Casting Stones: An Analysis of the Late Archaic Period at the Big Pine Tree Site, South Carolina, Based in Behavioral Ecology

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Abstract

The Big Pine Tree site (38AL143) is located in the Central Savannah River Valley in the coastal plain of South Carolina. A chert quarry site, it has been used since the Late Paleoindian period (12,850-11,200 cal yr BP) and is in fact still utilized to this day by employees of the nearby Archroma facility. The site has been extensively excavated under the direction of Albert C. Goodyear III for many years, resulting in a large assemblage. This research addresses an unusual 30-centimeter thick dark-brown soil stain located between 60-90 centimeters below ground surface that dates to the beginning of the Late Archaic. This band of soil has been referred to as a midden by people who have excavated at the site; this research tests the hypothesis that the midden levels had a higher or more intensive degree of occupation compared to other time periods at the site through mathematical models based in behavioral ecology. Although this research is constrained by the available sample size, the midden levels do appear to represent the most intense use of the site.

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Chapter One Introduction

This thesis addresses the question of the nature of site and resource usage in South Carolina during the early part of the Late Archaic period. This research is of great importance because during this time sedentism is thought to have arisen in parts of the Southeast. The data used in this study were collected from the Big Pine Tree site (38AL143) in Allendale County, South Carolina, on (and partially submerged in) Smith's Lake Creek, a tributary of the Savannah River. The site was first discovered in 1983 and subsequent excavations were carried out during 1983-1984 as well as in 1992, and 1995 through 1997 (Goodyear 1998:18). Personnel from the South Carolina Institute of Archaeology and Anthropology carried out these excavations under the overall direction of Dr. Albert C. Goodyear III. This site is remarkable because of the density and integrity of the deposits since, according to one recent synthesis, "the vast majority of Middle and Late Archaic sites in South Carolina […] consist of small scatters of flakes and broken bifaces" (Sassaman and Anderson 1994:62). This thesis focuses on the terminal Middle Archaic/initial Late Archaic period assemblage found at the site, which has been assigned to the Allendale phase (Whatley 2002).

Of most interest at Big Pine Tree is a 30-centimeter "midden-like zone" that has been attributed to the Late Archaic period (Goodyear 1998:20). In this dark organic zone, classified as a Bw /A paleosol that extends from 60 to 90 centimeters below ground surface, a sequence of distinct changes in material culture is represented (Goodyear 1998:20). Radiocarbon dates for the Allendale deposits, named after the projectile point type found in the midden levels, range from 4820 ±90 to 3980 ± 80 ^{14}C yr BP (3703- 3517 to 2585- 2392 cal yr BC) (Goodyear 1998:20). The following research will explore whether the occupation of Big Pine Tree by these people

reflects extensive short term re-use of the area, or more extended longer term occupation, i.e. sedentism,

This thesis is organized as follows: Chapter One provides an overview of research on the Archaic period in South Carolina to put the materials found at the Big Pine Tree site in perspective and context. The natural environment of the site is also described in addition to an overview of the previous excavations, operations, and analyses of Big Pine Tree. Chapter Two discusses the theoretical perspectives utilized in this research, such as hunter-gatherer mobility and subsistence strategies, organization of lithic technology, debitage analysis, and archaeological site formation. Chapter Three outlines all aspects of the methodology of the research conducted for this thesis including pre-excavation planning, on-site excavation and recovery, and laboratory analyses. Chapter Four presents the results of the research as well as a discussion of the findings. Chapter Five concludes this study with a synthesis of the research as well as implications of the findings and suggestions for future research.

History of Research

The study of Archaic hunter-gatherer groups is guided by the theoretical perspectives used by North American archaeologists. Early efforts were focused on recording, describing, and chronicling ancient peoples and their material culture (e.g., Willey and Phillips 1958; Willey and Sabloff 1974). Referred to as the cultural-historical approach, this kind of archaeology forms the basis for describing and identifying a culture and where it belongs in relation to the material remains of other cultural groups. The term "Archaic" was conceptualized by archaeologists as early as 1928. H.J. Spinden (1928) was the first to use the term "Archaic", and Ritchie (1932) further defined it as the preceramic, non-agricultural time period at Lamoka Lake, New York;

this term is currently still used, although we now know that both pottery and agriculture appeared during this period in the East (Anderson and Sassaman 2004, 2012; Smith 1986).

The Archaic fit into Steward's (1949) first stage of culture, based on a hunting and gathering subsistence strategy. Krieger (1953) conceptualized a similar classification consisting of "Paleo-Indian", "Food Gathering", "Food Producing," and "Urban" that was called, "the first adequate developmental scheme for North America as a whole" (Willey and Phillips 1958:68). Subsequently, Willey and Phillips (1958) devised a classification system consisting of five stages, beginning with a big game hunting Lithic period followed by the collecting Archaic period; Caldwell (1958:18-21; 72-73) expanded this classification system and further characterized the peoples living during the Archaic as hunter-gatherers. There are currently three subdivisions of the Archaic period used by archaeologists in the Southeast: Early, Middle, and Late (Anderson and Sassaman 1996, 2004, 2012; Caldwell 1958; Griffin 1967); this thesis will focus on the end of the Middle Archaic and the transition into the Late Archaic.

The Middle Archaic

The Middle Archaic in the Southeast begins roughly around 8000 ^{14}C yr BP (8900 cal yr BP) and lasted until 5000 ^{14}C yr BP (5700 cal yr BP) (Anderson 2001; Anderson and Sassaman 1996, 2012; Kidder and Sassaman 2009), and was differentiated from the Early Archaic locally by the adoption of new forms of biface technology. Joffre Coe (1964) described three Middle Archaic subphases in the southern Atlantic states based on projectile points found in the Piedmont of North Carolina. Chronologically, from earliest to latest these are the Stanly, Morrow Mountain, and Guilford phases. Sassaman and Anderson (1995:20-29) listed the diagnostic points of the Middle Archaic in the Coastal Plain of South Carolina in chronological order as:

Kirk Stemmed/ Serrated, Stanly Stemmed, Morrow Mountain Stemmed, Guilford Lanceolate (Coe 1964), and Briar Creek Lanceolate (Michie 1968). Originally referred to as Middle Archaic/Late Archaic (MALA) points (see below; Sassaman 1985), Allendale points as they are now known (Whatley 2002) are considered to be part of the terminal Middle Archaic in South Carolina (Sassaman 1985; Sassaman and Anderson 1994). A shift to more intensive aquatic resource exploitation during the late Middle Archaic would have stimulated changes in technology, mobility, and group organization. This resource exploitation continued through the Late Archaic (Sassaman 1983:52). Also, Blanton and Sassaman (1989:68) saw the use of local resources during the Late Archaic as an indicator of increased territoriality, or protection of a central foraging locale, because of possible increases in population. An increase in population would also cause more constrained mobility and territories that are more densely populated, leading to reoccupation of or a longer stay at a site (Amick and Carr 1996:44; Steponaitis 1986:372).

The Late Archaic

The Late Archaic period in many reconstructions is characterized by an increase in sedentism, defined here as the long term, multi-seasonal occupation of a site, as well as the development of pottery, social complexity, and extensive trade networks (Anderson and Sassaman 2012; Brooks and Sassaman 1990; 1991; Sassaman and Anderson 1994, 1996, 2004). Additionally, the Late Archaic has more artifact diversity than previous cultural periods in the southeastern United States. Pottery, soapstone cooking slabs, and grinding stones are all seen in the Southeast for the first time during this period. Coe (1964:120-124) was the first to formally define and describe phases of the Late Archaic periods locally based on projectile point types,

which he named the Savannah River Complexes. Currently the following point types are used to identify components of the Late Archaic period in the vicinity of the Savannah River: Savannah River Stemmed (Coe 1964), Parris Island Stemmed (Elliot 1985; Wood et al. 1986), Otarre Stemmed (Keel 1976:194-196), Kiokee Creek Stemmed (Smith 1974:212-213), Broad River (Michie 1966,1969), and Gary/Mack (Newell and Krieger 1949; for Mack variant see Beth and Parler 1982; Parler and Lee 1981), as are other artifact types, such as Stallings Island and St. Simmons fiber-tempered pottery, perforated soapstone objects and soapstone bowls (Anderson and Sassaman 1995:37-40). Radiocarbon dating from Big Pine (Table 1) indicates that the MALA horizon, as defined by Sassaman (1985), is diagnostic of the beginning of the Late Archaic period in the Savannah River Valley; the point form is thought to be localized to areas that have readily available supplies of Allendale/Coastal Plain chert (Goodyear 1998). MALA points are now referred to as Allendale points because of their connection with the local chert quarry (Sassaman 2006:41; Whatley 2002).

The earliest ceramics in North America, Stalling Island pottery, were first created in the South Carolina area around 4,500 ^{14}C yr BP and became widely used around 3,500 ^{14}C yr BP (Sassaman 1993:16-19; 43-44). Soapstone slabs were used as heat sources for stone boiling in the Savannah River Valley as early as 5,000 cal yr BP (Sassaman 1993:115-118). This type of cooking, however lost popularity and was no longer used by 3,500 ^{14}C yr BP. This thesis explores the lithic material recovered from an excavation unit opened at Big Pine Tree in 2010 that date to the time just before classic indicators of the Late Archaic in the Savannah River Valley (fiber-tempered pottery and soapstone slabs) came into use. In the analysis that follows, debitage is examined to explore the possibility that the midden was created by increased human activity.

Natural Environment

Located on Smith's Lake Creek, the Big Pine Tree site (38AL143) overlooks a meander scar/tributary of the Savannah River, on the upper edge of the middle Coastal Plain of the South Atlantic Slope (Figures 1 and 2). The Savannah River is over 340 km in length and has a basin of roughly 27,388 km^2 (Semlitsch and Gibbons 1991:17; United States Department of Energy 1990:3-13). With a gradient of 0.12 meters near the site and average flow of 316 m^3 per second, which is at its peak during March and April and lowest in summer and autumn, the Savannah is a formidable river. Goodyear and Foss (1994:27,39) found that during periods of flooding, the Savannah River flowed through Smith's Lake Creek, which appears to have been a former chute channel of the Savannah. Big Pine Tree is situated on a type one alluvial terrace (T1a/T1b), which was initially formed in the early Holocene (ca. 10,500 cal yr BP). By 4,500 cal yr BP, the hydrologic base had risen because of sea level rise, resulting in lower degrees of river grade, causing migration of the main river channel away from the site (Leigh 2004, 2006; Leigh and Feeney 1995; Sassaman et al. 1990:30-33; Schuldenrein 1995:26; Watts et al. 1995:29). Seasonal flooding of the area leads to occasional flooding of the site as well as erosion of the site into Smith's Lake Creek (Carter 1951; Dobher 2009).



Figure 1. Location of Big Pine Tree within the region. Map courtesy Google Earth.



Figure 2. Location of Big Pine Tree relative to Archroma, the nearby chemical plant. Map courtesy Google Earth.

Geological Characteristics

The Coastal Plain of South Carolina is comprised of old marine terraces formed by ocean flooding and draining during the Tertiary and Quaternary (Colquhoun and Johnson 1968; Cooke 1936). The first terrace above the floodplain is divided into two sections, T_{1a} and T_{1b} (Brooks et al. 1990). As they noted, "beginning with the Early Archaic period (ca. 10,000-8000 BP), T_{1a}exhibits evidence of substantial occupation and, hence, periods of relative landform stability" (Brooks et al. 1990:30). The current tributary floodplain along the Savannah River began to form around 4000 ^{14}C yr BP (Brooks et al. 1986). Waters et al. (2009) examined the geomorphology of the Big Pine Tree site, reporting it to be on T_1 and noting:

> "Terrace 1 is primarily a cut terrace composed of unconsolidated Tertiary bedrock that is covered by a thin veneer of late Quaternary alluvium. The bedrock consists of a fining-upward sequence of what appear to be alluvial deposits. At the base is loose, coarse-to-medium sand, conformably overlain by massive fine sand, silt, and clay. This unit is pedogenically altered and characterized by abundant, strong brown and yellowish red mottles.
>
> The late Quaternary sediments occupy a channel cut into the bedrock and also form a thin floodplain veneer over the truncated bedrock. The channel is filled with loose, very coarse to fine sand that fines upward to very fine silty sand (unit 4). Within the channel, clay lamellae extend from the bedrock into the sand of the channel. Clovis artifacts are found in the silty sand overlying the eroded bedrock surface, but have not been found within the channel fill" (Waters et al. 2009:1309).

The soils at Big Pine Tree follow the typology for Allendale County described by Eppinette (1993), and those in the immediate site area are of the Tawcaw-Chastain complex. These soils are poorly drained with a thin brownish loamy layer and loamy clayey subsoil, which is mottled and brownish to grayish in color (Munsell 7.5YR 4/6, 10YR 5/4, 10YR 6/2, 7.5YR 5/6) (Eppinette 1993:10-11). Tawcaw soils are "fine, kaolinitic, thermic Fluvaquentic

Dystrochrepts," with colors ranging from yellowish browns to reddish browns (Munsell 7.5YR 4/6, 10YR 5/4, 10YR 6/2, 7.5YR 5/6) (Eppinette 1993:83). Chastain soils are "fine, mixed, acid, thermec Typic Fluvaquents" with hues ranging from yellowish brown to distinct grays (10YR 5/6, 10YR 5/1, N6/0, 19YR 5/8, N4/1, N5/0, 10YR 5/8, N6/0) (Eppinette 1993:69). The "very strongly acid" (Eppinette 1993:69) nature of these soils result in poor preservation of organic archaeological material. Characterized as having slow runoff rates and permeability with moderate available water capacity and erosion hazard, these soils are found in frequently flooded areas (Eppinette 1993:140).

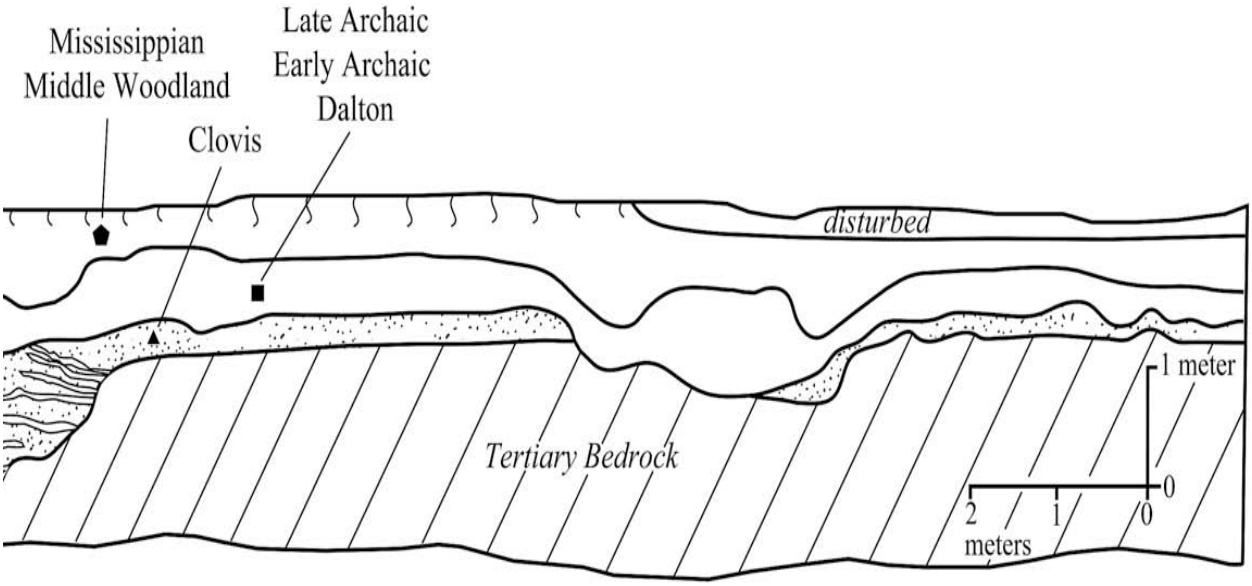


Figure 3. Late Quaternary stratigraphy from Big Pine Tree. Artifacts from the periods are found in the corresponding deposits (from Waters et al. 2009:1309).

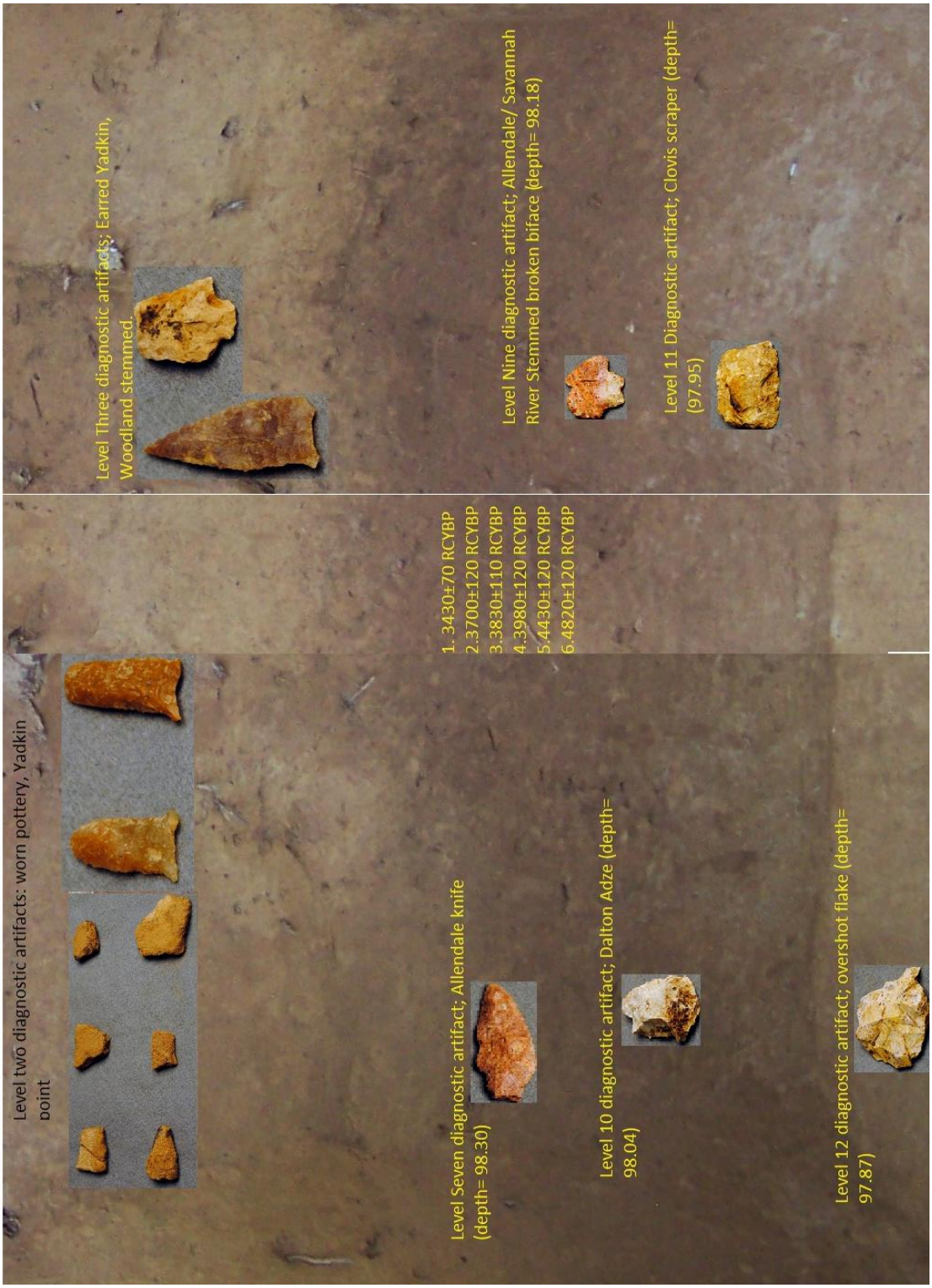


Figure 4. South profile of N175E94. Note dark band of soil. This band correlates to the "Late Archaic, Early Archaic, Dalton" strata from Waters et al. (2009:1309). Examples of diagnostic artifacts by culture with the relative depth where they were found in N175E94

Lithic Resources

The Savannah River area of the Coastal Plain of South Carolina is underlain by sedimentary deposits in which chert outcrops occur. At Big Pine Tree, the Flint River formation is easily accessible, with chert occurring on nearby hillsides and stream channels (Cooke 1936). Stretching from Tampa Bay, Florida, into the southwestern part of Allendale County, South Carolina, the chert in this Tertiary-Age formation is highly isotropic, silicified grainstone; thin-section analysis of Allendale chert found at Mattassee Lake (38BK226) shows that it also contains a great deal of microfossils (Anderson et. al 1982:126; Upchurch 1984). In a study of Allendale chert, Barker (1989:10) stated that the chert specifically is microcrystalline quartz that is composed of 97 to 99 percent silicon dioxide, up to one percent water, and very small amounts of ferric oxide, aluminum oxide, and other impurities. He found when thermally altered, Allendale chert had "a color change to shades of red and an increase in luster in almost every sample" (Barker 1989:67-68; see also Anderson 1979, who conducted extensive thermal alteration experiments with Allendale chert samples).

Specifically, Allendale chert ranges in color from a dark yellowish brown on first exposure to a "saltine white" after extensive weathering (Albert C. Goodyear, personal communication 2010). Chert cobbles that have been taken from the river tend to have a smooth brown cortex while chert from upland quarries has a lighter colored rough cortex because it has not been weathered by water. Also, although Allendale chert has been considered to have an exceptionally uniform cryptocrystalline structure, resulting in extremely high quality stone for lithic manufacture (cf. Goodyear 1979:7-8; McIntosh 2001; Upchurch 1984:143), this is not the case. Anderson et al. (1982:126), as well as Upchurch (1984) reported that the Allendale chert from the quarry at Mattassee Lake is actually highly fossiliferous. In addition, thermal alteration

of the chert can be used to improve the ease of fracture of the material (Crabtree 1972:5; Domanski and Webb 1992). Thermally altered Allendale chert typically becomes pinkish in color because of the presence of hematite in the stone (Anderson 1979; Anderson et al. 1982:115-137; Barker 1989); it also develops a glossy sheen as is typical of thermal alteration (Crabtree 1972; Domanski and Webb 1992). Intentional thermal alteration of Allendale chert is one of the hallmarks of the Middle and Late Archaic periods in South Carolina, occurring commonly on cherts during this time (Gardner 1976; Goodyear 1979; Sassaman and Anderson 1994).

Middle Archaic Climate Conditions

The Middle Archaic period is a time of drier, warmer weather globally known as the Hypsithermal, Altithermal, or Climatic Optimum, which lasted from roughly 8000 until 5000 ^{14}C BP (for a good overview see Anderson et al. 2007; see also Sassaman and Anderson 1994:6). Foss, Lewis, and Stiles (1992:227-251) postulated that this time may have been a period of desiccation in the uplands based on evidence from dune deposition at Copperhead Hollow in nearby Colleton County (38CT58). The early Holocene of the Southeast saw an increase of oak and hickory (although in much smaller numbers than in previous periods); walnut, hemlock, and hazelnut numbers greatly decrease (Brooks et al. 1990:22; Goodyear et al. 1979:30; Watts et al. 1994:35; Webb et al. 1993; Williams et al. 2004). In the Piedmont, the oak and hickory forest continued to the present, while in the Coastal Plain, the oak component lost more than 60 percent of its dominance to pine between 8000-6000 ^{14}C yr B.P (Delcourt and Delcourt 1987:257).

Middle Holocene to Present Climate Conditions

By the Middle Holocene, atmospheric circulation patterns were the same as they currently are, with thunderstorms and hurricanes during the summer months and increased rainfall throughout the growing season (Delcourt and Delcourt 2004; Delcourt et al. 1983:885; Goman and Leigh 2004). Moreover, Coastal Plain forests changed from a prevalence of oak and hickory to a southern pine dominated environment. Combined with atmospheric shifts, this may be a result of increased forest fires caused by increased lightning strikes from the thunderstorms (Delcourt and Delcourt 1985:20; Watts et al. 1995:36). Fires may have been intentionally set by Late Archaic peoples in order to clear and maintain forestlands (Abrams and Nowacki 2008; Sassaman and Anderson 1994:13), a practice documented in the ethnohistoric record of the Southeast as a method for hunting herds of deer by using the fires to panic and flush them out (Rountree 1989:40).

As the environment continued to change (not only the flora but also the fauna), there were direct effects on the foraging strategies of the hunter-gatherer groups at the Big Pine Tree site. The effective environment of Middle Archaic populations can be characterized as productive temperate deciduous forest having a homogeneous distribution (i.e., low patchiness) and high predictability; the environment of Late Archaic populations is modeled as more patchy and stable than the Middle Archaic, with resource management strategies changing with season by microenvironment (Sassaman 1983:99, 103).

Modern environmental conditions were most likely to have been in place by roughly 4,000 cal yr BP (Delcourt and Delcourt 1985:21; Schuldenrein 1995:3). Cypress trees with Spanish moss are found along the Savannah River today, and likely were present in the Late Archaic, when the Spanish moss was used to temper Stallings fiber-tempered pottery. The types

of forest present were "ecologically suitable for large game [and] economies based on hunting large game may have been favored [during the onset of the Late Archaic]" (Watts et al. 1995:37). While environmental conditions may have been optimal for this type of foraging, other factors from foraging theory must be considered before assuming this to be the main food-procurement strategy (see Chapter Two). Most important, however, is that modern climatic data can be used to make inferences about the climate during the early Late Archaic. This is not to say that there has been no change in the environment; nevertheless modern data are "most applicable to the mid-to-late Holocene when environmental conditions and ecological relationships were most similar to present" (Delcourt and Delcourt 2004; Goman and Leigh 2004).

While there has not been any identifiable bone discovered at Big Pine Tree, it is safe to say:

> Aquatic resources including fresh water mussels, resident and anadromous fish, and turtles are very common in the river and swamp. Procurement of these species would have been a relatively low cost endeavor … the resources of the swamp would have been available during most parts of the year, although procurement would not have been equally economical … if access to the resources was not inhibited by flood waters (Sassaman et al. 1990:46).

Moreover, the large number of projectile points and utilized flakes at Big Pine Tree, as documented below, strongly point to the likelihood that hunting and processing of game occurred at the site.

In classifying the forests of eastern North America, Braun (1950) described the area around Big Pine Tree as the Southeastern Evergreen Forest region. Subsumed under this is bottomland forest, specifically a swamp forest consisting of cypress and tupelo along the riverbanks and with hardwood into the uplands (Braun 1950:290-294). In South Carolina, bald cypress-tupelo gum swamps such as Smith's Lake Creek are "seasonally flooded forests on

floodplains of river systems dominated by *Taxodium distichum* and/or *Nyssa aquatica*" (Nelson 1986:6-7). Also surrounding the Big Pine Tree site are bottomland hardwoods, situation "flat dissected areas on floodplains somewhat elevated above adjoining cypress-gum swamp [with flora that are] extremely diverse" (Nelson 1986:6-7). To the east of the site is oak-hickory forest that is also populated with various pines (Nelson 1986:26). Of special interest here are the nut bearing trees. Valuable for their nutritional value, ethnohistoric records indicate that Native Americans in the southeastern Coastal Plain made extensive use of acorns, black walnuts, and hickory nuts.

A 1702-1703 account by Lawson states, "the next morning, got our breakfasts; roasted acorns being one of the dishes" (in Lefler 1967:51). Lawson also reported acorns were gathered for their oil, which can be used for tanning as well as for fuel (Lefler 1967:51). With the exception of white oak acorns, the nuts must be leached of tannins in order to be palatable for consumption. There are several methods of doing this, from pouring stream water over pulverized acorns (Swanton 1918:58) to boiling with wood ash (Swanton 1946:366) and parching with dry heat (Hariot 1893:29; Keller 1987:181). Readily available in the fall (Radford et al. 1968:374), white oaks yield a good crop every four to ten years with red and black oaks having a good acorn crop every two to seven years (Dimbleby 1967:37; Yarnell 1964:70). There is a significant amount of competition for this resource since insects and fungus ruin up to fifty percent of a crop, which is an important part of the diet of many species (Reidhead 1976:232-233). Petruso and Wickens (1984:366) demonstrated that the best time for harvesting acorns is in late autumn.

Hickory nuts must also be processed before use, and ethnohistoric accounts from South Carolina describe how this was done. One states that individuals "gathered each autumn large

quantities of hickory nuts, laboriously beating them up and extracting the oil, which they used both as shortening and gravy" (Milling 1969:17). Lawson's 1702-1703 account states, "[hickory] nuts are gotten in great quantities, by the Savages, and laid up for stores" (in Lefler 1967:105). William Bartram, clearly impressed by the intensive use of hickory nuts and walnuts described the importance of these trees based on their prevalence in abandoned towns: "these trees were cultivated by the ancients, on account of their fruit, as being wholesome and nourishing food" (in Van Doren 1928:58). He also detailed a family that processed over one hundred bushels of stored nuts (in Van Doren 1928:58). The nuts from all species of hickory are available in October, and while competition for these nuts is high, ethnographic accounts show that humans can successfully gather a large amount for consumption (Radford et al. 1968:366). Of all plant remains found at Big Pine Tree, hickory shell is the most prevalent (Bland 1995:98). In fact, "most nutshell from South Carolina sites of all time periods is hickory" (Wagner 1995:6). This may, however be because of the preservation of the shell due to its high density.

Site Discovery

The Big Pine Tree site was initially discovered as part of a systematic survey of the middle Savannah River by Goodyear and Charles (1984), whose goal was "to discover chert outcrops and quarries in western Allendale County and gather data sufficient to evaluate their eligibility for the National Register" (1984:8). The presence of flakes scattered on the road surface, as well as eroding from Smith's Lake Creek, lead to the discovery of the Big Pine Tree site in August 1983. Big Pine Tree was named because of a pine that was a meter in diameter in the middle of the road that leads to the creek (Goodyear and Charles 1984:55). The site is bordered on the north and west by the creek itself; however, the eastern and southern borders

have not yet been determined. In the original report, it is designated as "a chert processing location where chert cobbles, probably obtained from the creek bed of Smith's Lake Creek were reduced and transformed into cores and other tools" (Goodyear and Charles 1984:55). The original subsurface investigations at the site consisted of five auger tests in the road around the pine tree for which the site is named, which revealed lithic artifacts and pottery, as well as the extensive depth of the site, over two meters in some locations; unfortunately, precise locations for these tests could not be determined in subsequent investigations (Goodyear and Charles 1984:56, 63). In four of the five auger tests, artifact clusters were found from 45-90 centimeters below the ground surface; the artifacts found showed signs of thermal alteration because of their bright reddish colors in a glossy appearance, suggesting a Middle or Late Archaic age (Goodyear and Charles 1984:56).

Subsequent Excavations

The Underwater Division of the South Carolina Institute of Archaeology and Anthropology conducted underwater dredging operations in Smith's Lake Creek below and due west of the Pine Tree site in the late summer of 1985. A total of 93 diagnostic artifacts were recovered ranging from Paleoindian fluted performs to Mississippian triangular points (McIntosh 2001:182). After this, work at Big Pine Tree did not resume until July 7, 1992, after several artifacts and a charcoal lens were discovered through the excavation of a boat slip by the landowner, Sandoz Chemical Corporation, now Archroma. A quick excavation of a backhoe trench, excavated for the boat slip, was conducted.

The lens was determined to be from the Late Archaic period (Field Notes 1992; McIntosh 2001:75). Work continued on BHT1 in the summer of 1993 under the direction of Albert C.

Goodyear and the area of the trench was excavated using seven 1m-x-1m units by hand to 90 centimeters below ground surface (cmbs); several flakes were found with charcoal concentrations in the soil matrix (Field Notes 1993). Figure 3 illustrates the year each unit was excavated; Units A-G were the 1m-x-1m units excavated in 1993.

March of 1994 saw more archaeological work at Big Pine Tree by staff members from SCIAA and volunteers from the Archaeological Society of South Carolina (ASSC), again under the direction of Albert C. Goodyear. Eighteen square meters were excavated to a maximum depth of 155 cmbs (Goodyear 1994). In May of 1995, under the direction of Albert C. Goodyear and Kenneth E. Sassaman, an additional 31 m^2 were excavated, bringing the total area excavated to 49 m^2 (Field Notes 1995). The top 50 centimeters was removed with a backhoe and then shovel skimmed an additional 10 centimeters to get to the top of the "chocolaty-brown" soils (Field Notes 1995; Albert C. Goodyear, personal communication 2010). The deposits were then excavated using 1m-x-1m test units, opened into the inferred midden in three 10-centimeter levels.

McIntosh (2001:78) conducted a debitage analysis on several thousand flakes from 1993 units C, D, E and G that were hand excavated in three arbitrary 10-centimeter levels. His research focused solely on whole-flake attribute distribution, examining the assumption that "if whole-flake attribute distribution throughout the midden is heterogeneous, then variation in technological organization may be inferred" (McIntosh 2001:3). McIntosh analyzed 7,839 whole flakes using ogive comparisons to compare relative percentages of flakes in nine different size categories, each increasing by 0.5 cm, from 0.3 cm to larger than 4.5 cm in length (McIntosh 2001:88). From the flake size frequency, he determined that there was an emphasis on the production of large bifacial tools throughout the midden levels (McIntosh 2001:95).

Additionally, using statistical t-tests on flake attributes, McIntosh (2001:107) found that the flakes in each of the arbitrarily defined excavation levels were distinct in size, implying three populations. A decrease in usage of riverine chert was documented over time, paralleling sea level rise and presumed submergence of the sources (McIntosh 2001:143-147). While McIntosh's work helps with interpreting the midden levels, it did not, however, address post-depositional processes, site integrity, or artifacts from other time periods.

Excavations continued under the direction of Albert C. Goodyear for four weeks in May of 1996; however, only two 2m-x-2m units were opened during this season. Goodyear continued to lead excavations for four weeks in May 1997, and four more 2m-x-2m units were excavated. Excavations were halted after 1997 until June 2010. At the beginning of the 1998 season, flooding of the Big Pine Tree area caused Goodyear to move his excavations to the nearby Topper Site (38AL23), where they have continued to the present day, resulting in the discovery of dense Clovis and apparent Pre Clovis assemblages. Controlled underwater archaeological excavations conducted by SCIAA at Smith's Lake Creek re-commenced during the 2008 field season and were conducted in the 2009, 2010, and 2011 field seasons. In 2010, after the underwater teams left, a 2m-x-2m test unit was excavated at the site to evaluate the findings of previous work. The 2010 fieldwork was co-directed by the author and D. Shane Miller, then a graduate student at the University of Arizona, assisted by six volunteers. The fieldwork had as research objectives the recovery of lithic debitage, diagnostic stone tools, and paleoethnobotanical samples to better understand the nature of the site, and to evaluate whether the inferred midden was actually created by extended periods of human occupation.

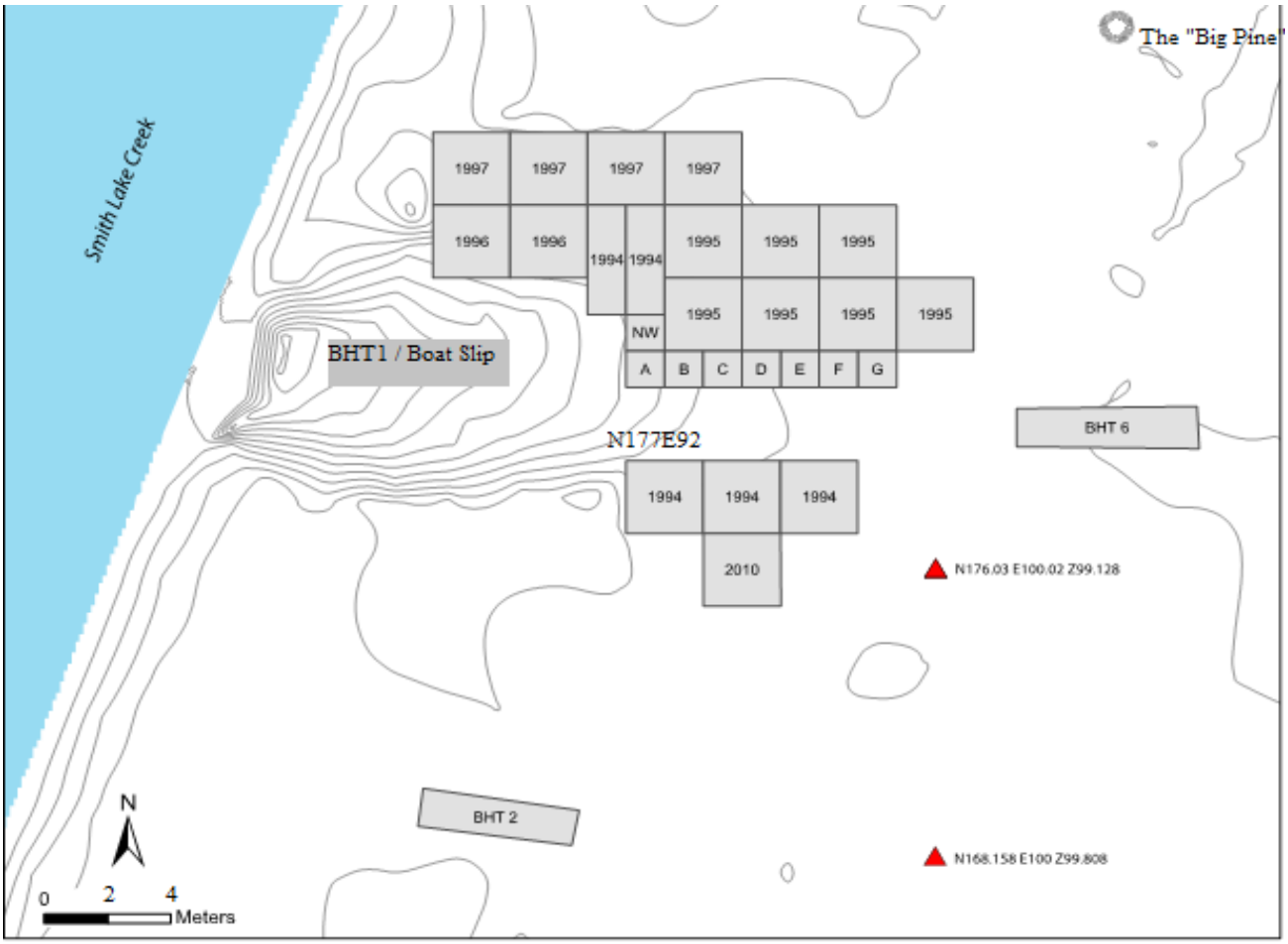


Figure 5. Topographic map of Big Pine Tree with excavated area. Auger tests were located north and west of BHT 6, however exact locations could not be determined. Dredging has occurred in Smith's Lake Creek west of the boat slip. Datum points are denoted by red triangles.

Material Culture

At Big Pine Tree, a distinct separation in the material culture was observed between the Middle and Late Archaic strata during excavation. Points were recovered in large numbers in the deposits that were similar to projectile points found and identified in the 1980s at the nearby Pen Point site (38BR383), where 20 such points were described as MALAs, named for their position between the Middle Archaic and Late Archaic strata (Sassaman 1985:1). Since renamed as

Allendale points (Whatley 2002), this type at Big Pine Tree was typically found between Savannah River and Morrow Mountain points in a dark organic zone classified as a Bw/A paleosol that occurs 60 to 90 cmbs. Although no midden staining was observed at Pen Point, this is similar to the context of the points found at Pen Point where the MALA zone is closer to the surface (30-55 cmbs), yet still situated between Morrow Mountain and Savannah River zones (Goodyear 1998:20; Sassaman 1985:1; Sassaman et al. 1990). These points were relatively dated to 6800-5750 cal yr BP at Pen Point based on their stratigraphic location (Sassaman 1985:16). At Big Pine Tree, however, radiocarbon dates (Table 1) indicate that the earliest occupation for the Allendale deposits at the site is at 4820 ±90 ^{14}C yr BP with the latest dating to 3980 ± 80 ^{14}C yr BP (Bland1995:74-79; Goodyear 1998:20). This 1000-year range of occupation was contained within a 30 centimeter "midden-like zone" and corresponds to the early part of the Late Archaic (Goodyear 1998:20).

The Allendale assemblage at Pen Point consists of hafted bifaces and byproducts of the production of this kind of stone tool (Sassaman 1985:2). At Pen Point, 14 intact or almost finished Allendale bifaces were found, as well as six broken bifaces (Sassaman 1985:2; Sassaman et al. 1990:100). Allendale/MALA points have flat, indented or excurvate bases without basal grinding, and the shoulder morphology of the points is square or barbed based on notching technique (Sassaman 1985:2). The majority of these points are lanceolate forms with parallel sides and an acute tip, many of which have impact fracture patterns that suggest a projectile nature; several different types of hafting elements are also visible on the points (Sassaman 1985:2, 2006:41). These points were created on flake blanks and initially produced by percussion methods that resulted in "broad shallow flake scars across most of the blade" (Sassaman 1985:2). Pressure flaking was performed around the edges not only to complete the

point, but also for resharpening the edges (Sassaman 1985:2). Allendale points were created from Coastal Plain chert that had been thermally altered, and were apparently intended to be attached to a slotted handle or shaft (Sassaman 1985:8; 2006:41). Several of these points recovered from the Big Pine Tree dredging operation are presented in Figure 6. The high projectile point discard and failure rate was originally interpreted as unfamiliarity with high-quality material. However, this was later attributed to a high standard of craftsmanship for the finished projectile point (Sassaman 2006:41).

Interestingly, at the Big Pine Tree site, substantially more of these points have been found than at Pen Point; as of 2010, 55 have been recovered *in situ* as well as 46 through dredging operations in Smith's Lake Creek (McIntosh 2001). Additionally, similar points have been found at the Theriault chert quarry on the Georgia side of the Savannah River as well as in private collections from the general area (Sassaman 1985:15). This could indicate trade networks were operating since Big Pine Tree is over forty kilometers from the Theriault quarry. However, this is only about a two days journey at most, which many hunting/gathering groups made regularly in the course of their regular activities (Binford 2001; Kelly 2013). Additionally, the points could have been made at the quarry areas, since raw material was readily available.



Figure 6. Allendale points recovered from Big Pine Tree Dredge Unit 4, recovered May 2008.

Table 1. Radiocarbon dates from Big Pine Tree.

Source	Location	Date	Lab ID
Bland 1995:74	Feature 8 90-100 cmbs	3700 ±120 ^{14}C yr BP cal BC 2462- 1867 (Calib 7.1)	Beta-80194 carbonized nutshell
Bland 1995:78	Feature 10 90-100 cmbs	3430±70 ^{14}C yr BP cal BC 1920- 1603 (Calib 7.1)	Beta-80919; carbonized nutshell
Bland 1995:79	Hearth Feature 99-114 cmbs	3830±110 ^{14}C yr BP cal BC 2572- 1971 (Calib 7.1)	Beta-55371; wood
Goodyear 1998:21	65-75 cmbs	3980±120 ^{14}C yr BP cal BC 2875- 2198 (Calib 7.1)	Not reported
Goodyear 1998:21	75-85 cmbs	4430±120 ^{14}C yr BP cal BC 3501- 3429 (Calib 7.1)	Not reported
Goodyear 1998:21	85-95 cmbs	4820±120 ^{14}C yr BP cal BC 3941- 3857 (Calib 7.1)	Not reported

Chapter Two Research Approach

Theory of Lithic Analysis

According to Andrefsky (2005), *lithic technology* is an inherently reductive process. Lithic technology, usually connoting chipped stone technology, has existed in various degrees of formality, from the relatively simple creation of flakes, to the highly complex methods of producing precisely flaked projectile points. While knocking flakes off of a larger stone to create a tool, a predetermined series of steps is necessary for the creation of many forms of stone tools. Crabtree (1972:2) states that this practice was "a carefully planned process of making stone tools." Lithic technology, as defined here, encompasses all facets of chipped stone tool production, from the initial acquisition of raw materials to the discarding of exhausted tools. All methods of stone tool production intrinsically require the initial step of acquiring of raw material.

In the book *Towards a Behavorial Ecology of Lithic Technology, Cases from Paleoindian Archaeology*, Todd Surovell (2009:1-2) developed "a formal theory of lithic technology, mathematically constructed from the expression of algorithms." He used theoretical perspectives from behavioral ecology to construct several different models that can be used to understand mobility patterns of hunter-gatherer groups based on lithic artifacts. The reasoning for this is that since stone tool production and use is a process that requires foresight and decision making, "decisions can be modeled as optimization problems" (Surovell 2009:9). In this thesis, I use Surovell's models and behavioral ecology to interpret past lifeways at the Big Pine Tree site.

One of the key concepts of Surovell's models is that "extremes in mobility should result in extreme constraints on technology" (2009:56). Additionally, he stated "because occupation span and the frequency of residential mobility are inversely related, measures of occupation by

their very nature are also measures of mobility. These measures of mobility can then be used as independent variables for the investigation of technological variability" (Surovell 2009:58). In other words, the degree of residential mobility can be investigated based on artifact changes and patterns found in the archaeological record at a site. I follow Surovell's definitions concerning differences in occupation span, occupation intensity, and per capita occupation span:

> Occupation span is defined as the time elapsed from the arrival of the first occupant a site to the departure of the last occupant for any continuous occupation. This is contrasted with occupation intensity, which is the sum of all time spent at a site for all the inhabitants. Occupation intensity is measured as the sum of all time spent at a site by all occupants in a unit of person time (e.g., person days). Finally, mean per capita occupation span is the average length of stay per site occupant. (Surovell 2009:67)

Occupation span can be measured by using horizontal artifact densities, "the number of artifacts per unit area in the horizontal dimension" as a proxy (Surovell 2009:68). By calculating these densities for the Big Pine Tree site, the 30-centimeter dark band of soil can be mathematically examined to determine the likelihood that the stain is in fact indicative of long-term occupation. To further test this hypothesis, these calculations will be compared to the nearby and roughly contemporaneous Late Archaic Lover's Lane site (9RI86), where post molds for structures were found in Block B (Elliot et al. 1994:283).

The second model used to test the length of occupation at Big Pine Tree is the "Rainy Day Model" (Surovell 2009:138). This model calibrates the amount of surplus, or stocked, raw material at the site related to occupation span. One of the main concerns associated with staying at a single location for an extended period of time is the depletion of available tool stone. Longer occupations will have a greater excess of raw material than shorter occupations because a way to prevent shortage of raw material is to create a surplus over the duration of residency at the site

(Surovell 2009:138). Since Big Pine Tree site is located so close to a quarry, embedded procurement of lithics gathering toolstone as part of a series of gathering tasks would require the least amount of expended time and energy because it can easily be done as part of another task (Surovell 2009:131). Surovell (2009:136) demonstrated how to mathematically compensate for sites situated close to a quarry by using artifact density as a proxy for occupation span; these calibrations are followed to determine the amount of surplus raw material present in the sample from Big Pine Tree. For one of the sites in his study, Barger Gulch Locality B, Surovell (2009:134) noted "It would be a rare event to walk 1 km from the site and not encounter a nodule of chert." By using artifact density as a proxy for occupation span, it is possible to infer the amount of surplus raw material found at a site, regardless of the closeness of the chert source (Surovell 2009:136).

The third model used to test the length of occupation is based on the production of lithic debitage, the waste material created as a result of the production of stone tools. Surovell (2009:178) viewed the production of debitage as a result of reducing raw material into a final product. Moreover, he stated, "debitage is an abundant location-specific record of flintknapping behaviors. To model the 'optimization of trash production' then is to model the optimization of behaviors that produce the trash" (Surovell 2009:178). Consequently, he modeled the discard of debitage as a product of tool, biface, and core production and reduction (Surovell 2009:179). By using the marginal value theorem (Charnov 1976), Surovell (2009:194) posited that, "the average use-life of tools should decrease as the time to replace tools decreases or as raw material availability increases." Therefore, the debitage assemblage from longer-term occupations will largely consist of core reduction flakes because with a readily available surplus of raw material, instead of maintaining and resharpening old tools, new ones will be made (Surovell 2009:183;

199-200). This allows flintknappers to become more selective for higher quality tool stone when manufacturing stone tools (Kuhn 1989, 1995; Parry and Kelly 1987; Rolland and Dibble 1990; Surovell 2009:207-210).

The application of proximity, that is *local* or *nonlocal*, into lithic analysis allows the researcher to address otherwise invisible social mechanisms present in pre-contact cultures. As somewhat arbitrary concepts, these terms are continually redefined based on a researcher's own theories and interpretations. I follow the definitions given by Surovell (2009:78): local material refers to stone that originated at the site or is found naturally occurring within 20 km of the site. Nonlocal raw material refers to stone with a natural source location in excess of 20 km from the site. When artifacts of nonlocal material are identified, some degree of mobility or social networking is inherently implied (Goodyear 1989). Furthermore, ethnographic research has shown that residentially mobile hunter-gatherers rarely make one-way trips of more than 20 km (Binford 2001:233-235). However, Speth et al. (2013) demonstrated that logistical task groups can in fact go further if specifically seeking a particular substance, such as tool stone or a religious/holy spot.

In regards to patterning of lithic assemblages and mobility, Surovell (2009:77) states, "*as occupation span is lengthened, archaeological assemblages will become increasingly dominated by artifacts acquired locally"* (emphasis in original). In other words, short-term occupations should have relatively high proportions of transported artifacts, because in the early phases of an occupation things brought into the site from elsewhere will dominate tool kits. As a result, artifact type ratios can be used to determine the average number of person days spent at the site if the discard rate of at least one artifact type changes as a function of occupation span (Surovell 2009:96). The way to measure this is to find "ratios of local:nonlocal raw materials and

debitage:nonlocal tools should provide proxy measures of the mean occupation span per site occupant […] horizontal artifact densities should reflect the cumulative occupation span of all of the occupations present within an assemblage" (Surovell 2009:96). Lithic stockpiling and the provisioning of places are expected to correlate with occupation span (Surovell 2009:139).

If a chert source is in close proximity to the camp, both direct and embedded (a side trip while foraging for another resource) procurement are inexpensive. However, because the source is never outside the logistical foray, embedded procurement is at its cheapest (Surovell 2009:131). Surovell explains "for a single raw material source, direct procurement is most expensive relative to embedded procurement when the source is close to camp. The word "close" must not be used in an absolute sense but must be considered relative to typical foraging distances" (Surovell 2009:131). In the case where there are multiple raw material sources, embedded procurement may occur at different raw material sources during different logistical forays (Surovell 2009:132).

In all, Surovell's analysis provides several methods for determining the length of occupation at a site based on lithic technology. This is vital to understanding the origins of sedentism in the Savannah River Valley because as residential mobility decreases and groups begin staying in one place for extended periods of time, populations increase and sociocultural mechanisms develop that eventually lead to complex societies. These processes are inferred to have taken place in the Savannah River Valley in the Middle and Late Archaic periods (e.g., Sassaman 1993; Sassaman et al. 1990, 2006), and are examined here at the Big Pine Tree site.

Parry and Kelly (1987) suggested that sedentism creates the ability to stockpile lithic raw material at residential locations, producing an "ultra-local" lithic raw material source, eliminating the advantage of producing core and tool forms designed for portability (Surovell

2009:132). They also argued that formal core reduction (e.g., bifacial or blade technology) is advantageous to mobile hunter-gatherers because it minimizes production waste and maximizes portability (Parry and Kelly 1987). The problem with formal reduction is the relatively high cost of production, use, and maintenance, while expedient production is not as efficient in terms of raw material use and portability but has significantly lower production costs (Surovell 2009:132).

Kuhn (1995:24-31) posited that highly mobile hunter-gatherers should emphasize the provisioning of individuals because of unpredictability of tasks and lithic raw materials. Additionally, Kuhn (1995) stated since lithic raw materials are a limited resource, the best way to avoid lithic shortfalls when highly residentially or logistically mobile is to bring your stone with you. In contrast to this, with "less mobile groups, with relatively long occupation spans, the emphasis instead should be on provisioning a place with lithic raw material to ensure a ready supply of tool stone when gearing up for logistical forays" (Surovell 2009:138). Most sedentary people can stockpile stone for future use, removing the need to spend their time and energy in extensive production of sophisticated tools (Bamforth 1990:70; Surovell 2009:138-140; Surovell 2009:142-176)

Foraging strategies

Binford (1980:5) presented differences in foraging versus collecting strategies by using the /Gwi San of the Kalahari to model foragers, while the Nunamuit of Alaska are an example of collectors. Although the environments between these areas and Big Pine Tree are quite different, an understanding of these strategies is necessary to better understand the Allendale culture. These models suggest which method of food procurement strategies the Allendale people most

likely utilized. This is important because having an understanding of foraging strategies describes how a group will most likely gather other resources, such as firewood or toolstone. More importantly, foraging strategies can directly influence group mobility, namely, how long they will stay at a specific location. Foraging societies have high residential mobility, and consequently move their populations to resources such as food and water (Binford 1980:15). In this type of society, groups leave and return to the base camp on a daily basis without using storage pits (Binford 1980:5). Forager subsistence is based on resources acquired through some combination of gathering, collecting, hunting, fishing, and trapping wild resources from groups' surrounding environments (Winterhalder and Smith 1992:12). These resources are categorized by abundance, quality, and timing of access, which results in a highly flexible use of the landscape that varies from year to year (Smith 2007:31). In forager groups, 5-10 individuals comprise task groups that are scattered across the landscape (Binford 1980:7). As resources in a particular area become depleted, foragers move their base camps to the next closest area of resource abundance. In some cases, foraging groups may be inclined to stay close to a specific resource, such as water in the case of the /Gwi (Kelly 1995:126-127). The chert outcrops at Big Pine Tree can be seen as having this kind of tethering effect on individuals in the Savannah River Valley.

Based on ethnographic interactions with the Nunamiut, Binford (1980:10) described a resource gathering strategy based on collecting. Collectors live in an environment with scattered, patchy resources and may utilize pits for storing food for later use in environments with effective temperature below ca. 15 degrees (Binford 1980:10). Additionally, groups using a collecting strategy would create different kinds of sites. In addition to the base camp and location, cache (storage) sites, field camps (sites where task groups would stay when away from base camp), and

station (information/resource exchange) sites are also present (Binford 1980:10-12). While collectors process some of their raw material on site at their base camp, task groups also process things at other locations and bring portions back to base camps (Binford 1980:10). In this vein, collectors "move goods to consumers," which results in a great deal less residential moves (Binford 1980:15).

Increasing population leads to a collecting strategy because of increased resource stress (Binford 1980:10). As groups became larger and more individuals were present in the area, mobility was restricted. With groups living closer to each other, increased competition as well as exchange occurred (Anderson 2001:160; Crumley 1995; Hayden 2001; Johnson 1982; Jefferies 1995, 1996, 1997). As population increased in the Late Archaic, regional stylistic diversity of lithic toolkits became apparent (Amick and Carr 1996:44; Sassaman 1995:179). Large-scale behavioral and organizational revolutions can be inferred in the Southeast through technological changes that began in the Middle Archaic, such as monumental architecture and tool production, and culminated in the Late Archaic use of ceramics, horticulture, and greater monumentality (Anderson and Sassaman 2012; Sassaman 2010). During the Middle Archaic in the Southeast, there is a divergence from the heavily curated lithic technologies of the Paleoindian and Early Archaic lithic toolkits, towards a more expedient lithic toolkit. This change has been attributed to switching from a more collector-based residential mobility towards forager-based logistical mobility (Binford 1980:15; Carr and Amick 1996:43-44). Moreover, Claggett and Cable (1982:764) state that cultural mechanisms, such as territoriality, mobility reduction and horticulture, during the Late Archaic acted to allow local peoples to more effectively exploit a coarse-grained environment. This allowed for a specialization of task groups that could exploit a greater variety of resources zones, resulting in a better adaptation to the environment.

Goodyear (1979) showed that a strong relationship exists between high-quality lithic raw material usage and the degree to which tool curation characterizes technological organization. Thus, a residentially mobile strategy demands a portable technology that relies on expediently produced "situational gear" (Binford 1979). However, with a readily available supply of high quality chert, the need to curate becomes greatly decreased (Surovell 2009:131-133). Additionally, the number of expedient tools may increase because there is less pressure to take the time to make a formal tool since there is an abundance of chert. In areas where there is an abundance of high-quality chert, sites that are close to the quarry and have a relatively high number of preforms and broken bifaces, like Pen Point, could be field camps because these artifact types indicate point manufacture and maintenance.

Some Late Archaic sites in the riverine zone of the Savannah seem to represent specialized activity sites of long-term reoccupation, but not large-scale habitation. One example of this is Sara's Ridge, 38AN29, a riverine early Late Archaic site with a reported average radiocarbon age of 2100 ^{14}C yr BP (Wood et al. 1986:286). Debitage indicates tool maintenance and secondary thinning of bifaces occurred; the range of functional stone tool types at the site is limited. Artifacts are distributed in two discrete clusters, suggesting reoccupation and/or spatial differentiation of activities. At Lover's Lane (9RI86), a site with clear evidence of structures, similar site patterning occurs with separate areas for chipped stone artifacts and cooking-related artifacts (Elliot et al. 1994:317). This mirrors patterns found in some of the inter-riverine studies, and suggests that residential mobility was reduced during the Late Archaic (Anderson and Schuldenrein 1985:151). At Cal Smoak (38BM4), it was argued that Stallings and Thom's Creek cultures stayed in the area for longer periods of time based on the lithic assemblage in conjunction with pottery and soapstone vessels (Anderson et al. 1979:92-93). Interestingly, at

38BK226, a quarry site on the Santee River, a low proportion of curated tools and a higher incidence of expedient tools was observed in the Late Archaic (Anderson et al. 1982:363). This is to be expected for long-term occupation sites because the marginal value theorem (Charnov 1979) indicates tool use-life decreases as length of stay at a site increases (Surovell 2009:198). There are a number of Piedmont/ Fall Line lithic raw materials in the assemblage at 38BK226, which strengthens the argument for increased residential mobility. This is because short term occupations should have a larger number of nonlocal artifacts since highly residential groups would not remain in an area long enough to acquire a toolkit made from primarily local material (Surovell 2009:77).

Sassaman (1983:77) stated:

> Late Archaic settlement patterns exhibit measurable variation in both site function and location. In many cases, sites of limited activity are distinguished from habitation camps. Habitation sites tend to be located on larger streams or margins of swamps, while limited activity sites are more spatially dispersed, perhaps representative of a continued generalized subsistence adaptation. Importantly, Late Archaic sites containing diverse assemblages are found in inter-riverine and upland contexts. It is suggested that these were dispersed habitation camps of populations which aggregated seasonally in lowland habitats. If so, much of the variability seen in Late Archaic settlement pattern resulted from seasonal adjustments in settlement organization. (Sassaman 1983:77)

Based on its location on the Savannah River as well as the type of lithic material found at the site, Big Pine Tree may have originally been a long-term seasonally reoccupied site that became a multi-seasonal camp during the Allendale period. Using a formal mathematical model developed by Surovell (2009), based on ratios of local:nonlocal materials as well a comparison

of cultural components, I will demonstrate how the site's lithic assemblage provides strong support for the inference that mobility changed in this way over time.

Optimal foraging models from evolutionary ecology assume that variance in foraging group size will be adjusted to the specific resources being exploited to produce a maximal net rate of energy capture per individual while foraging. The consequences of processes of co-residency, food sharing, and information-sharing are predicted for hunter-gatherer group size; as spatial and temporal disparity of resources increases, larger information sharing groups have a better chance of locating marginal resource zones (Smith 1981:43). In some cases, it would be better to select less optimal locations for aggregation in order to offset the disadvantages of not having the most valuable information during the rest of the year (Moore 1981:213). As settlement density increases, egalitarian information exchange becomes less effective in integrating the settlement strategies of individual groups; if a larger task group cannot perform efficiently, a hierarchical organization may be necessary (cf. Johnson 1982:403). Thus social demands are increased based on disproportionate information and resource availability. In turn, alliance and exchange networks must be formed, resulting in periods of aggregation for information and resource trading.

Seasonal aggregation is a result of a number of factors. As previously stated, an increase in population means that mobility benefits must be high enough to warrant investment in relocating. Additionally, resources must be abundant enough to support the large numbers of individuals that would gather at a site, otherwise environmental stress would call for a reorganization of society, such as a redistribution system because of the depletion of available resources. As a result, increases in the number of individuals on the landscape results in an information overload of sorts, and societies tend to reorganize to deal with the information stress

(Johnson 1982). In addition to social reorganization, technology must change to offset the decrease in residential mobility faced during aggregational settlement. There would also be greater functional variability of extraction locations in a logistically mobile system (Binford 1979; Hayden 1978). Most importantly, Sassaman's (1983) Adaptive Flexibility model, posited for local initial Middle Archaic Morrow Mountain phase populations, argued that an open social network with limited opport unities to restrict access to resources, and with labor organization that provides immediate return facilitates successful interaction of foraging groups (Anderson and Hanson 1988; Blanton and Sassaman 1989). Shifts in the structure of settlement strategies can alter how accessible subsistence resources are. If a group becomes less residentially mobile, staying in one place for a longer period of time to exploit a specific resource could result in previously available resources no longer being obtainable. Technological change can be a response to unforeseen problems associated with change in mobility (Sassaman 1983:97). Technological organization of raw material choice as well as tool maintenance greatly impacts the management of resource availability.

Constraints include all other factors involved in foraging, like the density and distribution of available resources, associated dangers, technology, an individual's knowledge of the local environment, and mobility patterns (Kaplan and Hill 1992:169). Additionally, hunter-gatherer groups focus their diet selection based on priority of need (Hayden 1981:398). Resource preference is based on food/water availability, ease of processing, resource abundance, and stability of the resource (Hayden 1981:398). Hayden (1981:357) also postulated that hunter-gatherer groups would prioritize the most reliable food source, generally plant resources; however hunting could provide high proportions of the diet depending on environment, resource

availability, food storage adaptations, cost of resource acquisition, and diet breadth (Kelly 2013:114-135).

Some indication of subsistence activity has come from the Big Pine Tree site itself. In a Masters' thesis utilizing materials from the Middle Archaic deposits, Bland (1995) analyzed plant materials collected from three presumed hearth features, Features 8, 9, and 10, and a more clearly defined hearth excavated under the supervision of Dr. Albert C. Goodyear on March 9-10, 1994 (Figures 6 &7). These were chosen because "they were circular in shape […], were not amorphous like many of the stains in the MALA midden, and their coloration was darker than the surrounding soil" (Bland 1995:57). He processed soil samples from these through a floatation machine and sent them to Dr. Gary Crites for analysis of plant species contained in the carbonized remains. Crites found thirty fragments of wood, as well as hickory and walnut shells. Using data from Bellomo (1993) concerning experimentally set fires, Bland (1995:73) concluded that the features were of a cultural origin and were likely hearths or campfires based on the number of thermally altered flakes present in their fill, because natural fires typically do not burn hot enough for sufficient amount of time to thermally alter chert. Additionally, Bland (1995:88) states, "It is doubtful the features at the Big Pine Tree Site served as storage pits. […] the Tawcaw-Chastain soils present at the site have a level of acidity and water retention that are not amenable to the preservation of anything organic underground.

Using the condition of the plant remains and the presence of grinding stones found at the site, Bland interpreted the feature contents as waste products from nut processing, (Bland 1995:82-83); however these grinding stones were not associated with the Late Archaic component and may be from a later period. Bland described the archaeological assemblage as fine-grained, characterized by low density and diversity, and associated with nut processing

(Bland 1995:85-86); his reasoning for this argument is not stated, however, and the current analysis comes to different conclusions about this Middle/Late Archaic assemblage.

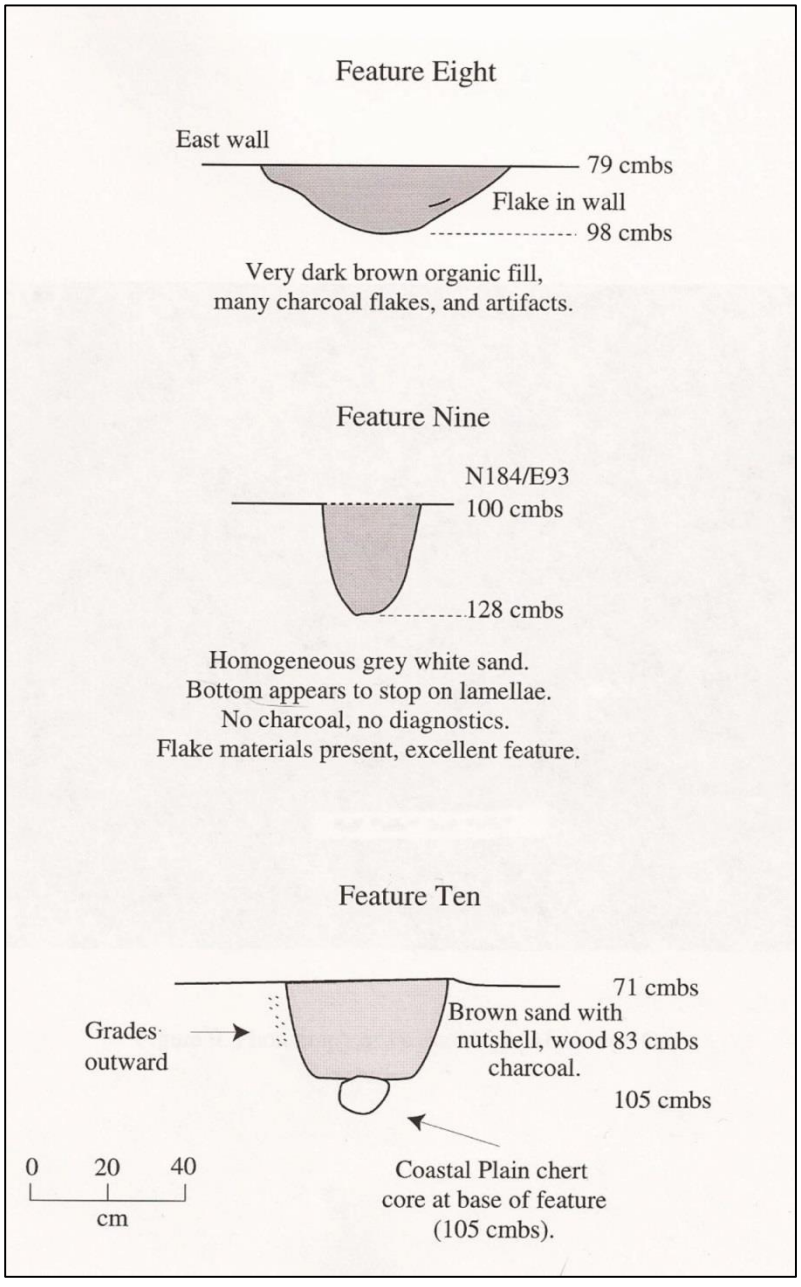
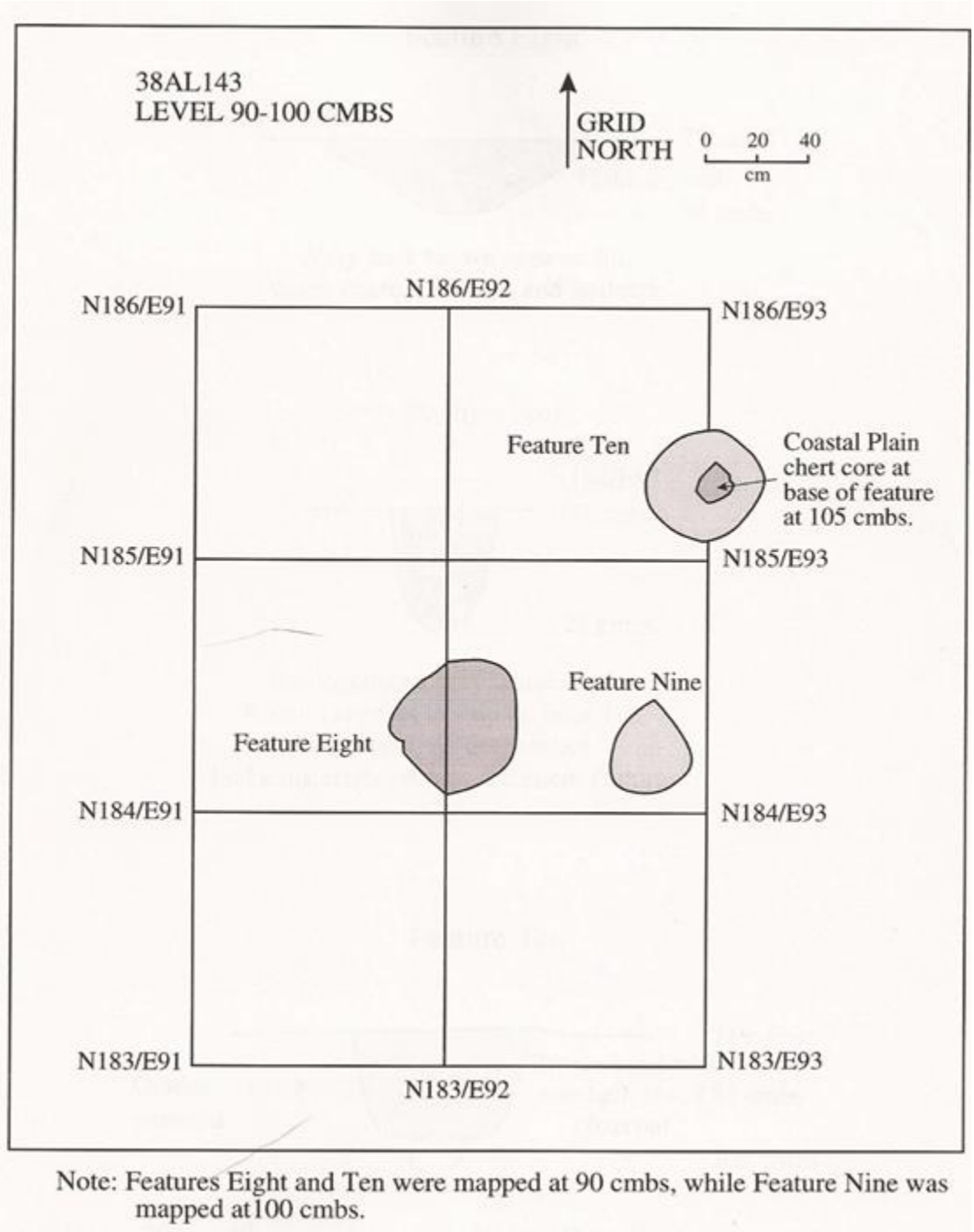


Figure 7. Profile Map of Features Eight, Nine, Ten (from Bland 1995:59)



Note: Features Eight and Ten were mapped at 90 cmbs, while Feature Nine was mapped at100 cmbs.

Figure 8. Planview map of Features Eight, Nine, and Ten (from Bland 1995:58).

Kelly (2013:111-160) used central-place foraging models and the marginal-value theorem to argue that hunter-gatherers should move camp when the potential foraging gain at a new location, minus the cost of moving to that location, outweighs the potential gains from staying in place. Additionally, Kelly (2013:152) argued that sedentism, "can be a product of local abundance in a context of regional scarcity." Sassaman and Brooks (1990:312-314) proposed that sites such as G.S. Lewis East were seasonally used as aggregation locales. Once the patches of food resources became depleted (during winter in this case) the group would move to areas with available food resources. Using the marginal value theorem, movement can be predicted over the landscape, at least in a general way, because groups should move through the environment as patches become depleted (Winterhalder 2001:17).

There are four different categories for mobility: free wandering (nomadic) groups with no territorial boundaries, like colonizing groups; restricted-wandering (semi-nomadic) groups with high population density and constrained by territories; central-based wandering groups (semisedentary) that return to one place based on season; and semipermanent sedentary groups that live in one village but occasionally move (Beardsley et al. 1956; Kelly 2013:116-117; Rowley-Conwy 2001:42). The number and distance of moves is related to the character of the environment (i.e., patchy versus homogeneous) and to effective temperature, which is a measure that "describes both the total amount and yearly distribution of solar radiation characteristic of a given place" (Binford 1980:13; see also Kelly 2013:117). In this vein, there are two types of settlement patterns that appear: residential mobility, where the entire group moves, and logistical mobility where tasks groups move between locations and home bases (Binford 1980:9-10). In Binford's (1980) forager/collector model, which I began this discussion with, foragers have high residential mobility and collectors exhibit lower mobility with logistic strategies (Binford

1980:15). Group size also restricts how much distance can be covered in one day (i.e., larger groups cannot travel as far) (Kelly 2013:130).

While foraging, an individual must choose to either ignore the first resource patch found and attempt to find one of higher rank, or exploit this convenient, possibly lower ranked patch. The amount of time available for foraging as well as travel to and from patches will influence this decision. Conversely, resources in the lower ranking patch may require more processing time, resulting in a lower overall return (Kaplan and Hill 1992:170). Also, it is not necessarily the case that resources are encountered one at a time and in a logical sequential order. An individual's knowledge of the landscape and hunting/gathering skill determines the efficiency of a resource procurement trip (Stephens and Krebs 1986:11).

The diet breadth model was developed for fine-grained environments, or those with evenly distributed resources; the model consists of two steps, time searching, and time catching and eating/processing (Winterhalder 1981:24). The diet breadth model is a measurement of cost and benefit, where cost increases over benefit, resources are less likely to be pursued; it predicts what resources hunter-gatherer groups should target in specific situations (Winterhalder 1981:25). Archaeologically, increases in diet breadth can be seen to be accompanied by increased investment in adding foods to an individual's diet (Kuhn and Stiner 2001:115). As the climate in the Southeast changed during the Holocene, more exploitable food resources became available. As such, the addition of mast products would be an easily collectable resource that non-hunters could gather. Goodyear (1998:20) reported that Gail Wagner conducted an analysis of plant species represented in the charcoal from the "MALA midden" at Big Pine Tree and found burned hickory nuts, evidence that these resources were in fact being used, complementing the work conducted by Bland and Crites as previously described. Furthermore, fauna such as the

white-tailed deer, which was a commonly hunted animal throughout the Mid-Holocene, as well as aquatic resources in riverine environments (Styles and Klippel 1995:115), could also have been utilized. The archaeological evidence for the utilization of white-tailed deer, however, would not easily be seen at the Big Pine Tree site because the soil does not have good qualities for organic preservation. Based on environmental similarities and the fact that white-tailed deer are currently present in the area, however, it is fair to assume that these resources would have been used.

The patch choice model identifies how many patches a forager would include in one trip to maximize the net caloric gain (Winterhalder 1981:26). In this model, patches will be added to the point that time spent hunting and exploiting the patches and the yield from those patches is balanced, and when favorable patches are known, cost can be reduced by keeping away from inferior patches (Winterhalder 1981:27). A correlate of this is the marginal value theorem, which states, "as a patch is exploited, returns from foraging within it often will fall" (Bird and O'Connell 2006:147; Charnov 1976).

An important assumption of the marginal value theorem is that while the predator is in a patch, its food intake rate *for that patch* decreases with time spent there (Charnov 1976:129). The predator is assumed to make decisions so as to maximize the net rate of energy intake during a foraging bout (Charnov 1976:131). The length of time between patches should be independent of length of time the predator hunts within any one (although the reverse statement is not true) (Charnov 1976:131). The predator should leave the patch it is presently in when the "marginal capture rate in the patch […] drops to the average capture rate for the habitat." (Charnov 1976:132).

An optimal forager abandons a patch when its declining *marginal* rate of return equals the net acquisition rate of foraging averaged over visits to many patches. Increasing encounter rates (lessened travel time) raise foraging efficiency and reduce patch residence time; lessened search costs have the same effect. As patches become richer or as harvest costs within the patch diminish, residence time will change accordingly. A forager moves more quickly through an environment dense with rich patches, taking less from each one encountered, than through an environment with fewer and/or lower quality patches. A forager nearly always will depart a patch before it has been fully depleted of resources (Winterhalder 2001:17). A decision to stop consumption or to cease one activity in preference for another is made by comparing the value of the last unit gained to the alternative. Thus the marginal value of the current patch is compared to the average value of moving on (Winterhalder 2001:19). Camps will move more often if (1) relocation costs are low, (2) depletion (or depression) of zones immediately around the occupied camp is rapid, and/or (3) alternative residential sites offer high initial rates of return (Winterhalder 2001:21). Changes in resource availability will modify the return curves independently of exploitation, and may produce relocation apart from, or in interaction with, depletion (Winterhalder 2001:22).

Archaeologically, patch choice and diet breadth models can be used to infer how much of and what resources hunter-gatherers would utilize and to what extent. The marginal value theorem complements the patch choice model in that it predicts when a forager should leave the patch, namely when cost for exploiting the patch becomes higher than moving to another location in the environment (Winterhalder 1981:28). The model predicts that as the distance between patches is increased, a forager should remain longer in a patch (i.e., become more sedentary).

Horn's model hypothesizes that the best pattern for forager distribution on a landscape is one in which they have to move the least to procure food; Horn's model predicts when foragers should be aggregated as well as when they should be dispersed over the landscape (Winterhalder 1981:31). Sassaman and Brooks (1990:313) suggested the most efficient time for aggregation would be during the spring and summer months and dispersal would occur during the fall and winter at the Savannah River Site. However, the use of hickory nuts may indicate that the site was utilized differently than their model implies. Hickory nuts usually begin to drop from the trees in early autumn, with the onset of frost. This could imply that the Big Pine Tree site was utilized at least through the early part of the fall. Moreover, based on Wagner's analysis, Goodyear (1998:20) stated that these nuts were charred by human agents, thus implying that the people that made the Allendale points associated with the site, and the "midden" that the hickory remains were found in also may have used the site during the fall season. He did not, however indicate his reasoning for invoking anthropogenic causes for the burnt nuts. Further analysis and excavation at the Big Pine Tree site is needed to reexamine the context of the midden, and attempt to find evidence for storage to more solidly determine the usage of the site.

Overall, if the "midden" levels are in fact periods of more intense occupations, it should be readily apparent. Higher artifact densities than during other occupations at the site should be apparent, and the more sedentary assemblage should be comprised of mostly local raw materials and debitage consisting primarily of core reduction flakes. A summary of the expectations is presented in Table Additionally, since there is no direct evidence for structures (which indicate long term occupations), comparing the Big Pine Tree materials with lithic assemblages found at the nearby Lover's Lane site, where they were present, will help determine if Big Pine Tree was a long-term occupation site during the early Late Archaic period.

Table 2. Basic Expectations of the models utilized in this thesis.

Model	Expectations for Short Term	Expectations for Long Term
Artifact Density	Low artifact densities	High artifact densities
Surplus Raw Material	Several large artifacts	Few "large artifacts
Cortical:Non-cortical ratio	smaller ratio of cortical:noncortical	Larger ratio of cortical:noncortical
Exotic Material	high % nonlocal raw material	Low % nonlocal raw material

Chapter Three The 2010 Field Program

In the southeastern United States, stratified archaeological sites containing terminal Pleistocene and early Holocene deposits are extremely rare (Anderson 2005; Goodyear 2005; Miller and Gingerich 2013). One exception to this pattern is the Big Pine Tree site (38AL143), which has multiple components buried by alluvial sediments from Paleoindian to historic times (Goodyear 1999; Waters et al. 2009). Consequently, the archaeological record of this site has the potential to yield information comparable to other stratified sites examined in the Savannah River Valley, such as Topper (Goodyear et al. 2007), Pen Point (Brooks and Sassaman 1990), G.S. Lewis East (Sassaman et al. 2002), Rucker's Bottom (Anderson and Schuldenrein 1985), Rae's Creek (Crook 1990), and Taylor Hill (Ledbetter 1990). While the Big Pine Tree site had been extensively investigated in the past (Goodyear 1999:459-462), the 2010 fieldwork, which encompassed the excavation of a 2m-x-2m^2 unit through the site midden deposits, was conducted with three goals in mind. These were: (1) to recover a continuous sample of archaeological material from the modern surface to the Pleistocene bedrock to analyze the amount of vertical postdepositional movement of materials; (2) to use material recovered to formally test the hypothesis that the dark brown band of soil is indicative of a long-term occupation span at Big Pine Tree; and (3) to use the total station to create a site-wide topographic map to integrate spatial information from past excavations. Debitage from N175E94 are listed in Appendix A and Appendix B lists debitage from N177E95. Appendix C lists piece=plotted artifacts from both units. Appendix D contains examples of field excavation forms. Photographs of the fieldwork are presented in Appendix E. Appendix F contains photographs of artifacts recovered from N175E94.

These goals were based on the nature of the excavation sample available for analysis. Until the 2010 excavation, only three units had been excavated by hand from the ground surface to the base of the cultural deposits, with all fill screened: N177E92, N177E94, and N177E96 (Figure 8). These units were excavated in 1994 along with N183E92 and N183E93; however, due to time constraints and research priorities, Goodyear removed the top 70 centimeters from N183E92 and N183E93 to expedite his main research goal of documenting the Paleoindian component at the site. This strategy was continued in subsequent years, with up to 75-80 centimeters of the upper deposits typically removed with a backhoe, including large portions of the Middle and Late Archaic midden in some units, resulting in an incomplete view of the archaeological record in most of the sample collected prior to the 2010 fieldwork.

Site Preparation and Mapping

In preparation for the 2010 excavation the pre-existing site grid was utilized. A "base" datum and backsight for the total station were set at the beginning of each day through the course of the excavations. Although the electronic calculations were quite precise, human error resulted in some levels being over-dug and others being under-dug. While these errors were minor, they are noted herein because precise values for level volume were critical for the comparative analyses that were undertaken. Additionally, landmarks were used to re-locate previous excavation areas in order to locate the area where the 2010 excavations would occur. The location for the 2m-x-2m unit excavated, N175E94, was chosen by the project Principal Investigator, Dr. Albert C. Goodyear, because it could easily be integrated into the existing grid and because of its location in relation to previously excavated units (see Figure 8). Finally, the

surface of the site was mapped in order to create a high-resolution three-dimensional map of the topography.

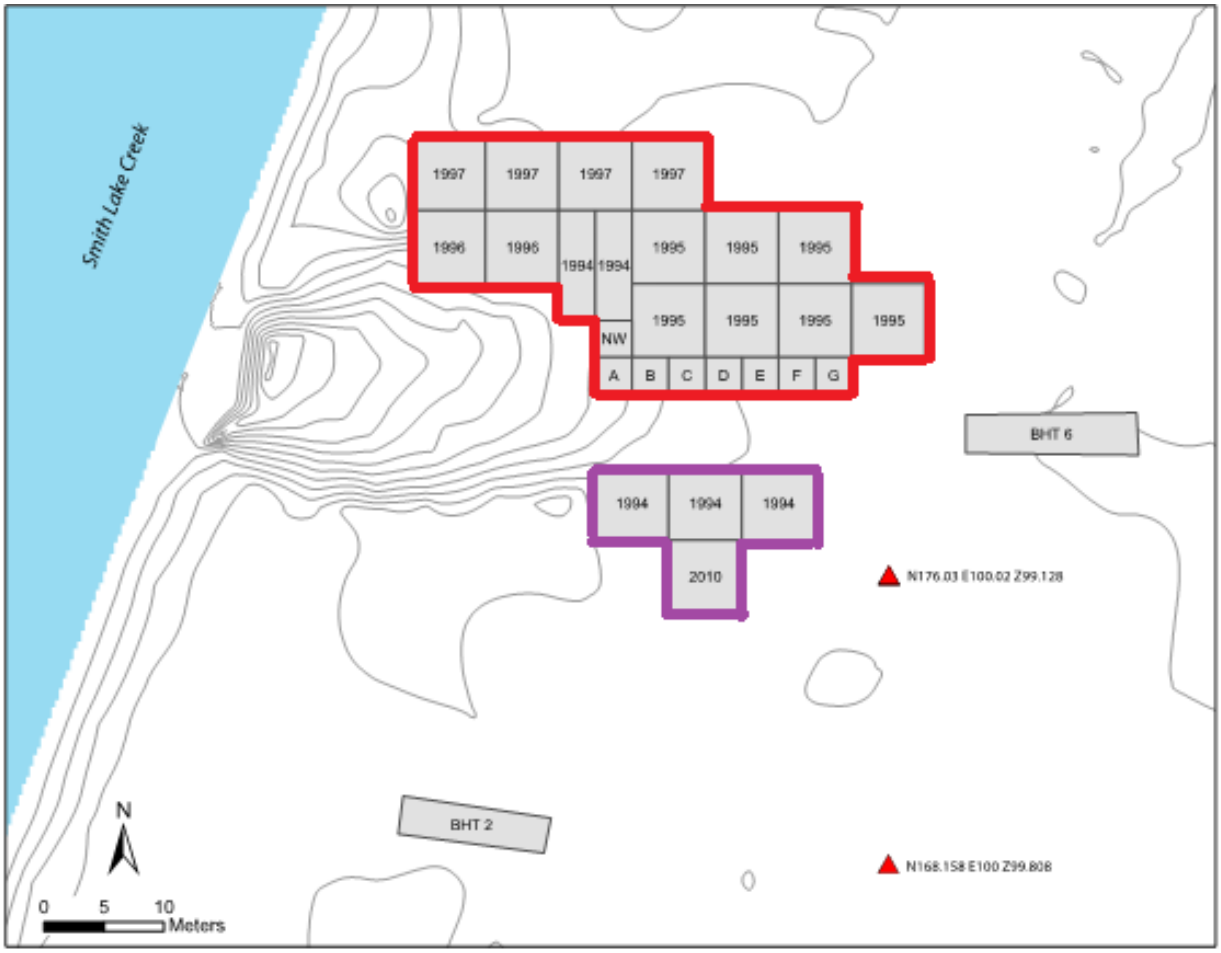


Figure 9. Site map distinguishing excavation methods. Units outlined in red were partially excavated by machinery. Units outlined in purple were hand excavated from top to bottom.

Excavation Plan

The 2010 excavation consisted of the excavation of one 2m-x-2m unit, subdivided into four equal 1m-x-1m quadrants (designated NW, SW, NE, SE) that were horizontally located by

the southwest corner grid coordinates of each 1m-x-1m unit. Vertical measurements were recorded relative to the site's actual vertical elevation, which coincidentally was 100 meters (USGS National Elevation Dataset). Data were recorded on level recording forms, piece plot logs, and specimen bags for each level or provenience identified within each 1x1m quadrant. This information included an assigned Field Specimen Inventory (FSI#) control number, horizontal (X-Y-Z) spatial dimensions of the level, the quadrant location, the Munsell color descriptions and the soil textures of the deposits, the nature and cause of any disturbances observed, the classes of cultural materials recovered, a sequentially numbered list of associated artifacts with their corresponding spatial grid coordinates, and the presence or absence of cultural or natural features.

Detailed field notes were kept describing each excavated level and all associated features, so that interpretation of the archaeological context would be possible at a later time. Each level was photographed upon completion and the photo information recorded in the project photo log.

All recovered materials were bagged according to unit, level, and elevation. Each level had an assigned "mother bag" (the bag containing all excavated material from that level), with additional mother bags used when the recovered material was more than could fit into a single bag; associated individual specimen bags for a specific level were identified with the same FSI control number. For this field season, all field specimen numbers began with the letters 'BP,' as in Big Pine Tree Site. For example, any materials collected from unit N152/E44, Level 5 would be assigned the FSI control number BPN152E44-5. Level mother bags, supplemental mother bags, artifact mother bags, and associated individual piece plot and specimen bags from a designated level were thus identified by site number, level, quadrant, FSI control number, corresponding (X-Y-Z) grid coordinates, as well as sequential artifact number (i.e. 1, 2, 3, etc.).

The official state trinomial (site number) for the Big Pine Tree site is 38AL143 and appears at the top of each mother bag and on every individual specimen bag. Lithic debitage that could not be determined to be a tool in the field was placed in the bulk mother bag. If more than one mother bag was required for a quadrant level, the bag was tagged "1 of 2," "2 of 2," "1 of 3,"etc., on the upper right hand corner of each bag. After closing out a unit level, the number of individual artifact (piece plot) bags contained in the artifact mother bags was recorded on the bag as well as in field notes. With the exception of different site and FSI numbers, this protocol is identical to the one currently in use at the Topper site (38AL23) (Goodyear et al. n.d.; Miller 2010). The excavators also used a recording form format consistent with the SEPAS Microsoft® Access Database, which is curated at the South Carolina Institute of Archaeology and Anthropology (Appendix D).

Plow Zone (PZ) Excavation

Plow zone removal was accomplished by troweling and with a shovel using a schnitt (shaving) technique in a single arbitrary manner beginning at the surface and extending to the end-depth of the O horizon (organic layer) following the natural slope of the site. While the general location for the 2010 test unit was selected by the project Principle Investigator, the exact location had to be determined through a series of procedures, including use of a total station and data from previous site maps, supplemented with geophysical techniques such as ground penetrating radar and magnetometry conducted by Stephen J. Yerka of the University of Tennessee Archaeological Research Laboratory. These procedures were used to find metal pins from the previous excavations. The area where the 2m-x-2m unit was to be placed was then prepared for excavation. The area was roped off, cleared of undergrowth, and photographed

before excavations began. The unit was then laid out with a total station. The humic zone was excavated as one 2x2 meter level and screened through 0.25" (quarter-inch) hardware mesh and the organics were separated and discarded. Piece plots were not taken of items located in the plow zone. Non-diagnostic cultural materials discovered in the plow zone were bagged in the level mother bag. Cultural items from the plow zone were sorted and group-bagged by specimen category (i.e. ceramics, glass, lithics, etc.) in the field. The category bags were placed inside the artifact mother bag. Both opening and closing elevations were recorded with a total station for this and all subsequent levels.

Sub-Plowzone Excavation

Levels 2 through 5 were excavated in 10 cm levels as a single 2m-x-2m unit. Levels 6 and 7 were excavated in 5 cm levels. This change in excavation method, designed to provide a finer grained sample of the midden deposits, unfortunately required more time than was expected. Consequently, the remainder of the unit (levels 8-12) was excavated in 10 cm levels. Each level below the plowzone was water-screened through 0.13 inch screen mesh to ensure recovery of smaller artifacts that would have been lost using 0.25 inch mesh. At elevations with little to no artifacts, shovel skimming was used to expedite the removal of sediments. Transition to trowel, bamboo pick, and brush excavation techniques were used where archaeological deposits with large numbers of artifacts or possible features were encountered.

Spatial positioning measurements (X-Y-Z coordinates) were calculated using a total station, with measurements recorded for each corner of every quad, as well as all piece plotted artifacts, which included unusual or diagnostic artifacts, and all those >4 cm in any one dimension, as described below. Strike and dip data measurements were recorded on artifacts with

a clearly definable long axis. Strike is the planar surface orientation of the artifact expressed as a compass bearing along the long axis using a baseplate compass. Dip is the angle of vertical tilt from the horizontal surface expressed in degrees of elevation using a handheld inclinometer. These measurements are important for understanding the integrity of the site by helping determine if water has rearranged the artifacts (strike) or sediment disturbances has vertically displaced artifacts (dip). Anderson and Schuldenrein (1985:400-403) calculated these values for a portion of the Early Archaic assemblage at Rucker's Bottom site, where many of the artifacts followed a "preferred" orientation. This was interpreted as an indication that the assemblage had been aligned and sorted as a result of water flowing over the site. Miller (2006, 2010) employed this methodology to test the vertical integrity of the Clovis hillside at the nearby Topper site (38AL23) based on the methodology of Bertran and Texier (1995) who analyzed nine European Paleolithic sites for potential postdepositional movement. Their analysis was based on the dip and strike of artifacts as well as from known natural events, such as "earth-slides, solifluction, debris flows, grain-flows, and avalanches" (Bertran and Texier 1995: 524). The sites tested by Bertran and Texier (1995:521-522) either had evidence of "human structures", or had a high probability of reworking by periglacial processes. Although a number of the sites in their sample did not have dip and strike recorded for artifacts, hand-drawn planview maps were used to ascertain strike (Bertran and Texier 1995:527). Miller (2010:38) used similar methods for his analysis, "by georeferencing the scanned images of the planview maps into ArcGIS 9.1. […] If no demonstrable long axis was evident, the artifact was excluded from the analysis." For the Big Pine Tree site, good planview maps were not available from the excavations conducted prior to 2010. As a result, only material from N175E94 was used for this type of analysis (see Chapter 4, below).

All artifacts approximately 4 cm (1.5 inch) in diameter and greater were pedestalled, mapped and photographed in-situ (or in-position when accidental displacement had occurred). This piece-plotting threshold, along with the inclusion of dip and strike measurements, allowed for examination of the integrity of each component. Each of these piece-plotted artifacts were assigned an individual specimen number (starting with the number 1) that ties that artifact back to a specific X-Y-Z grid location. With the beginning of each new level, the piece-plotted numbers started over with the number 1. Non-diagnostic artifacts smaller than 4 cm (1.5 inch) in diameter were removed with the rest of the soil matrix and screened and did not receive individual specimen numbers.

Sediment Sampling

Before the unit was closed at the end of the season, a reference column of sediment samples was removed for floatation and other specialized analyses from the northwest corner of the unit in each level in a 50 cm^2 area. These samples have been curated and remain available for analyses, such as soil particle size or flotation, where the light and heavy fractions could be used for ethnobotanical and the heavy fraction for microartifact analyses (Sherwood 2001). Charcoal samples that were found suitable for radiocarbon dating were wrapped in aluminum foil and placed in an open plastic bag. Plastic is a by-product of fossil fuels, which means that it contains carbon that can contaminate samples; therefore the foil creates a protective barrier against the carbon from the bag. Also, samples that remain damp can promote bacteria, fungi, and other living organisms that can introduce recent radiocarbon into samples. Consequently, the samples were dried before sealing.

Post excavation field artifact analysis

Preliminary analysis of recovered materials from the Big Pine Tree site was conducted at the field laboratory for the Topper Site. Non-diagnostic artifacts were poured through size-graded screens of 1inch, 0.5 inch, 0.25 inch, and 0.13 inch wire mesh *en masse*, and were subsequently sorted by raw material type then counted and weighed for each screen capture size. For levels that were not excavated in quadrants all materials were screened together. For levels that were excavated in quadrants (6-12), each quadrant was screened separately in this order: southwest, southeast, northwest, northeast. This was done consistently throughout the screening process in order to reduce the possibility that quadrants could accidentally be switched, adding a factor that could confound the analysis.

Non-diagnostic artifacts were quantified by number as well as aggregate weight in grams for each screen size. There were a total of 22,432 pieces of non-diagnostic artifacts separated in this manner. An additional 515 artifacts were piece-plotted. Upon closer examination of these piece plotted artifacts in the lab, 446 were determined to be non-diagnostic and included in the >1 inch screen size category, bringing the total number of nondiagnostic artifacts used in this study to 22,878. These artifacts were separated into the following categories: cortical chert flakes, chert flakes, quartz flakes, quartz pebbles, rhyolite, sandstone, sandstone concretions, steatite, charcoal, historic glass, quartz conglomerate, fire cracked rock, burnt rock, quartzite, granite, burnt material, soapstone, and orthoquartzite.

As previously stated, much of the archaeological material from the upper levels at Big Pine Tree was not collected in earlier excavations. Therefore, these units were not included in the analysis conducted here because it was not possible to look at changes in artifact or debitage patterns through time. This resulted in only having the three adjacent 2m-x-2m units available

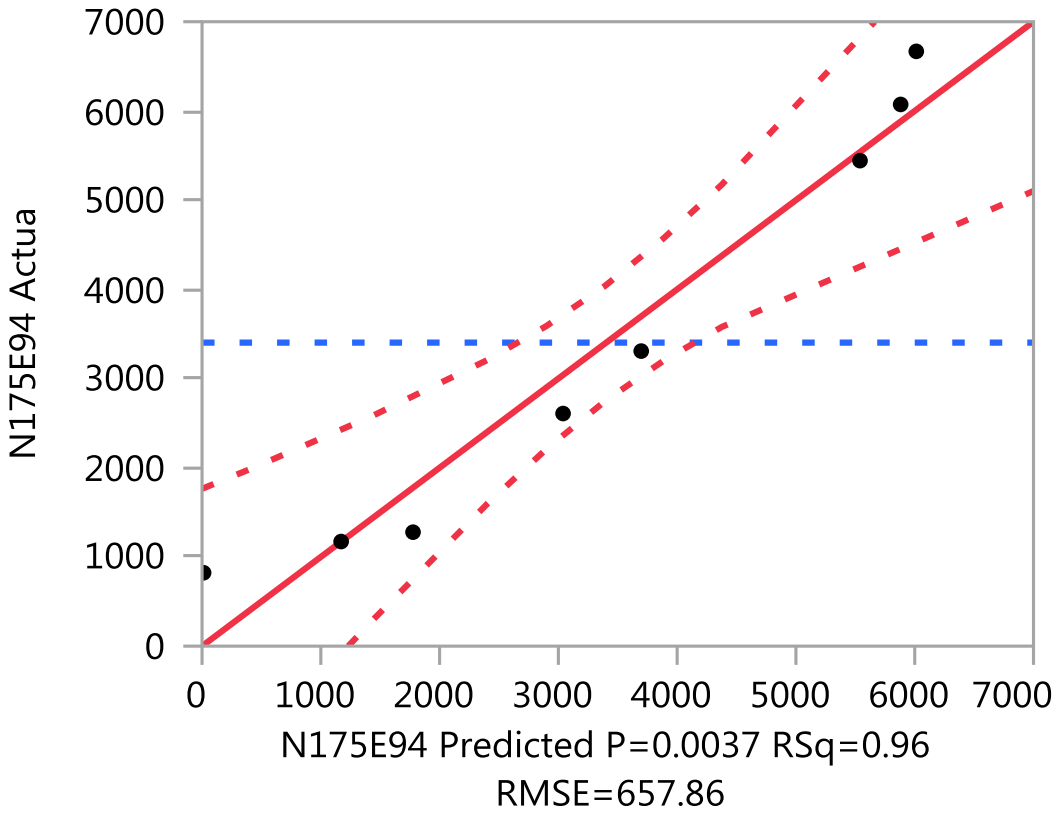
for the proposed analysis, although the collections from only one proved complete enough to examine. Two boxes of material from these three units could not be located in the storage facility at the South Carolina Institute of Archaeology and Anthropology (SCIAA), and there was no inventory of the contents of the missing boxes. After receiving what boxes were available (n=17) and sorting through as well as size grading their contents, it became apparent there was a significant amount of material missing from two units, N177E92 and N177E96. N177E92 is missing materials removed from 80-105 centimeters below surface, and N177E96 is missing materials removed from 60-105 centimeters below surface. Unfortunately, in both cases, the majority of this missing data consists of the "midden" levels. However, all material from N177E94 was complete, which was fortuitous because it was the unit directly north of the test unit dug in 2010, N175E94. As a result, the sample for this analysis comes from a 2m-by-4m trench.

Because different excavation strategies and recording technologies were used in the excavation of the two units (N177E94 was excavated in 1994), the data had to be calibrated. Fortunately, Douglas Sain, who was an employee of SCIAA at the time, had made these adjustments for all piece-plotted artifacts recovered from Big Pine Tree for his thesis on Clovis blade technology from the area (Sain 2012). Based on the calibrations provided by Sain, these units could be directly tied into a single continuous entity for analysis by correcting for a slight variation in datum elevation, 1.5 centimeters.

Chapter Four Results

The primary focus of this thesis is testing the hypothesis that hunter-gather groups in the early part of the Late Archaic occupied the Big Pine Tree site long enough to alter the landscape, creating the 30 centimeter band of dark brown soils. This will be tested using the models derived by Surovell (2009) and described in Chapter Two. Data for each of these tests will be presented in the following order: data from N175E94 will be presented first, then data from N177E94 (excavated in 1994), and finally data for these units combined. As previously stated, there are differences in excavation methodology and research strategies for each of these units. Consequently, two constraints on this data are noted. First, it can only be combined starting at Level 5 for N175E94 because excavation records begin with a 40-50cmbs level, which roughly aligns with the 2010 unit. Although this does not present a complete picture of the archaeological record at Big Pine Tree, it is, however representative of the time period that is the focus of this thesis. To determine this, artifact densities based on weights for additional units at Big Pine Tree were calculated and compared to N175E94 and Analysis of Variance (ANOVA) conducted. ANOVA tests help determine if means of multiple groups are equal. If the p-value of the ANOVA is higher than .05, the hypothesis that N175E94 is different than other units at Big Pine Tree is rejected. Additionally, a predictive model was created to show the similarities between observed artifact densities and what would be within the range for a unit comparable to the others in the analysis. Figure 10 shows the results of the ANOVA. The p-value is 0.0037 and the observed values are within the predicted range, indicating N175E94 is statistically similar to the other units at Big Pine Tree.

Actual by Predicted Plot



Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	3	37009595	12336532	28.5057
Error	4	1731099	43277.74	Prob > F
C. Total	7	38740694		0.0037*

Figure 10. Predictive model and ANOVA for N175E94. The X axis presents the predicted artifact densities and the Y-axis presents the actual artifact density.

Table 3 Artifact weights used for ANOVA comparison of N175E94. Data courtesy Albert C. Goodyear III.

	N177E92	N177E94	N177E96	N182E95	N182E99	N182E93	N182E97
70-80	5342.41	3821	2659.7	3738.4	x	4798	2773.9
80-90	5424	4195	2389.8	3390	936.6	2360.5	2595.4
90-100	5159.6	3603.8	1991.7	2209	1000.6	775.5	985.6
100-105	1812.8	1296.7	824.4	1564.4	444.2	854.2	580.8
105-110	2423.6	1653.5	1592.3	2400.7	1118.2	1653.8	403.8
110-115	6657.3	4097.4	1886.9	2285.5	1060.4	1608	791.7
115-120	8498.9	2102.6	4185.3	1079.3	736.3	1521.6	899.2
120-125	3376	1739.2	3780.7	574.1	462.1	736.2	818.7
125-130	879	994	1222.4	27.6	x	390.9	807.5
130-135	189.6	138.4	663.7	x	x	28.1	305

Artifact Densities

Artifact densities are calculated by dividing the total number of artifacts found in that level by the volume of an excavated level. Volume is determined by using the formula (length of the excavated area x width of the excavated area x depth excavated). The same numbers (2m x 2m x depth excavated) are utilized for each individual unit since they were both two meters^2, however when combined, the formula becomes 4m x 2m x depth excavated. Both diagnostic artifacts and debitage are included in this measurement. Levels 6 and 7 for N175E94 were excavated in 5-centimeter arbitrary levels while the remaining levels, besides that of the plow zone, were excavated in 10 centimeter levels. Human error led to some levels being dug deeper than intended, and some being dug shallower than intended, which is why the volumes for differing 10cm levels are not exactly comparable. Artifact densities for N175E94 and N177E94 are presented in Tables 3 and 4, respectively, and the combined densities are presented in Table 5.

Surovell (2009:102) stated, "all measures of mean *per capita* occupation span are correlated with artifact density." Therefore, more intensely occupied sites will have higher artifact densities than less intense occupations. The sample from Big Pine Tree is not large enough to differentiate between single and continuous occupations; however, occupation intensity can still be inferred. It is interesting to note that the Paleoindian and Early Archaic levels conform nicely to the expectations described by Surovell's model, having lower artifact densities than later time periods (i.e. less intensely utilized).

Levels 8 and 9, which comprise two-thirds of the midden, are the most intensely occupied based on artifact density. The remainder of the midden, the combined level 6 and 7, however is not as strongly occupied; in fact the density is less than 50% of either Level 8 or 9. This indicates that while it is likely that the majority of the dark-brown soils at Big Pine Tree have anthropogenic origins, there appears to be another origin for the uppermost portion of the stain, possibly an old stable ground surface. A larger sample size from Big Pine Tree may serve to answer these questions; however, as described in Chapters Two and Three, these data were not recovered in previous excavations.

Table 4. Artifact densities (artifacts per cubic meter) for N175E94.

Level	1 Inch	1/2 Inch	1/4 inch	Total	Level Volume	Artifact Density
1	29	8	4	41	0.76	53.94
2	37	25	89	151	0.36	419.44
3	31	57	184	272	0.48	566.67
4	2	7	67	76	0.36	211.11
5	27	88	657	772	0.4	1930
6/7	207	575	2036	2818	0.4	7045
8	235	1162	4302	5699	0.4	14247.5
9	191	1161	4362	5714	0.4	14285
10	125	579	2406	3110	0.4	7775
11	175	489	2185	2849	0.44	6475
12	20	109	857	986	0.44	2240.91
Total	1079	4260	17149	22488		

Table 5. Artifact densities (artifacts per cubic meter) for N177E94.

Cmbs	1 inch	1/2 inch	1/4 inch	Total	Level Volume	Density
40-50	1	21	121	143	0.4	357.5
50-60	2	152	490	644	0.4	1610
60-70	13	498	1660	2171	0.4	5427.5
70-80	46	927	2662	3635	0.4	9087.5
80-90	52	1111	2234	3397	0.4	8492.5
90-100	36	795	2544	3375	0.4	8437.5
100-110	37	523	2176	2736	0.4	6840
110-125	130	863	2490	3483	0.4	8707.5
125-135	43	243	631	917	0.4	2292.5
Total	360	5133	15008	20501		

Table 6. Combined artifact densities (artifacts per cubic meter) for the two units in this study.

Level	1 inch	1/2 inch	1/4 inch	Level Total	Level Volume	Density
5	29	257	1171	1457	0.96	1517.7
6/7	197	1029	1946	3606	0.8	4507.5
8	191	1856	6653	8700	0.8	10875
9	199	2591	5798	8588	0.8	10735
10	156	1091	4539	5786	0.8	7232.5
11	264	1083	4354	5701	0.84	6786.9
12	157	970	3358	4485	1.04	4312.5
13	43	243	631	917	0.4	2292.5
Total	1236	9120	28450	39240		

Surplus Raw Material

Surovell (2009:121) observed that the longer a site is occupied, surplus raw material should increase. Surplus materials are gathered in the event of a shortage of raw material, which should occur at sites occupied for an extensive period of time. This is one of the underlying factors for his "Rainy Day Model" as discussed in Chapter Two. It is possible, therefore, to model site occupation based on the overall size of artifacts, given that large artifacts should become less present at an extensively occupied site (Surovell 2009:123). It is important to reiterate, however, that extensively occupied sites do not necessarily imply long-term occupation: 100 hunter-gatherers occupying a site for 10 days will have the same occupation intensity as 10 hunter-gatherers occupying a site for 100 days (Surovell 2009:67-68). Because of differences in excavation and available data, this analysis is limited to artifact counts only. Surovell (2009:124-125) used this methodology for five Paleoindian sites in the Great Basin as well as a deeply stratified site in Australia that was continuously occupied for 10,000 years. Weights were available for the five Great Basin sites analyzed; although these data

strengthened his analysis, they did not change his conclusions. To test his model at a singular site through time, Surovell examined Puntatjarpa Rockshelter in Australia (Surovell 2009:92-94). This deeply stratified site were continuously occupied for over 10,000 years, and Surovell used paleoenvironmental data to successfully correlate lake levels with mobility. Although the assemblage records from Puntutjarpa Rockshelter did not have weights available, count-based analysis nevertheless were able to support the hypothesis that longer occupation spans had fewer large artifacts, and "lithic surplus is maintained to cushion against raw material shortfalls" (Surovell 2009:123). Figure 11 presents artifact counts by size grade, in the form of a ratio of small (under 1 inch) to large (greater than or equal to 1 inch) flakes, for the material from N175E94 and N177E94 at Big Pine Tree. With the exception of the combined levels 6&7, the midden levels have the largest amount of "lithic surplus" at the site.

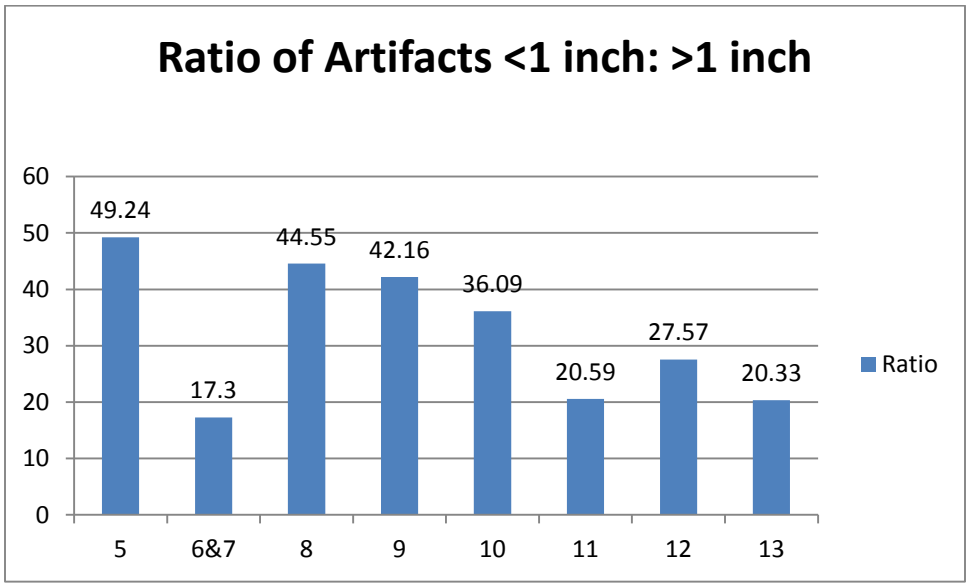


Figure 11. Histogram of Artifact Ratios. "Midden" occurs in levels 6-9.

Cortical Flakes

The amount of cortex present on a flake can be used to understand what stage of tool creation the knapper was working on (Johnson 1989; Morrow 1984; Stafford 1980). This is based on the idea that the cortex, being the outermost part of a rock, will be removed in the beginning of the tool making process (Andrefsky 2005). Mauldin and Amick (1989:70) have shown that the majority of cortex is removed from an objective piece halfway through the reduction process. This has implications for understanding past mobility strategies in that sites containing a larger amount of material with noncortical flakes are most likely long-term occupation sites because longer occupations allow for increased stockpiling of raw materials and a shift in technological focus from tool manufacture to maintenance (Surovell 2009:184-187).

Although excavations of the deepest occupation levels of the site have yielded the largest amount of debitage with attached cortex, this is to be expected with first populations exploiting the site. An interesting observation made in the field, as well as upon laboratory analysis is that all cortical flakes recovered are from Allendale chert. Table 6 and Figure 11 present the number of cortical and noncortical flakes from the combined units. The ratio of noncortical to cortical flakes indicates long-term usage of Big Pine Tree during the Late Archaic. For the midden levels (6-9), the ratio of noncortical chert flakes to cortical chert flakes indicates the most intense occupations at Big Pine Tree; this finding coincides with the previous analyses of these levels at the site (Bland 1995; McIntosh 2001). In fact, the highest ratio for these levels, in levels 6-7, is almost triple (28.53:1) that of the highest ratio for older occupations (10.66 for level 11). An important distinction can also be seen in these ratios; there is a clear separation of occupation intensity between the midden levels and older periods. The ratio for Level 9 is more than double that of Level 10 (17.39 to 8.03, respectively).

Table 7. Incidence of cortical and non-cortical chert flakes found per level for the combined unit.

LEVEL	NC chert	Cortical	Ratio NC:Cortical
6-7	4992	175	28.53
8	8077	308	26.22
9	7897	454	17.39
10	5507	686	8.03
11	4912	461	10.66
12	3565	659	5.41
13	782	79	9.90
Total	36467	2827	

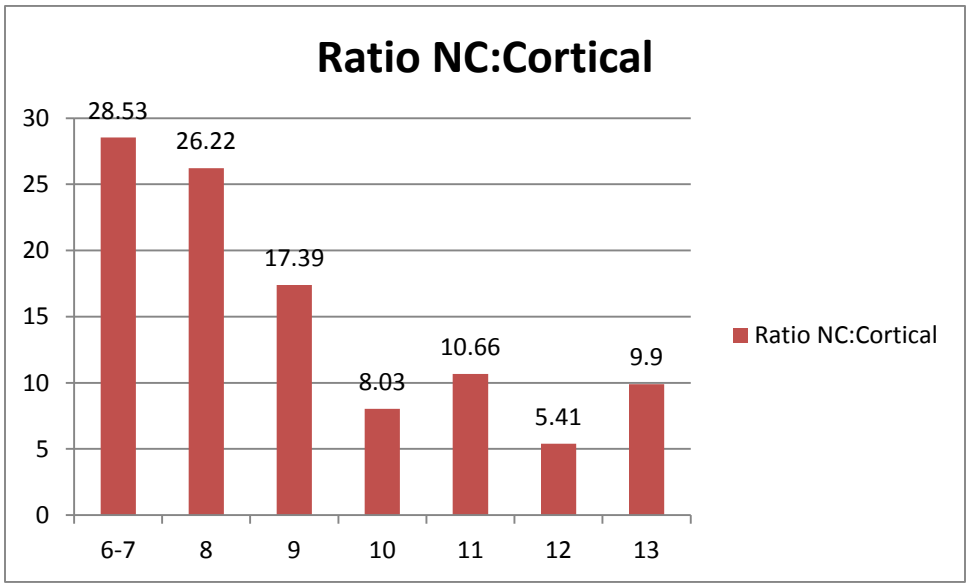


Figure 12. Ratio of Noncortical to cortical flakes

Local:nonlocal debitage

Raw materials exceeding a 20 km linear distance from a site are considered nonlocal because recent hunter-gatherers studies suggest that 20 km one-way foraging distances are extremely rare (Binford 2001:235-238). Ratios of local:nonlocal raw materials should provide proxy measures of the mean occupation span per site occupant (Surovell 2009:96). Surovell (2009:75-78) demonstrated that short-term occupations will have higher amounts of nonlocal raw material than long-term occupations; more time spent at a site results in more time to acquire local materials. Surovell cautioned, however that this model cannot be applied if there is not any nonlocal material is not found in the assemblage (Surovell 2009:82). Goodyear (2010 personal communication) stated there were three distinct types of raw material that could be found at the Big Pine Tree site: flow-banded rhyolite, steatite, and an unidentified type of metavolcanic stone. During excavation of N175E94, granite and rhyolite were recovered in small quantities in the midden levels. In the laboratory analysis conducted in 2011 of materials from N177E94, only two pieces of exotic materials were found, both contained in the 115-120 cmbs level. Goodyear (field notes 1994) observed that rhyolite was found in the 40-50 cmbs level; however, it could not be found in the boxes of materials for this unit. Because of the dearth of these material types, only combined nonlocal materials are presented (Table 7). The ratios of these types of materials compared to local raw materials are so small they are essentially uninformative, making any attempt at this type of analysis basically conjecture.

Table 8. Combined nonlocal raw materials (rhyolite) for the two units in this study. It is important to note that rhyolite was found primarily in the "midden" (levels 6-9).

Level	1 inch	1/2 inch	1/4 inch	Total
5	0	0	0	0
6-7	1	7	36	44
8	3	30	12	45
9	1	11	29	41
10	0	0	0	0
11	1	2	1	4
12	0	0	0	0
13	0	0	0	0
Total	6	50	78	130

Deposit Integrity

Site integrity at Big Pine Tree was determined by measuring the dip and strike of piece plotted artifacts for N175E94. Any item that was larger than four centimeters in any single direction was piece plotted and dip and strike measurements were recorded before the object was removed and bagged. Strike is used to measure the horizontal movement of artifacts. Any effects on archaeological material at the Big Pine Tree site are most likely related to flooding and changes in the river channel because of its proximity to the Savannah River and Smith's Lake Creek. Table 8 displays counts of the strike measurements for the piece-plotted artifacts from N175E94. Figures 12-18 display strike measurements in Rose diagrams. The most likely cause for non-random distribution of archaeological material is flooding of the Savannah River Valley (*sensu* Anderson and Schuldenrein 1985; see also Carter 1951and Dobher 2009 for flood patterns in the Savannah River Valley). McIntosh (2001:175) noted variability in the amount of riverine chert for the midden levels over time and inferred fluctuation in accessibility of this raw material. His observation is supported by the non-random distribution of artifact orientations in Levels 8

and 11, as the materials seem to have been subjected to environmental factors, namely winnowing causing the artifacts to be oriented in the same general direction.

Dip measures the vertical displacement of artifacts to indicate possible disturbance. Artifacts dropped on a flat surface should remain flat if they have not been disturbed after being deposited. Table 9 displays the dip of piece-plotted artifacts for N175E94. I follow methodology employed by Miller (2010:39) to test the statistical significance of these counts, using Pearson's Chi-square test with a theoretical even distribution, since a random discard pattern would provide an equal chance that an artifact would fall into any of the angle categories unless the surface was flat at the time of deposition. Goodness of fit values larger than 0.05 indicate random distribution (Table 10). Measurements of Dip and Strike for each piece-plotted artifact from N175E94 were entered into JMP Pro 11.1 by level and Chi-square tests were computed. These measurements can be found in Appendix C. Based on this test, measurements for dip show a clear bias in vertical orientation towards a flat (less than 30 degrees) angle. Therefore, it appears that the piece plotted artifacts are in close to a primary, undisturbed, vertical context. However, Levels 8 and 11 appear to have non-random distributions of strike, possibly indicating periods of inundation and water resorting. Figures 12-18 are rose diagrams showing Strike values in increments of 20 degrees East of North.

Table 9. Counts of strike measurements from N175E94 in 20-degree increments.

Degrees	0 -20	21-40	41-60	61-80	81-100	101-120	121-140	141-160	161-180	Total
Level 2	5	1	0	1	0	0	1	0	0	8
Level 3	0	2	1	0	2	1	2	2	0	10
Level 4	0	0	0	0	0	0	0	0	0	0
Level 5	0	1	2	0	0	0	0	2	0	5
Level 6-7	7	4	12	5	13	3	7	5	5	61
Level 8	22	9	7	14	10	5	11	11	4	93
Level 9	14	10	9	9	7	12	10	10	3	84
Level 10	5	4	6	7	6	5	8	7	3	51
Level 11	31	10	19	18	17	21	15	25	11	167
Level 12	4	3	0	1	3	4	0	4	0	19
Total	88	44	56	55	58	51	54	66	26	498
% Sample	18%	9%	11%	11%	12%	10%	11%	13%	5%	100%

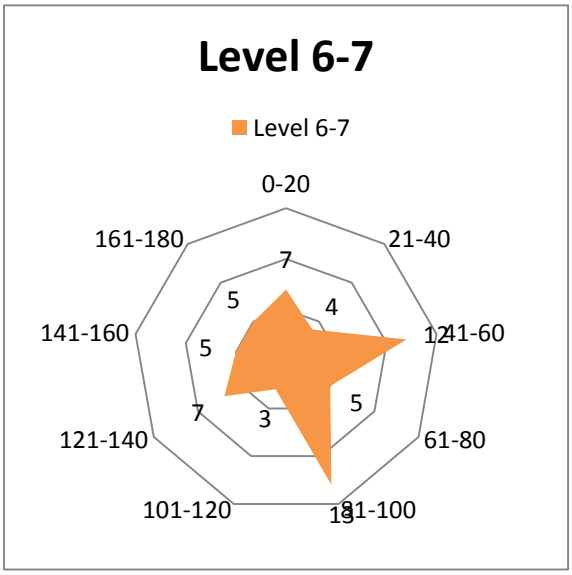


Figure 13. Rose diagram for strike for artifacts from Levels 6 and 7.

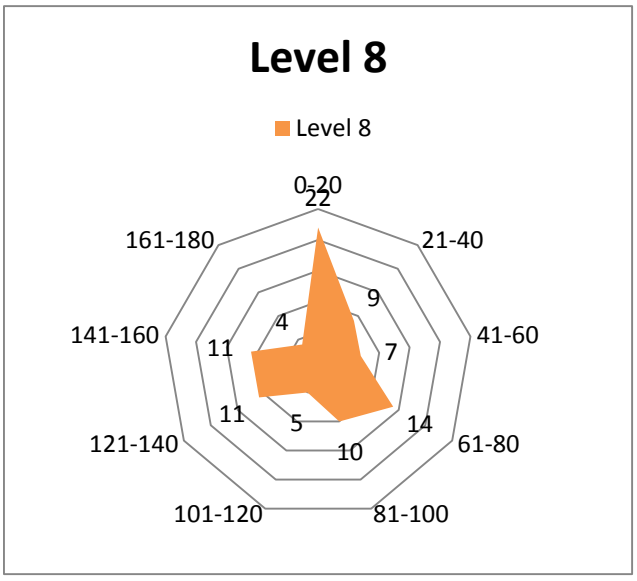


Figure 14. Rose diagram for strike for artifacts from Level 8.

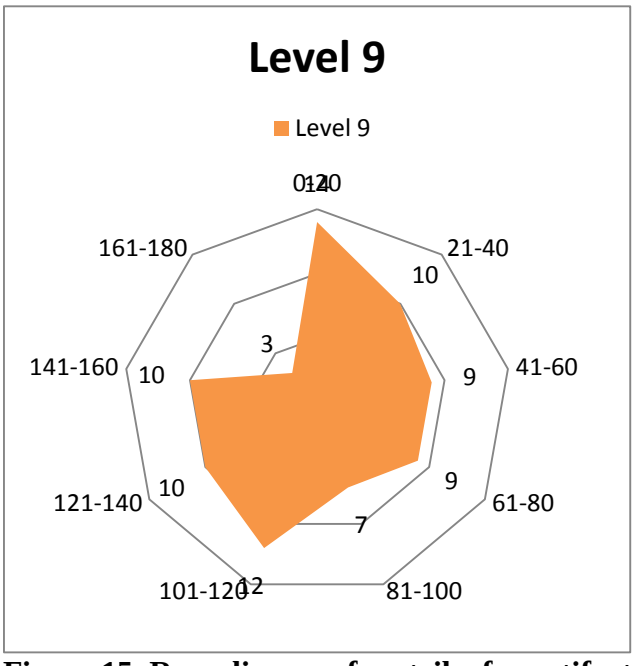


Figure 15. Rose diagram for strike for artifacts from Level 9.

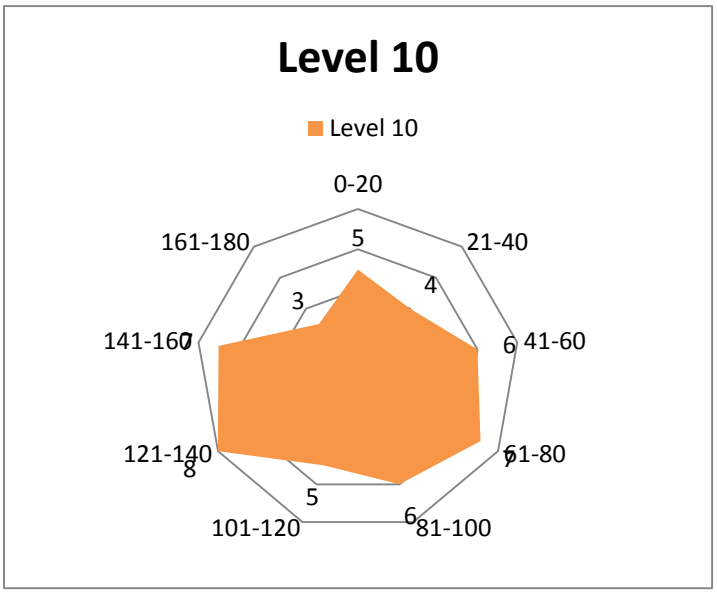


Figure 16. Rose diagram for strike for artifacts from Level 10.

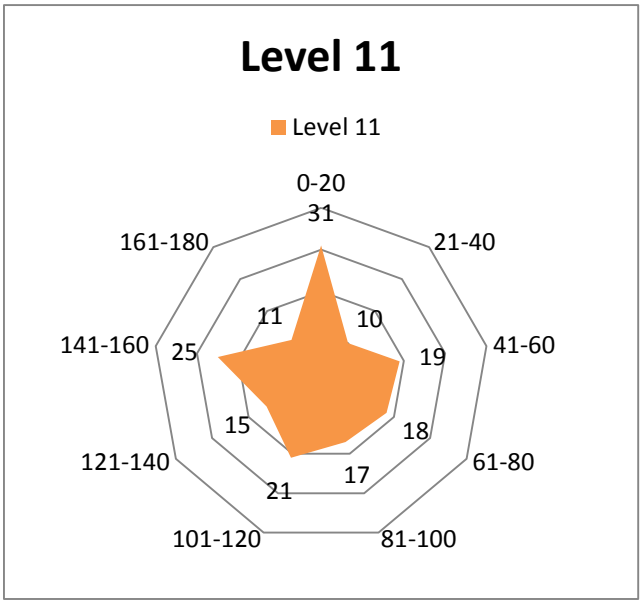


Figure 17. Rose diagram for strike for artifacts from Level 11.

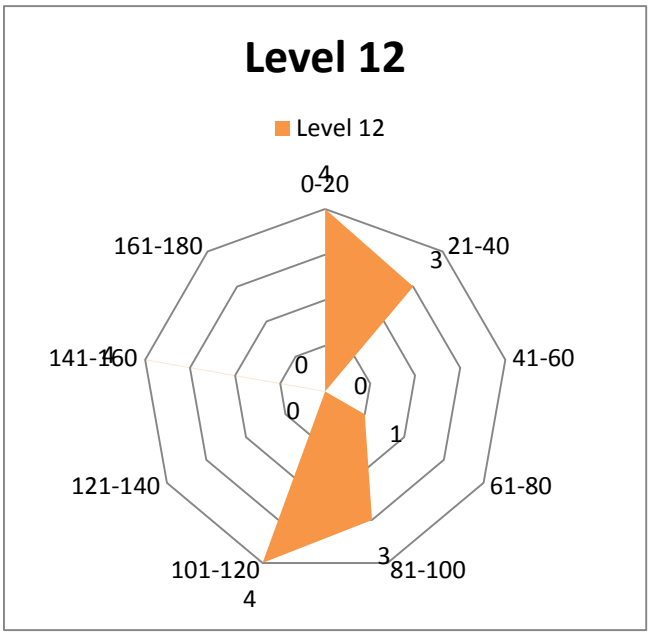


Figure 18. Rose diagram for strike for artifacts from Level 12.

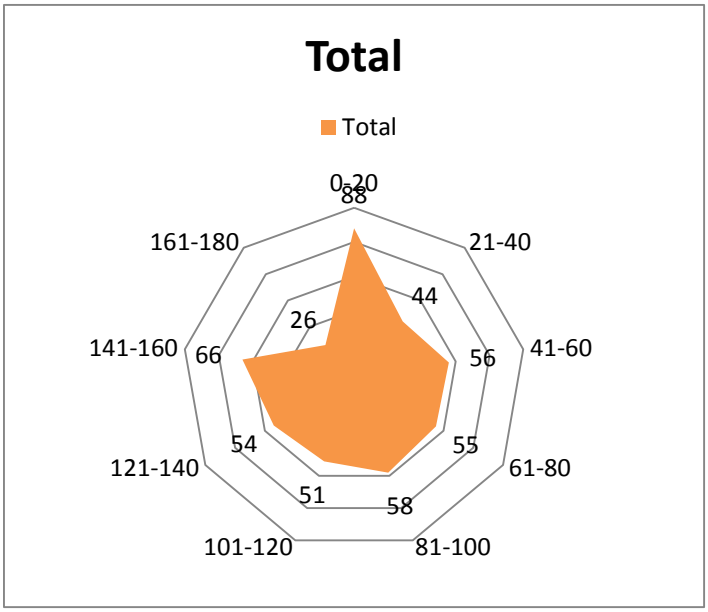


Figure 19. Rose diagram for strike for all artifacts.

Table 10. N175E94 piece plot vertical orientations by level. Lack of artifacts in the first five levels make Chi square tests suspect.

Degrees	0-10	11-20.	21-30	31-40	41-50	51-60	61-70	71-80	81-90	Total
Level 2	5	0	2	1	0	0	0	0	0	8
Level 3	4	0	1	1	4	0	0	0	0	10
Level 4	0	0	0	0	0	0	0	0	0	0
Level 5	0	0	1	1	1	1	0	1	0	5
Level 6-7	20	12	9	9	5	4	2	0	3	64
Level 8	36	19	15	5	8	5	2	1	3	94
Level 9	31	17	9	4	8	4	2	2	4	81
Level 10	15	6	9	9	4	2	3	0	3	51
Level 11	41	23	28	19	22	14	9	5	5	166
Level 12	3	4	2	0	5	4	0	1	0	19
Total	155	81	76	49	57	34	18	10	18	498
%	31%	16%	15%	10%	11%	7%	4%	2%	4%	100%

Table 11. Chi-squared Goodness of Fit for strike and dip by level for N175E94. Highlighted levels indicate non-random distribution. Table derived from JMP Pro 11.1.

Level	Goodness of Fit-Strike	Goodness of Fit-Dip
Level 6/7	0.081765416	6.85483E-07
Level 8	0.000603313	8.24E-17
Level 9	0.38116286	4.41E-10
Level 10	0.89918965	0.00033917
Level 11	0.01240265	2.43E-10
Level 12	0.09576515	0.050122055

Chapter Five Conclusion

The analyses presented in this thesis indicate intensive site usage at Big Pine Tree at the beginning of the Late Archaic period. In areas where an abundance of different types of resources (e.g., water, food, tool stone) converge, long term, extensively occupied sites should emerge (Surovell 2009:226). During the Late Archaic, the middle Savannah River Valley was rich in resources, leading to documented long term settlements, the oldest dated pottery in North America, and an apparent population explosion. As such, the Late Archaic usage at Big Pine Tree could have important implications on how the origins of sedentism in the region came about.

Since no structural features have been found at Big Pine Tree, a semi-sedentary or fully sedentary occupation of the site is not likely, although factors of preservation may be operating that mask such features and their recognition. To evaluate this possibility, artifact patterns from the Late Archaic occupation at Big Pine Tree were compared to those from other sites throughout the area. Five Late Archaic sites were chosen based on proximity to Big Pine Tree. Structures were inferred at three of these sites: G.S. Lewis East (38AK228) (Sassaman et al. 2002), Phinizy Swamp (9RI178) (Elliot et al. 1994)., and Lover's Lane Block B (9RI86) (Elliot et al. 1994). The Late Archaic component at G.S. Lewis East was interpreted as a seasonal occupation characterized by biface manufacture with highly curated ground stone artifacts (Sassaman 2001:145). Six possible households were inferred here (Sassaman 2001:156-166). Phinizy Swamp was interpreted as a possible long-term occupation based on artifact density with food processing floors and potential habitation areas inferred (Elliot et al. 1994:163-164). Lover's Lane Block B has definite post holes with Late Archaic five structures identified, as well as pottery and cooking technology (Elliot et al. 1994:355-369). The Pen Point site (39BR383)

(Sassaman 1985), where Allendale points were first described, is also included as well as 38BR34 (Sassaman et al. 1990), which is interpreted as a tool discard site.

Artifact densities for these sites were entered into JMP Pro and an ANOVA test was conducted. The results of this analysis are presented in Figure 19 and densities used presented in Table 11. Big Pine Tree is statistically different (p-value=.7885) than contemporaneous sites in the Middle Savannah River valley that have evidence of long term settlement. The two outliers on the regression plot are 38BR34 and Feature 361 at Lover's Lane, a discard area. In sum, it appears that while Big Pine Tree was extensively utilized throughout the Late Archaic, continuous long-term settlements with structures do not appear to have occurred at the site.

So how do we interpret these results? Bland (1995:89) explored four cultural features and determined the seasonality of site use as during the fall based on evidence for nut processing. Additionally, he placed Big Pine Tree within the aggregation-dispersal subsistence model put forth by Sassaman et al. (1990:312-315) as a dispersal period, limited activity extraction site. McIntosh (2001:175) examined whole flake data from three square meters to determine that the primary lithic activity at Big Pine Tree was biface reduction, which decreased over time, "related to a shift in technological focus from lithic tool manufacturing to ceramic production." Decreased access to the riverine chert outcrops over time was also inferred based on fewer flakes with riverine cortex, most likely related to sea level fluctuations (McIntosh 2001:175).

Summary

This thesis sought to determine if the "midden" layer at Big Pine Tree was indicative of a long term occupation at the site. Unfortunately, much of the data for this area from across the site was not recovered; however, statistical analyses determined that the sample recovered seems to

be representative of the site for the Paleoindian and Archaic times. The depositional integrity of the site was verified through an analysis of the vertical and horizontal displacement of artifacts through dip and strike of piece plotted artifacts. Artifact densities for the "midden" levels indicate much more intensive utilization of the site during the beginning of the Late Archaic. Raw material surplus also suggests the most extensive occupation at the site occurred during this time. Finally, high ratios of cortical:noncortical chert imply the longest occupation of Big Pine Tree occurred during the Late Archaic. An attempt to examine local:nonlocal debitage was made, however not enough nonlocal raw material was recovered to make this analysis informative. However, it is important to note that the majority of the nonlocal material was recovered from the "midden" levels

Through multiple lines of evidence--artifact densities, cortical:noncortical flake ratios, and artifact size ratios--it was determined that the "midden" layer is in fact the most intensely occupied time at Big Pine Tree. Using artifact densities, a proxy for occupation span was determined (Surovell 2009:101). The "Rainy Day Model" (Surovell 209:138) demonstrated longer occupations will have a greater excess of raw material than shorter occupations because a way to prevent shortage of raw material is to create a surplus over the duration of residency at the site. "Optimization of trash production" (Surovell 2009:179) indicated long term occupation since the debitage assemblage from longer-term occupations will largely consist of core reduction flakes because with a readily available surplus of raw material, instead of maintaining and resharpening old tools (Surovell 2009:183; 199-200). Finally, exotic artifacts should not have been a large portion of the assemblage (Surovell 2009:96) however the dearth of exotic material found in the study units made this test uninformative. These findings support the previous work at Big Pine Tree by providing auxiliary lines of evidence indicating a good fit

with the aggregation-dispersion model as stated by Bland (1995). Although it does not appear to have been utilized year round, it is quite likely that Big Pine Tree was an important place for local Late Archaic peoples to visit. In fact, the abundance of resources at the site attracts to this day.

Future work at Big Pine Tree should include more controlled, systematic unit excavation similar to N175E94. This will allow for a more comprehensive understanding of the upper deposits at the site. Additional units need to be excavated outside of the plowed area to examine the upper portion of the assemblage in an undisturbed context, i.e. unplowed. Microwear analysis should be conducted on the debitage from Big Pine Tree to help determine if in fact the deposits from Level 8 and Level 11 have in fact been sorted by water flow. The nearby Topper Site (38AL23) and Bubba Site should be examined with the models presented in this thesis to see how they relate to Big Pine Tree. Finally, more controlled dredging of Smith's Lake Creek should be conducted to recover more of the deposit that has eroded away so these artifacts are not lost.

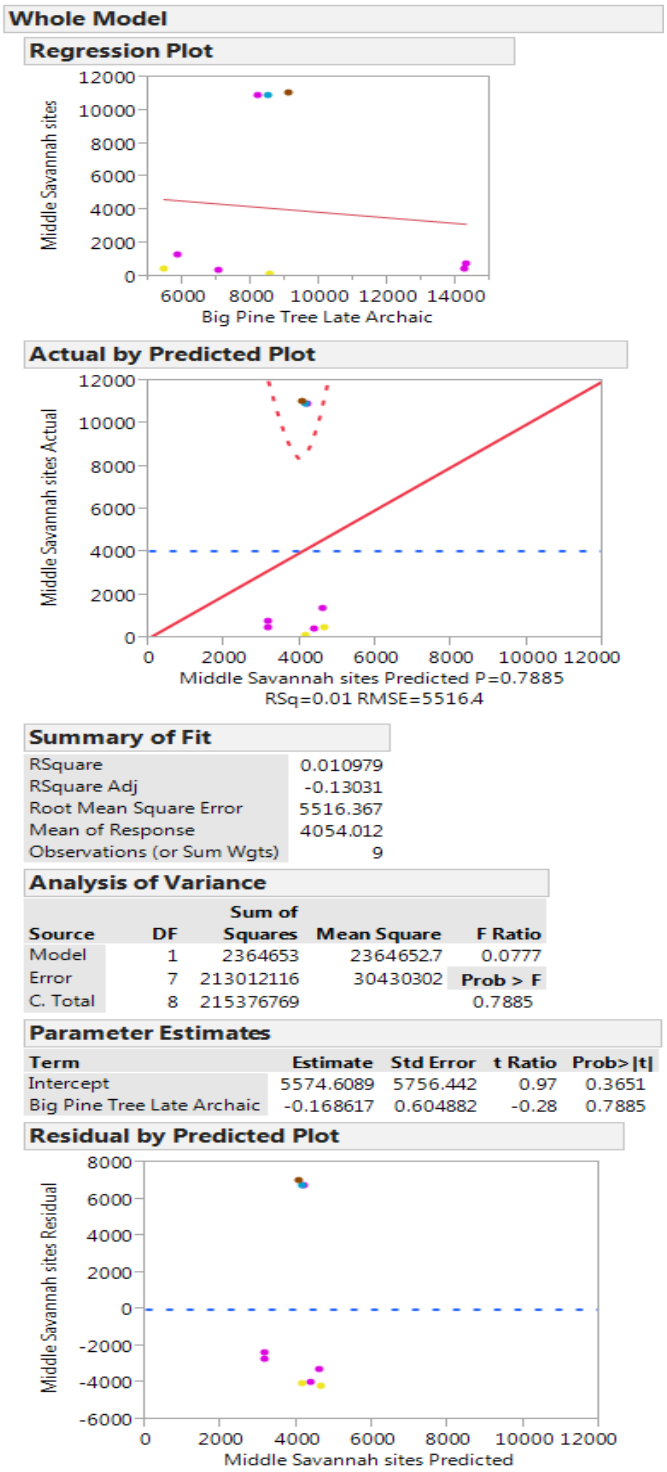


Figure 20. Artifact density ANOVA of Big Pine Tree and select contemporaneous sites. Pink dots represent Lover's Lane. Yellow dots represent G.S. Lewis East Block excavations. The brown dot represents Pen Point. The blue dot is a dump pit from Lover's Lane.

Table 12. Artifact densities used for ANOVA of Big Pine Tree Late Archaic and contemporaneous sites.

Big Pine	Lover's Lane	G.S. Lewis East	Phinizy Swamp	38BR34	Pen Point Feat 14	Pen Point Block
7045	393	120.45	31.5	11056	482	10908
14247.5	464		53.75			
14285	803.96		45.42			
5836	1351.36					
8205						
8535						
5428						
9088						
8493						

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Appendices

Appendix A: Debitage from N175E94

Level/Screen	Pottery	Chert Flake	Quartz Cobble	Quartz Flake	Quartz Pebble	Sand - stone	glass	Quart -zite	Char -coal	burn	Gra- nite	FC R	Rhy- olite
Level 1, 1”	3	16	4	0	0	0	0	0	0	0	0	0	0
Level 1, ½”	0	3	0	0	0	0	0	0	0	0	0	0	0
Level 1, ¼”	0	0	0	3	0	0	3	0	0	0	0	0	0
Level 1, 1/8”	0	5	0	0	0	0	0	0	0	0	0	0	0
Level 2, 1”	6	13	0	0	6	0	0	2	0	0	0	0	0
Level 2, ½”	5	13	0	0	7	0	0	0	0	0	0	0	0
Level 2, ¼”	2	72	0	0	15	0	0	0	0	0	0	0	0
Level 3, 1”	4	5	0	0	8	0	0	0	0	0	0	0	0
Level 3, ½”	4	20	0	0	26	6	0	0	0	0	0	0	0
Level 3, ¼”	15	12	0	94	37	10	0	0	14	0	0	0	0
Level 4, 1”	0	0	0	0	2	0	0	0	0	0	0	0	0
Level 4, ½”	0	4	0	0	3	0	0	0	0	0	0	0	0
Level 4, ¼”	18	32	0	18	0	1	0	0	0	18	0	0	0
Level 4, 1/8”	0	165	0	0	71	0	0	0	0	157	0	0	0
Level 5, 1”	0	21	0	0	1	0	0	0	0	0	0	0	0
Level 5, ½”	0	77	0	0	7	2	0	2	0	0	0	0	0
Level 5, ¼”	0	518	0	40	2	51	0	0	46	0	0	0	0
Level 6 SW 1”	0	22	0	0	0	2	0	0	0	0	1	0	0
Level 6 SW ½”	0	79	0	0	2	0	0	0	0	0	0	0	0
Level 6 SW ¼”	0	337	0	3	4	5	0	0	0	0	0	0	7
Level 6 SE 1”	0	37	0	0	0	0	0	0	0	0	0	0	0
Level 6 SE ½”	0	34	0	0	0	2	0	0	0	0	0	0	0
Level 6 SE ¼”	0	34	0	7	0	8	0	0	0	0	0	0	4

Level 6 NW 1”	0	12	0	0	0	0	0	0	0	0	0	0	0
Level 6 NW ½”	0	56	0	2	0	3	0	0	0	0	0	0	1
Level 6 NW ¼”	0	244	0	3	0	7	0	0	2	5	0	0	5
Level 6 NE 1”	0	7	0	0	0	0	0	0	0	0	0	0	0
Level 6 NE ½”	0	39	0	0	1	0	0	0	0	0	0	0	3
Level 6 NE ¼”	0	228	0	0	1	16	0	6	3	0	0	0	4
Level 7 SW 1”	0	18	0	0	2	2	0	0	0	0	0	0	0
Level 7 SW ½”	0	128	0	7	0	10	0	1	0	0	0	1	3
Level 7 SW ¼”	0	350	0	13	0	17	0	0	0	0	0	0	9
Level 7 SE 1”	0	17	0	0	1	0	0	0	0	0	0	0	0
Level 7 SE ½”	0	65	0	4	0	4	0	0	0	0	0	2	0
Level 7 SE ¼”	0	288	0	9	0	13	0	0	0	0	0	0	0
Level 7 NW 1”	0	10	0	0	0	1	0	0	0	0	0	0	0
Level 7 NW ½”	0	55	0	0	0	5	0	0	0	0	0	0	0
Level 7 NW ¼”	0	274	0	7	0	13	0	0	0	0	0	0	0
Level 7 NE 1”	0	8	0	0	0	2	0	0	0	0	0	0	0
Level 7 NE ½”	0	59	0	0	0	6	0	0	0	0	0	0	0
Level 7 NE ¼”	0	49	0	6	0	13	0	0	0	0	0	0	7
Level 8 SW 1”	0	27	0	0	0	0	0	0	0	0	0	0	0
Level 8 SW ½”	0	209	0	4	3	0	0	29	0	0	0	4	0
Level 8 SW ¼”	0	900	0	0	35	32	0	0	0	0	0	0	0
Level 8 SE 1”	0	18	0	0	6	11	0	0	0	0	0	0	0
Level 8 SE ½”	0	219	0	7	0	28	0	0	0	0	0	0	0
Level 8 SE ¼”	0	938	0	23	6	16	0	0	0	0	0	0	2
Level 8 NW 1”	0	4	0	0	0	5	0	1	0	0	0	0	0
Level 8 NW ½”	0	237	0	1	2	36	0	0	0	0	0	0	13
Level 8 NW ¼”	0	858	0	19	9	18	0	0	0	0	0	0	11
Level 8 NE 1”	0	20	0	0	0	26	0	0	0	0	0	0	3
Level 8 NE ½”	0	173	0	3	6	92	0	0	0	0	0	0	17
Level 8 NE ¼”	0	1199	0	43	0	76	0	0	4	0	0	0	0

Level 9 SW 1”	0	13	0	0	0	1	0	0	0	0	0	0	0
Level 9 SW ½”	0	245	0	5	6	15	0	0	0	0	0	0	11
Level 9 SW ¼”	0	1059	0	59	5	79	0	0	6	0	0	0	0
Level 9 SE 1”	0	23	0	0	0	8	0	0	0	0	0	0	0
Level 9 SE ½”	0	276	0	0	6	0	0	0	0	0	0	0	0
Level 9 SE ¼”	0	874	0	0	22	38	0	0	0	0	0	0	29
Level 9 NW 1”	0	14	0	0	1	6	0	0	0	0	0	0	0
Level 9 NW ½”	0	191	0	3	0	24	0	4	0	0	0	0	0
Level 9 NW ¼”	0	977	4	0	0	54	0	0	2	0	0	0	0
Level 9 NE 1”	0	5	0	1	0	14	0	0	0	0	0	0	1
Level 9 NE ½”	0	234	0	6	0	39	0	0	0	0	0	0	0
Level 9 NE ¼”	0	802	0	36	0	28	0	0	0	0	0	0	0
Level 10 SW 1”	0	18	0	0	0	0	0	0	0	0	0	0	0
Level 10 SW ½”	0	149	0	0	4	0	0	0	0	0	0	0	0
Level 10 SW ¼”	0	400	0	0	16	10	0	0	0	0	0	0	0
Level 10 SE 1”	0	7	0	0	0	0	0	0	0	0	0	0	0
Level 10 SE ½”	0	102	0	6	1	4	0	0	0	0	0	0	0
Level 10 SE ¼”	0	615	0	9	24	11	0	0	0	0	0	0	0
Level 10 NW 1”	0	9	0	0	2	0	0	0	0	0	0	0	0
Level 10 NW ½”	0	92	0	0	2	3	0	0	0	0	0	0	0
Level 10 NW ¼”	0	464	0	0	48	0	0	0	3	0	0	0	0
Level 10 NE 1”	0	5	0	0	0	0	0	0	0	0	0	0	0
Level 10 NE ½”	0	85	0	2	4	3	0	0	0	0	0	0	0
Level 10 NE ¼”	0	428	0	28	0	0	0	0	0	0	0	0	0
Level 11 SW 1”	0	0	0	0	0	0	0	0	0	0	0	0	0
Level 11 SW ½”	0	89	0	0	0	0	0	1	0	0	1	0	0
Level 11 SW ¼”	0	607	0	35	0	0	0	0	0	0	0	0	0
Level 11 SE 1”	0	0	0	0	0	0	0	0	0	0	0	0	0

Level 11 SE ½”	0	51	0	0	3	0	0	0	0	0	0	0	0
Level 11 SE ¼”	0	380	0	28	8	0	0	0	0	0	0	0	0
Level 11 NW 1”	0	0	0	0	0	0	0	0	0	0	0	0	0
Level 11 NW ½”	0	111	0	0	6	1	0	0	0	0	0	0	0
Level 11 NW ¼”	0	570	0	32	8	0	0	0	1	0	0	0	0
Level 11 NE 1”	0	2	0	0	0	0	0	0	0	0	0	0	0
Level 11 NE ½”	0	68	0	7	5	1	0	0	0	0	0	0	0
Level 11 NE ¼”	0	478	0	20	12	0	0	0	0	0	0	0	0
Level 12 SW ½”	0	19	0	1	0	0	0	0	0	0	0	0	0
Level 12 SW ¼”	0	177	0	24	0	0	0	0	0	0	0	0	0
Level 12 SE ½”	0	21	0	0	0	0	0	0	0	0	0	0	0
Level 12 SE ¼”	0	179	0	18	6	0	0	0	0	0	0	0	0
Level 12 NW ½”	0	0	0	0	0	0	0	0	0	0	0	0	0
Level 12 NW ¼”	0	0	0	11	4	0	0	0	0	0	0	0	0
Level 12 NE 1”	0	0	0	0	0	0	0	0	0	0	0	0	0
Level 12 NE ½”	0	25	0	0	0	2	0	0	0	0	0	0	0
Level 12 NE ¼”	0	257	0	36	0	0	0	0	0	0	0	0	0

Appendix B: Debitage from N177E94

Level/Screen	Quartz Pebbles	River Cortex	Interior Flakes	Burned Cortex	Upland Cortex	Rhyolite	Metavolacanic
40-50 CMBS 1 Inch	0	1	0	0	0	0	0
40-50 CBMS 1/2 Inch	3	0	18	0	0	0	0
40-50 CBMS 1/4 Inch	17	4	100	0	0	0	0
50-60 CBMS 1 Inch	0	2	0	0	0	0	0
50-60 CBMS 1/2 Inch	3	8	133	3	5	0	0
50-60 CBMS 1/4 Inch	15	16	442	17	0	0	0
60-70 CMBS 1 Inch	0	0	9	2	0	0	0
60-70 CBMS 1/2 Inch	16	22	402	21	37	0	0
60-70 CBMS 1/4 Inch	58	36	1471	28	67	0	0
70-80 CBMS 1 Inch	0	11	14	8	2	0	0
70- 80 CBMS 1/2 Inch	8	43	767	46	63	0	0
70- 80 CBMS 1/4 Inch	58	28	2435	55	86	0	0
80- 90 CBMS 1 Inch	1	3	22	11	4	0	0
80- 90 CBMS 1/2 Inch	25	39	976	51	20	0	0
80- 90 CBMS 1/4 Inch	83	49	1998	80	24	0	0
90- 100 CMBS 1 Inch	0	8	23	1	0	0	0
90- 100 CMBS 1/2 Inch	22	53	679	12	29	0	0
90- 100 CMBS 1/4 Inch	52	77	2374	12	29	0	0
100- 105 CMBS 1 Inch	0	7	5	0	0	0	0
100- 105 CMBS 1/2 Inch	6	40	220	0	0	0	0
100- 105 CMBS 1/4 Inch	35	48	1113	1	0	0	0
105- 110 CMBS 1 Inch	0	12	6	0	3	0	0
105- 110 CMBS 1/2 Inch	5	42	189	0	20	0	0
105- 110 CMBS 1/4 Inch	28	53	889	0	8	0	0
110- 115 CMBS 1 Inch	0	32	8	1	14	0	0
110- 115 CMBS 1/2 Inch	10	78	194	0	21	0	0
110- 115 CMBS 1/4 Inch	38	89	814	0	33	0	0
115- 120 CMBS 1 Inch	1	26	15	0	1	0	0
115- 120 CMBS 1/2 Inch	3	79	196	0	18	1	0
115- 120 CMBS 1/4 Inch	56	66	655	0	11	0	1
120- 125 CMBS 1 Inch	0	16	18	0	0	0	0
120-125 CMBS 1/2 Inch	4	54	205	0	0	0	0
120-125 CMBS 1/4 Inch	52	72	601	2	0	0	0
125- 130 CMBS 1 Inch	0	10	29	0	0	0	0
125- 130 CMBS 1/2 Inch	0	33	173	0	0	0	0
125- 130 CMBS 1/4 Inch	30	22	364	0	0	0	0

130- 135 CMBS 1 Inch	0	0	1	0	0	0	0
130- 135 CMBS 1/2 Inch	0	3	34	0	0	0	0
130- 135 CMBS 1/4 Inch	23	11	181	0	0	0	0

Appendix C: Diagnostic Artifact Piece-plots

Artifact Number	Artifact type	North	East	Elev.	cmbs
134	Allendale point	177.32	94.43	98.29	68
135	Allendale preform	177.38	94.45	98.28	69
139	Guilford point	177.33	95.02	98.2	77
140	Biface	178.6	95.77	98.17	80
142	Biface	177.71	95.13	98.2	77
143	Biface	178.48	95.18	98.22	75
144	Biface	178.85	94.56	98.2	77
145	Biface	178.32	95	98.18	79
146	Biface	177.33	95.69	98.21	76
147	Biface	177.94	94.68	98.18	79
149	Biface	177.85	95.66	98.16	81
150	Biface	177.09	95.18	98.16	81
151	Biface	179.15	94.4	98.2	77
152	Biface	179.15	94.1	98.24	73
159	Broken biface tip	177.65	95.5	98.11	86
160	Biface preform	177.15	95.62	98.07	90
161	Broken biface	178.36	95.13	98.06	89
162	Biface preform	178.07	95.13	98.07	90
163	Biface	179.17	95.13	98.16	81
164	Biface	179.18	95.78	98.14	83
165	Biface	179.14	94.29	98.07	90
166	Biface	179.2	94.38	98.08	89
167	Biface	179.03	94.48	98.08	89
169	Biface preform	178.05	94.26	98.05	92
170	TA Biface	178.61	95.17	98.04	93
171	Broken biface	178.54	94.19	98.02	95
172	Broken biface	178.45	94.11	98.04	93
176	Preform base	179.02	94.18	97.95	102
189	Biface	177.11	95.18	97.9	107
190	TA fluted biface	177.96	95.18	97.87	110
193	Taylor point	177.14	94.53	97.87	110
196	Biface-river cortex	177.6	94.12	97.83	114
203	Biface	178.44	94.36	97.815	115.5
205	Lanceolate preform	178.59	95.74	97.82	115
208	Biface core	177.65	95.69	97.85	112
211	Biface-retouch	177.68	95.16	97.84	113
215	Biface	178.03	94.72	97.78	119
217	Biface	178.72	94.43	97.79	118

220	Biface fragment	179.3	95.7	97.81	116
222	Biface	177.68	95.67	97.81	116
223	Biface	177.68	95.67	97.79	118
234	Biface preform frag	179.04	94.43	97.78	119
237	Biface tip-matches lanceolate	178.58	95.34	97.75	122
239	Bifacial core	177.78	95.78	97.76	121
253	Biface fragment	178.8	95.22	97.74	123
260	Biface fragment	179.05	95.41	97.72	125
273	Bifacial core	179.18	95.87	97.72	125
276	Biface fragment	179.12	95.47	97.72	125
278	Biface fragment	179.19	95.59	97.7	127
280	Biface-uniface polished edge	179.19	95.25	97.78	119
290	Biface fragment	178.54	95.92	97.7	127
291	Biface	178.13	95.7	97.69	128
293	Biface edge	178.57	95.76	97.7	127
FSI#	**Artifact type**	**North**	**East**	**Elev.**	
BPN175E94-02	Pottery (y)	176.69	94.71	98.71	
BPN175E94-02	Pottery (y)	176.34	95.17	98.71	
BPN175E94-02	Pottery (y)	176.18	95.73	98.7	
BPN175E94-02	Pottery (y)	176.18	95.67	98.7	
BPN175E94-02	Pottery (y)	175.33	95.13	98.71	
BPN175E94-02	Pottery (y)	175.5	94.68	98.72	
BPN175E94-02	biface (y)	175.07	95.04	98.72	
BPN175E94-03	biface (y)	175.18	95.39	98.6	
BPN175E94-03	TA biface (y)	175.58	94.99	98.65	
BPN175E94-03	TA biface frag (y)	175.8	95.29	98.65	
BPN175E94-03	Yadkin point (y)	176.72	95.28	98.67	
BPN175E94-03	woodland stemmed (y)	176.45	95.59	98.67	
BPN175E94-03	Pottery	175.16	95.17	98.63	
BPN175E94-05	Pottery (y)	175.77	95.25	98.51	
BPN175E94-07	MALA preform(y)	175.65	95.53	98.32	
BPN175E94-07	Allendale point (y)	175.33	95.24	98.3	
BPN175E94-08-85	TA biface frag	175.39	94.91	98.26	
BPN175E94-08-90	biface frag (y)	175.38	94.31	98.21	
BPN175E94-08-92	TA biface	175.2	94.39	98.23	
BPN175E94-08-93	TA biface (y)	175.18	94.36	98.24	
BPN175E94-09-7	TA biface tip (y)	176.4	94.47	98.2	
BPN175E94-09-22	TA biface frag (y)	175.83	95.64	98.19	
BPN175E94-09-25	TA biface (y)	175.6	95.25	98.11	

BPN175E94-09-30	TA biface frag (y)	175.43	95.99	98.16	
BPN175E94-09-33	biface frag (y)	175.36	95.19	98.13	
BPN175E94-09-56	TA Savannah River Stem	175.34	94.76	98.18	
BPN175E94-09-62	TA biface (y)	175.44	95.03	98.21	
BPN175E94-09-69	TA biface (y)	176.01	95.43	98.15	
BPN175E94-09-79	TA biface (y)	176.34	95.87	98.17	
BPN175E94-09-81	TA biface (y)	176.66	95.95	98.18	
BPN175E94-10-16	bifacial thinning flake	176.11	95.44	98.06	
BPN175E94-10-20	TA biface (y)	175.81	94.82	98.04	
BPN175E94-10-21	TA biface frag (y)	176.3	95.65	97.97	
BPN175E94-10-28	biface (y)	176.38	94.59	98.08	
BPN175E94-10-33	biface frag (y)	176.09	94.52	98.03	
BPN175E94-10-36	biface adze? (y)	176.2	94.16	98.04	
BPN175E94-10-42	TA biface (y)	175.65	95.25	98.11	
BPN175E94-10-47	paleo biface (y)	175.41	95.15	98.01	
BPN175E94-11-13	paleo biface	175.61	94.76	97.92	
BPN175E94-11-22	paleo blade fragment	175.86	94.15	97.91	
BPN175E94-11-27	paleo biface	175.99	94.38	97.91	
BPN175E94-11-28	paleo biface	175.96	94.45	97.94	
BPN175E94-11-31	paleo biface	175.86	94.7	97.92	
BPN175E94-11-40	paleo biface	175.88	95.02	97.95	
BPN175E94-11-44	paleo biface frag	176.07	95.57	97.92	
BPN175E94-11-58	paleo biface	176.7	95.16	97.92	
BPN175E94-11-67	sweet paleo biface	175.56	94.32	97.92	
BPN175E94-11-92	paleo biface (y)	175.44	95.17	97.92	
BPN175E94-11-96	paleo biface	175.14	95.82	97.9	
BPN175E94-11-97	overshot flake	175.24	95.54	97.89	
BPN175E94-11-111	paleo blade fragment	176.19	94.89	97.92	
BPN175E94-11-115	paleo biface/scraper	176.14	94.42	97.95	
BPN175E94-11-119	paleo biface	176.21	94.15	97.99	
BPN175E94-11-141	paleo biface	176.76	95.05	97.92	
BPN175E94-12-8	overshot flake	176.93	94.8	97.87	
BPN175E94-12-19	Paleo biface tip	175.61	95.95	97.82	

Appendix D: N175E94 Piece Plotted Artifact Location, Strike, and Dip

Material	Northing	Easting	Depth	Strike	Dip
biface	N175.178	E95.394	98.598	138	45
frag, thermally altered (TA)	N175.802	E95.285	98.661	228	10
frag, TA	N175.575	E94.987	98.648	322	5
pebble, quartz	N175.112	E95.075	98.663	122	0
pebble, quartz	N175.057	E95.258	98.672	90	35
pebble, quartz	N175.184	E94.193	98.696	210	45
pottery fragment	N175.91	E94.178	98.699	278	50
Yadkin projectile point	N176.72	E95.278	98.668	110	25
biface fragment	N176.445	E95.593	98.672	40	0
pottery fragment	N175.156	E95.166	98.629	150	45
pottery fragment	N175.768	E95.246	98.514	154	30
hammerstone	N176.345	E94.714	98.448	160	60
flake, tertiary	N176.665	E94.707	98.43	240	35
battered quartz cobble	N175.37	E94.884	98.452	32	75
cobble, quartz, battered	N175.594	E94.533	98.45	240	45
chunk, steatite	N175.085	E94.855	98.36	168	60
chunk, steatite	N175.209	E94.829	98.343	274	45
flake, tertiary, TA	N175.278	E94.799	98.383	222	15
flake, tertiary, TA	N175.274	E94.731	98.375	238	30
flake, tertiary, TA	N175.565	E94.426	98.373	172	10
flake, thinning	N175.644	E94.475	98.38	58	0
cobble, quartz, battered	N175.667	E94.509	98.366	310	30
chunk, sandstone	N175.512	E94.893	98.347	240	50
flake, tertiary	N175.932	E94.57	98.398	172	45
steatite	N175.965	E94.85	98.362	20	0
flake, tertiary	N176.202	E94.403	98.389	260	20
flake, cortical chert	N176.456	E94.238	98.368	250	0
fire cracked rock	N176.788	E94.33	98.375	332	10
flake, tertiary	N176.663	E94.813	98.403	150	0
flake, tertiary	N176.696	E95.974	98.385	30	20
flake, cortical chert	N176.613	E95.97	98.357	54	20
flake, tertiary	N175.727	E95.945	98.358	180	40
flake, tertiary, TA	N175.684	E94.158	98.393	340	20
flake, tertiary, TA	N175.756	E94.175	98.374	320	90
flake, tertiary, TA	N175.589	E94.433	98.366	312	20
shatter, chert	N176.252	E95.059	98.298	5	60
chert, river cobble	N176.141	E95.075	98.323	100	5
chert, cortical, river cobble	N176.195	E94.915	98.336	90	30
blade fragment	N176.03	E94.637	98.306	50	40

fragment, chert, TA	N176.805	E94.309	98.343	240	70
flake, tertiary	N176.22	E94.923	98.313	85	65
flake, tertiary	N175.815	E95.781	98.304	110	50
lithic?	N176.203	E94.931	98.3	90	40
lithic?	N175.817	E95.824	98.303	20	15
chunk, chert	N175.771	E96.004	98.304	70	10
flake, tertiary	N175.333	E95.991	98.325	140	30
flake, tertiary	N175.327	E95.646	98.312	80	5
biface preform flake	N175.651	E95.533	98.316	25	40
flake, cortical chert	N175.061	E95.487	98.332	60	35
cobble, chert	N175.261	E95.431	98.329	10	25
Allendale Projectile point	N175.334	E95.244	98.303	50	25
steatite	N175.376	E95.232	98.316	40	0
flake, tertiary	N175.251	E95.097	98.352	110	15
charcoal sample	N175.403	E95.285	98.32		
fragment, chert TA	N175.512	E95.513	98.339	100	5
flake, tertiary with charcoal	N176.294	E95.973	98.303	160	70
flake, tertiary	N176.544	E95.983	98.301	20	30
flake, cortical chert	N176.582	E95.893	98.291	10	60
chunk, cortical	N176.625	E95.621	98.294	20	5
flake, tertiary	N176.702	E95.367	98.319	160	5
flake, cortical chert	N176.848	E95.322	98.287	80	45
flake, tertiary	N175.974	E94.571	98.298	90	25
core	N175.749	E94.584	98.299	125	0
flake, tertiary	N175.736	E94.201	98.32	90	10
flake, retouched	N175.583	E94.283	98.329	140	25
flake, tertiary	N175.645	E94.757	98.319	170	35
flake, tertiary	N175.736	E94.863	98.318	105	50
cobble, quartz	N175.665	E94.865	98.309	50	20
flake, cortical chert	N175.644	E95.028	98.308	60	40
steatite	N175.512	E94.879	98.33	90	0
flake, tertiary	N175.238	E94.94	98.319	140	20
cobble, quartz	N175.12	E94.904	98.31	35	20
cobble, quartz	N175.172	E94.779	98.294	40	10
flake, tertiary	N175.225	E94.454	98.332	140	10
quartz/FCR	N175.076	E94.754	98.289	100	5
flake, tertiary	N175.073	E94.665	98.289	100	90
flake, tertiary	N175.249	E94.894	98.311	120	30
fragment, chert, TA	N176.9	E94.478	98.222	170	50
fire cracked rock	N176.67	E94.723	98.194	0	0
flake, cortical chert	N176.71	E95.049	98.254	0	30
flake, tertiary	N176.578	E94.873	98.21	110	10

fire cracked rock	N176.479	E94.776	98.196	140	20
fire cracked rock	N176.364	E95.012	98.274	70	10
biface, early stage	N176.381	E94.919	98.288	170	15
flake, tertiary	N176.277	E94.946	98.293	20	10
flake, tertiary	N176.313	E94.775	98.236	130	20
fire cracked rock	N176.169	E94.775	98.225	10	10
flake, cortical chert	N176.01	E94.697	98.213	30	5
flake, thermally altered	N176.357	E94.474	98.214	105	5
flake, thermally altered	N176.311	E94.806	98.197	160	30
fire cracked rock	N175.085	E95.145	98.212	10	0
fire cracked rock	N175.046	E95.517	98.284	100	10
biface	N175.152	E95.627	98.211	30	45
flake, tertiary	N175.295	E95.474	98.206	170	5
pebble, quartz	N175.254	E95.518	98.262	60	10
flake, tertiary	N175.3	E95.512	98.304	0	15
flake, tertiary	N175.326	E95.837	98.215	130	90
fire cracked rock	N175.404	E95.659	98.235	70	20
flake, tertiary	N175.596	E95.484	98.304	80	50
fire cracked rock	N175.658	E95.57	98.242	70	20
fire cracked rock	N175.454	E95.281	98.28	140	30
flake, tertiary	N175.526	E95.268	98.267	140	55
fire cracked rock	N175.606	E95.362	98.235	140	0
flake, tertiary	N175.778	E95.073	98.265	10	10
biface fragment	N175.78	E95.402	98.216	50	20
sandstone with mica	N175.826	E95.385	98.195	5	15
biface fragment	N175.964	E95.438	98.281	5	25
fire cracked rock	N175.947	E95.471	98.261	70	15
shatter, chert	N175.882	E95.533	98.264	10	0
flake, tertiary, TA	N175.797	E95.567	98.291	20	10
flake, tertiary	N175.878	E95.629	98.25	140	55
fire cracked rock	N175.876	E95.76	98.287	160	20
flake, tertiary	N175.773	E95.781	98.204	85	0
scraper possible, river cobble	N175.839	E95.908	98.258	160	40
flake, big	N175.953	E95.927	98.279	140	15
flake, tertiary	N175.93	E95.968	98.287	20	90
flake, tertiary	N175.87	E95.769	98.275	40	40
flake, tertiary	N175.841	E95.906	98.264	20	15
flake, tertiary	N176.029	E95.204	98.222	30	30
flake, tertiary	N175.997	E95.435	98.249	160	15
fire cracked rock	N176.004	E95.535	98.228	90	20
flake, tertiary	N176.079	E95.593	98.216	60	15
fire cracked rock	N176.002	E95.674	98.261	80	10

fire cracked rock	N176.055	E95.887	98.299	60	60
chopper	N176.028	E95.842	98.257	55	0
flake, tertiary	N176.125	E95.869	98.264	10	40
fire cracked rock	N176.163	E95.718	98.257	110	5
flake, tertiary	N176.192	E95.689	98.264	45	65
quartz, battered	N176.184	E95.898	98.264	80	20
flake, tertiary	N176.305	E95.743	98.254	20	30
flake, tertiary	N176.38	E96.002	98.244	130	90
flake, tertiary	N176.395	E95.983	98.24	120	50
flake, tertiary	N176.445	E95.962	98.263	90	0
flake, tertiary	N176.581	E95.891	98.187	100	30
fire cracked rock	N176.551	E95.85	98.207	20	50
fire cracked rock	N176.703	E95.853	98.204	130	30
fire cracked rock	N176.396	E95.607	98.21	160	0
flake	N176.309	E95.45	98.255	40	45
flake, tertiary	N176.223	E95.407	98.269	80	10
fire cracked rock	N176.299	E95.364	98.278	160	10
flake, cortical chert	N176.365	E95.313	98.269	80	0
fire cracked rock	N176.28	E95.28	98.265	10	20
fire cracked rock	N176.226	E95.257	98.272	40	5
fire cracked rock	N176.201	E95.098	98.181	n/a	0
fire cracked rock	N176.33	E95.144	98.202	90	25
flake, tertiary	N176.619	E95.586	98.289	100	10
flake, tertiary	N176.736	E95.507	98.205	20	10
biface	N176.742	E95.241	98.286	90	20
fire cracked rock	N176.875	E95.077	98.242	20	30
flake, tertiary	N176.937	E95.09	98.302	20	0
fire cracked rock	N176.369	E95.551	98.246	10	60
fire cracked rock	N176.245	E95.37	98.249	70	50
fire cracked rock	N176.305	E95.428	98.247	140	25
flake, tertiary	N176.318	E95.494	98.226	10	15
fire cracked rock	N176.037	E95.567	98.223	90	5
flake, tertiary	N176.037	E95.919	98.208	170	5
fire cracked rock	N176.142	E95.988	98.296	160	10
flake, tertiary	N175.947	E94.798	98.241	170	60
flake, tertiary	N175.899	E94.84	98.219	40	25
flake, tertiary	N175.782	E94.453	98.276	60	25
biface fragment	N175.389	E94.908	98.256	70	10
fire cracked rock	N175.459	E94.719	98.263	100	5
flake, tertiary	N175.38	E94.748	98.235	160	70
fire cracked rock	N175.368	E94.476	98.241	50	35
fire cracked rock	N175.334	E94.488	98.242	95	25
biface fragment	N175.424	E94.33	98.207	40	50

fire cracked rock	N175.382	E94.311	98.214	160	20
biface fragment	N175.196	E94.389	98.227	70	30
biface fragment	N175.183	E94.355	98.244	160	0
flake, tertiary, thinning	N175.144	E94.234	98.244	120	80
core tab	N176.152	E94.522	98.176	160	0
flake, tertiary	N176.082	E94.543	98.118	40	60
flake, tertiary	N176.077	E94.485	98.108	60	90
flake, tertiary	N176.059	E94.333	98.11	120	70
flake, tertiary	N176.186	E94.343	98.16	70	20
flake, tertiary	N176.309	E94.24	98.132	120	20
Distal TA biface fragment,	N176.399	E94.473	98.197	90	10
flake, cortical chert	N176.456	E94.681	98.194	110	15
flake, tertiary	N176.623	E94.312	98.185	90	15
fire cracked rock	N176.518	E94.756	98.194	20	0
fire cracked rock	N176.603	E94.701	98.194	150	25
flake, tertiary	N176.639	E94.747	98.185	20	10
fire cracked rock	N176.702	E94.869	98.185	160	15
fire cracked rock	N176.826	E94.657	98.205	160	5
fire cracked rock	N176.862	E94.879	98.164	20	50
fire cracked rock	N176.788	E94.979	98.193	40	0
fire cracked rock	N176.381	E94.207	98.11	110	15
flake fragment	N176.571	E94.682	98.146	40	40
fire cracked rock	N176.919	E94.587	98.168	10	20
fire cracked rock	N176.929	E94.649	98.175	30	5
fire cracked rock	N176.88	E94.647	98.168	150	20
biface fragment	N175.832	E95.638	98.188	110	25
flake, tertiary	N175.681	E95.713	98.198	40	0
flake, tertiary	N175.628	E95.571	98.16	110	20
biface fragment	N175.603	E95.253	98.112	5	15
flake, tertiary	N175.462	E95.252	98.178	130	20
flake, secondary	N175.346	E95.734	98.127	140	0
flake, tertiary	N175.235	E95.801	98.153	170	25
shatter	N175.48	E95.988	98.152	60	25
biface fragment	N175.428	E95.992	98.16	50	20
flake, tertiary	N175.429	E96	98.161	70	10
flake, tertiary	N175.333	E95.278	98.132	130	50
biface fragment	N175.362	E95.191	98.134	160	80
flake, tertiary	N175.355	E95.157	98.147	160	10
flake, tertiary	N175.293	E95.129	98.167	90	15
flake, tertiary	N175.221	E95.149	98.184	140	45
flake, tertiary	N175.193	E95.178	98.207	50	10
fire cracked rock	N175.146	E95.201	98.204	110	0

shatter	N175.143	E95.253	98.173	20	10
flake, tertiary	N175.15	E95.309	98.122	15	75
flake, tertiary	N175.128	E95.839	98.149	10	10
shatter	N175.137	E95.202	98.185	210	5
fire cracked rock	N175.124	E95.291	98.122	242	50
flake, secondary	N175.182	E95.147	98.177	340	90
flake, tertiary	N175.32	E95.167	98.126	250	20
flake, tertiary, trimming	N175.954	E94.645	98.107	60	40
flake, tertiary	N175.816	E94.747	98.183	60	35
flake, tertiary	N175.772	E94.543	98.194	140	5
cobble, quartz	N175.707	E94.645	98.173	80	0
flake, secondary	N175.59	E94.488	98.19	160	15
flake, tertiary	N175.199	E94.246	98.172	90	0
flake, tertiary	N175.071	E94.745	98.213	170	5
flake, tertiary	N175.136	E94.712	98.192	100	10
flake, tertiary	N175.163	E94.948	98.177	120	25
shatter	N175.161	E94.928	98.149	110	30
biface	N175.338	E94.758	98.18	120	0
flake, tertiary	N175.312	E94.972	98.14	140	55
flake, tertiary	N175.359	E95.053	98.16	80	85
flake, tertiary	N175.395	E95.018	98.127	50	10
flake, tertiary	N175.453	E94.955	98.216	170	20
flake, tertiary	N175.339	E94.692	98.127	30	5
biface	N175.441	E95.031	98.205	40	25
flake, tertiary	N175.551	E95.058	98.169	40	5
flake, tertiary	N175.63	E94.935	98.21	70	25
flake, tertiary	N175.674	E94.605	98.103	70	60
fire cracked rock	N175.821	E94.997	98.166	130	35
fire cracked rock	N175.723	E95.144	98.158	110	5
flake, tertiary	N175.977	E95.178	98.154	140	45
biface	N176.006	E95.431	98.151	0	0
fire cracked rock	N176.087	E95.311	98.187	140	30
flake, tertiary	N176.136	E95.294	98.153	120	45
core	N176.272	E95.225	98.123	75	45
fire cracked rock	N176.345	E95.202	98.176	160	10
fire cracked rock	N176.556	E95.117	98.192	60	0
flake, tertiary	N176.609	E95.308	98.116	5	70
fire cracked rock	N176.715	E95.343	98.197	100	10
flake, tertiary	N176.797	E95.306	98.207	60	0
flake, tertiary	N176.106	E95.922	98.142	20	60
biface	N176.338	E95.87	98.171	40	45
flake, tertiary	N176.46	E95.777	98.136	5	0

biface	N176.663	E95.954	98.179	90	10
flake, tertiary	N176.917	E95.838	98.167	10	45
flake, tertiary	N176.922	E95.845	98.168	320	90
flake, primary	N175.957	E94.883	98.022	70	10
biface	N175.8	E94.833	98.072	140	20
core fragment	N175.722	E94.958	98.055	100	30
flake, tertiary	N175.808	E94.253	98.041	170	60
flake, tertiary	N175.515	E94.172	98.07	30	40
flake, tertiary	N175.564	E94.749	98.009	40	35
flake, tertiary	N175.49	E94.816	98.062	20	10
flake, biface thinning	N175.48	E95.004	98.067	15	50
flake, tertiary	N175.491	E94.966	98.013	50	65
flake, primary	N175.363	E94.733	98.044	20	5
flake, tertiary	N175.201	E94.475	97.996	50	10
flake, tertiary	N175.154	E94.47	97.995	70	5
flake, tertiary	N175.264	E94.998	98.066	150	60
fire cracked rock	N176.883	E95.295	98.054	90	45
flake, tertiary	N176.125	E95.146	97.985	50	25
flake, tertiary	N176.105	E95.439	98.058	40	15
flake, tertiary	N176.416	E95.465	98.077	40	30
flake, tertiary	N176.41	E95.547	98.074	160	0
flake, tertiary	N176.469	E95.571	98.064	140	70
biface	N175.812	E94.821	98.036	150	15
biface fragment	N176.304	E95.646	97.974	0	90
flake, tertiary	N176.796	E94.788	98.026	60	40
biface fragment	N176.734	E94.418	97.986	70	5
flake, tertiary	N176.705	E94.375	97.989	30	30
flake, tertiary	N176.701	E94.278	97.984	140	0
cobble, quartz	N176.777	E94.162	98.096	0	0
flake, secondary	N176.564	E94.414	97.983	130	30
biface	N176.375	E94.59	98.075	90	10
flake, tertiary	N176.36	E94.323	97.992	160	30
flake, primary	N176.235	E94.424	97.962	120	30
flake, tertiary	N176.094	E94.752	98.033	60	45
flake, tertiary	N176.036	E94.605	98.003	70	10
biface fragment	N176.092	E94.516	98.027	140	70
flake, tertiary	N176.076	E94.508	98.042	120	90
flake, tertiary	N176.169	E94.236	98.05	150	30
biface	N176.2	E94.163	98.04	60	10
flake, tertiary	N176.027	E94.182	98.043	120	90
flake, tertiary	N175.887	E95.84	98.056	160	0
flake, modified	N175.968	E95.687	98.001	100	10

flake, tertiary	N176.002	E95.554	98.1	130	15
flake, tertiary	N175.86	E95.51	97.977	100	40
flake, tertiary	N175.654	E95.246	98.105	170	40
flake, secondary	N175.76	E95.189	98.094	10	0
flake, primary, river cobble	N175.574	E95.125	97.977	130	15
flake, tertiary	N175.486	E95.101	98.072	80	20
flake, tertiary	N175.491	E95.122	98.063	150	40
biface	N175.411	E95.152	98.006	100	40
flake, secondary	N175.153	E95.082	98.005	110	40
flake, tertiary	N175.133	E95.304	98.081	80	10
flake, secondary	N175.219	E95.819	98.03	170	40
flake, tertiary	N175.372	E95.811	98.051	110	25
flake, tertiary	N175.318	E95.884	97.976	80	30
core, river cobble	N175.214	E95.073	97.912	120	35
flake, primary	N175.249	E94.986	97.925	20	25
flake, tertiary, modified	N175.309	E94.829	97.947	5	30
flake, primary	N175.158	E94.839	97.876	20	35
flake, tertiary	N175.271	E94.792	97.887	160	80
flake, modified	N175.231	E94.761	97.901	170	40
flake, tertiary	N175.152	E94.713	97.96	170	50
flake, primary	N175.021	E94.802	97.971	20	35
flake, tertiary	N175.224	E94.636	97.93	100	90
flake, secondary	N175.126	E94.6	97.924	160	40
blade??	N175.354	E94.547	97.896	160	10
core	N175.554	E95.019	97.94	120	30
biface	N175.608	E94.756	97.923	30	45
flake, primary	N175.691	E94.735	97.927	120	50
flake, secondary	N175.561	E94.667	97.921	20	55
flake, tertiary	N175.629	E94.626	97.921	155	15
flake, tertiary, modified	N175.349	E94.267	97.897	120	5
flake, secondary	N175.477	E94.382	97.918	140	0
flake, primary	N175.635	E94.261	97.94	160	40
abrader??	N175.52	E94.17	97.934	130	0
flake, secondary	N175.564	E94.185	97.898	120	75
blade	N175.856	E94.151	97.908	170	20
flake, secondary	N175.908	E94.205	97.917	170	35
flake, tertiary	N175.902	E94.254	97.91	80	50
flake, tertiary	N175.951	E94.285	97.915	130	50
flake, primary	N175.923	E94.396	97.912	160	35
biface	N175.99	E94.384	97.91	75	55
biface	N175.958	E94.446	97.935	70	10
flake, tertiary	N175.828	E94.561	97.915	20	40
flake, tertiary	N175.662	E94.56	97.884	20	70

biface	N175.859	E94.702	97.916	70	20
flake, tertiary	N175.968	E94.645	97.901	170	70
flake, secondary	N175.905	E94.714	97.948	70	5
flake, tertiary	N175.853	E94.751	97.944	140	10
flake, tertiary	N175.797	E94.774	97.858	160	2
core tab	N175.812	E94.844	97.934	110	25
flake, primary	N175.837	E94.894	97.943	160	5
flake, tertiary	N175.924	E94.893	97.938	110	30
flake, tertiary	N175.986	E94.878	97.935	120	30
biface	N175.883	E95.015	97.941	50	10
flake, tertiary	N176.153	E95.112	97.936	170	5
flake, tertiary	N176.101	E95.316	97.94	120	50
flake, tertiary	N176.162	E95.383	97.92	160	25
biface fragment	N176.073	E95.57	97.919	140	15
flake, tertiary	N176.182	E95.551	97.938	110	40
flake, secondary	N176.158	E95.634	97.872	150	10
flake, primary	N176.285	E95.926	97.894	80	5
flake, primary	N176.337	E95.916	97.936	100	30
core	N176.392	E95.673	97.892	70	30
flake, primary	N176.333	E95.578	97.929	60	25
flake, secondary	N176.44	E95.443	97.9	10	25
flake, primary	N176.299	E95.35	97.883	90	45
sandstone	N176.35	E95.11	97.875	10	0
flake, secondary	N176.382	E95.293	97.91	10	30
flake, secondary	N176.525	E95.493	97.87	0	0
pebble, quartz	N176.472	E95.657	97.843	40	90
flake, secondary	N176.453	E95.652	97.878	60	25
biface	N176.699	E95.156	97.919	40	35
pebble, quartz	N176.676	E95.284	97.904	40	20
flake, secondary	N176.81	E95.394	97.863	5	40
flake, modified	N176.699	E95.407	97.857	60	60
abrader, sandstone	N176.722	E95.508	97.877	90	0
flake, secondary	N176.733	E95.687	97.857	60	5
flake, tertiary	N176.684	E95.73	97.885	140	15
flake, tertiary, TA	N176.675	E95.822	97.943	20	65
flake, primary	N176.707	E95.924	97.898	100	30
biface "sweet Paleo"	N175.558	E94.315	97.915	70	30
flake, tertiary	N175.576	E94.628	97.895	5	55
flake, tertiary	N175.667	E94.706	97.934	40	30
flake, tertiary	N175.945	E94.463	97.936	160	30
pebble, quartz	N175.865	E94.834	97.94	150	50
flake, tertiary	N175.728	E94.912	97.953	60	5
orthoquartzite fragment	N175.349	E94.72	97.879	60	70

flake, tertiary	N175.07	E94.572	97.91	140	30
quartz fragment	N175.077	E94.665	97.918	20	60
flake, secondary	N176.119	E95.267	97.925	50	10
flake, tertiary	N176.047	E95.559	97.93	80	70
flake, tertiary	N176.146	E95.555	97.879	20	10
flake, secondary	N176.136	E95.645	97.9	160	70
flake, secondary	N176.612	E95.284	97.875	30	5
flake, modified - scraper	N176.723	E95.181	97.902	100	30
flake, tertiary/blade?	N176.445	E95.649	97.883	120	25
flake, primary	N176.8	E95.829	97.863	120	15
flake, primary	N176.649	E95.793	97.904	120	20
flake, secondary	N176.64	E95.82	97.883	60	60
flake, secondary	N176.382	E95.874	97.902	15	80
flake, tertiary	N175.997	E95.982	97.896	55	20
flake, tertiary	N175.98	E95.534	97.944	50	60
flake, primary	N175.839	E95.49	97.917	80	15
flake, primary	N175.719	E95.309	97.949	40	45
flake, tertiary	N175.738	E95.169	97.921	75	30
biface	N175.443	E95.165	97.923	90	5
flake, tertiary	N175.56	E95.403	97.895	80	45
flake, secondary	N175.391	E95.657	97.948	150	25
flake, tertiary	N175.327	E95.917	97.897	60	40
biface	N175.135	E95.816	97.901	120	0
flake, primary, overshot	N175.235	E95.537	97.891	90	90
flake, tertiary	N175.107	E95.32	97.933	120	15
flake, tertiary, modified	N175.876	E95.525	97.886	175	45
flake, secondary	N175.916	E95.48	97.927	60	55
flake, tertiary	N175.748	E95.304	97.903	80	30
flake, secondary	N175.672	E95.29	97.899	160	90
flake, primary	N176.015	E95.092	97.919	20	40
flake, tertiary	N176.071	E95.09	97.918	50	70
flake, tertiary	N176.332	E95.118	97.866	120	35
flake, tertiary	N176.225	E95.026	97.929	20	30
core, river cobble	N176.113	E95	97.934	90	5
flake, tertiary	N176.045	E95.003	97.899	20	75
flake, tertiary	N176.098	E94.883	97.962	60	5
flake, secondary	N176.158	E94.911	97.966	175	90
flake, tertiary/blade	N176.185	E94.893	97.921	70	70
flake, secondary	N176.228	E94.931	97.858	170	45
flake, tertiary	N176.064	E94.71	97.951	20	60
flake, secondary	N176.007	E94.608	97.933	10	50
biface/scraper	N176.138	E94.424	97.947	160	55

flake, secondary	N176.13	E94.391	97.942	60	30
flake, secondary	N176.235	E94.565	97.874	140	5
flake, primary	N176.321	E94.438	97.906	160	15
biface	N176.213	E94.154	97.985	5	20
flake, tertiary, modified	N176.354	E94.147	97.908	140	10
flake, tertiary, disturbed	N176.388	E94.43	97.908	90	0
flake, secondary	N176.384	E94.581	97.948	20	60
flake, secondary	N176.3	E94.708	97.957	0	45
flake, secondary	N176.472	E94.841	97.935	160	30
flake, secondary	N176.336	E95.001	97.917	50	25
cobble, quartzite	N176.431	E95.012	97.941	140	10
flake, secondary	N176.453	E95.019	97.942	130	60
flake, secondary	N176.48	E94.962	97.895	120	60
flake, secondary	N176.533	E95.09	97.919	130	10
flake, tertiary	N176.606	E95.032	97.906	150	10
flake, secondary	N176.597	E95.003	97.901	160	20
flake, tertiary/blade core frag	N176.535	E94.886	97.895	150	30
flake, secondary	N176.542	E94.855	97.945	130	20
flake, secondary	N176.624	E94.807	97.935	140	5
flake, secondary	N176.676	E94.772	97.949	70	40
flake, tertiary	N176.717	E94.712	97.931	100	50
core fragment, blade	N176.71	E94.828	97.885	80	20
flake, secondary	N176.712	E94.866	97.881	20	10
flake, primary	N176.753	E95.131	97.881	160	45
flake, tertiary	N176.794	E95.104	97.874	130	80
biface	N176.76	E95.053	97.921	90	35
flake, tertiary	N176.822	E94.965	97.902	30	0
flake, secondary	N176.791	E94.908	97.892	110	5
flake, secondary	N176.917	E94.999	97.914	100	45
flake, tertiary	N176.82	E94.853	97.905	80	40
flake, primary	N176.811	E94.811	97.931	170	45
flake, primary	N176.804	E94.746	97.863	30	40
pebble, quartz	N176.548	E94.631	97.942	60	20
core	N176.5	E94.586	97.929	175	20
blade fragment	N176.559	E94.519	97.947	160	30
flake, secondary	N176.561	E94.494	97.943	20	20
flake, secondary	N176.616	E94.254	97.905	160	30
flake, secondary	N176.643	E94.357	97.921	120	45
flake, primary	N176.707	E94.364	97.949	110	15
flake, secondary	N176.75	E94.38	97.936	120	90
core fragment	N176.785	E94.486	97.921	20	10
flake, secondary	N176.81	E94.556	97.91	100	0
flake, tertiary	N176.882	E94.466	97.929	100	45

flake, tertiary	N176.757	E94.276	97.947	100	50
flake, secondary	N176.735	E94.22	97.939	75	45
cobble, quartz	N176.874	E94.293	97.995	10	5
flake, secondary	N176.594	E95.101	97.866	155	65
flake, tertiary	N176.435	E94.898	97.862	0	20
flake, tertiary	N176.591	E95.026	97.884	50	10
flake, tertiary	N176.782	E94.235	97.932	40	5
flake, secondary, possible utilized	N176.869	E94.273	97.936	100	5
flake, tertiary	N176.768	E94.165	97.94	40	0
flake, tertiary	N175.235	E94.418	97.84	160	60
flake, tertiary/early stage blade	N176.233	E95.574	97.875	20	15
flake, tertiary	N176.333	E95.884	97.827	160	45
flake, secondary	N176.412	E95.965	97.813	40	15
flake, secondary	N176.64	E95.876	97.807	155	60
flake, secondary	N176.826	E95.614	97.844	25	30
flake, tertiary	N176.955	E95.383	97.824	20	50
flake, overshot, early	N176.932	E94.796	97.874	110	25
flake, primary	N176.888	E94.642	97.853	40	5
flake, tertiary	N176.745	E94.711	97.789	10	80
flake, secondary	N176.712	E94.628	97.848	90	45
flake, secondary	N176.758	E94.638	97.849	70	50
flake, tertiary	N175.482	E95.962	97.879	110	20
flake, tertiary	N175.613	E95.977	97.852	10	0
flake, tertiary	N175.622	E95.707	97.856	120	45
flake, secondary	N175.529	E95.479	97.863	90	60
flake, primary	N175.831	E95.216	97.811	170	30
flake, modified/scraper	N175.1	E95.345	97.877	160	15
biface fragment, tip	N175.61	E95.95	97.822	10	0

Appendix E: Field Excavation Form Sample

University of South Carolina | **Southeastern PaleoAmerican Survey**
Big Pine Tree Site 38AL143 2010 | **Page 1 of 2**
FSI #: BPN175E94-

Level Form

Unit Size:	2x2 m	**Date Opened:**	21-Mar-15
Northing/Easting:	N175/E94	**Recorder(s):**	
Level:	**Ex. Depth:**	**Supervisor:**	ADR/DSM
Top Elevation:		**Crew:**	
Bottom Elevation:		**Screeners:**	
Feature(s):		**Feature Type:**	
Screening Method		**Datum:**	98.97
Screening Method 2		**Datum Location**	SW Corner

☐ Modern ☐ Holocene ☐ Clovis ☐ Pre-Clovis ☐ Mixed ☐ Other

Bifaces:	
Ceramics:	
Other Artifacts:	

Camera		**Frame #**		**Munsell wet/dry**
Munsell:		**Munsel 2:**		
Texture:		**Texture 2:**		
Soil Desc				

Changes noted from previous level ☐ **This Level was excavated in Quadrants**

Disturbances and where located:

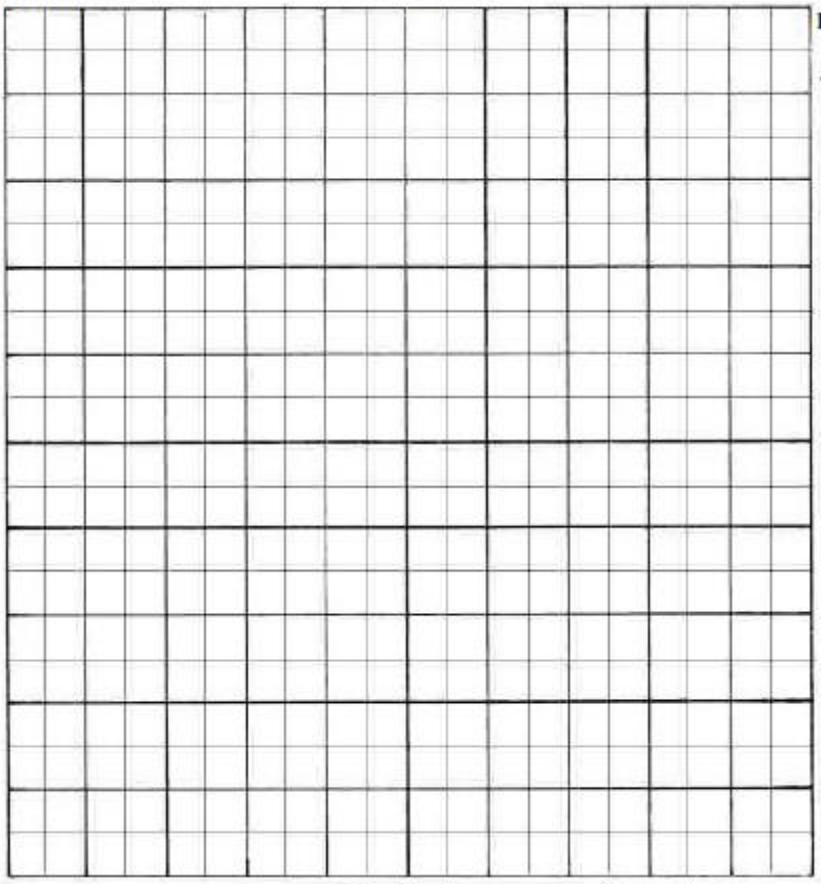
Additional Notes

☐ Pebbles ☐ Chert ☐ Quartz ☐ Angular ☐ Rounded ☐ Fire Cracked Rock

☐ Flakes ☐ Chert ☐ Quartz ☐ Thermally Altered ☐ River Cobble ☐ Burned ☐ Cortical ☐ Tertiary ☐ Thinning

 # debitage bags: ☐ **# artifact mother bags** ☐

FSI: BPN175E94- **Datum** 98.97



Datum Loc:
SW Corner

N

0 10 20 40 50

Starting Elevations

Closing Elevations

Key

Drawn By _____ **Date:** _____

Appendix F: Field Photographs



The author using a stadia rod to shoot in the datum for N175E94.



Closing photograph of N175E94 Level 1 excavation.



Closing photograph for N175E94 Level 2 with artifacts *in situ*. The dark circles seen in the photograph are water from a sprayer malfunction.



Closing photograph of N175E94 Level 4. No piece-plotted artifacts were found in this level.



Closing photograph of N175E94 Level 5 with artifacts *in situ*. The dark stain in the wall is due to differential drying.



Closing photograph of N175E94 Level 6 with artifacts *in situ*. Note the dark brown stain appearing along the edge of the unit. Green markers were placed in the unit as control points for the total station. This is the top of what is considered the midden.



N175E94 Level 7 Southwest quad artifacts *in situ*. Green markers were placed in the unit as control points for the total station.



N175E94 Level 8 Northeast quad artifacts *in situ*. Green markers were placed in the unit as control points for the total station.



N175E94 Level 9 Northwest quad artifacts *in situ*. Green markers were placed in the unit as control points for the total station.



N175E94 Level 10 Northeast quad artifacts *in situ.* Note the gradual disappearance of the dark brown soils at the base of this level. Grey soils are a result of differential drying in the unit. Green markers were placed in the unit as control points for the total station.



N175E94 Level 10 closing photograph. The base of this level is below the dark brown soils. The "midden" layer can clearly be seen in the east wall of the unit in this photograph.



N175E94 Level 11 Southwest quad artifacts *in situ.* Green markers were placed in the unit as control points for the total station.



N175E94 Level 12 Southeast quad artifacts *in situ*. Green markers were placed in the unit as control points for the total station



N177E92 West profile. The midden levels are well pronounced in this photograph.



Allendale blade *in situ.* Artifact found in N175E94 Level 9. Green markers were placed in the unit as control points for the total station. Piece plotted artifacts were assigned numbers and placed next to the artifact as an identifier.



Volunteer archaeologists from the University of Tennessee, Kat Forst and Chad Holman teach their son Damien how to water screen.



Relaxing after a hard day of working. From left to right, DuVal Lawrence, D. Shane Miller, Ted Brown, Adam Russell.



Unidentifiable pottery from N175E94 Level 2



Yadkin Points found in N175E94 Level 2.



Unidentifiable pottery found in N175E94 Level 3.



Yadkin point found in N175E94 Level 3.



Unidentifiable Woodland period point found in N175E94 Level 3.



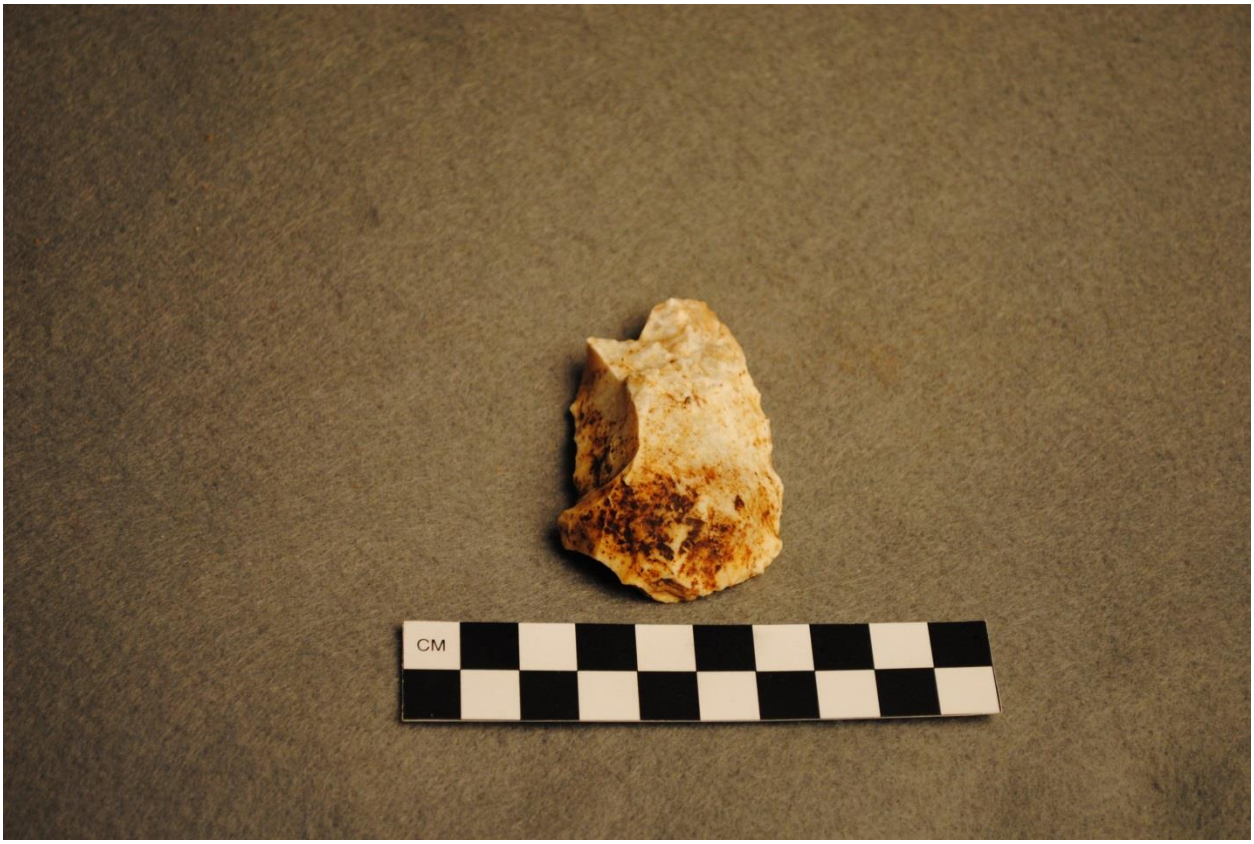
Simple Stamped pottery found in N175E94 Level 5.



Allendale knife found in N175E94 Level 7.



Allendale/Savannah River Stemmed point found in N175E94 Level 9.



Possible Dalton Adze found in N175E94 Level 10.



Clovis scraper found in Level 11.



Possible Clovis blade found in Level 11.



Abraider found in Level 11.



Overshot flake found in Level 12.

Vita

Adam Russell was born in Kodak, Tennessee, where he lived for quite some time. Eventually his wanderlust got the better of him and he found himself in Denmark for a year. This experience changed his life and paved the way for his entrance into the social sciences. Anthropology was his true calling and he received his B.A. in Anthropology in 2008 from the University of Tennessee, where he stayed for his M.A. in Archaeology. Soon after his acceptance in the M.A. program, however, the wanderlust hit Adam again drawing him north to Alaska where he spent several years doing cultural resource management archaeology and various jobs in the Last Frontier.