# Analysis of Plant Remains from the Ravensford site

prepared by:
Amber M. VanDerwarker
Jennifer V. Alvarado

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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 Ravensford site, North Carolina, a multi-component site spanning the Archaic through Woodland periods (Savannah River phase through the Late Qualla phase). Temporal patterns reveal an adoption of corn agriculture during the Early Pisgah phase. The shift from Early to Late Qualla, however, is marked by a significant drop in corn production, corresponding to a rise in the collection of nuts and wild fruits. This decrease in farming investment is likely linked to the overall disruption in cultural practices linked to European contact. Increased disease and death associated with European contact had ramifications for many groups, often leading to shrinkage of family groups and communities which would have impacted the farming through the reduction in labor during key times (e.g., planting & harvesting). In addition to a temporal analysis, we conducted a spatial analysis of a Late Qualla winter house that was abandoned and burned; the plant remains deposited on the floor of the structure are interpreted as *in situ* occupational refuse pre-dating the abandonment of the structure. We identified three clusters of floor activity located away from the vestibule opening of the structure: (1) a food processing area for corn & nuts, (2) an area of bottle gourds likely used for liquid storage, and (3) an area of storage for dried fruits.

## 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. Burned house structures can also yield carbonized plant deposits, and these deposits often differ dramatically from refuse deposits (Scarry 1986). The Ravensford site boasts such a context, a burned structure that yielded phenomenal plant preservation (Structure 34). The plant assemblage from this house has a significantly richer array of taxa than the other contexts at the site, including more than 1800 specimens of bottle gourd fragments, most of which come from the rind of the gourd; the identification of bottle gourd is quite rare in open air sites. 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 used both plant weight and soil volume to standardize the data – interestingly, both measures yielded similar patterning in the data. Thus, most of the data are presented as density measures.

Finally, the analysis presented below also uses diversity analysis (the Shannon-Weaver Index) to evaluate the richness and evenness of plant taxa in the assemblages from different temporal contexts. The Shannon-Weaver Index determines diversity based on count data, and diversity values for different assemblages are compared directly. In addition, the Shannon-

Weaver diversity index (H′, see below) combines both richness and evenness into a single measure. The mathematical formula is as follows (Reitz and Wing 1999:105):

$$H' = -\sum_{i=1}^{s} (p_i)(\text{Log } p_i)$$

where:

$H'$ = the diversity index

$p_i$ = the relative abundance of the $i^{th}$ taxon in the sample (for the animal assemblages, this is calculated as NISP and MNI)

Log $p_i$ = the logarithm of $p_i$ (this is calculated to the base 10 for both assemblages)

$s$ = the number of different taxa represented in the sample

When comparing the diversity among different samples, higher numeric values (for H′ ) indicate higher species diversity (Reitz and Wing 1999). Because the Shannon-Weaver index combines both richness and evenness, the diversity of one sample relative to another depends upon how richness and evenness co-vary. For example, if Assemblage A is richer than Assemblage B, but both are similarly even, then Assemblage A will yield a higher diversity value. In addition, if the categories in Assemblage C are more evenly distributed than the categories in Assemblage D, but both are similarly rich, then Assemblage C will yield a higher diversity value (Reitz and Wing 1999:105). While evenness (or equitability) is a component of the diversity index (H′), it can also be considered independently, as follows:

$$V' = H'/\text{Log } s$$

where:

$V'$ = equitability

$H'$ = the diversity index (as calculated above)

$s$ = the number of different taxa represented in the sample

Equitability values (V′) can range from 0 to 1, with a value of 1 indicating an even distribution of taxa, and lower values representing less even distributions (Reitz and Wing 1999:106)

<u>Laboratory Procedures</u>

Flotation samples from the Ravensford 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; given the burned nature of Structure 35, we encountered many species that are infrequently identified in plant assemblages from open air sites. All plant specimens were identified to the lowest possible taxonomic level. 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, taxon counts were estimated by their respective weights. For each light and heavy fraction that yielded more than 200 specimens of a single taxon, the absolute number was extrapolated from the weight of a sub-sample of 200 specimens with respect to the weight of all specimens of that taxonomic category in the light or heavy fraction sample. The equation is expressed as follows:

$$\frac{x}{b} = \frac{200}{a} \quad \rightarrow \quad ax = 200b \quad \rightarrow \quad x = \frac{200b}{a}$$

where *a* is the weight of the sub-sample of 200 corn kernels, and *b* is the weight of the entire sample of corn kernels; *x* is the variable to solve for.

In addition to sampling a portion of the flotation samples that were sent to UCSB, we also 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 Ravensford site, which forms the basis for the quantitative analysis that follows. Plant data from flotation samples are summarized by site in Table 1, organized by temporal period (data summary by feature/structure are listed in Appendix A; data summary by individual sample are listed in Appendix B; a compete inventory of all flotation samples sent to UCSB indicating which ones were sampled and which were not is listed in Appendix D). Table 2 lists all taxonomic names that correspond to the common names provided in Table 1 and throughout the report. Raw counts and weights are provided for each taxon; plant weight, wood weight, and soil volume are also provided. Macrobotanical data recovered through hand collection are summarized in Table 3 (these data are detailed by bag number in Appendix C). All appendices are provided as MS Excel files, as they are too large for formatting in MS Word.

A total of 596 flotation samples were sent to UCSB for analysis; given time and funding constraints, not all samples were sorted. At the request of TRC Garrow & Associates, we sorted and analyzed all samples from level 3 of Structure 35. Other features, however, were sub-sampled. We selected samples from every feature that was sent to our lab, attempting to get full coverage of all levels excavated in each feature; when this was not possible (as some features had numerous samples), we selected alternate levels for analysis. Of the 596 samples send to the UCSB paleoethnobotany lab, 146 samples were sorted, representing a total of 3,616 liters of soil with a total plant weight of 3651.93 grams. Combined, these samples yielded 69 plant taxa (identified to the Genus level), including corn, a variety of nuts and fruits, and numerous small seeds (Tables 1).

Corn (*Zea mays*), bean (*Phaseolus* sp.), sumpweed (*Iva annua*), sunflower (*Helianthus annuum*) and bottle gourd (*Lagenaria siceraria*) were the only definitive field cultigens present in the samples (We list sumpweed and sunflower in the Grain/Oil/Green seed category). Corn and beans are often discussed together as they commonly represent partner crops. Whether or not they co-evolved as part and parcel of the same domestication process, corn and beans have a long tradition of inter-cropping and successional cropping in the New World (Lentz 2000). Inter-cropping corn and beans is often beneficial in that corn stalks support the bean vines throughout plant growth (Smartt 1988:149). Moreover, inter-cropping also reduces the risk of pest and disease outbreaks than in pure stands (Smartt 1988:149). Corn and beans are also complementary in terms of nutritional value; corn is deficient in essential amino acids lysine and isoleucine, which beans have in abundance (Bodwell 1987:264; Giller 2001:140). Thus, in addition to the benefits of cropping corn and beans together, there are also benefits to eating corn and beans together. Bottle gourd fruit, seeds, oil and leaves are edible and the gourds are easy to grow. The rinds can also be hollowed out for storage of water and other substances.

Nutshell recovered from the Ravensford flotation samples includes acorn (*Quercus* sp.), hickory (*Carya* sp.), and walnut (*Juglans* sp.). Hickory was the most abundant nut recovered, followed closely by acorn and black 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).

The hazelnut identified in the assemblage probably represents the American hazelnut (*Corylus americana*). Unlike the other nuts which come from trees, hazels are shrubs; they prefer open and anthropogenic habitats, and form dense thickets (Scarry 2003). While the nuts begin to ripen in the late summer, they don't fall to the ground until October/November, at which time they are quickly consumed by animals (Scarry 2003). These factors would have resulted in low collection rates for this type of nut (Scarry 2003; Talalay et al. 1984). Hazelnuts are high in fat and were probably processed for the nutmeats themselves, as opposed to the oil they produce (Scarry 2003).

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 are represented by a combination of wild and domestic species. The only definitive domesticated fruit identified was peach (*Prunus persica*), represented by 58 fragments deposited in Late Qualla features, the majority found in Feature 4404 (other features include 466, 1450, 5109, and Structure 35). The presence of peach, an Old World species, does not necessarily indicate direct contact with Europeans. Rather, this species was probably incorporated into native food systems through traditional exchange networks (Gremillion 1993)[1]. Several wild grape (*Vitis* sp.) seeds were also identified, in addition to hawthorn (*Crataegus* sp.) and persimmon (*Diospyros virginiana*). Other fruit taxa identified in the samples are represented by several wild species, including blackberry/raspberry (*Rubus* sp.), blueberry (*Vaccinium* sp.), plum/cherry (*Rubus* sp.), elderberry (*Sambcus* sp.), groundcherry (*Physalis* sp.), gum (*Nyssa* sp.), hackberry (*Celtis* sp.), maypop (*Passiflora incarnata*), nightshade (*Solanum* sp.), snowberry (*Symphoricarpos* sp.), sumac (*Rhus* sp.), possible chokeberry (*Aronia* sp.), haw (*Viburnum* sp.), and huckleberry (*Vaccinium* sp.). All are edible except for snowberry, which can be toxic if ingested in large quantities.

A variety of grain seeds, oil seeds, and greens was also identified in the Ravensford assemblage (see Tables 1 & 2). These include amaranth (*Amaranthus* sp.), bearsfoot (*Polymnia uvedalia*), bedstraw (*Galium* sp.), bullgrass cf. (*Paspalum boscianum* cf.), bulrush (*Scirpus* sp.), chenopod (*Chenopodium* sp.), copperleaf (*Acalypha ostryaefolia*), doveweed (*Croton* sp.), holly (*Ilex* sp.), knotweed (*Polygonum* sp.), morninglory (*Convolvulus*/*Ipomoea* sp.), purslane (*Portulaca* sp.), sage cf. (*Salvia* sp. cf.), sedge (*Carex* sp.), smartweed (*Polygonum* sp.), tickclover (*Desmodium* sp.), and wildbean (*Strophostyles* sp.), among others. People probably collected and consumed the seeds of amaranth, bearsfoot, chenopod, knotweed, smartweed, and sumpweed. Amaranth, chenopod, knotweed, purslane, and smartweed, in addition to doveweed and wildbean, may also have been eaten green or as potherbs (Hedrick 1972; Medsger 1966, Ulmer and Beck 1951). Chenopod (*Chenopodium* sp.), a common weed throughout the southeastern U.S., is represented in the assemblage by more than a thousand seeds. These chenopod seeds likely represent a combination of wild and domesticated Chenopodium. Other potential grain/oil seeds and green seeds identified include dock (*Rumex* sp.), little barley (*Hordeum pusillum*), pokeweed (*Phytolacca americana*), ragweed (*Ambrosia* sp.), and seeds from the mallow family (Malvaceae). Little barley is a grain seed and a good source of carbohydrates; ragweed and sunflower are oil seeds and contain more fat and protein. Grain seeds were probably parched and could be ground down to a meal and baked into bread or incorporated into stew. Similarly, oil seeds could be mixed into bread meal and/or stews. Dock,

[1] Peach may have also extended its range naturally throughout the southeastern U.S. (Gremillion 1993).

pokeweed and mallow family seeds were most likely gathered for their edible greens (Scarry 2003).

Other seeds that probably represent incidental inclusions in the assemblage include bedstraw, bullgrass, bulrush, copperleaf, sedge, and tickclover. Bedstraw may also have been consumed as a tea and the weedy legume may have been used as food (Hedrick 1972; Peterson 1977). Possible clover seeds (Trifolium sp.) may indicate clover leaves were being consumed. Some species of morninglory produce edible tubers, although the seeds identified in the samples might simply be field weeds (Medsger 1966). Notable are *Ilex* and possible *Ilex* seeds identified in Feature 518 (Early Qualla) and Structure 35 (Late Qualla); although this holly seed could not be identified to species, it is possible that it represents yaupon holly (*Ilex vomitoria*), a ritual plant known as the primary ingredient in the native Black Drink. Additionally, 12 sage seeds were identified in the samples; the particular species of sage is not certain, but there are four species of the genus *Salvia* that are native to region. These sage seeds may represent an incidental inclusion or they might have been used medicinally. Other seeds found include alder (*Alnus* sp.), carpetweed (*Mollugo* sp.), filaree (*Erodium* sp.), flatsedge (*Cyperus* sp.), goosegrass (*Eleusine indica*), magnolia (*Magnolia grandiflora*), mannagrass (*Glyceria* sp.), pine nut (*Pinus* sp.), spikerush (*Eleocharis* sp.), spurge (*Euphorbia* sp.), verbena (*Verbena* sp.), violet (*Viola* sp.), and wax myrtle (*Myrica* sp.). Possible seed identifications include crowngrass (*Paspalum* sp.), dandelion (*Taraxacum* sp.), dogwood (*Cornus* sp.), falsenettle (*Boehmeria* sp.), honeysuckle (*Lonicera* sp.), pepperweed (*Lepidium* sp.), mustard (*Brassica* sp.), queensdelight (*Stillingia* sp.), selfheal (*Prunella* sp.), and wild sunflower (*Helianthus* sp.). Alder would not have been eaten but the wood could have been burned for fuel. Carpetweed is a weed seed and was probably not consumed. Filaree greens and flowers are edible, flatsedge (chufa) has edible tubers that are collectible year round (Scarry 2003; http://www.arthurleej.com/a-filaree.html). Goosegrass seeds can be used as potherbs or ground into a meal (http://www.plantsforuse.com/index.php?page=1&id=2262#2262&pst= Eleusine indica). Magnolia trees have edible flowers and wood that can be used for fuel. Mannagrass seeds are also edible. Pinenuts can be collected and eaten and pine wood used for fuel. Crowngrass, queensdelight, spikerush, spurge and verbena are not usually consumed by humans. Honeysuckle and violet flowers are edible, and wax myrtle leaves can be dried and used for seasoning; their berries are edible but bitter (http://hubpages.com/hub/Common-Edible-Wild-Plants---Part-I). Dandelion flowers, greens and roots are edible and can be eaten raw or boiled and made into a tea (http://www.essortment.com/all/aredandelion_rlrr.htm). Some species of dogwood fruit are sweet and edible. Falsenettle is not believed to be edible but its plant fibers can be used for cordage (Austin 2004). Mustard and pepperweed seeds can be used as seasonings in stews and other foods. Selfheal greens are edible and the whole plant can be used for medicinal purposes. Of all of the seeds grouped in the “Other Seeds” category, spurge was by far the most numerous, with the majority coming from Structure 35 (see Appendix A).

Table 1. Counts and weights of plant taxa by temporal period.

| | Savannah River | | Connestee | | Early Pisgah | | Late Pisgah | | Early Qualla | | Late Middle Qualla | | Late Qualla | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N of Samples | 3 | | 5 | | 15 | | 3 | | 22 | | 4 | | 94 | |
| Total Volume (l) | 141 | | 28 | | 300 | | 255 | | 795 | | 292 | | 1805 | |
| Plant Weight (g) | 231.18 | | 39.84 | | 255.31 | | 48.36 | | 905.19 | | 86.01 | | 2086.04 | |
| Wood Weight (g) | 50.67 | | 36.65 | | 162.02 | | 42.30 | | 669.96 | | 87.75 | | 1706.48 | |
| | | | | | | | | | | | | | | |
| COMMON NAME | (n) | (g) | (n) | (g) | (n) | (g) | (n) | (g) | (n) | (g) | (n) | (g) | (n) | (g) |
| **Cultigens** | | | | | | | | | | | | | | |
| Corn cob | | | | | | | | | | | | | 40 | 5.89 |
| Corn cob cf. | | | | | | | | | | | | | 118 | 0.58 |
| Corn cupule | | | 1 | 0.01 | 795 | 4.32 | 505 | 1.74 | 28286 | 102.89 | 886 | 3.83 | 15865 | 94 |
| Corn cupule cf. | | | | | 2 | 0.01 | 2 | 0.01 | 20 | 0.08 | | | 108 | 0.21 |
| Corn kernel | | | | | 94 | 0.77 | 48 | 0.32 | 1649 | 10.35 | 664 | 4.92 | 1476 | 8.26 |
| Corn kernel cf. | | | | | 6 | 0.02 | | | 67 | 0.3 | 2 | 0.01 | 7 | 0.05 |
| Common bean | | | | | 1 | 0.01 | | | 51 | 0.25 | 98 | 1.1 | 52 | 0.42 |
| Bean cf. | | | | | 5 | 0 | | | 33 | 0.1 | 2 | 0.04 | 71 | 0.76 |
| Bean/persimmon | | | | | | | | | | | | | 6 | 0.01 |
| Bottle gourd | | | | | | | | | | | | | 62 | 0.11 |
| Bottle gourd cf. | | | | | | | | | | | | | 181 | 0.3 |
| Bottle gourd rind cf. | | | 1 | 0.01 | 2 | 0.02 | 1 | 0.01 | 150 | 0.6 | 8 | 0.04 | 1543 | 5.66 |
| **Nuts** | | | | | | | | | | | | | | |
| Acorn cap | 8 | 0.04 | | | 4 | 0.02 | | | | | | | 6 | 0.06 |
| Acorn cap cf. | | | | | | | | | 4 | 0.02 | 2 | 0.04 | 2 | 0.02 |
| Acorn meat | | | 12 | 0.18 | 18 | 0.83 | | | | | 6 | 0.55 | 2 | 0.02 |
| Acorn meat cf. | | | | | 13 | 0.29 | | | 9 | 0.09 | | | 3 | 0.02 |
| Acorn nutshell | | | 209 | 0.51 | 9496 | 38.41 | | | 1987 | 4.64 | 3 | 0.03 | 286 | 1.32 |
| Acorn nutshell cf. | | | | | 1 | 0.01 | | | 26 | 0.08 | | | 61 | 0.17 |
| Hazelnut | | | 16 | 0.21 | | | 1 | 0.01 | 7 | 0 | | | | |
| Hazelnut cf. | | | | | 1 | 0.02 | | | | | | | | |
| Hickory | 13146 | 180.34 | 164 | 1.77 | 3044 | 44.58 | 390 | 3.65 | 8179 | 95.24 | 362 | 3.77 | 13743 | 154.5 |
| Hickory cf. | | | | | | | | | | | | | 13 | 0.04 |
| Hickory husk | | | | | 54 | 0.43 | | | | | | | | |
| Hickory meat cf. | | | | | 23 | 0.65 | | | | | | | | |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Black walnut | | | 7 | 0.43 | 4 | 0.13 | 7 | 0.21 | 70 | 3.46 | 16 | 0.57 | 2626 | 82.18 |
| Walnut family | | | | | | | | | | | | | | |
| Walnut family cf. | | | | | | | | | 4 | 0.04 | | | 5 | 0.07 |
| **Fleshy Fruits** | | | | | | | | | | | | | | |
| Blackberry/Raspberry | | | 16 | 0 | 2 | 0 | 2 | 0 | 5 | 0 | | | 44 | 0 |
| Blueberry | | | | | | | | | 4 | 0 | 2 | 0 | 3 | 0 |
| Blueberry cf. | | | | | | | | | 4 | 0 | | | 3 | 0 |
| Chokeberry cf. | | | | | | | | | | | | | 1 | 0 |
| Elderberry | | | | | 1 | 0 | 1 | 0 | | | | | | |
| Grape | | | 1 | 0 | | | | | 103 | 0.47 | | | 68 | 0.17 |
| Grape cf. | | | | | | | | | 20 | 0 | | | | |
| Groundcherry | | | 4 | 0 | | | 6 | 0 | 23 | 0 | | | 80 | 0 |
| Gum | | | | | | | | | | | | | 2 | 0.03 |
| Hackberry | | | | | | | | | 5 | 0.04 | | | | |
| Hackberry cf. | | | | | | | | | 1 | 0 | | | 1 | 0 |
| Haw cf. | | | | | | | | | | | | | | |
| Hawthorn | | | | | | | | | 1 | 0 | | | 1 | 0.01 |
| Hawthorn cf. | | | 1 | 0 | | | | | | | | | 4 | 0.01 |
| Huckleberry cf. | | | | | | | 1 | 0 | | | | | | |
| Maypop | | | | | 3 | 0 | 6 | 0.01 | 228 | 0.34 | 43 | 0.05 | 248 | 0.65 |
| Nightshade | | | | | | | | | | | | | 26 | 0 |
| Nightshade cf. | | | 10 | 0 | 2 | 0 | | | 4 | 0 | | | 12 | 0 |
| Peach | | | | | | | | | | | | | 58 | 4.03 |
| Peach cf. | | | | | | | | | | | | | 1 | 0.07 |
| Persimmon | | | | | | | | | | | | | 66 | 1.75 |
| Persimmon cf. | | | | | | | | | | | 4 | 0.04 | 6 | 0.07 |
| Plum/Cherry | | | | | 2 | 0.02 | | | | | | | 2 | 0.01 |
| Plum/Cherry cf. | | | | | | | | | | | | | 4 | 0.06 |
| Snowberry | | | | | | | | | 2 | 0.02 | | | | |
| Sumac | | | | | 3 | 0 | | | | | | | 185 | 0.17 |
| Sumac cf. | | | | | | | | | | | | | 1 | 0 |
| **Grains/Oil Seeds & Greens** | | | | | | | | | | | | | | |
| Amaranth | | | 3 | | | | 1 | | 19 | | 1 | | 21 | 0 |
| Amaranth cf. | | | | | | | | | | | | | 1 | 0 |
| Bean Family | | | | | | | | | | | | | 1 | 0 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bearsfoot | | | | | | | | | | | | | 1 | 0 |
| Cheno/am | | | | | 4 | | | | 5 | | | | 26 | 0 |
| Chenopod | 1 | | 37 | | 21 | | 22 | | 412 | | 30 | | 522 | 0 |
| Chenopod cf. | | | | | 1 | | | | 1 | | | | 12 | 0 |
| Dock | | | | | | | | | 2 | | | | | |
| Knotweed | | | | | | | | | 5 | | | | 1 | 0 |
| Knotweed cf. | | | | | 1 | | | | | | | | | |
| Little barley | | | | | | | | | 2 | | | | | |
| Little barley cf. | | | | | | | | | | | | | 2 | 0 |
| Pokeweed | | | | | 7 | | 6 | | 63 | | | | 10 | 0 |
| Pokeweed cf. | | | 1 | | | | | | | | | | 39 | 0 |
| Portulacca family | | | | | 1 | | | | | | | | | |
| Purslane | | | | | 1 | | | | 138 | | | | 19 | 0 |
| Ragweed | | | | | | | | | | | | | 4 | 0 |
| Ragweed cf. | | | | | 1 | | | | | | | | | |
| Sumpweed | | | | | 1 | | | | 4 | | | | | |
| Sumpweed cf. | | | | | | | | | 4 | | | | 1 | 0 |
| Sumpweed/sunflower | | | | | | | | | | | | | 1 | 0 |
| Sumpweed/sunflower cf. | | | | | | | | | | | | | 4 | 0.04 |
| Sunflower | | | | | | | | | 6 | | | | 9 | 0.02 |
| Mallow family | | | | | | | | | 7 | | | | 5 | 0 |
| **Wild Legumes** | | | | | | | | | | | | | | |
| Clover cf. | | | | | | | | | | | | | 1 | 0 |
| Tickclover | | | | | 3 | | 1 | | | | | | 8 | 0 |
| Tickclover cf. | | | | | 2 | | | | | | | | 6 | 0 |
| Wild bean | | | | | | | | | 6 | | | | | |
| Wild bean cf. | | | | | | | | | | | | | 1 | 0 |
| Bean Family | | | | | | | | | 14 | | | | | |
| **Other Seeds** | | | | | | | | | | | | | | |
| Alder | | | | | | | | | | | | | 19 | |
| Bedstraw | | | 3 | | 1 | | 8 | | 30 | | | | 4 | |
| Bedstraw cf. | | | | | | | | | 8 | | | | | |
| Bulrush | | | 1 | | 15 | | | | 18 | | | | 6 | |
| Bulrush cf. | | | 1 | | | | | | | | | | 1 | |
| Carpetweed | | | | | 1 | | 3 | | 6 | | | | 33 | |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carpetweed cf. | | | | | | | | | | | | | 1 | |
| Composite family | | | | | 1 | | | | | | | | | |
| Copperleaf | 1 | | | | 3 | | | | 16 | | 23 | | 5 | |
| Crowngrass cf. | | | | | | | | | | | | | 5 | |
| Dandelion cf. | | | | | 1 | | | | | | | | | |
| Dogwood cf. | | | | | | | | | | | | | 2 | |
| Falsenettle cf. | | | | | | | | | | | | | 3 | |
| Filaree | | | | | | | | | 5 | | | | | |
| Flatsedge | | | | | | | | | 5 | | | | 1 | |
| Goosegrass | | | | | | | | | | | | | 1 | |
| Grass family | | | 5 | | 4 | | | | 23 | | | | 315 | |
| Grass family cf. | | | | | | | | | | | 2 | | | |
| Holly | | | | | | | | | | | | | 7 | |
| Holly cf. | | | | | | | | | 1 | | | | 3 | |
| Honeysuckle cf. | | | | | | | | | 2 | | | | | |
| Magnolia | | | | | | | | | | | | | 1 | |
| Mannagrass | | | | | | | | | 139 | | | | 11 | |
| Mannagrass cf. | | | | | 1 | | | | | | | | | |
| Morninglory cf. | | | 8 | | | | | | | | | | 4 | |
| Mustard cf. | | | | | | | | | | | | | 1 | |
| Nightshade family | | | | | | | | | | | | | | |
| Pepperweed cf. | | | | | 1 | | | | | | 2 | | 1 | |
| Pine nut | | | | | | | | | | | | | 7 | |
| Pine nut cf. | | | | | | | | | | | | | 5 | |
| Queensdelight cf. | | | | | | | | | | | | | 2 | |
| Sage | | | | | | | | | 2 | | | | 4 | |
| Sage cf. | | | | | 1 | | | | 4 | | | | 1 | |
| Sedge | | | | | | | | | | | | | 1 | |
| Sedge cf. | | | | | | | | | | | | | 1 | |
| Selfheal cf. | | | | | | | | | | | | | 1 | |
| Smartweed | | | | | | | | | | | 1 | | 5 | |
| Smartweed cf. | | | | | | | | | | | | | 2 | |
| Solanaceae | | | | | | | | | 5 | | | | | |
| Spikerush | | | | | | | | | 5 | | | | | |
| Spikerush cf. | | | | | 2 | | | | | | | | 8 | |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Spurge | | | 1 | | 3 | | 4 | | 33 | | | | 72 | |
| Spurge cf. | | | | | 11 | | | | | | | | 4 | |
| Verbena | | | | | | | 1 | | | | | | 5 | |
| Violet cf. | | | | | | | | | 1 | | | | 2 | |
| Violet | | | | | | | | | | | | | 6 | |
| Wax myrtle | | | | | 22 | | | | | | | | 1 | |
| Wax myrtle cf. | | | | | | | | | 16 | | | | 2 | |
| Wild sunflower cf. | | | | | | | | | | | | | 4 | |
| **Miscellaneous** | | | | | 1 | | | | | | | | | |
| Pine cone flap | | | | | | | | | | | | | 3 | 0.01 |
| Pine pitch cf. | | | | | | | | | | | | | 15 | 0.14 |
| **Unidentified** | | | | | | | | | | | | | | |
| Unidentified | | | | | | | | | 13 | 0.26 | 17 | 0.17 | 108 | 1.12 |
| Unident. peduncle | | | | | 14 | 0 | | | 2 | 0 | | | 3 | 0 |
| Unidentified seed | 33 | 0.12 | 16 | 0.06 | 455 | 2.67 | | | 125 | 0 | | | 185 | 0.02 |
| Unidentifiable | 3 | 0.01 | 31 | 0 | 21 | 0 | 37 | 0.11 | 3159 | 14.75 | 230 | 0.96 | 3669 | 17.07 |
| Unidentifiable seed | | | | | | | 32 | 0 | 282 | 0.09 | 39 | 0 | 985 | 0.27 |

Table 2. Correspondence of common and taxonomic names.

| COMMON NAME | TAXONOMIC NAME |
|---|---|
| **Cultigens** | |
| Corn cob | *Zea mays* |
| Corn cob cf. | *Zea mays* cf. |
| Corn cupule | *Zea mays* |
| Corn cupule cf. | *Zea mays* cf. |
| Corn kernel | *Zea mays* |
| Corn kernel cf. | *Zea mays* cf. |
| Common bean | *Phaseolus vulgaris* |
| Bean cf. | *Phaseolus* sp. |
| Bean/persimmon | *Phaseolus/Diospyros* |
| Bottle gourd | *Lagenaria siceraria* |
| Bottle gourd cf. | *Lagenaria siceraria* cf. |
| Bottle gourd rind cf. | *Lagenaria siceraria* cf. |
| **Nuts** | |
| Acorn cap | *Quercus* sp. |
| Acorn cap cf. | *Quercus* sp. cf. |
| Acorn meat | *Quercus* sp. |
| Acorn meat cf. | *Quercus* sp. cf. |
| Acorn nutshell | *Quercus* sp. |
| Acorn nutshell cf. | *Quercus* sp. cf. |
| Hazelnut | *Corylus* sp. |
| Hazelnut cf. | *Corylus* sp. cf. |
| Hickory | *Carya* sp. |
| Hickory cf. | *Carya* sp. cf. |
| Hickory husk | *Carya* sp. |
| Hickory meat cf. | *Carya* sp. |
| Black walnut | *Juglans nigra* |
| Walnut family | Juglandaceae |
| Walnut family cf. | Juglandaceae cf. |
| **Fleshy Fruits** | |
| Blackberry/Raspberry | *Rubus* sp. |
| Blueberry | *Vaccinium* sp. |
| Blueberry cf. | *Vaccinium* sp. cf. |
| Chokeberry cf. | *Aronia* sp. |
| Elderberry | *Sambucus* sp. |
| Grape | *Vitis* sp. |
| Grape cf. | *Vitis* sp. cf. |
| Groundcherry | *Physalis* sp. |
| Gum | *Nyssa* sp. |
| Hackberry | *Celtis* sp. |
| Hackberry cf. | *Celtis* sp. cf. |
| Haw cf. | *Viburnum* sp. cf. |
| Hawthorn | *Crataegus* sp. |
| Hawthorn cf. | *Crataegus* sp. cf. |
| Huckleberry cf. | *Vaccinium* sp. cf. |
| Maypop | *Passiflora incarnata* |

| | |
|---|---|
| Nigthshade | *Solanum* sp. |
| Nightshade cf. | *Solanum* sp. cf. |
| Peach | *Prunus persica* |
| Peach cf. | *Prunus persica* cf. |
| Persimmon | *Diospyros virginiana* |
| Persimmon cf. | *Diospyros virginiana* cf. |
| Plum/Cherry | *Prunus* sp. |
| Plum/Cherry cf. | *Prunus* sp. cf. |
| Snowberry | *Symphoricarpos* sp. |
| Sumac | *Rhus* sp. |
| Sumac cf. | *Rhus* sp. cf. |
| **Grains/Oil Seeds & Greens** | |
| Amaranth | *Amaranthus* sp. |
| Amaranth cf. | *Amaranthus* sp. cf. |
| Bean Family | Fabaceae |
| Bearsfoot | *Polymnia uvedalia* |
| Cheno/am | *Chenopodium/Amaranthus* |
| Chenopod | *Chenopodium* sp. |
| Chenopod cf. | *Chenopodium* sp. cf. |
| Dock | *Rumex* sp. |
| Knotweed | *Polygonum* sp. |
| Knotweed cf. | *Polygonum* sp. cf. |
| Little barley | *Hordeum pusillum* |
| Little barley cf. | *Hordeum pusillum* cf. |
| Pokeweed | *Phytolacca americana* |
| Pokeweed cf. | *Phytolacca americana* cf. |
| Portulacca family | Portulacaeae |
| Purslane | *Portulaca* sp. |
| Ragweed | *Ambrosia* sp. |
| Ragweed cf. | *Ambrosia* sp. cf. |
| Sumpweed | *Iva annua* |
| Sumpweed cf. | *Iva annua* cf. |
| Sumpweed/sunflower | *Iva/Helianthus* |
| Sumpweed/sunflower cf. | *Iva/Helianthus* cf. |
| Sunflower | *Helianthus annuus* |
| Mallow family | Malvaceae |
| **Wild Legumes** | |
| Clover cf. | *Trifolium* sp. cf. |
| Tickclover | *Desmodium* sp. |
| Tickclover cf. | *Desmodium* sp. cf. |
| Wild bean | *Strophostyles* sp. |
| Wild bean cf. | *Strophostyles* sp. cf. |
| Bean Family | Fabaceae |
| **Other Seeds** | |
| Alder | *Alnus* sp. |
| Bedstraw | *Galium* sp. |
| Bedstraw cf. | *Galium* sp. cf. |
| Bulrush | *Scirpus* sp. |

| | |
|---|---|
| Bulrush cf. | *Scirpus* sp. cf. |
| Carpetweed | *Mollugo* sp. |
| Carpetweed cf. | *Mollugo* sp. cf. |
| Composite family | Asteraceae |
| Copperleaf | *Acalypha virginica* |
| Crowngrass cf. | *Paspalum* sp. cf. |
| Dandelion cf. | *Taraxacum* sp. cf. |
| Dogwood cf. | *Cornus* sp. cf. |
| Falsenettle cf. | *Boehmeria* sp. |
| Filaree | *Erodium* sp. |
| Flatsedge | *Cyperus* sp. |
| Goosegrass | *Eleusine indica* |
| Grass family | Poaceae |
| Grass family cf. | Poaceae cf. |
| Holly | *Ilex* sp. |
| Holly cf. | *Ilex* sp. cf. |
| Honeysuckle cf. | *Lonicera* sp. |
| Magnolia | *Magnolia grandiflora* |
| Mannagrass | *Glyceria* sp. |
| Mannagrass cf. | *Glyceria* sp. cf. |
| Morninglory cf. | *Ipomoea/Convolvulus* cf. |
| Mustard cf. | *Brassica* sp. cf. |
| Nightshade family | Solanaceae |
| Pepperweed cf. | *Lepidium* sp. cf. |
| Pine nut | *Pinus* sp. |
| Pine nut cf. | *Pinus* sp. cf. |
| Queensdelight cf. | *Stillingia* sp. cf. |
| Sage | *Salvia* sp. |
| Sage cf. | *Salvia* sp. cf. |
| Sedge | *Carex* sp. |
| Sedge cf. | *Carex* sp. cf. |
| Selfheal cf. | *Prunella* sp. cf. |
| Smartweed | *Polygonum* sp. |
| Smartweed cf. | *Polygonum* sp. cf. |
| Solanaceae | Solanaceae |
| Spikerush | *Eleocharis* sp. |
| Spikerush cf. | *Eleocharis* sp. cf. |
| Spurge | *Euphorbia* sp. |
| Spurge cf. | *Euphorbia* sp. cf. |
| Verbena | *Verbena* sp. |
| Violet cf. | *Viola* sp. cf. |
| Violet | *Viola* sp. |
| Wax myrtle | *Myrica* sp. |
| Wax myrtle cf. | *Myrica* sp. cf. |
| Wild sunflower cf. | *Helianthus* sp. cf. |
| **Miscellaneous** | |
| Pine cone flap | *Pinus* sp. |
| Pine pitch cf. | *Pinus* sp. cf. |

Table 3. Summary of macrobotanical data from hand-picked samples.

| | | | | | |
|---|---|---|---|---|---|
| N of Samples | | 187 | | 9 | |
| Wood Weight (g) | | 34.99 | | 3.99 | |
| | | | | | |
| | | Structure 35 | | Other Samples* | |
| COMMON NAME | TAXONOMIC NAME | (n) | (g) | (n) | (g) |
| Acorn cf. | *Quercus* sp. cf. | 1 | 0.02 | | |
| Black walnut | *Juglans nigra* | 180 | 44.13 | | |
| Bottle gourd (seed) | *Lagenaria siceraria* | 876 | 8.36 | | |
| Bottle gourd cf. (rind) | *Lagenaria siceraria* cf. | 269 | 4.1 | | |
| Common bean | *Phaseolus vulgaris* | 6 | 0.08 | 47 | 2.24 |
| Corn cob | *Zea mays* | 640 | 230.53 | 14 | 4.58 |
| Corn cupule | *Zea mays* | 1906 | 26.95 | 31 | 1.44 |
| Corn kernel | *Zea mays* | 3 | 0.02 | 182 | 11.82 |
| Corn kernel cf. | *Zea mays* cf. | 1 | 0.02 | | |
| Hickory | *Carya* sp. | 156 | 17.99 | 2 | 0.43 |
| Hickory cf. | *Carya* sp. cf. | | | 2 | 0.23 |
| Peach | *Prunus persica* | 12 | 5.54 | 8 | 2.25 |
| Persimmon | *Diospyros virginiana* | 4 | 0.27 | | |
| Plum/Cherry | *Prunus* sp. | 2 | 0.47 | | |
| Walnut cf. | *Juglans* sp. cf. | 5 | 0 | | |
| Walnut family | Juglandaceae | 1 | 0.01 | | |
| UID | | 24 | 0.28 | 3 | 0.02 |
| UID seed | | | | 1 | 0.25 |

* See Appendix C for complete listing of contexts for hand-picked macrobotanical data.

A general assessment of seasonality for these plants indicates the harvesting and collection of resources from April through November. We have broken up the seasonality data by temporal period (Tables 4-10). Regardless to temporary or permanent occupation, most plants do not bloom in the winter months, between December and March, which make plant seasonality data difficult to assess length of occupation without other complementary datasets. A perusal of the seasonality tables, however, reveals that most plants are ripe and ready for collection between May and October. Clearly, there is a bounty of wild plant foods that can be collected fresh throughout the spring, summer, and fall months. Many of these can be stored for later use in the winter.

Table 4. Seasonality of taxa from Savannah River Phase contexts in order of bloom.

| | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Copperleaf | | | | | | X | X | X | X | X | | |
| Chenopod | | | | | | | X | X | X | X | X | |
| Acorn | | | | | | | | | X | X | X | |
| Hickory | | | | | | | | | | X | | |

Table 5. Seasonality of taxa from Connestee Phase contexts in order of bloom.

| | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Dandelion cf. | | | | X | X | X | X | X | X | X | | |
| Blackberry/ Raspberry | | | | | X | X | | | | | | |
| Bedstraw | | | | | X | X | X | X | | | | |
| Pokeweed | | | | | X | X | X | X | | | | |
| Bottle gourd | | | | | X | X | X | X | X | | | |
| Crowngrass cf. | | | | | | X | X | X | X | X | | |
| Groundcherry | | | | | | X | X | X | X | X | X | |
| Nigthshade | | | | | | X | X | X | X | X | X | |
| Amaranth | | | | | | | X | X | X | | | |
| Bulrush | | | | | | | X | X | X | | | |
| Corn | | | | | | | X | X | X | | | |
| Dock | | | | | | | X | X | X | | | |
| Hazelnut | | | | | | | X | X | X | | | |
| Spurge | | | | | | | X | X | X | X | | |
| Chenopod | | | | | | | X | X | X | X | X | |
| Morninglory cf. | | | | | | | X | X | X | X | X | |
| Grape | | | | | | | | X | X | X | | |
| Hawthorn | | | | | | | | | X | X | | |
| Acorn | | | | | | | | | X | X | X | |
| Hickory | | | | | | | | | | X | | |
| Walnut | | | | | | | | | | X | | |

Table 6. Seasonality of taxa from Early Pisgah contexts in order of bloom.

| | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pepperweed cf. | | | | X | X | X | X | X | | | | |
| Dandelion cf. | | | | X | X | X | X | X | X | X | | |
| Wax myrtle | | | | X | X | X | X | X | X | X | | |
| Blackberry/ Raspberry | | | | | X | X | | | | | | |
| Bedstraw | | | | | X | X | X | X | | | | |
| Mannagrass | | | | | X | X | X | X | | | | |
| Pokeweed | | | | | X | X | X | X | | | | |
| Bottle gourd | | | | | X | X | X | X | X | | | |
| Purslane | | | | | X | X | X | X | X | | | |
| Carpetweed | | | | | | X | X | X | | | | |
| Plum/Cherry | | | | | | X | X | X | X | | | |
| Spikerush | | | | | | X | X | X | X | | | |
| Copperleaf | | | | | | X | X | X | X | X | | |
| Elderberry | | | | | | X | X | X | X | X | | |
| Sumac | | | | | | X | X | X | X | X | | |
| Nightshade | | | | | | X | X | X | X | X | X | |
| Bulrush | | | | | | | X | X | X | | | |
| Corn | | | | | | | X | X | X | | | |
| Hazelnut | | | | | | | X | X | X | | | |
| Common bean | | | | | | | X | X | X | X | | |
| Maypop | | | | | | | X | X | X | X | | |
| Spurge | | | | | | | X | X | X | X | | |
| Chenopod | | | | | | | X | X | X | X | X | |
| Knotweed | | | | | | | X | X | X | X | X | |
| Sage | | | | | | | | X | X | | | |
| Tickclover | | | | | | | | X | X | X | | |
| Ragweed | | | | | | | | X | X | X | X | |
| Acorn | | | | | | | | | X | X | X | |
| Sumpweed | | | | | | | | | X | X | X | |
| Hickory | | | | | | | | | | X | | |
| Walnut | | | | | | | | | | X | | |

Table 7. Seasonality of taxa from Late Pisgah contexts in order of bloom.

| | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Blackberry/ Raspberry | | | | | X | X | | | | | | |
| Bedstraw | | | | | X | X | X | X | | | | |
| Pokeweed | | | | | X | X | X | X | | | | |
| Bottle gourd | | | | | X | X | X | X | X | | | |
| Carpetweed | | | | | | X | X | X | | | | |
| Huckleberry cf. | | | | | | X | X | X | | | | |
| Elderberry | | | | | | X | X | X | X | X | | |
| Verbena | | | | | | X | X | X | X | X | | |
| Groundcherry | | | | | | X | X | X | X | X | X | |
| Amaranth | | | | | | | X | X | X | | | |
| Corn | | | | | | | X | X | X | | | |
| Hazelnut | | | | | | | X | X | X | | | |
| Maypop | | | | | | | X | X | X | X | | |
| Spurge | | | | | | | X | X | X | X | | |
| Chenopod | | | | | | | X | X | X | X | X | |
| Tickclover | | | | | | | | X | X | X | | |
| Hickory | | | | | | | | | | X | | |
| Walnut | | | | | | | | | | X | | |

Table 8. Seasonality of taxa from Early Qualla contexts in order of bloom.

| | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Holly | | | | X | X | | | | | | | |
| Wax myrtle | | | | X | X | X | X | X | X | X | | |
| Blackberry/ Raspberry | | | | | X | X | | | | | | |
| Little barley | | | | | X | X | X | | | | | |
| Bedstraw | | | | | X | X | X | X | | | | |
| Blueberry | | | | | X | X | X | X | | | | |
| Mannagrass | | | | | X | X | X | X | | | | |
| Pokeweed | | | | | X | X | X | X | | | | |
| Violet | | | | | X | X | X | X | | | | |
| Bottle gourd | | | | | X | X | X | X | X | | | |
| Filaree | | | | | X | X | X | X | X | | | |
| Purslane | | | | | X | X | X | X | X | | | |
| Carpetweed | | | | | | X | X | X | | | | |
| Snowberry | | | | | | X | X | X | | | | |
| Flatsedge | | | | | | X | X | X | X | | | |
| Honeysuckle cf. | | | | | | X | X | X | X | | | |
| Spikerush | | | | | | X | X | X | X | | | |
| Copperleaf | | | | | | X | X | X | X | X | | |
| Groundcherry | | | | | | X | X | X | X | X | X | |
| Nightshade | | | | | | X | X | X | X | X | X | |
| Amaranth | | | | | | | X | X | X | | | |
| Bulrush | | | | | | | X | X | X | | | |
| Corn | | | | | | | X | X | X | | | |
| Dock | | | | | | | X | X | X | | | |
| Haw cf. | | | | | | | X | X | X | | | |
| Hazelnut | | | | | | | X | X | X | | | |
| Common bean | | | | | | | X | X | X | X | | |
| Maypop | | | | | | | X | X | X | X | | |
| Spurge | | | | | | | X | X | X | X | | |
| Sunflower | | | | | | | X | X | X | X | | |
| Wild bean | | | | | | | X | X | X | X | | |
| Chenopod | | | | | | | X | X | X | X | X | |
| Knotweed | | | | | | | X | X | X | X | X | |
| Hackberry | | | | | | | X | X | X | X | X | X |
| Sage | | | | | | | | X | X | | | |
| Grape | | | | | | | | X | X | X | | |
| Hawthorn | | | | | | | | | X | X | | |
| Acorn | | | | | | | | | X | X | X | |
| Sumpweed | | | | | | | | | X | X | X | |
| Hickory | | | | | | | | | | X | | |
| Walnut | | | | | | | | | | X | | |

Table 9. Seasonality of taxa from Late Middle Qualla contexts in order of bloom.

| | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pepperweed cf. | | | | X | X | X | X | X | | | | |
| Blueberry | | | | | X | X | X | X | | | | |
| Bottle gourd | | | | | X | X | X | X | X | | | |
| Copperleaf | | | | | | X | X | X | X | X | | |
| Amaranth | | | | | | | X | X | X | | | |
| Corn | | | | | | | X | X | X | | | |
| Common bean | | | | | | | X | X | X | X | | |
| Maypop | | | | | | | X | X | X | X | | |
| Chenopod | | | | | | | X | X | X | X | X | |
| Smartweed | | | | | | | X | X | X | X | X | |
| Persimmon | | | | | | | | | X | X | | |
| Acorn | | | | | | | | | X | X | X | |
| Hickory | | | | | | | | | | X | | |
| Walnut | | | | | | | | | | X | | |

Table 10. Seasonality of taxa from Late Qualla contexts in order of bloom.

| | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Holly | | | | X | X | | | | | | | |
| Chokeberry cf. | | | | X | X | X | | | | | | |
| Dogwood cf. | | | | X | X | X | | | | | | |
| Pepperweed cf. | | | | X | X | X | X | X | | | | |
| Alder | | | | X | X | X | X | X | X | X | | |
| Wax myrtle | | | | X | X | X | X | X | X | X | | |
| Blackberry/ Raspberry | | | | | X | X | | | | | | |
| Little barley | | | | | X | X | X | | | | | |
| Bedstraw | | | | | X | X | X | X | | | | |
| Blueberry | | | | | X | X | X | X | | | | |
| Mannagrass | | | | | X | X | X | X | | | | |
| Pokeweed | | | | | X | X | X | X | | | | |
| Violet | | | | | X | X | X | X | | | | |
| Bottle gourd | | | | | X | X | X | X | X | | | |
| Magnolia | | | | | X | X | X | X | X | | | |
| Purslane | | | | | X | X | X | X | X | | | |
| Queensdelight cf. | | | | | X | X | X | X | X | | | |
| Peach | | | | | | X | X | | | | | |
| Carpetweed | | | | | | X | X | X | | | | |
| Clover cf. | | | | | | X | X | X | | | | |
| Flatsedge | | | | | | X | X | X | X | | | |
| Plum/Cherry | | | | | | X | X | X | X | | | |
| Spikerush | | | | | | X | X | X | X | | | |
| Copperleaf | | | | | | X | X | X | X | X | | |
| Crowngrass cf. | | | | | | X | X | X | X | X | | |
| Selfheal cf. | | | | | | X | X | X | X | X | | |
| Sumac | | | | | | X | X | X | X | X | | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Verbena | | | | | | X | X | X | X | X | | |
| Groundcherry | | | | | | X | X | X | X | X | X | |
| Nightshade | | | | | | X | X | X | X | X | X | |
| Amaranth | | | | | | | X | X | X | | | |
| Bearsfoot | | | | | | | X | X | X | | | |
| Bulrush | | | | | | | X | X | X | | | |
| Corn | | | | | | | X | X | X | | | |
| Falsenettle cf. | | | | | | | X | X | X | | | |
| Mustard cf. | | | | | | | X | X | X | | | |
| Common bean | | | | | | | X | X | X | X | | |
| Gum | | | | | | | X | X | X | X | | |
| Maypop | | | | | | | X | X | X | X | | |
| Spurge | | | | | | | X | X | X | X | | |
| Sunflower | | | | | | | X | X | X | X | | |
| Wild bean | | | | | | | X | X | X | X | | |
| Chenopod | | | | | | | X | X | X | X | X | |
| Goosegrass | | | | | | | X | X | X | X | X | |
| Knotweed | | | | | | | X | X | X | X | X | |
| Morninglory cf. | | | | | | | X | X | X | X | X | |
| Smartweed | | | | | | | X | X | X | X | X | |
| Hackberry | | | | | | | X | X | X | X | X | X |
| Sage | | | | | | | | X | X | | | |
| Grape | | | | | | | | X | X | X | | |
| Tickclover | | | | | | | | X | X | X | | |
| Wild sunflower cf. | | | | | | | | X | X | X | | |
| Pine nut | | | | | | | | X | X | X | X | |
| Ragweed | | | | | | | | X | X | X | X | |
| Hawthorn | | | | | | | | | X | X | | |
| Persimmon | | | | | | | | | X | X | | |
| Acorn | | | | | | | | | X | X | X | |
| Sumpweed | | | | | | | | | X | X | X | |
| Hickory | | | | | | | | | | X | | |
| Walnut | | | | | | | | | | X | | |
| Sedge | | | | | | | | | | X | X | X |

Quantitative Results I: Temporal Analysis

A consideration of temporal changes in the data reveals a variety of patterns supported by a different measure. Here we employ relative percentages, relative densities, ubiquity analysis, and diversity analysis, in addition to box plots, which reveal statistical differences through time. We begin by summing the raw counts by the taxonomic grouping presented in Table 1: cultigens, nuts, fleshy fruits, grain/oil/green seeds, wild legumes, and other seeds (Table 11). These same data are converted to (1) relative percentages by period (Table 12) and (2) density measures (Table 13). Given that percentages are dependent measures (for one value to increase, another must decrease), we believe that the density measure better reflect changes in the data (see above discussion of quantitative methods in the section "Methods of Quantification").

Based on the density data in Table 13, it is clear that cultigens increase through time, peaking in the Early Qualla, only to decrease during the subsequent Late Middle and Late Qualla periods. These patterns are supported in the box plots presented below. This pattern is inversely related to nut density, which remains high during the Savannah River, Connestee, and Early Pisgah phases, but begins to decline during the Late Pisgah; nut densities continue to drop during the Early and Late Middle Qualla periods, but then increase again during the Late Qualla. Thus, the drop in cultigens during the Late Qualla period appears to be compensated for by an increase in nut collection and processing. It is possible that European contact had a negative impact on crop production; exposure to disease (resulting in death) may very well have placed limitations on field labor during critical periods of the cropping cycle. Indeed, it is during the Late Qualla that we see an increase in all other plant categories, including fruits and edible seeds.

Table 11. Raw specimen counts by plant group and period*.

| | SR | CO | EP | LP | EQ | LMQ | LQ |
|---|---|---|---|---|---|---|---|
| Cultigens | | 2 | 905 | 556 | 30256 | 1660 | 19529 |
| Nuts | 13154 | 408 | 12658 | 398 | 10286 | 389 | 16747 |
| Fleshy Fruits | | 32 | 13 | 16 | 413 | 49 | 816 |
| GOG seeds^ | 1 | 41 | 38 | 29 | 668 | 31 | 679 |
| Wild Legumes | | | 5 | 1 | 20 | | 16 |
| Other Seeds | 1 | 19 | 67 | 16 | 319 | 28 | 557 |
| **TOTAL** | **13156** | **502** | **13686** | **1016** | **41962** | **2157** | **38344** |

* SR = Savannah River, CO = Connestee, EP = Early Pisgah, LP = Late Pisgah, EQ = Early Qualla, LMQ = Late Middle Qualla, LQ = Late Qualla

^ This is a grouping that includes grain seeds, oily seeds, and greens.

Table 12. Relative percentages by plant group and period*.

| | SR | CO | EP | LP | EQ | LMQ | LQ |
|---|---|---|---|---|---|---|---|
| Cultigens | 0.0 | 0.4 | 6.6 | 54.7 | 72.1 | 77.0 | 50.9 |
| Nuts | 100.0 | 81.3 | 92.5 | 39.2 | 24.5 | 18.0 | 43.7 |
| Fleshy Fruits | 0.0 | 6.4 | 0.1 | 1.6 | 1.0 | 2.3 | 2.1 |
| GOG seeds^ | 0.0 | 8.2 | 0.3 | 2.9 | 1.6 | 1.4 | 1.8 |
| Wild Legumes | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 |
| Other Seeds | 0.0 | 3.8 | 0.5 | 1.6 | 0.8 | 1.3 | 1.5 |

* SR = Savannah River, CO = Connestee, EP = Early Pisgah, LP = Late Pisgah, EQ = Early Qualla, LMQ = Late Middle Qualla, LQ = Late Qualla

^ This is a grouping that includes grain seeds, oily seeds, and greens.

Table 13. Density measures by plant group and period*.

| | SR | CO | EP | LP | EQ | LMQ | LQ |
|---|---|---|---|---|---|---|---|
| Cultigens | 0.0 | 0.1 | 3.0 | 2.2 | 38.1 | 5.7 | 10.8 |
| Nuts | 93.3 | 14.6 | 42.2 | 1.6 | 12.9 | 1.3 | 9.3 |
| Fleshy Fruits | 0.0 | 1.1 | 0.0 | 0.1 | 0.5 | 0.2 | 0.5 |
| GOG seeds^ | 0.0 | 1.5 | 0.1 | 0.1 | 0.8 | 0.1 | 0.4 |
| Wild Legumes | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Other Seeds | 0.0 | 0.7 | 0.2 | 0.1 | 0.4 | 0.1 | 0.3 |

* SR = Savannah River, CO = Connestee, EP = Early Pisgah, LP = Late Pisgah, EQ = Early Qualla, LMQ = Late Middle Qualla, LQ = Late Qualla

^ This is a grouping that includes grain seeds, oily seeds, and greens.

Ubiquity Analysis can shed further light on temporal patterns in the plant data. Unfortunately, we cannot calculate ubiquity for all periods represented as this type of analysis requires a minimum of 10 samples (Hubbard 1976). Thus, our examination of ubiquity values is limited to the Early Pisgah, Early Qualla, and Late Qualla periods (see Table 14 for tabulation of samples per period). Tables 15-17 list ubiquity values in descending order for the three periods with sufficient samples. Table 18 summarizes these data and presents the top 5 ranked resources by ubiquity for each period, thus allowing for comparison of the taxa that occur most routinely in the samples. For all three periods under consideration, hickory and corn are the top ranking plant foods. During all periods, hickory is ranked number one; during the Early Qualla, however, corn is tied with hickory for the top rank. During the Early Pisgah and Late Qualla periods, corn ranks second, below hickory. Acorn ranks below corn and hickory for the Early Pisgah and Early Qualla periods. By the Late Qualla, however, acorn has dropped from the top 5 plant resources, to be supplanted by walnut. Walnut ranks 4th during the Early Qualla, but became more important during the Late Qualla. Chenopod ranks either 4th or 5th during all periods represented, demonstrating its importance as a subsistence food throughout the sequence. The chenopod seeds identified in the Ravensford samples likely represent a mix of both wild and domestic plants, indicating both collection of wild greens and garden cultivation as well. Finally, bottle gourd ranks 5th for the Late Qualla samples, a likely bias from the unique preservation of Structure 35. This structure was burned and the floor materials represent abandonment refuse. The house floor was littered with bottle gourd seeds and rind fragments, which is uncommon in typical refuse. We will discuss Structure 35 in more detail in a separate analysis below.

Table 14. Correspondence between period and ubiquity analysis.

| | Total Samples Analyzed | Ubiquity Calculated* |
|---|---|---|
| Savannah River | 2 | No |
| Connestee | 4 | No |
| Early Pisgah | 15 | Yes |
| Late Pisgah | 3 | No |
| Early Qualla | 22 | Yes |
| Late Middle Qualla | 4 | No |
| Late Qualla | 92 | Yes |

* A minimum of 10 samples is required to calculate ubiquity (Hubbard 1976).

Table 15. Ubiquity values for Early Pisgah contexts in descending order.

| | Samples Present | Total Samples | Ubiquity Measure (%) |
|---|---|---|---|
| Hickory (all parts) | 14 | 15 | 93.3 |
| Corn (all parts) | 13 | 15 | 86.7 |
| Corn cupule | 11 | 15 | 73.3 |
| Corn kernel | 9 | 15 | 60.0 |
| Acorn (all parts) | 8 | 15 | 53.3 |
| Chenopod | 6 | 15 | 40.0 |
| Acorn nutshell | 5 | 15 | 33.3 |
| Acorn cap | 3 | 15 | 20.0 |
| Copperleaf | 3 | 15 | 20.0 |
| Corn kernel cf. | 3 | 15 | 20.0 |
| Grass family | 3 | 15 | 20.0 |
| Bean cf. | 2 | 15 | 13.3 |
| Black walnut | 2 | 15 | 13.3 |
| Blackberry/Raspberry | 2 | 15 | 13.3 |
| Bottle gourd rind cf. | 2 | 15 | 13.3 |
| Bulrush | 2 | 15 | 13.3 |
| Cheno/am | 2 | 15 | 13.3 |
| Nightshade cf. | 2 | 15 | 13.3 |
| Sumac | 2 | 15 | 13.3 |
| Verbena | 2 | 15 | 13.3 |
| Acorn meat | 1 | 15 | 6.7 |
| Acorn meat cf. | 1 | 15 | 6.7 |
| Bedstraw | 1 | 15 | 6.7 |
| Carpetweed | 1 | 15 | 6.7 |
| Chenopod cf. | 1 | 15 | 6.7 |
| Common bean | 1 | 15 | 6.7 |
| Composite family | 1 | 15 | 6.7 |
| Corn cupule cf. | 1 | 15 | 6.7 |
| Dandelion cf. | 1 | 15 | 6.7 |
| Elderberry | 1 | 15 | 6.7 |
| Hazelnut cf. | 1 | 15 | 6.7 |
| Hickory husk | 1 | 15 | 6.7 |
| Hickory meat cf. | 1 | 15 | 6.7 |
| Knotweed cf. | 1 | 15 | 6.7 |
| Mannagrass cf. | 1 | 15 | 6.7 |
| Maypop | 1 | 15 | 6.7 |
| Pepperweed cf. | 1 | 15 | 6.7 |
| Pine cone flap | 1 | 15 | 6.7 |
| Plum/Cherry | 1 | 15 | 6.7 |
| Pokeweed | 1 | 15 | 6.7 |
| Portulacca family | 1 | 15 | 6.7 |
| Purslane | 1 | 15 | 6.7 |
| Ragweed cf. | 1 | 15 | 6.7 |
| Sage cf. | 1 | 15 | 6.7 |
| Spurge | 1 | 15 | 6.7 |
| Spurge cf. | 1 | 15 | 6.7 |

| | | | |
|---|---|---|---|
| Sumpweed | 1 | 15 | 6.7 |
| Tickclover | 1 | 15 | 6.7 |
| Tickclover cf. | 1 | 15 | 6.7 |
| Wax myrtle cf. | 1 | 15 | 6.7 |

Table 16. Ubiquity values for Early Qualla contexts in descending order.

| | Samples Present | Total Samples | Ubiquity Measure (%) |
|---|---|---|---|
| Corn (all parts) | 21 | 22 | 95.5 |
| Hickory (all parts) | 21 | 22 | 95.5 |
| Corn cupule | 21 | 22 | 95.5 |
| Corn kernel | 18 | 22 | 81.8 |
| Acorn (all parts) | 13 | 22 | 59.1 |
| Maypop | 12 | 22 | 54.5 |
| Acorn nutshell | 11 | 22 | 50.0 |
| Black walnut | 10 | 22 | 45.5 |
| Chenopod | 9 | 22 | 40.9 |
| Grape | 7 | 22 | 31.8 |
| Pokeweed | 7 | 22 | 31.8 |
| Bean cf. | 5 | 22 | 22.7 |
| Bedstraw | 5 | 22 | 22.7 |
| Bottle gourd rind cf. | 5 | 22 | 22.7 |
| Corn cupule cf. | 5 | 22 | 22.7 |
| Spurge | 5 | 22 | 22.7 |
| Amaranth | 4 | 22 | 18.2 |
| Copperleaf | 4 | 22 | 18.2 |
| Corn kernel cf. | 4 | 22 | 18.2 |
| Acorn nutshell cf. | 3 | 22 | 13.6 |
| Bulrush | 3 | 22 | 13.6 |
| Common bean | 3 | 22 | 13.6 |
| Grape cf. | 3 | 22 | 13.6 |
| Grass family | 3 | 22 | 13.6 |
| Groundcherry | 3 | 22 | 13.6 |
| Mannagrass | 3 | 22 | 13.6 |
| Wax myrtle cf. | 3 | 22 | 13.6 |
| Acorn meat cf. | 2 | 22 | 9.1 |
| Blackberry/Raspberry | 2 | 22 | 9.1 |
| Carpetweed | 2 | 22 | 9.1 |
| Hackberry | 2 | 22 | 9.1 |
| Mallow family | 2 | 22 | 9.1 |
| Wild bean | 2 | 22 | 9.1 |
| Acorn cap cf. | 1 | 22 | 4.5 |
| Bean Family | 1 | 22 | 4.5 |
| Bedstraw cf. | 1 | 22 | 4.5 |
| Blueberry | 1 | 22 | 4.5 |
| Blueberry cf. | 1 | 22 | 4.5 |
| Cheno/am | 1 | 22 | 4.5 |
| Chenopod cf. | 1 | 22 | 4.5 |
| Dock | 1 | 22 | 4.5 |

| | | | |
|---|---|---|---|
| Filaree | 1 | 22 | 4.5 |
| Flatsedge | 1 | 22 | 4.5 |
| Hackberry cf. | 1 | 22 | 4.5 |
| Hawthorn | 1 | 22 | 4.5 |
| Hazelnut | 1 | 22 | 4.5 |
| Holly cf. | 1 | 22 | 4.5 |
| Honeysuckle cf. | 1 | 22 | 4.5 |
| Knotweed | 1 | 22 | 4.5 |
| Little barley | 1 | 22 | 4.5 |
| Nightshade cf. | 1 | 22 | 4.5 |
| Nightshade family | 1 | 22 | 4.5 |
| Purslane | 1 | 22 | 4.5 |
| Sage | 1 | 22 | 4.5 |
| Sage cf. | 1 | 22 | 4.5 |
| Snowberry | 1 | 22 | 4.5 |
| Spikerush | 1 | 22 | 4.5 |
| Sumpweed | 1 | 22 | 4.5 |
| Sumpweed cf. | 1 | 22 | 4.5 |
| Sunflower | 1 | 22 | 4.5 |
| Viburnum cf. | 1 | 22 | 4.5 |
| Violet | 1 | 22 | 4.5 |
| Walnut family cf. | 1 | 22 | 4.5 |

Table 17. Ubiquity values for Late Qualla contexts in descending order.

| | Samples Present | Total Samples | Ubiquity Measure (%) |
|---|---|---|---|
| Hickory (all parts) | 89 | 92 | 96.7 |
| Corn (all parts) | 81 | 92 | 88.0 |
| Corn cupule | 78 | 92 | 84.8 |
| Black walnut | 67 | 92 | 72.8 |
| Corn kernel | 65 | 92 | 70.7 |
| Bottle gourd rind cf. | 64 | 92 | 69.6 |
| Chenopod | 53 | 92 | 57.6 |
| Maypop | 35 | 92 | 38.0 |
| Grass family | 28 | 92 | 30.4 |
| Sumac | 28 | 92 | 30.4 |
| Groundcherry | 25 | 92 | 27.2 |
| Acorn (all parts) | 23 | 92 | 25.0 |
| Carpetweed | 23 | 92 | 25.0 |
| Spurge | 22 | 92 | 23.9 |
| Acorn nutshell | 21 | 92 | 22.8 |
| Grape | 19 | 92 | 20.7 |
| Bean cf. | 17 | 92 | 18.5 |
| Acorn nutshell cf. | 14 | 92 | 15.2 |
| Blackberry/Raspberry | 14 | 92 | 15.2 |
| Persimmon | 14 | 92 | 15.2 |
| Common bean | 13 | 92 | 14.1 |
| Bottle gourd cf. | 12 | 92 | 13.0 |
| Purslane | 10 | 92 | 10.9 |

| | | | |
|---|---|---|---|
| Amaranth | 9 | 92 | 9.8 |
| Bottle gourd | 8 | 92 | 8.7 |
| Pokeweed | 7 | 92 | 7.6 |
| Peach | 6 | 92 | 6.5 |
| Cheno/am | 5 | 92 | 5.4 |
| Corn cupule cf. | 5 | 92 | 5.4 |
| Mannagrass | 5 | 92 | 5.4 |
| Smartweed | 5 | 92 | 5.4 |
| Acorn cap | 4 | 92 | 4.3 |
| Copperleaf | 4 | 92 | 4.3 |
| Corn cob | 4 | 92 | 4.3 |
| Corn kernel cf. | 4 | 92 | 4.3 |
| Holly | 4 | 92 | 4.3 |
| Persimmon cf. | 4 | 92 | 4.3 |
| Pokeweed cf. | 4 | 92 | 4.3 |
| Spurge cf. | 4 | 92 | 4.3 |
| Tickclover | 4 | 92 | 4.3 |
| Tickclover cf. | 4 | 92 | 4.3 |
| Bedstraw | 3 | 92 | 3.3 |
| Blueberry cf. | 3 | 92 | 3.3 |
| Bulrush | 3 | 92 | 3.3 |
| Nightshade cf. | 3 | 92 | 3.3 |
| Plum/Cherry cf. | 3 | 92 | 3.3 |
| Verbena | 3 | 92 | 3.3 |
| Acorn meat cf. | 2 | 92 | 2.2 |
| Blueberry | 2 | 92 | 2.2 |
| Chenopod cf. | 2 | 92 | 2.2 |
| Corn cob cf. | 2 | 92 | 2.2 |
| Crowngrass cf. | 2 | 92 | 2.2 |
| Hickory cf. | 2 | 92 | 2.2 |
| Holly cf. | 2 | 92 | 2.2 |
| Mallow family | 2 | 92 | 2.2 |
| Pine nut cf. | 2 | 92 | 2.2 |
| Pine pitch cf. | 2 | 92 | 2.2 |
| Smartweed cf. | 2 | 92 | 2.2 |
| Spikerush cf. | 2 | 92 | 2.2 |
| Violet | 2 | 92 | 2.2 |
| Walnut family cf. | 2 | 92 | 2.2 |
| Acorn cap cf. | 1 | 92 | 1.1 |
| Acorn meat | 1 | 92 | 1.1 |
| Alder | 1 | 92 | 1.1 |
| Amaranth cf. | 1 | 92 | 1.1 |
| Bean Family | 1 | 92 | 1.1 |
| Bean/persimmon | 1 | 92 | 1.1 |
| Bulrush cf. | 1 | 92 | 1.1 |
| Carpetweed cf. | 1 | 92 | 1.1 |
| Chokeberry cf. | 1 | 92 | 1.1 |
| Clover cf. | 1 | 92 | 1.1 |

| | | | |
|---|---|---|---|
| Dogwood cf. | 1 | 92 | 1.1 |
| Falsenettle cf. | 1 | 92 | 1.1 |
| Flatsedge | 1 | 92 | 1.1 |
| Goosegrass | 1 | 92 | 1.1 |
| Gum | 1 | 92 | 1.1 |
| Hackberry cf. | 1 | 92 | 1.1 |
| Hawthorn | 1 | 92 | 1.1 |
| Hawthorn cf. | 1 | 92 | 1.1 |
| Knotweed | 1 | 92 | 1.1 |
| Little barley cf. | 1 | 92 | 1.1 |
| Magnolia | 1 | 92 | 1.1 |
| Morninglory cf. | 1 | 92 | 1.1 |
| Mustard cf. | 1 | 92 | 1.1 |
| Nigthshade | 1 | 92 | 1.1 |
| Peach cf. | 1 | 92 | 1.1 |
| Pepperweed cf. | 1 | 92 | 1.1 |
| Pine cone flap | 1 | 92 | 1.1 |
| Plum/Cherry | 1 | 92 | 1.1 |
| Queensdelight cf. | 1 | 92 | 1.1 |
| Ragweed | 1 | 92 | 1.1 |
| Sage | 1 | 92 | 1.1 |
| Sage cf. | 1 | 92 | 1.1 |
| Sedge | 1 | 92 | 1.1 |
| Sedge cf. | 1 | 92 | 1.1 |
| Selfheal cf. | 1 | 92 | 1.1 |
| Sumac cf. | 1 | 92 | 1.1 |
| Sumpweed cf. | 1 | 92 | 1.1 |
| Sumpweed/sunflower | 1 | 92 | 1.1 |
| Sumpweed/sunflower cf. | 1 | 92 | 1.1 |
| Sunflower | 1 | 92 | 1.1 |
| Violet cf. | 1 | 92 | 1.1 |
| Walnut family | 1 | 92 | 1.1 |
| Wax myrtle | 1 | 92 | 1.1 |
| Wax myrtle cf. | 1 | 92 | 1.1 |
| Wild bean cf. | 1 | 92 | 1.1 |
| Wild sunflower cf. | 1 | 92 | 1.1 |

Table 18. Comparison of top 5 ubiquity values by period, ranked in descending order.

| Rank | EARLY PISGAH | EARLY QUALLA | LATE QUALLA |
|---|---|---|---|
| 1 | Hickory | Corn/Hickory | Hickory |
| 2 | Corn | Acorn | Corn |
| 3 | Acorn | Maypop | Black Walnut |
| 4 | Chenopod | Black Walnut | Bottle Gourd Rind cf. |
| 5 | Copperleaf/ Grass Family | Chenopod | Chenopod |

Understanding changes in diet require that we consider changes in diet breadth, which can be measured via diversity analysis, which combines richness (number of taxa) with equitability (how evenly those taxa are distributed among the categories). We use the Shannon-Weaver index, a common standard in paleoethnobotany (see above for description of this method). The higher the diversity value (H`), the richer the assemblage is. Equitability values range from 0 to 1, with 0 indicating a skewed assemblage and 1 indicating a perfectly even distribution. Table 19 tabulates the results of the diversity analysis by period; the table also includes Structure 35 for later discussion. The Savannah River phase values are quite low, a product of low samples size for this assemblage. A perusal of the other values, however, reveals some clear patterning. The drop in taxonomic richness between the Connestee phase and the Early Pisgah phase likely reflects the shift to corn dependency that took place throughout the southeastern United States at around AD 1000. Equitability values also drop after the Connestee phase, fluctuating slightly from Early Pisgah through the Late Qualla phases. At this point, people streamlined their collection of wild plant foods and focused their efforts more towards farming. People still continued to collect wild plant foods, but they focused on high-volume resources like nuts and fruits. Taxonomic richness fluctuates a little after the Early Pisgah phase, but then rises dramatically during the Late Qualla phase. As demonstrated above, density analysis reveals a drop in cultigens and a rise in other plant foods during the Late Qualla phase; this shift is supported by the diversity analysis.

Table 19. Shannon-Weaver diversity & equitability values by period* (includes Structure 35).

| | SR | CO | EP | LP | EQ | LMQ | LQ | Structure 35 |
|---|---|---|---|---|---|---|---|---|
| H' (Diversity Index) | 0.01 | 1.53 | 0.82 | 1.04 | 0.93 | 0.98 | 1.35 | 1.68 |
| V' (Equitability Index) | 0.00 | 0.53 | 0.24 | 0.36 | 0.25 | 0.36 | 0.33 | 0.41 |

* SR = Savannah River, CO = Connestee, EP = Early Pisgah, LP = Late Pisgah, EQ = Early Qualla, LMQ = Late Middle Qualla, LQ = Late Qualla (Structure 35 is Late Qualla).

Thus far, quantitative analysis has revealed two major shifts in subsistence occurring (1) after the Connestee phase, with the shift towards farming corn, and (2) during the Late Qualla phase, a period of cultural disruption caused by European contact. The box plot analysis presented below considers these shifts more closely. Box plots allow us to determine if two distributions of data are statistically different at the 0.05 level (see also Cleveland 1994; McGill et al. 1978; Scarry and Steponaitis 1997; Wilkinson et al. 1992). Box plots summarize distributions of data using several key features. The median value of the distribution is marked by the line at the center of the box. The edges of the box, or hinges, represent the 25$^{th}$ and 75$^{th}$ percentiles of the distribution—the approximate middle 50% of the data fall between the hinges (Cleveland 1994:139). Vertical lines, or whiskers, extend outward from the box and represent the tails of the distribution. Box plots also designate outliers—these are unusually large or small data values that "portray behavior in the extreme tails of the distribution" (Cleveland 1994:140). Outliers are depicted as asterisks and far outliers as open circles. Box plots can also be notched, which converts the box shape to an hourglass shape – the notches in the hourglass shape represent the 95% confidence intervals for the distribution. If any the notched areas on any two plots do not overlap, then the two distributions can be said to differ significantly. The box plots presented here use density data (calculate per sample).

We begin with a consideration of nuts, particularly hickory and acorn, in addition to a measure of total nutshell (includes walnut and hazelnut). Hickory densities are presented in

Figure 1. Immediately apparent is a statistical drop in hickory after the Savannah River phase, which is not surprising, given that this represents a period before the adoption of corn. However, the Connestee phase is also pre-corn; diversity values, however, reveal a higher taxonomic richness and equitability for Connestee than the Savannah River phase samples. It is possible that the Savannah River samples (n=3) are biased towards feature contexts that represent the exclusive processing of hickory, while the Connestee phase samples come from contexts that represent an accumulation of food trash. Also apparent is a statistical increase in hickory during the Early and Late Qualla periods relative to the Connestee, Late Pisgah, and Late Middle Qualla phases. This same pattern is evident for acorn densities (Figure 2). The lower hickory and acorn values for the Late Middle Qualla phase seems aberrant, and is probably related to the low numbers of samples that date to this period (n=4). If we ignore the Late Middle Qualla values, then we have a clear increase in acorn and hickory densities from the Pisgah into Qualla times. When we look at nutshell as a whole (Figure 3), the pattern is nearly identical to the overall trend for hickory and acorn, with a huge drop after the Savannah River phase, another drop during the Late Pisgah, and then an increase during the Early and Late Qualla phases.

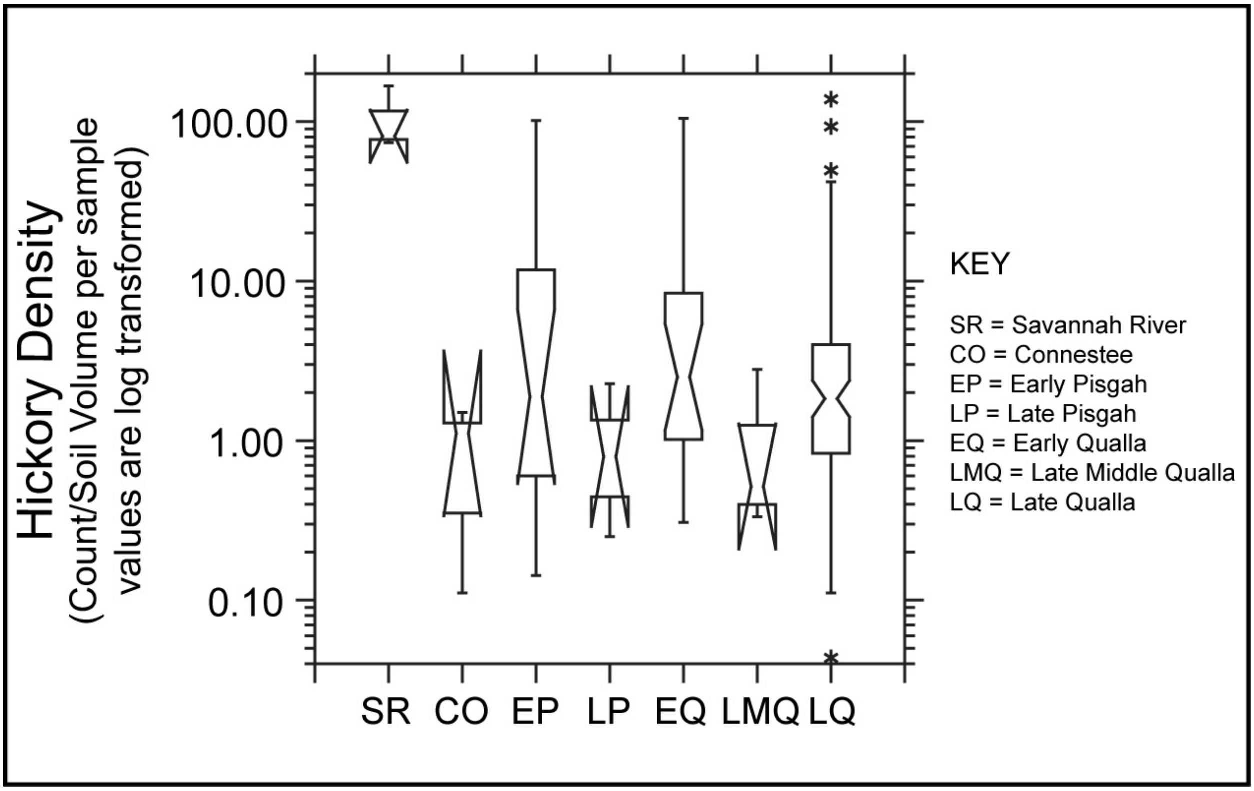


Figure 1. Box plot of hickory densities by phase.

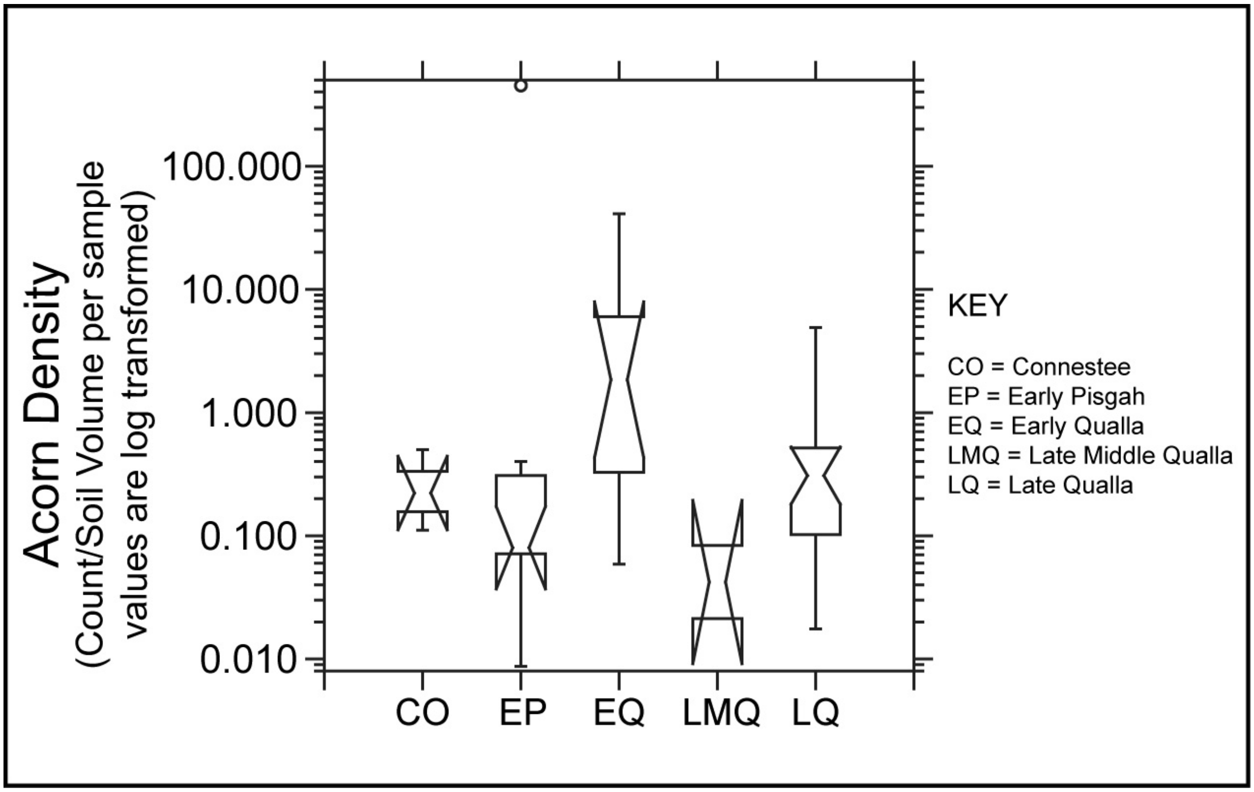


Figure 2. Box plot of acorn densities by phase.

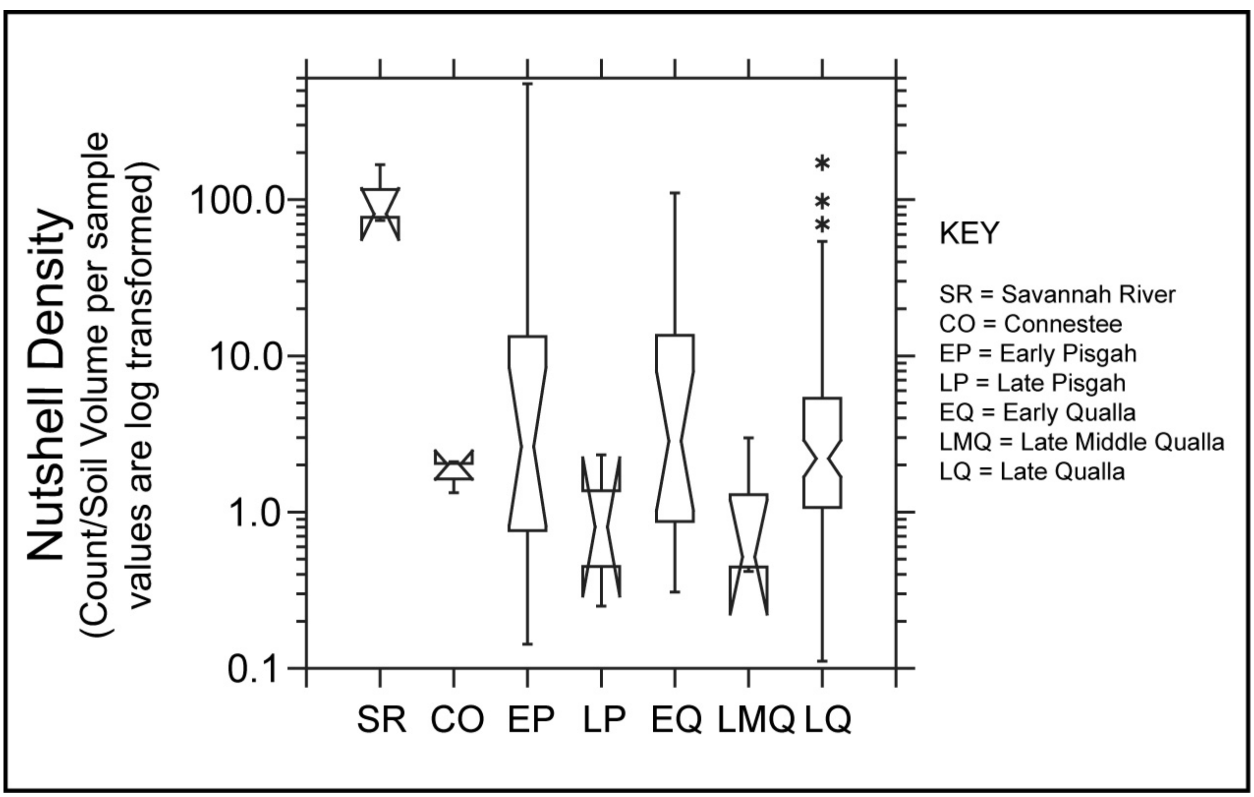


Figure 3. Box plot of nutshell densities (hickory, acorn, walnut, hazelnut) by phase.

Box plots of corn densities were generate for the Pisgah and Qualla phases, including all corn parts, in addition to kernels and cupules separately (Figure 4). In terms of the total corn, there is a clear statistical increase in corn from Pisgah to Qualla phases, with a slight (though not statistically significant drop from Early to Late Qualla phases. When we consider corn kernels only (the consumable part), the difference between Early/Late Pisgah and the Early Qualla phase is even more pronounced. Moreover, the drop in kernels from Early to Late Qualla is statistically significant, as the notched areas of the two plots do not overlap. It appears that Late Qualla phase residents of the Ravensford site were eating less corn than their Early Qualla ancestors. There do not appear to be any significant differences in the distribution of corn cupules through time, however. As cupules represent processing debris from shelling ears of corn, an increase or decrease would indicate changes in processing intensity. What is clear from Figure 4, however, is that people did not significantly alter the amount of corn that they processed through time at the site (at least relative to soil volume). If people did not change the amount of corn they processed, then why would the amount of consumables (kernels) decrease? In order to understand this, we turn to an alternate measure, standardizing the corn data by plant weight instead of soil volume. By doing so, we can consider changes in corn cupules relative to other *plants* identified in the samples. Figure 5 presents the distribution of corn cupules standardized by plant weight against time. This set of box plots shows a clear trend of decreasing corn cupule distributions from Early to Late Qualla times. The difference is not statistically significant, but still visually apparent. Thus, it appears that overall corn production decreased at Ravensford during the Late Qualla phase; this is also supported by the overall drop in cultigens during the Late Qualla presented in Tables 12 & 13.

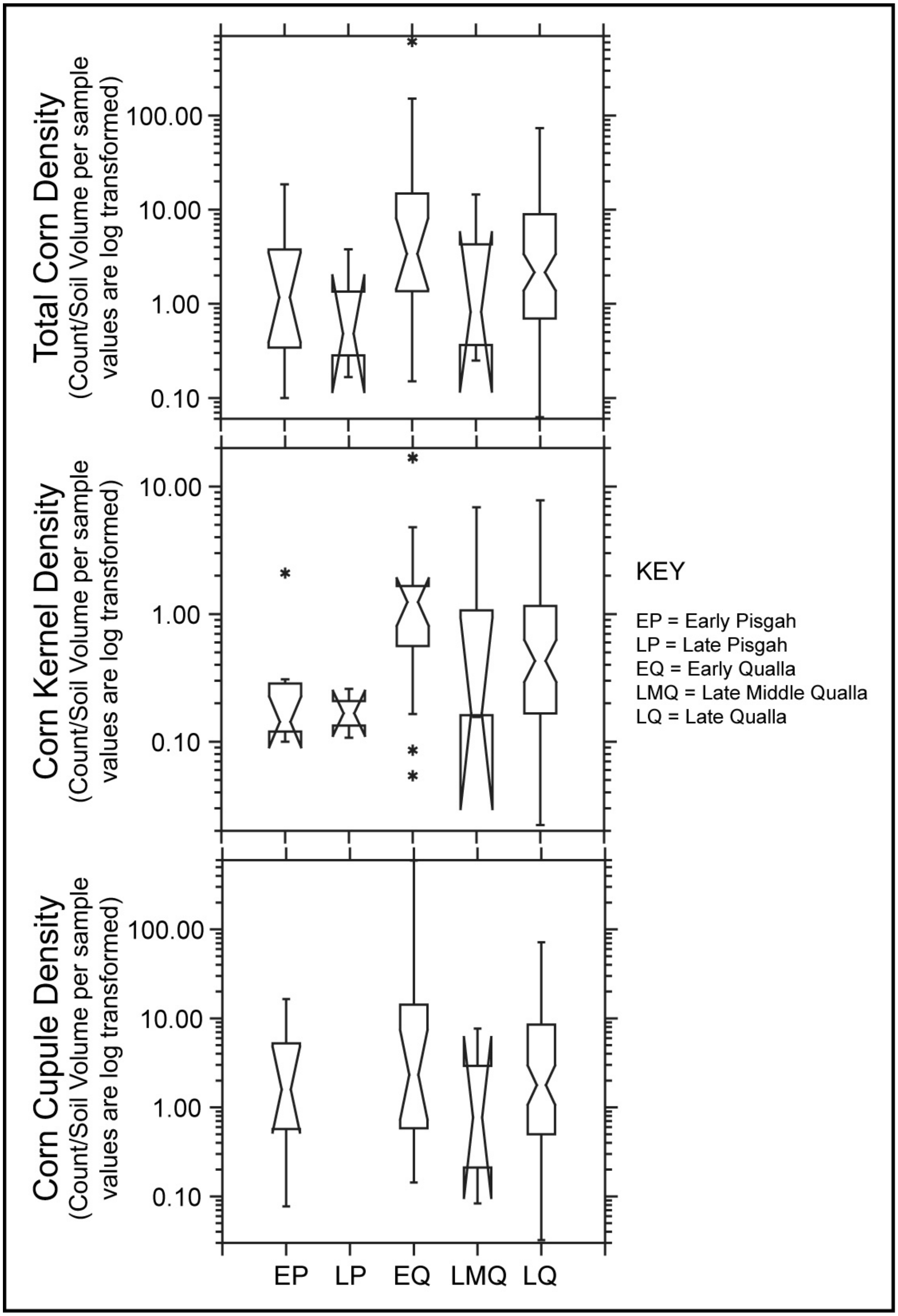


Figure 4. Box plot of corn densities by phase.

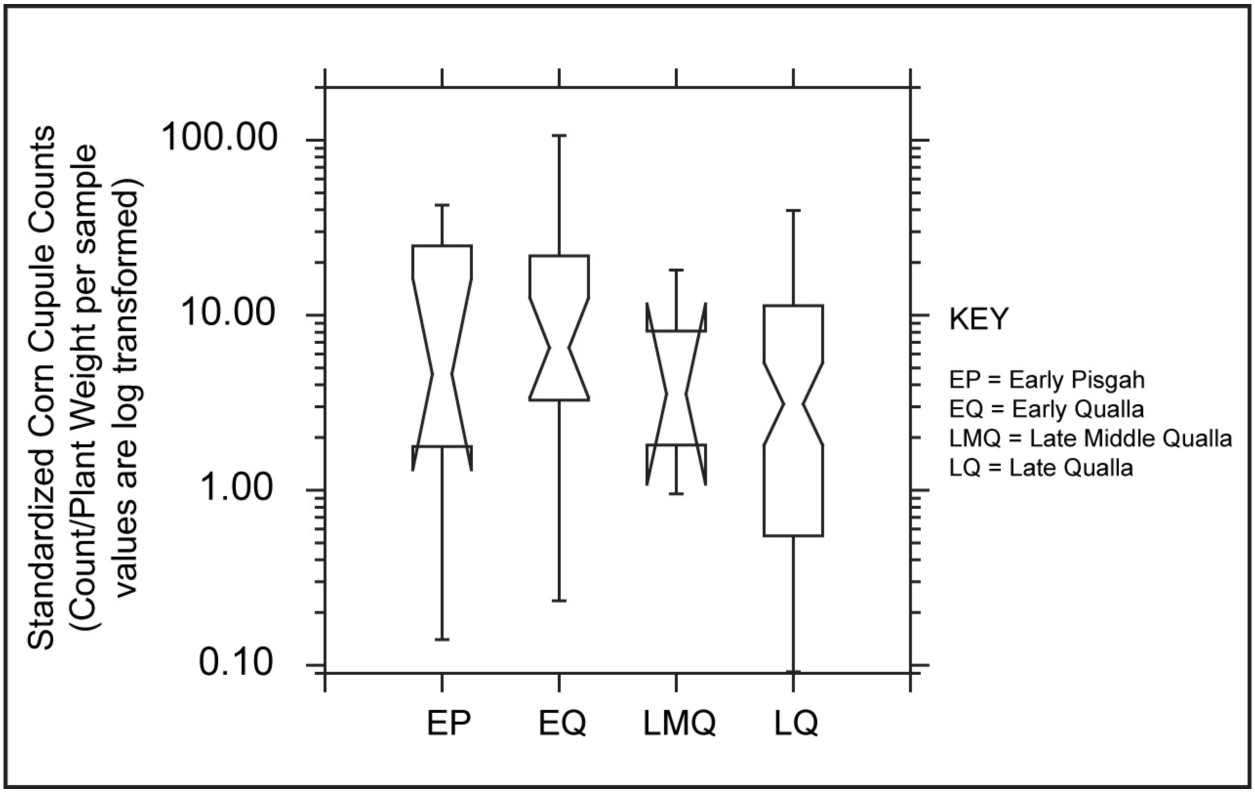

Figure 5. Box plot of corn cupules standardized by plant weight by phase.

A consideration of fleshy fruits also reveals some clear temporal patterning, in the form of a clear statistical increase in fruits from the Pisgah to Qualla phases. The vast majority of fruit remains from the Qualla phase derive from grape and groundcherry; more than half of the grape and groundcherry seeds from the Late Qualla phase were recovered from the floor of Structure 35. Given the unique context of Structure 35 (*in situ* abandonment refuse), it is possible that the elevated level of fruits during the Late Qualla is a consequence of comparing apples and oranges (e.g., secondary refuse vs. abandonment refuse). However, the increase from Pisgah to Early Qualla cannot be explained away in the same manner. Thus, it seems pretty clear that the Qualla phase is marked by an increase in fruit collection and consumption, particularly grapes and groundcherries.

Box plots of grain seeds, oil seeds, and seeds of weedy greens reveal no apparent differences through time (Figure 7). Apparently, people collected and consumed relatively equivalent amounts of these plants throughout the Pisgah and Qualla phases.

In sum, overall temporal patterns reveal an increase in nut and fruit collection and consumption during the Qualla phase, with a corresponding decrease in corn production and consumption during the Late Qualla phase. This shift towards a greater emphasis on the exploitation of high-ranking wild plants and a concomitant decrease in food production may be related to cultural disruptions caused by Europeans. Exposure to European diseases had vast negative impacts on native populations; increasing mortality at the Ravensford site during the Late Qualla phase would have significantly impacted the labor requirements of planting and harvesting seasons, thereby reducing the amount of land under production. A decrease in food production would have to be compensated for in other ways, likely through more intensive collection of high-calorie wild plants available in volume, such as nuts and fruits.

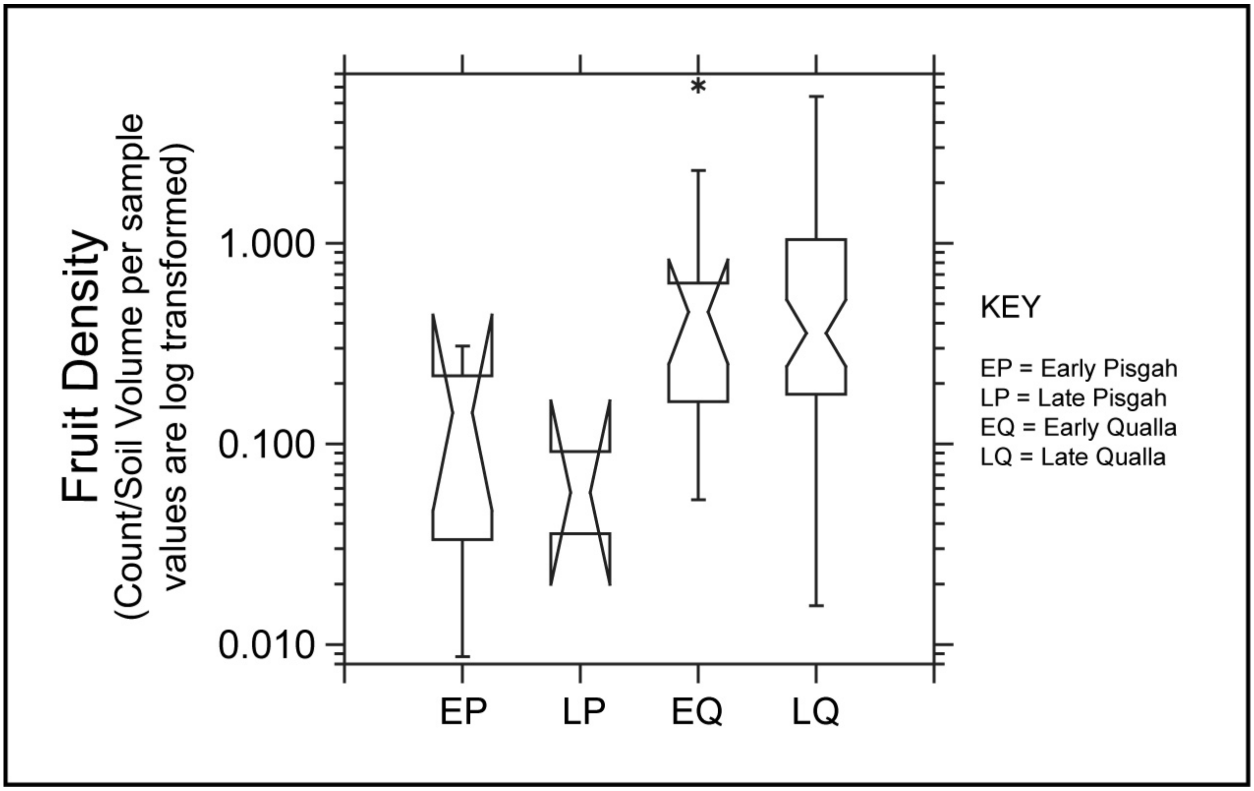


Figure 6. Box plot of fruit densities by phase.

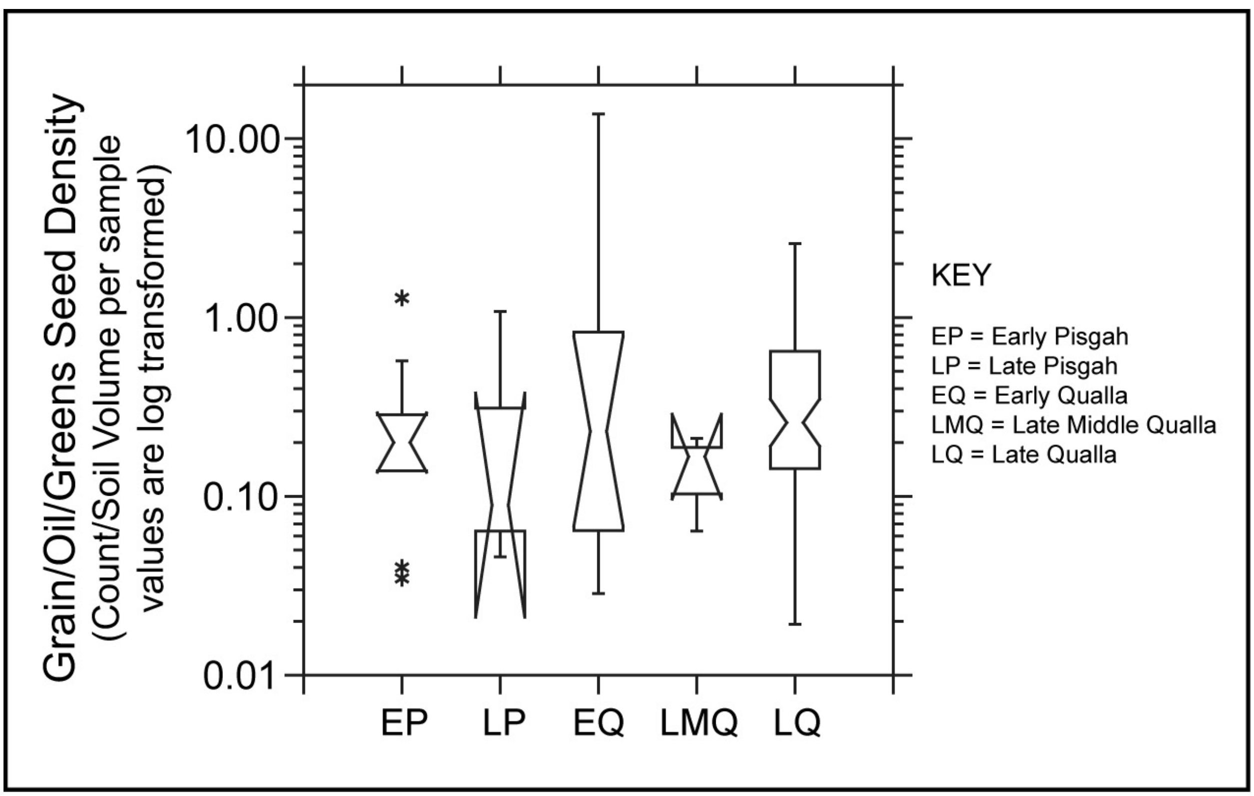


Figure 7. Box plot of densities of grain/oil/greens seeds by phase.

Quantitative Results II: Spatial Analysis of Structure 35

Plant materials from the floor of Structure 35 were identified from both flotation samples and specimens collected by hand. The quantitative analysis presented here deals with flotation samples only. The materials deposited on the floor appear to represent in situ occupational debris that corresponds to activities that actually occurred in the house prior to and associated with abandonment. The fact that Structure 35 was burned at the time of abandonment allows for a unique look into the organization of foodways at the household level. Prior to abandonment and burning, large vessels and site furniture (e.g., metates) were removed from the structure (Paul Webb, personal comm.), which might lead one to surmise that any materials found in the house represent post-abandonment refuse, unrelated to the activities that occurred in the house prior to its burning. However, this structure appears to be the final structure occupied at the site, which means that it is highly unlikely that there was anyone living at the site post-abandonment to produce the refuse the was excavated from the structure floor (Paul Webb, personal comm.). Given these details of timing, burning, and abandonment, it seems likely that plants recovered from the floor of the structure may be related to activities that occurred in the structure towards the end of its uselife. Given this conclusion, we approach our spatial analysis as a means to understand the organization of food storage and processing as reflected in the distribution of plant remains across the house floor. A plan map of Structure 35 with units labeled is provided in Figure 8.

Two methods are employed to identify clusters of plants on the floor: principle components analysis using standardized counts of taxa that occur in a minimum of 5 samples or exceed a count of 10 specimens in at least one sample. Our analysis uses taxa counts that are standardized to plant weight for each unit in which they occur. This type of multivariate statistic uses interval/ratio data and calculates multiple correlations using a Pearson's R correlation matrix. The closer the actual computed values are to zero (on both axes), the closer they are to the average expected value. The further away from zero, the more a case (e.g., unit) departs from expected values. The first PCA run identified several units that appear to form two clusters that diverge from the average expected value (Figure 9). The first cluster (Cluster 1) is represented by a single unit (TU2531) that is located near the southern corner of the structure. Plant taxa that appear to be associated with this unit are tickclover, sumpweed, sunflower, and maypop (Figure 9b). The second cluster (Cluster 2) includes five units (TU2480, TU2481, TU2490, TU2491, and TU2501) that are all adjacent, located in northwestern area of the structure. The association of taxa with this cluster is less clear, and thus we draw two taxa clusters, a narrow one in a solid line, and a larger cluster in a dotted line. Taxa that appear to plot midway between unit clusters can be interpreted as being shared by both clusters; thus, the lack of a clear association between taxa with the second unit cluster indicates such a scenario. Taxa that associate with this cluster include greens (*Polygonum*, purslane, spurge, and chenopod), nuts (walnut and hickory), cultigens (corn cupules & bottle gourd seeds and rind), and various fruits (raspberry, grape, sumac, persimmon, and groundcherry).

We conducted a second PCA run, excluding the units from Clusters 1 and 2 in order to determine if any additional patterning could be identified. Interestingly, the second run results in three additional units being pulled away from the origin (TU2530 and TU2470, and TU2497); two of these three units (TU2530 and TU2470) are adjacent to Clusters 1 and 2, respectively. The third unit (TU2497) represents a possible 3rd cluster (Cluster 3). Figure 11 shows the patterning of these clusters on the Structure 35 map. Unfortunately, the principle components analysis did not reveal clear patterning among the taxa (factor loadings) as it did for the units (factor scores).  Thus, while we can determine which units forms clusters in the house on the basis of standardized plant counts, it is difficult to identify which plants are responsible for forming these clusters.  In order to clarify this patterning, we turn to box plots.

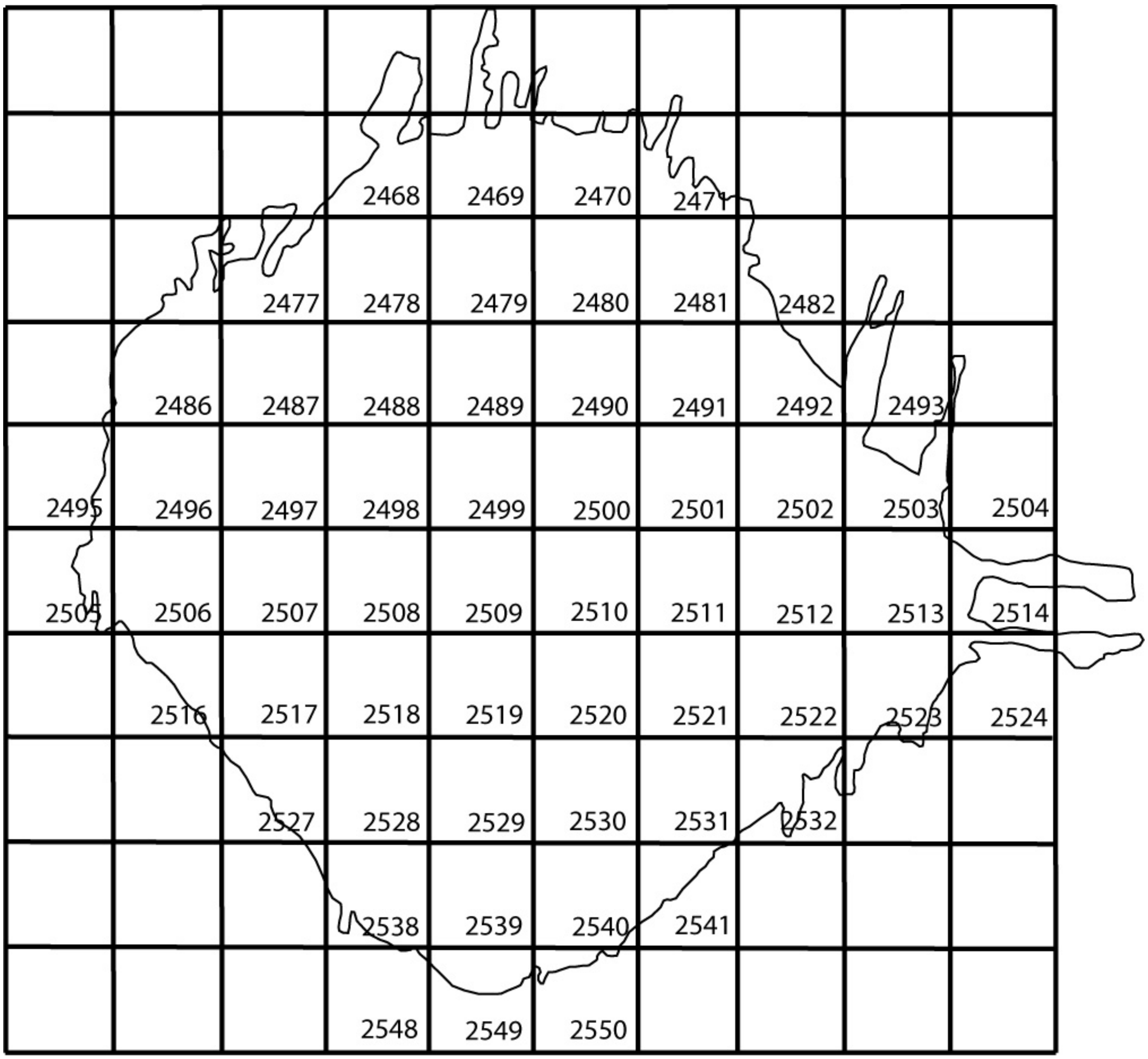

Figure 8. Map of Structure 35 with units labeled.

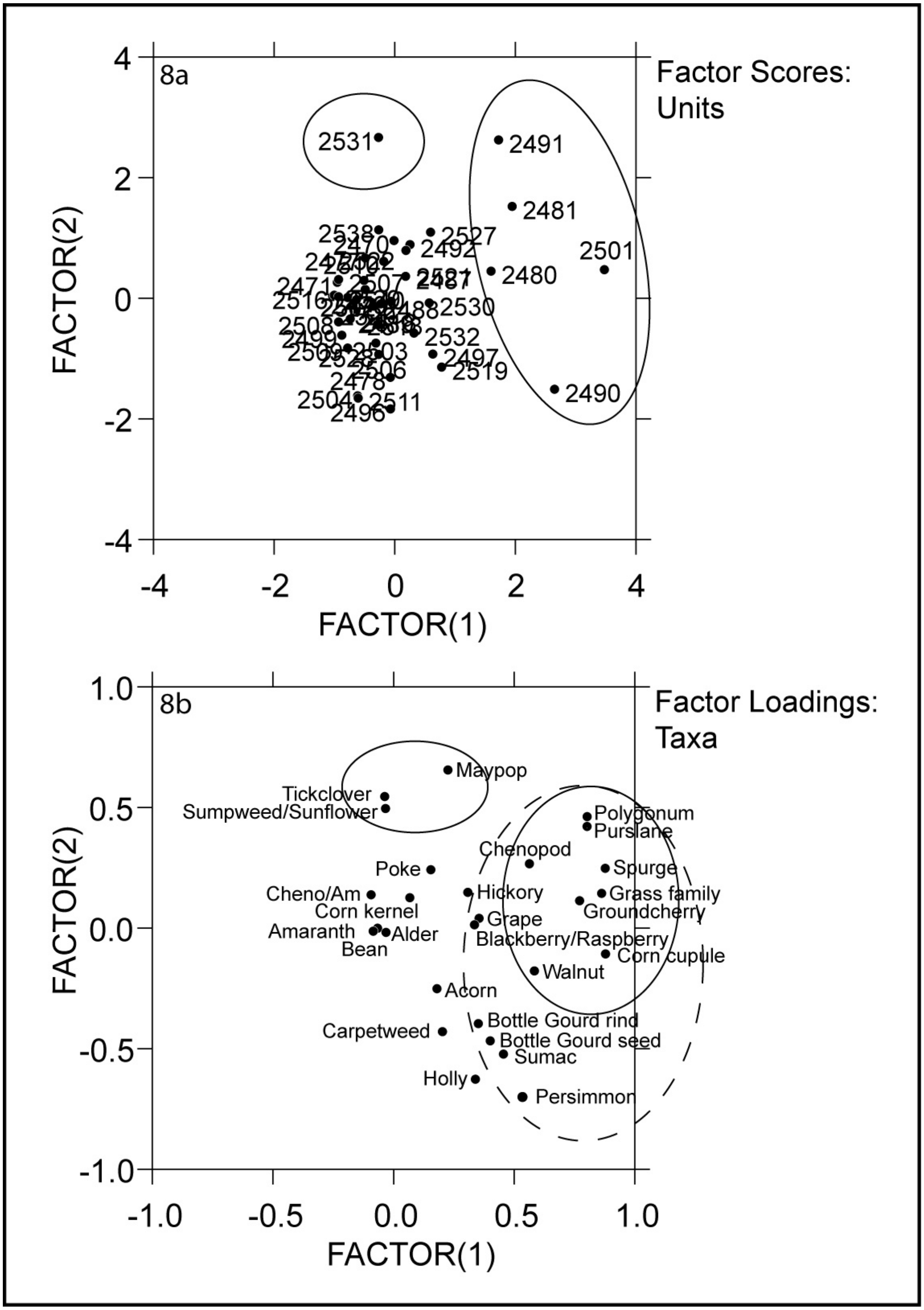


Figure 9. Biplot of PCA scores and loadings from first run.

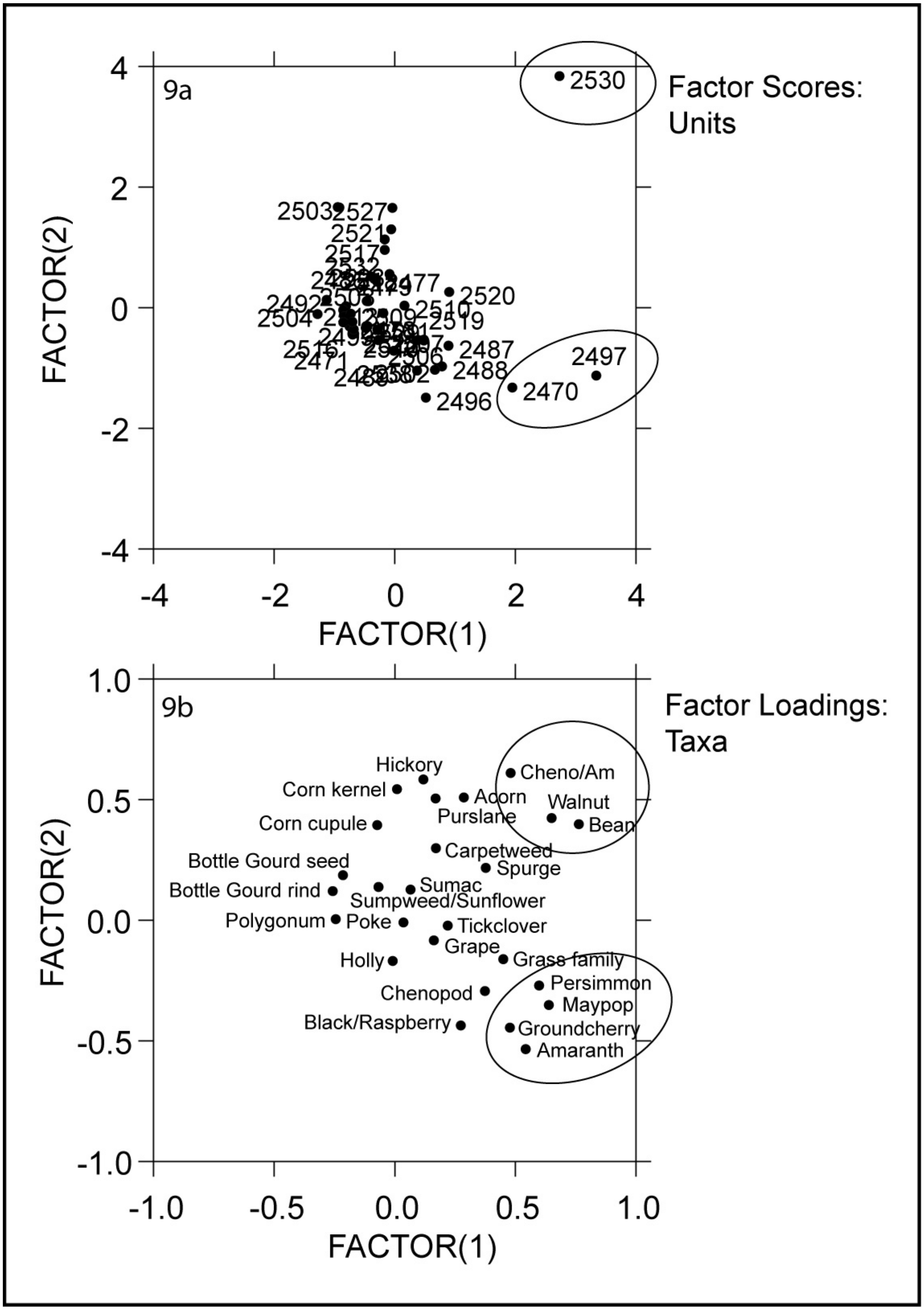


Figure 10. Biplot of PCA scores and loadings from second run.

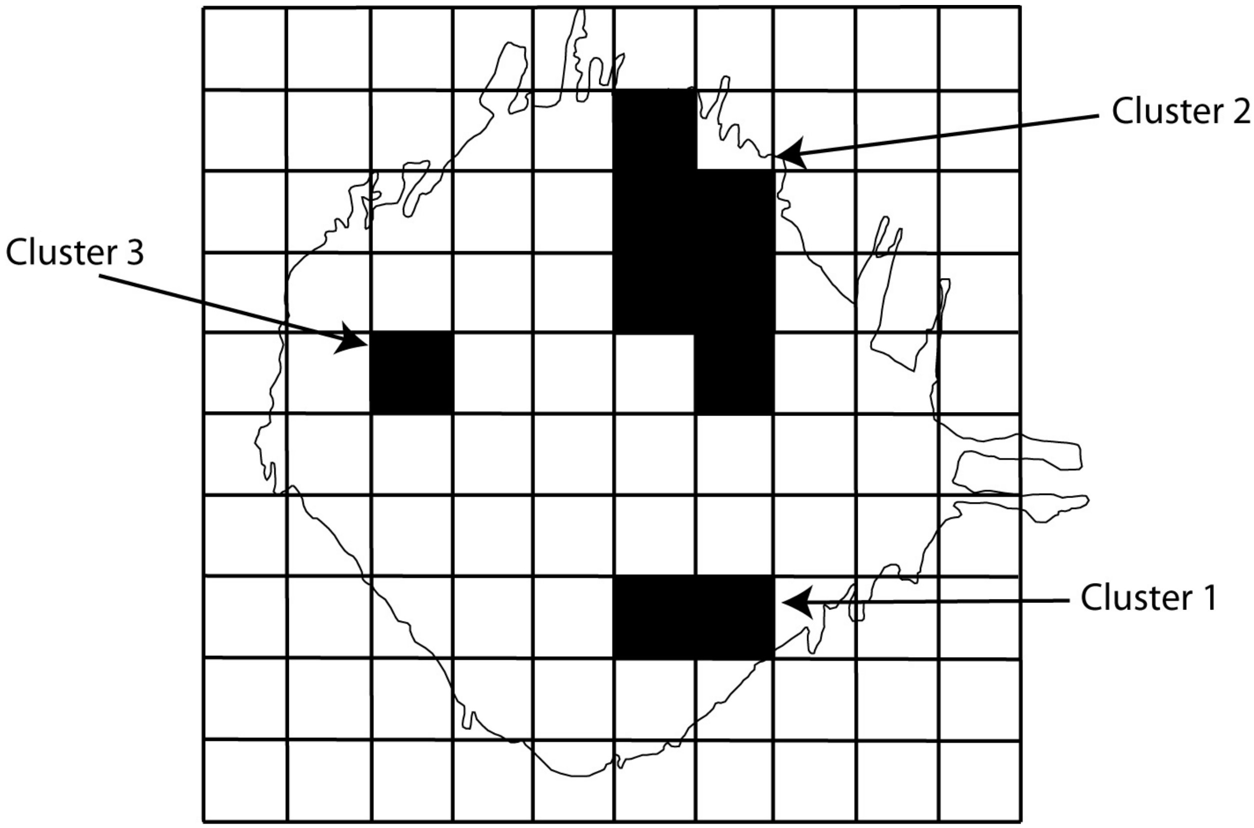


Figure 11. Map of Structure 35 showing PCA clusters in black.

The purpose of generating box plots for the Structure 35 analysis differs from their use in the temporal analysis presented above. Here our concern is not to identify statistical differences between different distributions of data, but instead to find statistical outliers. In this case, we are looking for units that have statistically more of a given taxon than other units. As explained above, box plots show a distribution of data by portraying the median value and how the other values vary around the median. Statistical outliers are represented by asterisks, and far outliers by circles. In this analysis we consider one plant taxon at a time; for each taxon, we present a box plot with outliers labeled (with unit numbers) and a map of Structure 35 showing those units shaded in black. Only taxa represented in the structure by at least 30 specimens was included, and all counts were converted to density measures prior to inclusion in the analysis. We consider fruits first (Figs. 12-15), followed by nuts (Figs. 16-19), and then cultigens & likely cultigens (e.g., chenopod) (Figs. 20-23).

The principle components analysis identified three clusters of units based on the distribution of plant remains on the floor of Structure 35: Cluster 1 at the southern corner of the house; Cluster 2 along the northeastern wall of the house; and Cluster 3 near the western corner (see Figure 11). The identification of these clusters is confirmed by the density box plot outlier analysis (Figure 24). Moreover, the identification of extreme outliers allows us to better understand what these clusters mean. Cluster 1 is characterized by high outliers of sumac, acorn, hickory, walnut, bean, chenopod, corn, and the bottle gourd. Of these taxa in Cluster 1, outliers of acorn, hickory, bean, and corn occur exclusively in this cluster. The remaining taxa also occur in other clusters (sumac and chenopod in Cluster 2, walnut and bottle gourd in Cluster 3). Cluster 2 is characterized by high outliers of maypop, persimmon, blackberry/raspberry, sumac, and chenopod. With the exception of chenopod, all of these taxa are fruits. Cluster 3 is characterized by high outliers of walnut and bottle gourd. In fact, all but one bottle gourd outlier is found in Cluster 3. It should also be noted that bottle gourd was present in all but five units in Structure 35; thus, it is distributed across most of the structure floor. Cluster 3 then represents an area that is defined by the densest concentration of bottle gourd seeds and rind.

Based on these clusters, it is possible to offer an interpretation of the spatial layout of subsistence-based activities in Structure 35. Cluster 1 is made up of nutshell and corn kernels and cupules. The presence of great quantities of nutshell (not nutmeats, not whole nuts) indicates significant nut processing in the southern corner of the structure. The fact that outliers of both corn kernels and cupules also occur in this cluster suggest that corn processing was occurring here too. The presence of cupules indicates that people were engaged in shelling corn in this area of the structure. That so many corn kernels also occur there indicate either (1) that shelling had not yet been completed (the kernels had not been removed and stored elsewhere) or (2) that this was a two stage process, with shelling followed by grinding, which was either planned or underway. Regardless, these data tell us that the southern corner of the structure was likely a locus of food processing.

Cluster 2 is made of almost exclusively of fruit outliers. With the exception of a sumac outlier also occurring in Cluster 1, all the fruit outliers are restricted to Cluster 2. We interpret this cluster as an area of dried fruit storage. After collecting fresh fruits, we surmise that the structures residents dried and stored these fruits, possibly hanging them from the building rafters.

Cluster 3 is composed of bottle gourd seeds and rind fragments. Although one walnut outlier was also identified in this cluster, the remaining walnut outliers fall within Cluster 1. It bears repeating that bottle gourd remains were littered along the entire floor of the structure. The densest concentration of these remains, however, can be found near the western corner. The amount of bottle gourd identified in this structure is quite rare, especially for an open air site. In all the years VanDerwarker has analyzed southeastern plant assemblages, she has never come across a single bottle gourd seed or rind fragment. It is clear that Structure 35 offers unique preservation conditions for this plant. Bottle gourds are commonly thought to function as liquid storage containers. Given the high densities of seeds and rind in the western corner, we suggest that bottle gourds were hung from the rafters in the western corner, possible filled with liquids. When the beams collapsed during the structure's burning, the gourds fell to the floor (some also probably fell prior to the collapse of the beams). At impact, the gourds broke and fragments likely scattered across the floor; this would explain the high ubiquity of bottle gourd fragments throughout the floor, coupled with the higher densities in the western corner.

What is interesting is that these clusters are all located away from the structure opening/vestibule in the eastern corner. The area of the structure directly inside the doorway was kept clear of food processing activities and food/liquid storage. Instead these locales were placed along the walls tangent to the opening and along the opposite (western) corner.

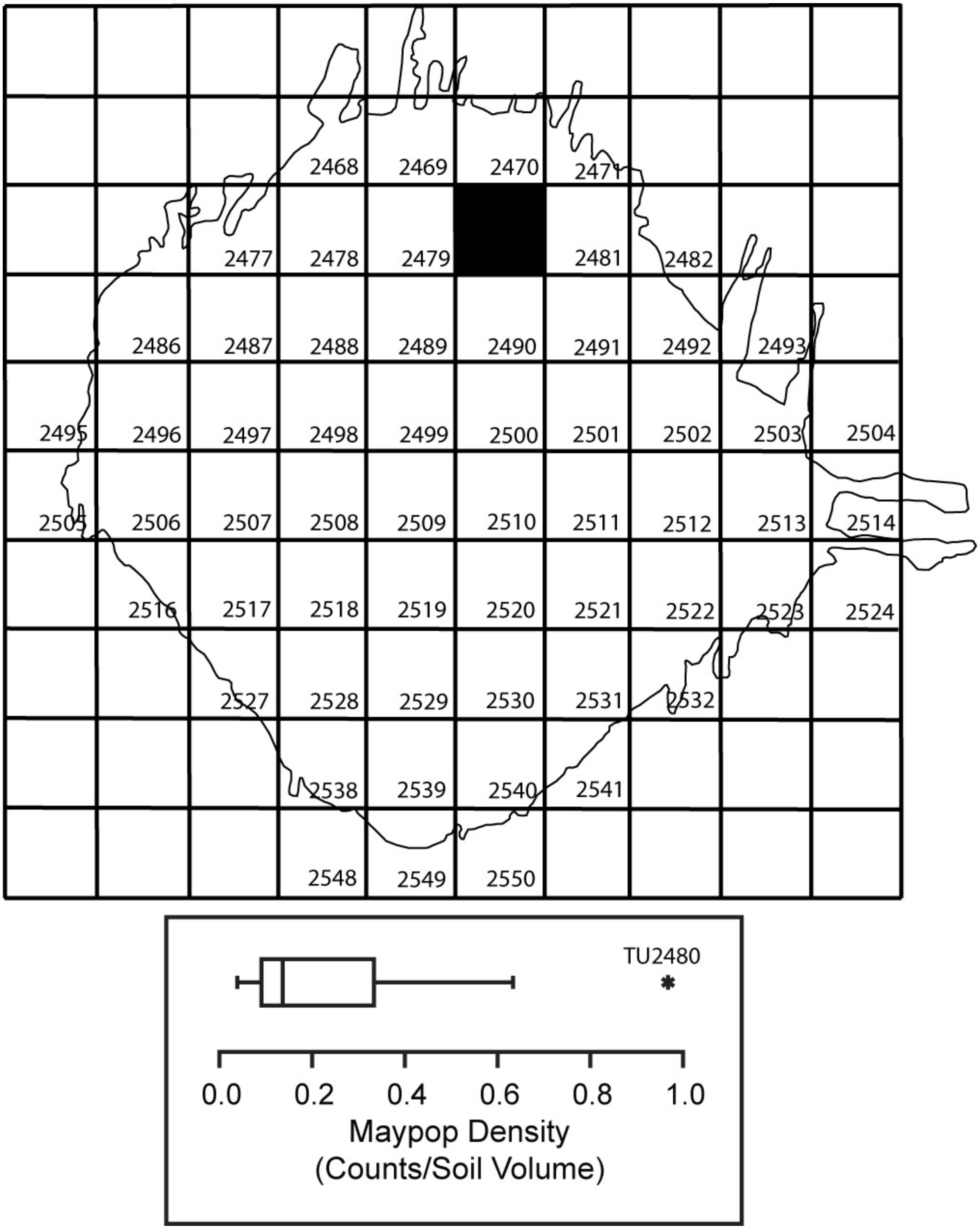


Figure 12. Map of Structure 35 showing maypop outlier with density box plot.

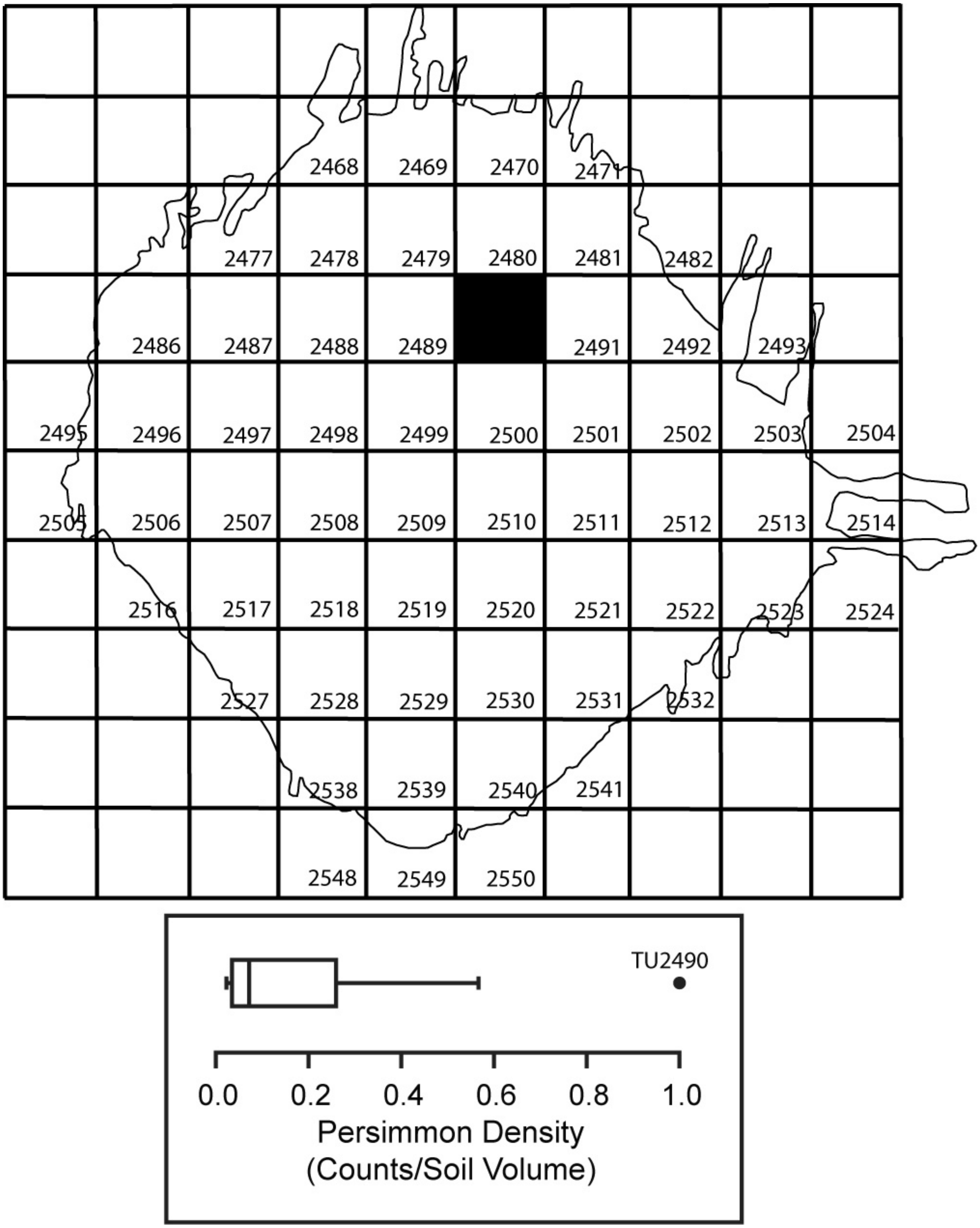


Figure 13. Map of Structure 35 showing persimmon outlier with density box plot.

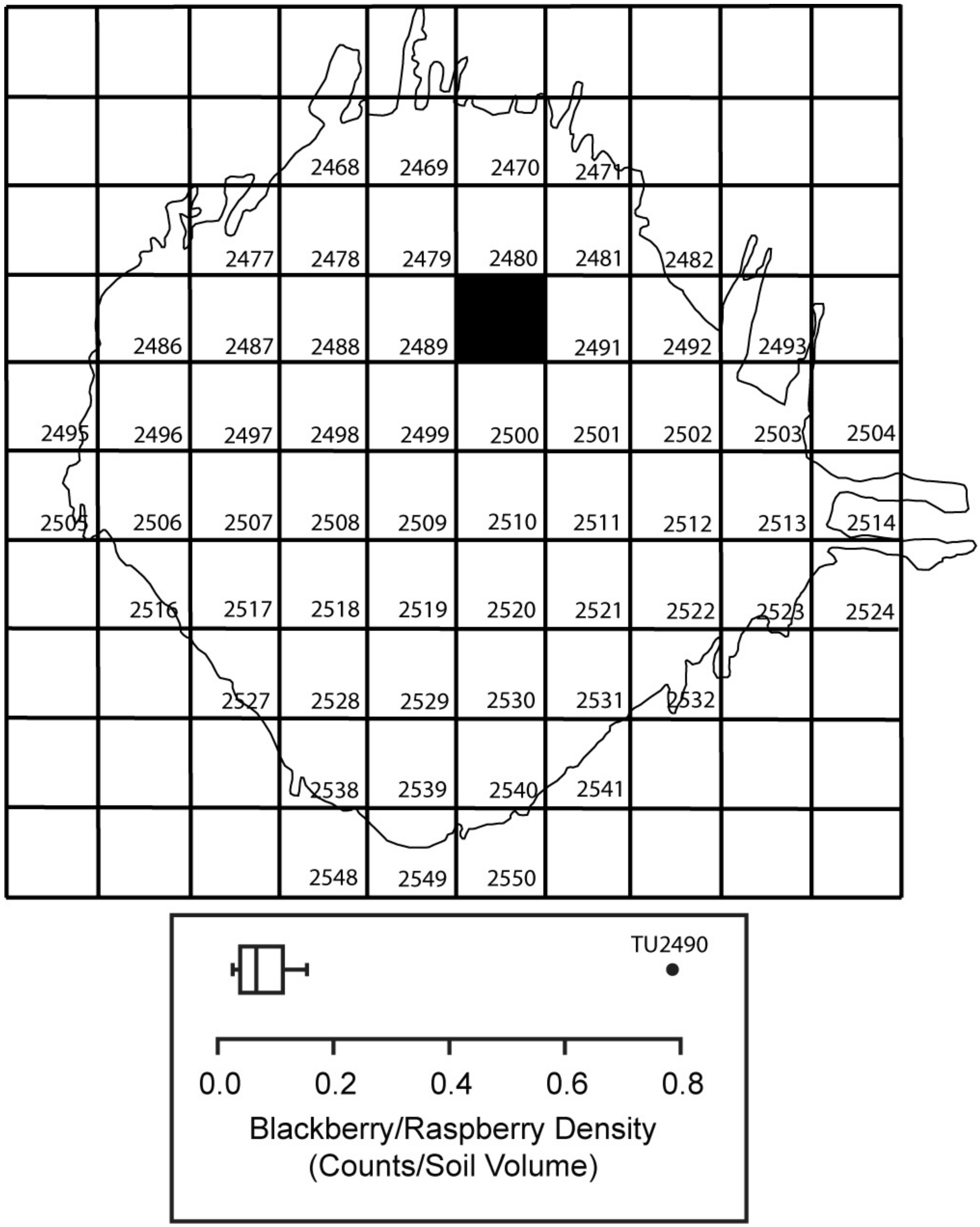


Figure 14. Map of Structure 35 showing blackberry/raspberry outlier with density box plot.

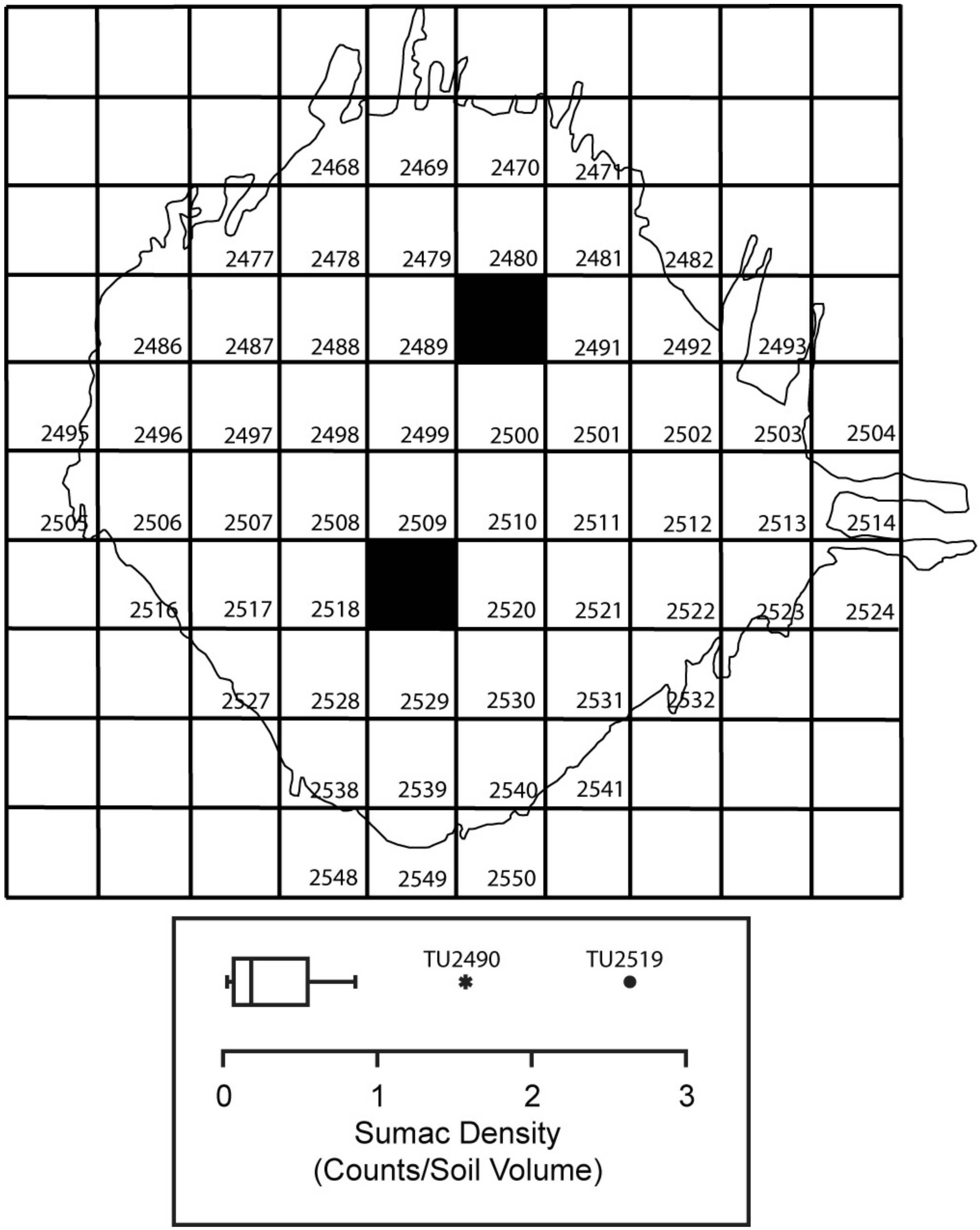


Figure 15. Map of Structure 35 showing sumac outliers with density box plot.

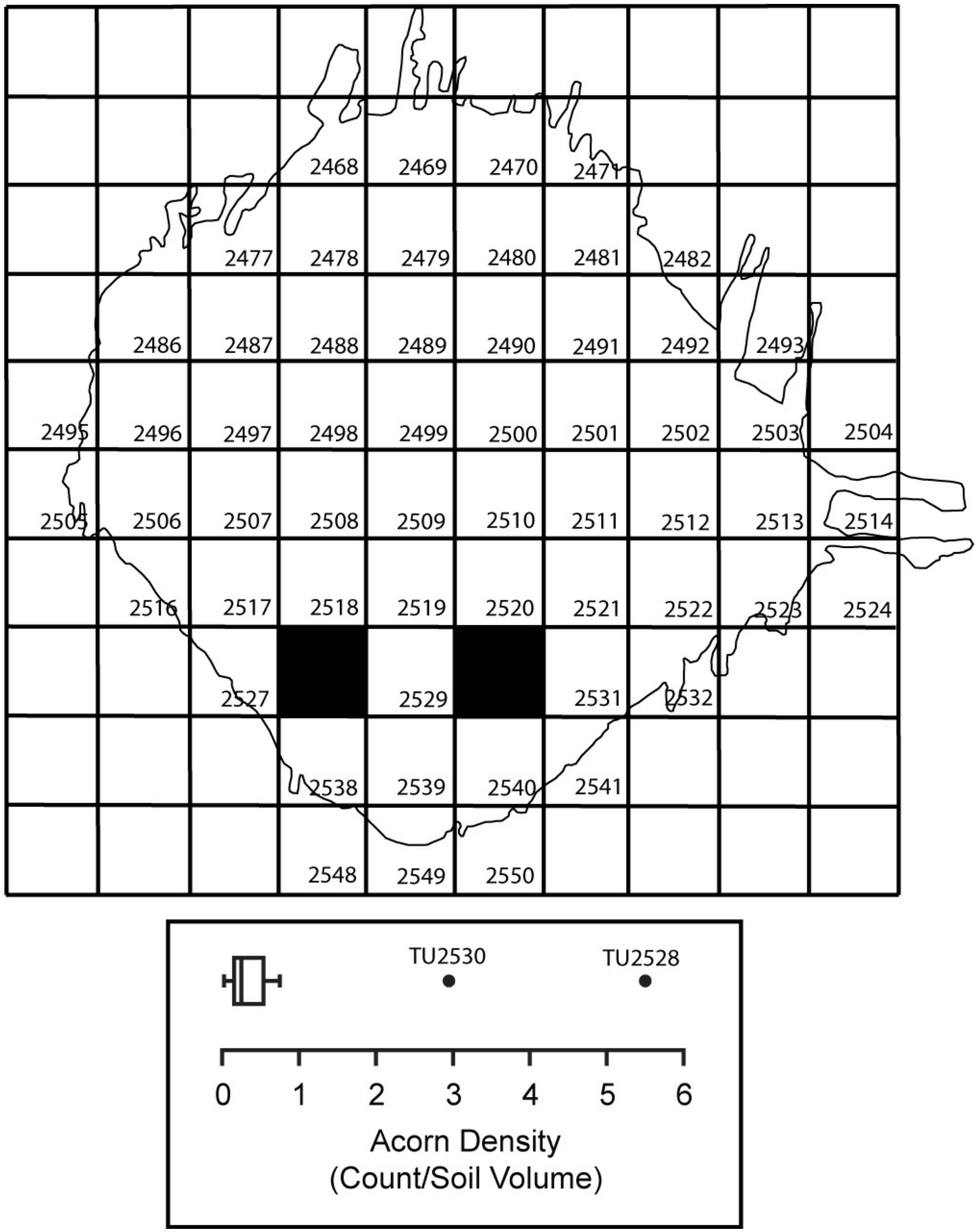


Figure 16. Map of Structure 35 showing acorn shell outliers with density box plot.

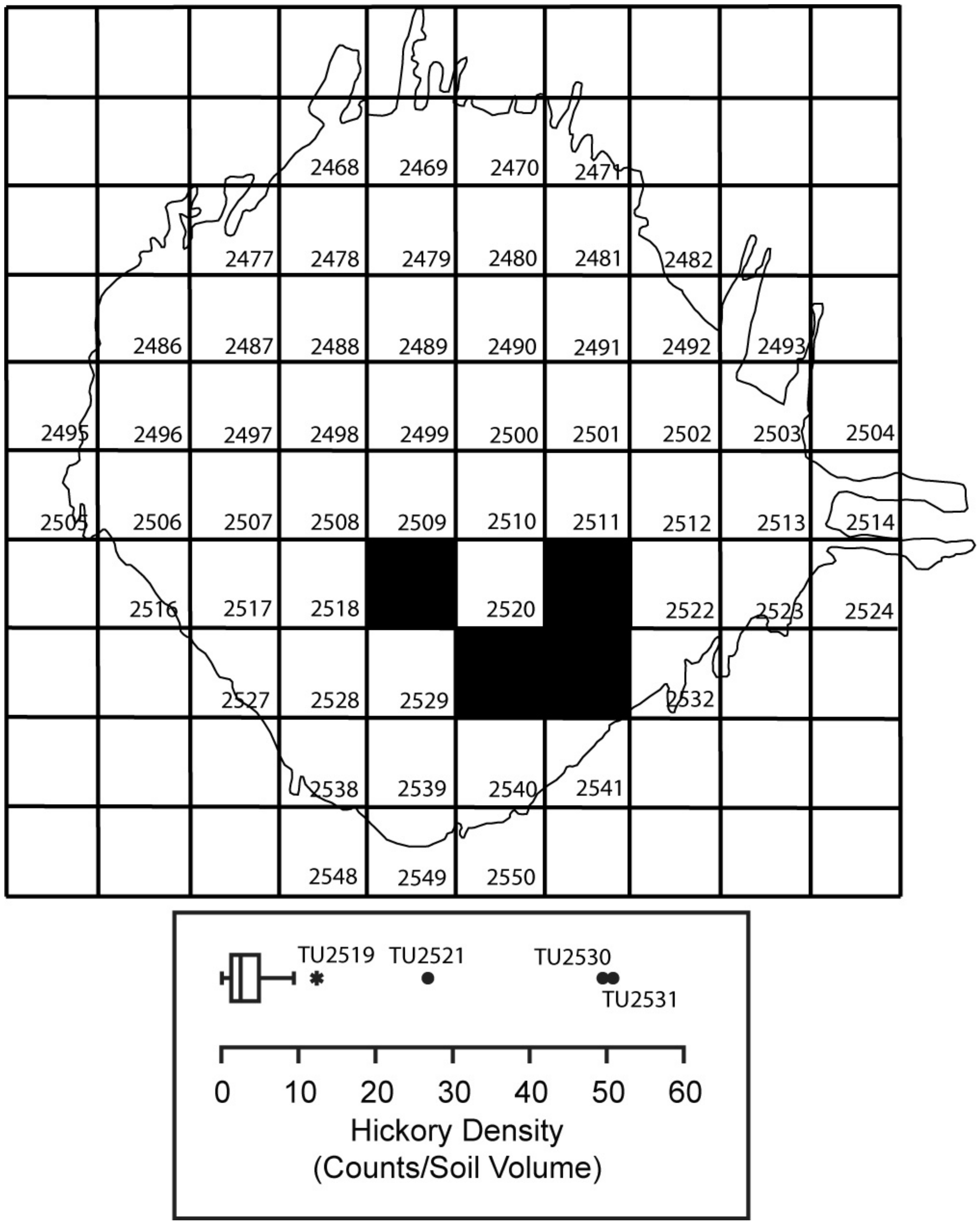


Figure 17. Map of Structure 35 showing hickory shell outliers with density box plot.

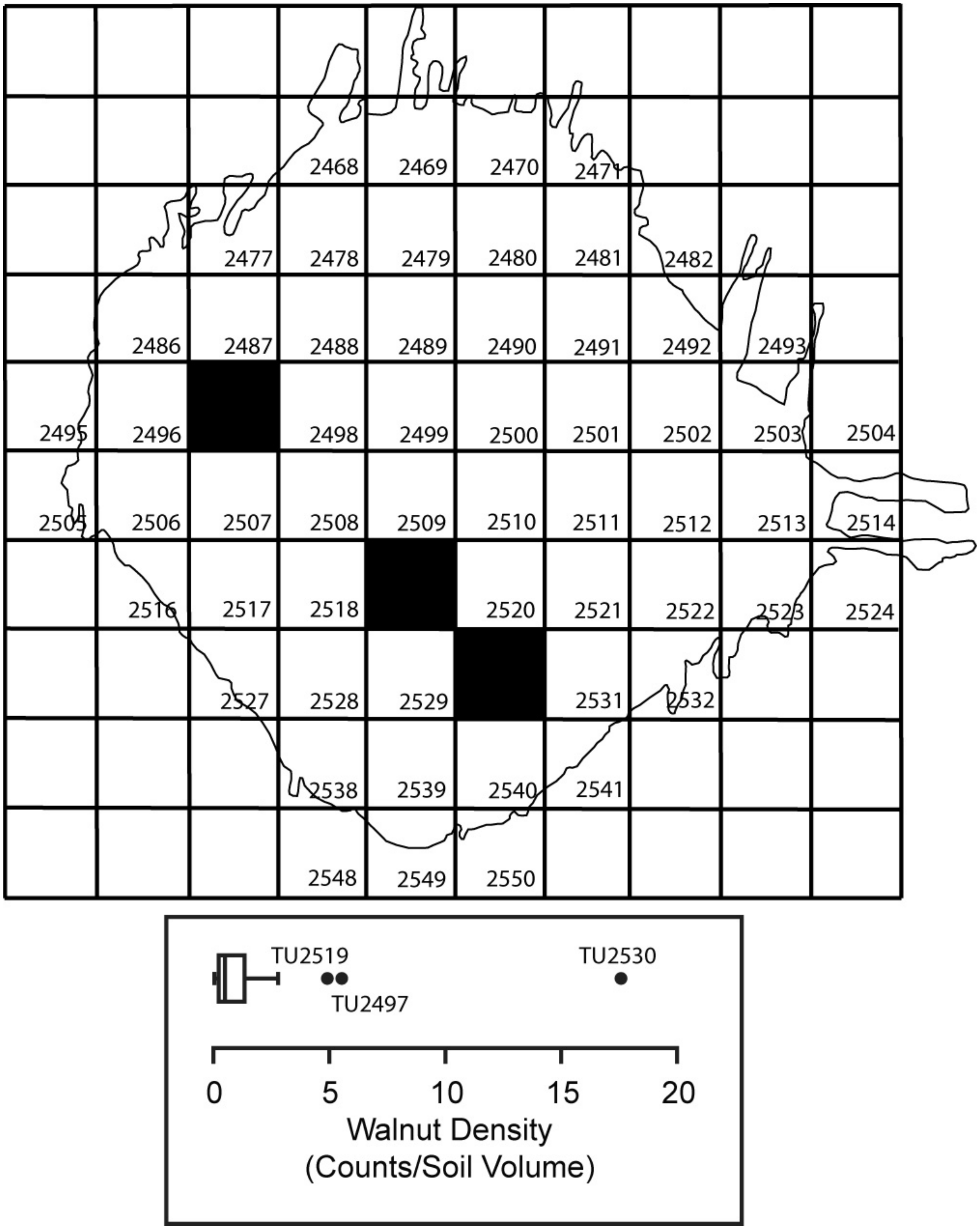


Figure 18. Map of Structure 35 showing walnut shell outliers with density box plot.

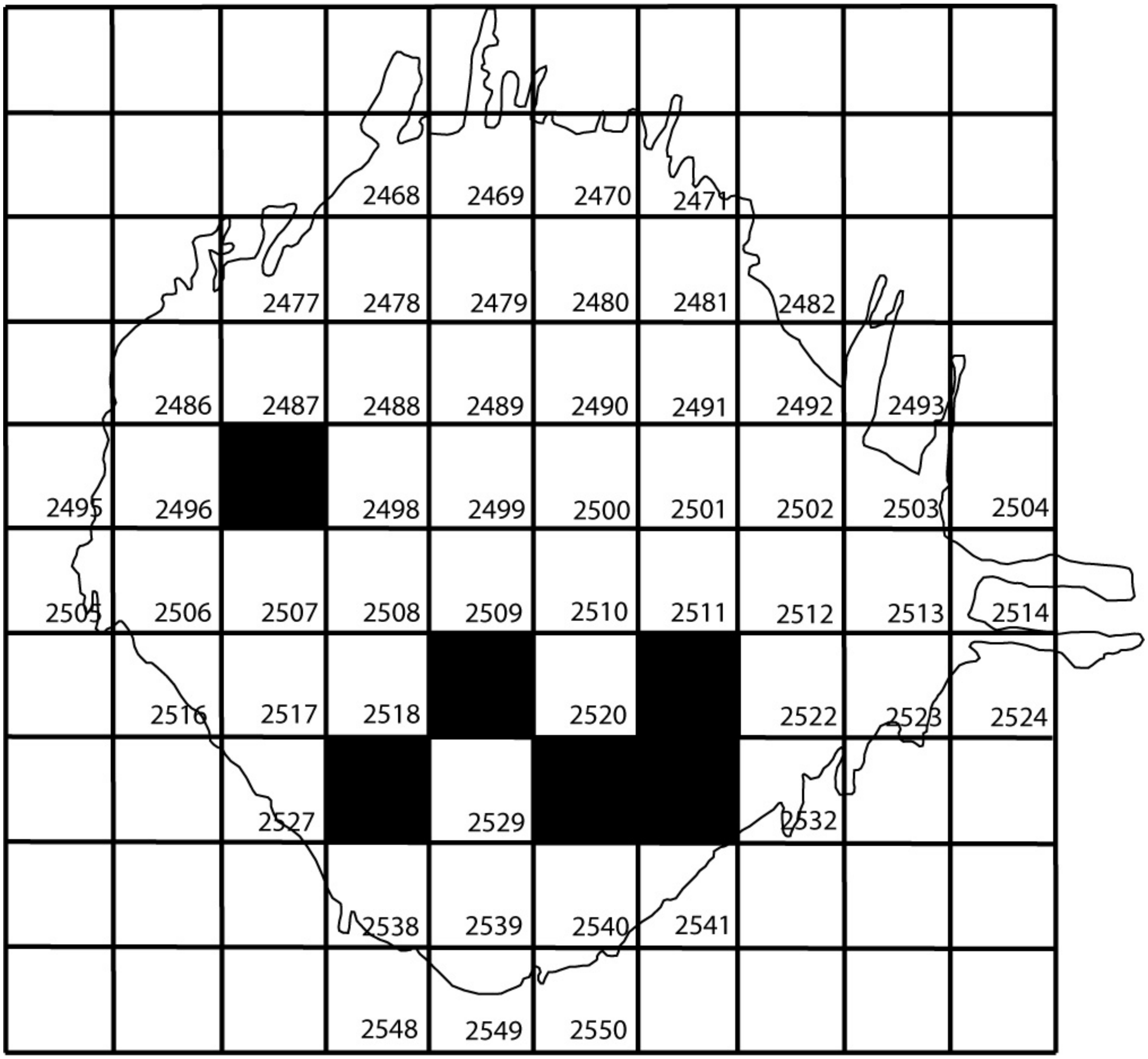


Figure 19. Map of Structure 35 showing all nutshell outliers.

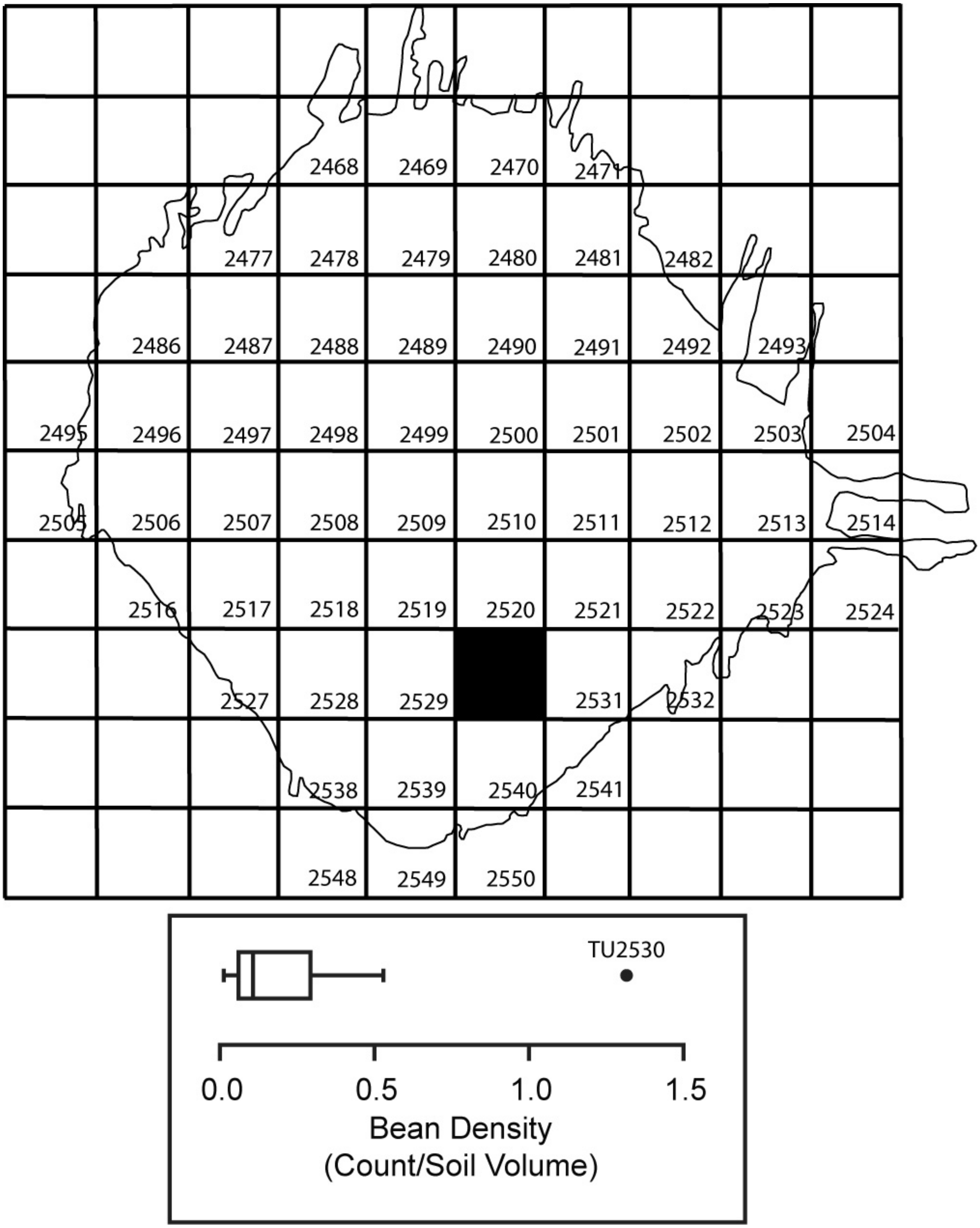


Figure 20. Map of Structure 35 showing bean outliers with density box plot.

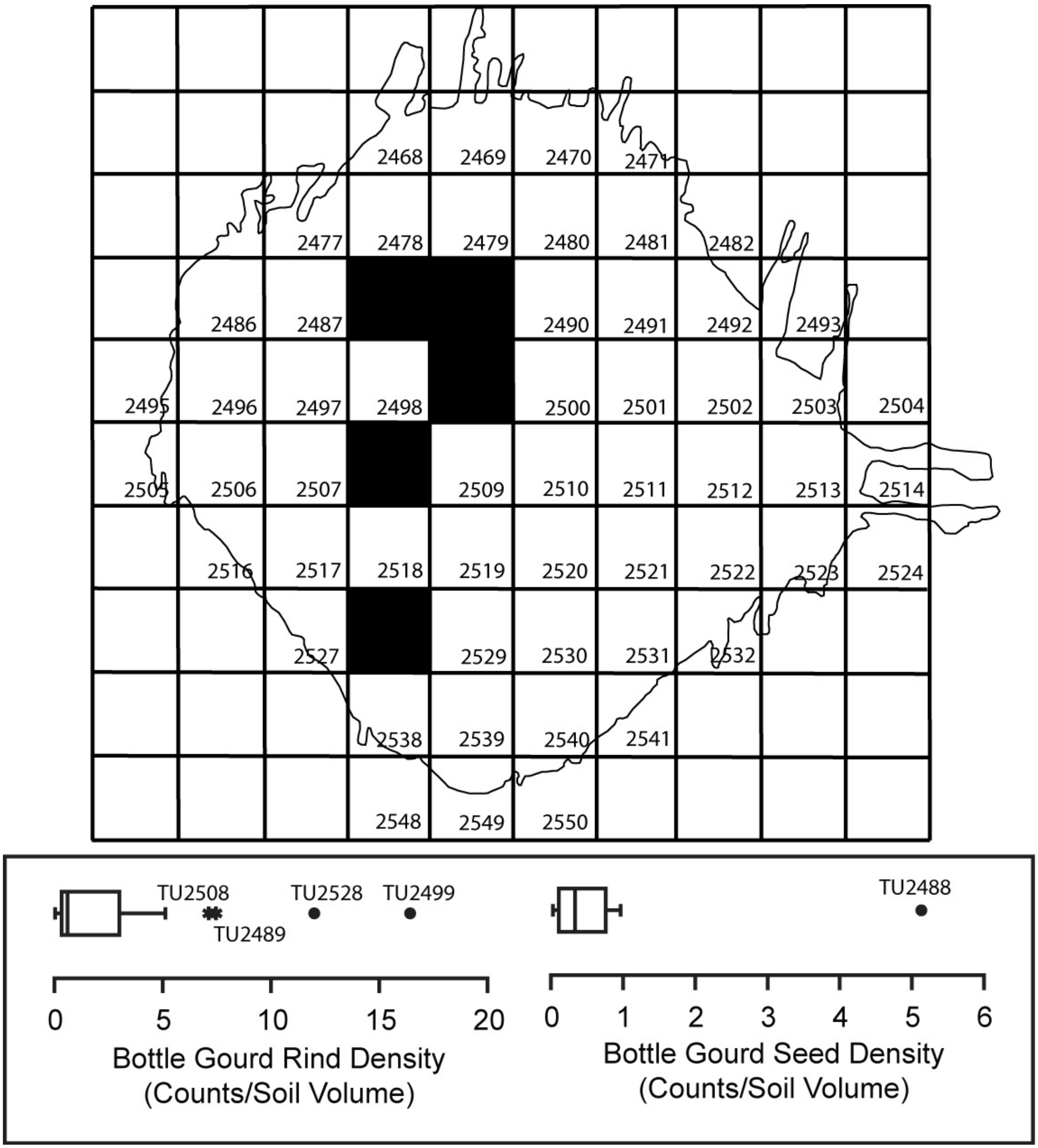


Figure 21. Map of Structure 35 showing bottle gourd seed and rind outliers with density box plot.

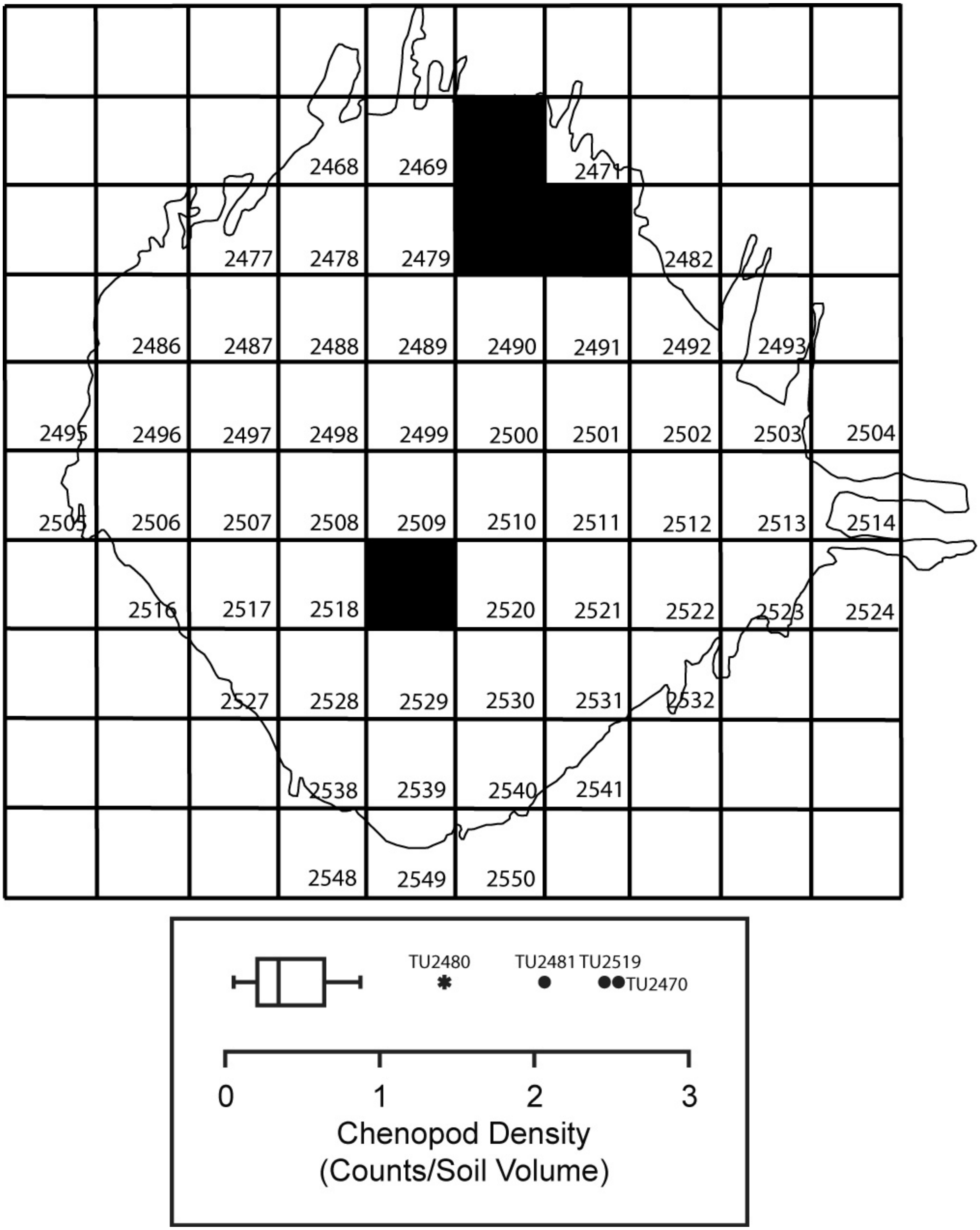


Figure 22. Map of Structure 35 showing chenopod outliers with density box plot.

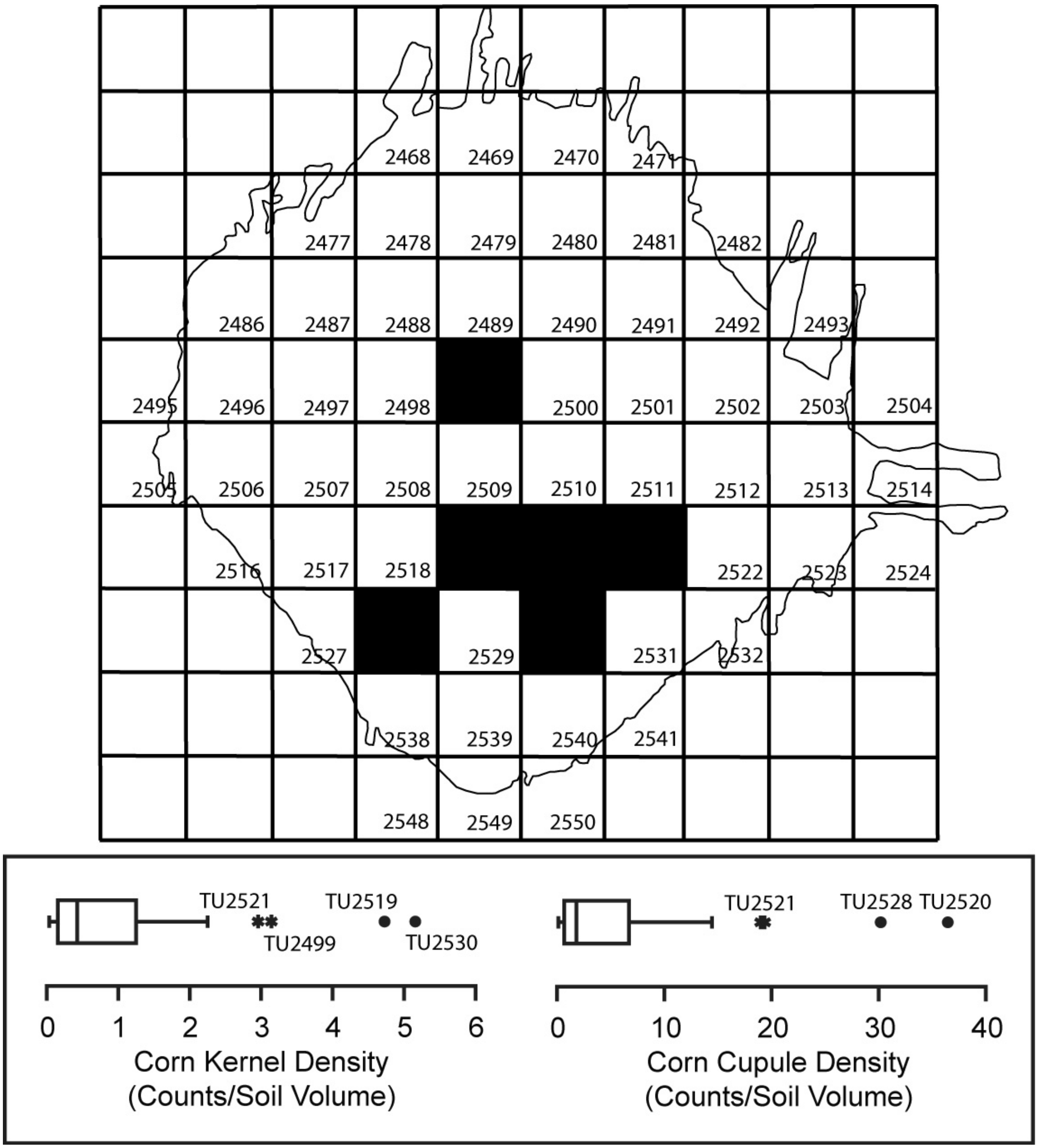


Figure 23. Map of Structure 35 showing corn kernel and cupule outliers with density box plot.

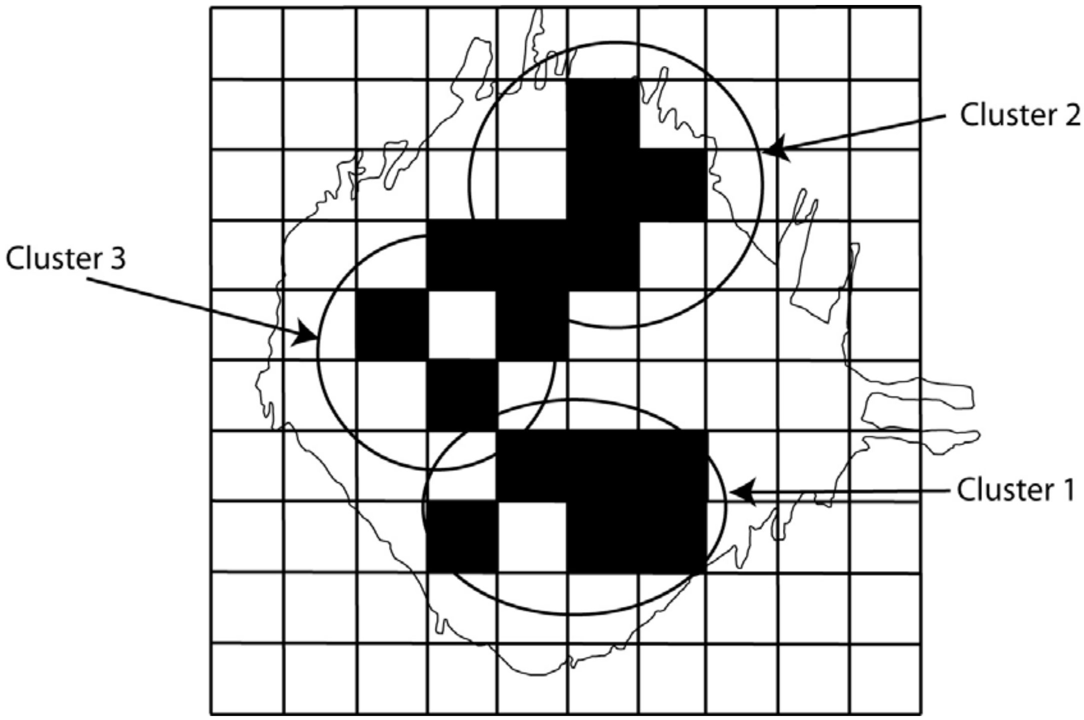


Figure 24. Structure 35 showing clusters as revealed by the box plot density/outlier analysis.

Conclusions

In summary, the analysis of plant remains from the Ravensford site reveals interesting temporal and spatial patterning. The Early Pisgah phase is marked by a drop in nut collection & processing coupled with a focus on corn production. The emphasis on corn remains relatively stable through the Late Pisgah and Early Qualla phases. The transition to the Late Qualla phase, however, is marked by a significant drop in corn cultivation and an increase in the collection of nuts and fruits. This drop in agricultural production is interpreted as a consequence of cultural disruption brought about through increasing contact with Europeans and European diseases. Reduced labor availability for key times in the agricultural cycle (e.g., planting, harvesting) led to the cultivation of less acreage. Decreased corn yields were augmented by a more intensive focus on nut and fruit collection.

The unique preservation circumstances and abandonment context of Structure 35 have allowed for a spatial analysis of plant-related activities on the house floor. This provides a rare look into household activity space and how/where foods were processed and stored within living space. We identified three clusters that represent: (1) a processing locale for corn and nuts in the southern corner of the house, just to the left of the vestibule entrance, (2) an area of dried fruit storage in the northern corner of the structure, to the right of the house entrance (probably stored in the roof beams), and (3) an area of possible liquid storage in the far western corner of the structure. This liquid storage area is denoted by the high density of bottle gourd remains in that corner; bottle gourds were likely strung up from the rafters and came crashing down when the beam collapsed during the fire that incinerated the structure.

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