017 |
| Sample 3 | 31BN976 | 1 | 3 | 2 | 50-56 cmbs | Hickory Nutshell | 0.008 |
| Sample 4 | 31BN976 | 1 | 4 | 3 | 56-66 cmbs | Hickory Nutshell | 0.004 |

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