Modeling Early Archaic Mobility and Subsistence: Evaluating Resource Risk Across The South Carolina Landscape

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MODELING EARLY ARCHAIC MOBILITY AND SUBSISTENCE: EVALUATING RESOURCE RISK ACROSS THE SOUTH CAROLINA LANDSCAPE

by

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DEDICATION

This thesis is dedicated to Steve Williams, a devoted grandfather, father, husband, archaeology enthusiast, artifact collector, flintknapper, and friend. He was a very generous, kind, and considerate man who would do everything he could for those he cared about. A man who stood by his principles and was firm in his convictions. He was very generous in sharing his artifact collections with me, data from which have greatly contributed to this thesis, his observations regarding stone tools, and his expertise with flintknapping. Thank you Steve, you will be missed.
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ABSTRACT

Previous models predicting Early Archaic mobility and subsistence strategies in South Carolina have evaluated behavioral negotiations of specific resource distributions. A new model is presented using empirical datasets that quantify and evaluate the quality and geographic distributions of lithic raw materials and drainage systems in the state. By utilizing datasets from private collections and landscape elevation data, this model is generated using Geographic Information Systems (GIS) software in order to produce a "Risk Landscape" from which predictions of site density, artifact density, lithic raw material diversity, and the condition of lithic toolkit assemblages can be generated based on landscape location. This model is tested using geographically extensive private collections from site specific locations and demonstrate variability in archaeological assemblages based on proximity to resources.
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CHAPTER ONE
INTRODUCTION

Hunter-gatherer populations in the distant past experienced lives full of unpredictability and uncertainty. The landscape upon which they lived was dynamic and the quality of its resources fluctuated frequently due to continuous changes in their environment. A lifestyle dependent on this active landscape would require efficient and effective means of negotiating and exploiting variable resource predictabilities in order to thrive. A comprehensive understanding of the influences of resource distributions and relative qualities is important for evaluating their effects on regionally mobile hunter-gatherer populations, and for understanding the social implications of negotiating such resources. The goal of archaeological works such as this thesis, should be to evaluate human conditions in the past as a means for understanding current and future conditions. An important first step in understanding the social conditions of past peoples is to assess the environment within which they lived and the resources they exploited. Doing so provides a means of assessing variability in strategies of resource exploitation, variability that forms a foundation for evaluating changes in human conditions through time.

Previous models of settlement and subsistence during the Early Archaic in South Carolina evaluated hunter-gatherer negotiations of single resource types as primary influencers of mobility and subsistence strategies. In this thesis, I use Geographic Information Systems (GIS) to evaluate the distribution and relative qualities of two
resource types in tandem -- river drainage networks, and lithic raw material sources -- to generate predictions of Early Archaic strategies of mobility and subsistence as reflected in site size, site density, artifact density, toolkit condition, and raw material diversity at specific locations across the landscape of South Carolina. This evaluation represents what I am calling the Risk Landscape Model, a new model for evaluating the negotiation of geographically dispersed resources. This model represents a new approach capable of identifying social negotiations of environmental variability, and a method for evaluating what such negotiations meant for past peoples.

THEORETICAL ORIENTATION AND BACKGROUND

Previous attempts at modeling Early Archaic mobility and subsistence strategies in South Carolina evaluated behavioral negotiations of single resource distributions, and operate under the assumptions of optimal foraging theory (Anderson and Hanson 1988; Daniel 1998, 2001; Dyson-Hudson and Smith 1978; Grimstead 2010, 2012; Hitchcock and Ebert 1989; O’Brien 2005; Shennan 2002; Smith 1979; Smith et al. 1983; Smith and Wishnie 2000; Winterhalder 1981). Optimal foraging theory, when applied to frequently mobile hunter-gatherers, seeks to predict the optimal strategy of minimizing both risk and cost while maximizing energy yields from the acquisition of food and other resources. This approach has been helpful in evaluating human populations with regards to their subsistence strategies, and when applied to archaeological records remains a useful tool for evaluating the negotiation of resources. Several examinations of the Early Archaic evaluate the importance of major river drainages (and the biological resources tied to them) on seasonal movement of Early Archaic hunter-gatherers (Anderson and Schuldenrein 1983; Anderson and Hanson 1988; Goodyear et al. 1979; Sassaman 1996).
These models focus their analyses on lithic raw material movement and artifact densities. One operating assumption is that the abundance of surface water found along major river drainages supports an affluence of biological diversity, which would be capable of supporting highly mobile groups of people.

Three optimal foraging models relevant to this thesis have been proposed that evaluate Early Archaic mobility and subsistence strategies in South Carolina. The Band-Macroband Model (Anderson and Hanson 1988) proposes that bands centralized their mobility patterns along major drainages in order to exploit resources on a seasonal basis, but crossed drainages primarily for hunting and social purposes. The Uwharrie-Allendale Settlement Model (Daniel 1998, 2001) has evaluated the negotiation of predictable lithic raw material sources on movement along and across river drainages. This model demonstrated that cross-drainage movement of lithic raw materials occurs quite frequently, and that these predictable resources allowed Early Archaic strategies of mobility to take advantage of a large, cross-drainage area of foraging landscape. One last model of relevance to this thesis employs Geographic Information Systems (GIS) software in predicting site location in proximity to water across the landscape in southwestern South Carolina. Gillam (2015) demonstrates that Early Archaic sites most frequently occur within close proximity to surface water. This study also demonstrates the merit that GIS systems can have on making predictions of site location across the landscape.

In the creation of the Risk Landscape Model, I use GIS software to incorporate the assumptions of both the Band-Macroband (Anderson and Hanson 1988) and the Uwharrie-Allendale Settlement (Daniel 1998, 2001) models, to calculate predictions of
the relative risks encountered during movement around drainages of different volumes of flow, as well as the cost of movement around predictable lithic raw material sources of variable qualities. Doing so allows for an evaluation of the effects of both on archaeological assemblages found in different localities across the landscape.

MODEL PREDICTIONS

Optimal foraging perspectives operate under the assumption that biological organisms (in this case humans) develop strategies of subsistence that reduce costs and maximize efficiency (Dyson-Hudson and Smith 1978; Grimstead 2010, 2012; Hitchcock and Ebert 1989; O’Brien 2005; Shennan 2002; Smith 1979; Smith et al. 1983; Smith and Wishnie 2000; Winterhalder 1981). Incorporating a perspective of relative changes of risk provides an accurate means of evaluating the ways in which strategies of subsistence must be modified in order to remain efficient. In this thesis risk will be applied to the variable qualities of biological resources across the landscape around which people negotiated their mobility and subsistence strategies. Risk is tied to the assumption that more available surface water in a given location means more plants and animals, however, just because large drainages can support more wildlife than smaller drainages, does not mean that they always do. The fluctuation and variations in biological resource densities represent an unpredictable resource which Early Archaic hunter-gatherers (and other hunter-gatherers throughout prehistory) would have to negotiate. Proximity to variably ranked drainages alters the relative risk that hunter-gatherers encounter during movement across the landscape, and distance between both biological and lithic raw material resources equals time and energy needed to negotiate relative degrees of risk and cost.
The distinction made between the terms "risk" and "cost" is meant to reflect degrees of predictability. In terms of biological resources, risk refers to its unpredictable nature, whereas, lithic raw materials represent a predictable resource and the term cost is better suited. Relative degrees of lithic raw material costs will be evaluated in a similar manner in order to generate a clearer understanding of the effects that lithic raw material distributions and relative qualities have on toolkit design, maintenance, and the distribution and condition of archaeological residues.

Using GIS I have created a set of predictions regarding the condition of the archaeological record in specific localities. By calculating relative changes in resource risk given differing proximities to available resources, the Risk Landscape Model generates independent and overlapping predictions for each layer created by the GIS calculations. The layers created from the empirical datasets have generated optimal predictions for given locations, such as site density, artifact density, toolkit design, and lithic raw material diversity.

Predictions of site density result from the assumption that localities that possess the lowest resource risk or cost, would be visited more frequently, would support larger aggregations of people per visit, and would be occupied for longer periods of time per visit. Due to the problem of equifinality, relatively poor preservation of organic material culture, and high resolution temporal separation of the remaining lithic technology during the Early Archaic in South Carolina, determinations of individual visits cannot be determined. This problem is characteristic of most Early Archaic sites in South Carolina. However, when evaluating large-scale geographic and temporal patterns of mobility it is
sufficient to assume that site density reflects the quality of the environment in terms of resource availability and risk.

This argument applies equally to artifact density: I assume that relative artifact density positively correlates with site density at least on a zonal level. Specific sites with high artifact densities are also predicted to correspond with specific locations of low risk and low cost for the same reasons described above.

Predictions of tool kit design pertain to the cultural period being studied and are based on a general understanding of the average toolkit of that period (Sassaman et al. 1988). The Early Archaic lithic toolkit in South Carolina is considerably more diverse than toolkits from either the earlier Paleoindian or more recent Middle Archaic populations. High mobility often requires strategies for tool curation and toolkit maintainability (Binford 1979a; Goodyear 1979). These strategies are reflected by reconditioning and recycling to prolong tool utility (Binford 1979a; Goodyear 1974, 1979).

As lithic raw material cost is negotiated, toolkit condition is expected to reflect changes in the stages of reconditioning and recycling (Bleed 1986; Bousman 2005; Ditchfield 2016; Fontes et al. 2016; Lurie 1989; Morrow and Jeffries 1989; Rigtrup 2009; Torrence 1983). Bleed (1986), who applies an engineering design perspective to material culture, proposes that material culture can be designed to optimize availability in two different ways. Maintainable toolkit designs should emphasize flexibility in unpredictable situations, whereas reliable toolkit designs would be over-engineered and under-stressed in situations of predictability. This spectrum of toolkit design applies directly to a perspective of cost, in that locations of high lithic raw material cost would
expect to contain evidence of maintainable toolkit designs that were under higher stresses than the predicted reliable toolkit designs at locations in close proximity to low lithic raw material cost. Hafted bifaces, for example, would be less likely to be reconditioned or heavily resharpened in close proximity to high quality lithic raw material sources, whereas in a situation of high cost away from raw materials sources, these same tools would be reconditioned or recycled on a much more frequent basis. Precise linear reduction of the toolkit does not need to be demonstrated to prove this point, as movement away from raw material sources would have a different discard, loss, and reconditioning pattern than return trips and, due to equifinality, determinations of site occupation in regard to this two-way movement cannot be determined. However, as will be discussed later, deviations from expected predictions can represent evidence of sociocultural negotiations.

One further prediction that this model provides is raw material diversity or, simply put, raw material frequencies as calculated by percentages of the total assemblage. By taking the distribution maps and the interpolated surface generated from the distribution data, a diversity index can be calculated to predict the relative frequencies expected to be present at a specific location. In doing so, any specific tool type (such as hafted bifaces or hafted endscrapers) can be considered for large-scale movement around geographically dispersed raw material sources. Expedient flake tool use of low quality local materials is expected to alter raw material frequencies if local scale predictions are not calculated in order to identify local sources. These relative frequency predictions for hafted bifaces have already been calculated at the county level for the state of South Carolina by Charles and Moore (2017) in the production of raw material distribution maps.
METHODOLOGY

I use two empirical datasets to calculate a “risk landscape” from which predictions can be generated. The first dataset involves a raster-based Digital Elevation Model (DEM) that, when manipulated in GIS software, can generate approximations of surface water runoff into stream networks across the landscape. Stream networks are generated by calculating flow direction due to changes in elevation, which can then be used to calculate flow accumulation within the determined stream networks. By ranking the streams within the stream network by either the Strahler or Shreve system of flow accumulation, relative changes in flow volume can be approximated in the software. High water volume within these stream networks is assumed to be positively associated with relative biodiversity and biological resource densities.

The second empirical dataset is the South Carolina state-wide collector database that has been accumulated by Tommy Charles and others of the South Carolina Institute of Archaeology and Anthropology (Charles 1981, 1983, 1986). Ongoing work is consolidating this data to generate distribution maps of projectile point styles by raw material throughout prehistory (Charles and Moore 2017). Artifact distributions by raw materials within the Early Archaic can be used to calculate the relative qualities of various lithic raw materials, as well as approximations for quarry sources. The assumption that lithic raw materials of higher quality will travel farther and be more flexible has previously been theorized in the context of Paleoindian mobility (Goodyear 1979).

Predictions generated from the manipulation of these empirical datasets will then be tested using an accumulation of datasets acquired through the analysis of privately and
professionally collected assemblages across the state of South Carolina. While professionally collected assemblages do exist within the study area that would provide adequate datasets for evaluating the proposed model, far more potential for geographically extensive examination of the archaeological record lies in the hands and personal collections of private artifact collectors. A cross-drainage transect of well-provenienced site-specific artifact collections have been analyzed across the Middle Coastal Plain of South Carolina, as well as numerous collections perpendicular to this transect along a major river drainage stretching from the Piedmont to the Coastal Plain. I evaluate these data in several selective manners in order to evaluate the various predictions generated by the risk model.

**SUMMARY**

This introduction has provided a brief explanation of the issues addressed in this thesis, as well as a glimpse into its methods and general approach to evaluating Early Archaic strategies of mobility and subsistence. These topics will be expanded throughout this thesis as organized in a series of chapters as described here:

In Chapter Two I review topics relevant to this thesis such as a cultural overview of the Early Archaic time period, it's environmental setting, general social structures and associated technologies, a brief discussion of technological organization relevant to the Early Archaic, theoretical perspectives incorporated into this thesis, the environmental and geographic settings within South Carolina, as well as lithic raw materials and their distributions across South Carolina.
Chapter Three will discuss the background and application of several theoretical perspectives within previous models of Early Archaic and hunter-gatherer mobility and subsistence strategies in South Carolina, detailed discussions of these previous models and investigations of the Early Archaic in South Carolina and the broader Southeast.

In Chapter Four, I provide detailed descriptions of the methodological approaches taken within this work. The GIS calculations are fully explained and the nuances of the importance of each step expressed in view of the goals of this research.

In Chapter Five I introduce the archaeological assemblages analyzed for this research, and apply these assemblages to the model predictions in order to evaluate variability as predicted by the model. This variability is discussed with regards to the data examined and trends are highlighted as the data is presented.

In the concluding chapter, Chapter Six, I discuss interpretations of the comparisons made between the model's predictions and the analysis of collections. The implications that the results create on evaluating Early Archaic cultures, and social factors that would influence the results are discussed in order to place this quantitative approach within broader anthropological consideration. I also discuss the successes and shortcomings of this approach, and discuss implications this work has on future research. I make suggestions for the ways in which this approach may be refined, and new directions this approach may take in further evaluating Early Archaic life ways.
CHAPTER TWO
THEORETICAL, TECHNOLOGICAL, ENVIRONMENTAL, AND CULTURAL CONSIDERATIONS

The Early Archaic was a time of considerable environmental change that saw dramatic shifts in human-environment relationships visible in new settlement and mobility patterns, procurement strategies and toolkits. This chapter outlines the world of the Early Archaic peoples in terms of the new, Post Pleistocene environment in which they lived, the tool forms by which they are known and their distribution across the southeastern United States, and especially in South Carolina. The second part of this chapter discusses frameworks for understanding the relationships between people, environments and resources and third part details the lithic resources that were used by the Early Archaic peoples and which provide archaeologists with a means of understanding human movements and orientations toward specific loci on the landscape and the potentials they offer for subsistence and settlement.

THE EARLY ARCHAIC

The Early Archaic is an archaeological period that is defined by particular projectile point styles. It begins in the Holocene just after the end of the Younger Dryas about 11,600 years ago, with the onset of modern climatic conditions that brought about significant environmental changes and concomitant cultural responses world-wide (Goodyear 1999; Meeks and Anderson 2012; Watts 1980). In the Americas, the Early
Archaic follows the Paleoindian cultures that are recognized archaeologically by their distinctive fluted point styles and highly mobile, big game hunting subsistence strategies. Radiocarbon and stratigraphic evidence indicates that the Early Archaic began around 10,500 years ago, lasted roughly 2500-3000 years until around 8,000 years before present, and contains distinct sub-phases based on projectile point changes (Anderson and Hanson 1988; Anderson and Sassaman 1996, 2012: 5; Bense 1994; Broyles 1971; Coe 1964; Daniel 1998, 2001; Dejarnette et al. 1962; Goodyear 1982, 1999, 2013, 2014; Goodyear et al. 1993; Sassaman 1996; Tuck 1974). Although the Early Archaic had some continuity with Paleoindian stone tool technology, it had a more diverse lithic toolkit that included notched projectile points, many unifacial tool forms, and the addition of the adze (Anderson and Sassaman 1996; Coe 1964; Daniel 1998; Goodyear 1974; Morse and Goodyear 1973; Sassaman et al. 2005; Sassaman et al. 2002). It appears to represent an extensive population expansion all over the Southeast, compared to earlier Paleoindian records.

The Early Archaic Environment

The abrupt end of the last great ice age ushered in dramatic changes in the global environment that were also felt in the southeastern United States. As global temperature increased, vast sheets of ice melted, sea-levels rose, and biota of plants and animals better suited to warmer climates thrived as the new dominant species as they replaced many mega fauna that went extinct as a result of this abrupt end (Edwards 1967). It is this significant change in the environment that likely influenced noticeable changes in societal structure and organization, as well as technological reorganization throughout the Early Archaic (Meeks and Anderson 2012). South Carolina experienced an expansion of
deciduous forests dominated by oak, beech, and hickory and abundant populations of white-tail deer and bison replaced the Pleistocene megafauna (Moore et al. 2016; Watts 1980:196-198). Human populations increased as well, responding to warmer, more homogeneous environments with toolkits adapted to exploit the new dominant plant and animal species.

The Early Archaic Toolkit

The Early Archaic toolkit is comprised of a variety of notched hafted bifaces that change throughout the time period, a variety of expedient and formal unifacial tool forms, carefully made stone drills, flake tools, chipped and ground adzes, and ground stone artifacts known as eggstones (Broyles 1971; Coe 1964; Daniel 1998; Dejarnette et al. 1962; Goodyear 1974; Goodyear et al. 1993; Morse and Goodyear 1973; Rachels and Knight 2004; Sassaman et al. 2002). The variety of tool types present throughout the Early Archaic represent a continuation of highly curated technologies that resemble those in the preceding Paleoindian period in their strategies of technological organization.

Hafted Bifaces. Hafted biface styles vary throughout the Early Archaic in South Carolina and have been found to be separated chronologically. The variability found throughout the Early Archaic are reflections of technological adaptations and cultural change. Lanceolate hafted biface styles that are characteristic of Paleoindian technologies are replaced by notched styles. The method of notching also changes throughout the Early Archaic, from side notched, to corner notched, and eventually basal notched styles. Towards the end of the Early Archaic, stemmed varieties emerge that lead to socket hafting mechanics into the Middle Archaic (Blanton 1983; Sassaman
Overall changing trends have been identified in stratigraphic contexts and demonstrated to reflect technological change through time with certain styles indicative of specific periods of time (Coe 1964; Dejarnette et al. 1962; Broyles 1971; Lewis and Lewis 1961). These styles will be discussed by the temporal positions they hold relative to each other starting with the oldest styles, and ending with the youngest.

**Dalton.** Dalton hafted bifaces are lanceolate in form and exhibit bifacially resharpened blades that often include prominent serrations. These hafted biface types have been found in archaeological assemblages throughout the Southeast, and have been determined to have been used primarily as hafted knives (Goodyear 1974; Morse 1971, 1973). An investigation and evaluation of Dalton hafted bifaces in Arkansas determined the variability in blade morphology of Dalton bifaces were the result of a continuum of blade resharpening that reduces the blade width gradually over time (Goodyear 1974). While slight differences exist between Dalton biface morphology across the Southeast, this interpretation of blade reduction appears to remain true among South Carolina examples with one small difference: blade resharpening techniques in South Carolina tend to be bifacially resharpened much more frequently than the beveled strategy present among Arkansas examples (Goodyear 1974; Goodyear et al. 1990; Morse 1971, 1973). While some have argued that Dalton hafted bifaces fall within late Paleoindian technology (Anderson 2005; Goodyear 1974, 1982; Morse 1971, 1973), I have included them in my study as the people making and using them were experiencing approximately the same environmental conditions after the last great ice age, as later peoples within the Early Archaic.
**Side Notched.** Hafted bifaces that have been identified as side notched, exhibit notching features on the sides of the basal margins. Several side notched hafted biface varieties exist across the state of South Carolina that have not been effectively separated chronologically. A variety that has some continuity with Dalton hafted bifaces is the Hardaway side notched hafted biface (Coe 1964; Daniel 1998). Its distribution is firmly positioned within modern day North Carolina, but is found distributed across the northern half of South Carolina (Sassaman 1996:Figure 4.1). This variety is easily recognizable by the "rams horn" appearance that its basal ears exhibit due to a deeply concave base. This variety was originally defined by Coe (1964) at the Hardaway site in North Carolina. Another side notched variety sometimes present in South Carolina that has firm roots within modern North Carolina state lines, is the Rowan side notched hafted biface. This variety exhibits broad side notches, a slight basal concavity, and a blade that is most often bifacially resharpened (Gunn and Rovner 2003). In the Southeastern portion of South Carolina Taylor hafted bifaces are widespread across the Coastal Plain and along the Savannah River and into Georgia (Michie 1966, 1970, 1996; Sassaman 1996:Figure 4.1). Taylor hafted bifaces have a straight to slightly concave base with square or slightly rounded basal ears, and a blade that is often resharpened with a distinctive bevel. The Van Lott variety is similar in appearance to the Taylor style, but often exhibits a deeply concave base and distinctive basal thinning flakes that resemble long and narrow pressure flutes (Michie 1965).

**Corner Notched.** Corner notched hafted bifaces stratigraphically follow side notched varieties across a great portion of the Southeast, and especially within South Carolina (Coe 1964; Daniel 1998, 2001; Sassaman 1996; Sassaman et al. 2002). The most
prevalent types are Kirk and Palmer, though they differ in several characteristics, they have not been effectively separated chronologically (Coe 1964; Daniel 1998, 2001; Sassaman 1996; Sassaman et al. 2002; Tuck 1974:76). The Kirk variety has been of particular interest to several researchers because it is found across the entire eastern United States, suggesting a pattern of a geographically extensive social interaction sphere (Tuck 1974, White 2016). Kirk corner notched hafted bifaces are most often bifacially resharpened and exhibit straight basal edges with basal thinning flakes, sharp "V" shaped basal ears, and deep corner notches (Coe 1964; Daniel 1998; Tuck 1974). The Palmer variety is somewhat similar, but is much smaller in size, particularly the haft length, bases are typically straight and heavily ground, and the blade is often bifacially resharpened with prominent serrations (Coe 1964; Daniel 1998). It is often accepted by researchers that these types are contemporary, as there has not been conclusive evidence of temporal separation between these styles. However, the term Palmer has often been used by researchers in past works as the default stylistic determination for notched projectile points throughout the state of South Carolina, and has not always been used in compliance with Coe's (1964) strict definition (Anderson and Schudlenrein 1983; Goodyear et al. 1979; Sassaman et al. 2002).

The Hardin barbed point has a wide, though infrequent distribution across the Southeast and within South Carolina (Charles 1981:32; Sassaman et al. 2005:Figure 4). The densest distribution of this type is in the upper central Mississippi River valley in Illinois, Missouri, Arkansas, the western most portions of Kentucky and Tennessee, and into Iowa and Oklahoma (Bell 1960; Justice 1987; Munson 1967; Scully 1951). Morphological traits of Hardin hafted bifaces in South Carolina include a slightly convex
basal shape that is lightly ground on a stem-like/corner notched hafting element, a distinct "V" shaped notch termination with a sometimes crescent shaped notch, a bifacially resharpened blade that often has a slight (as opposed to chisel-like) left bevel. Hardin barbed points have been studied and presented within this thesis with the corner notched hafted bifaces.

Post-Kirk. Towards the end of the Early Archaic hafted biface styles begin to show significant changes in morphology through time into the Middle Archaic. Corner notched styles transition into basally notched (bifurcated) styles, and eventually transition into stemmed varieties. Following corner notched styles are several varieties of hafted bifurcate varieties such as LeCroy and MacCorkle, followed by stemmed varieties of Kirk and Stanley. These hafted bifaces all represent styles of the latter part of the Early Archaic and the beginning of Middle Archaic technologies (Anderson 1991; Broyles 1971; Coe 1964; Steen 1985). Bifurcated hafted bifaces are present in South Carolina, but are most often found in the northern half of the state (Anderson 1991; Broyles 1971; Sassaman 1996:Figure 4; Steen 1985). These styles are delicately made on thin flakes, with notched bases and small notches on the side or corner which create lobed or rounded basal ears. The blades are bifacially resharpened and often have prominent serrations. Kirk stemmed hafted bifaces were first described by Coe (1964) when he excavated them in stratigraphic contexts above corner notched varieties. Although Coe (1964) made a distinction between Kirk stemmed and Kirk serrated, clearer understandings of resharpening strategies make the assumption that they are the same type very probable (Goodyear 1974). Kirk stemmed hafted bifaces have a stemmed hafting element with a straight to slightly concave basal shape. The blade is often bifacially resharpened into
prominent serrations. This stylistic type is distributed throughout South Carolina, with higher densities also in the northern part of the state. Stanley stemmed hafted bifaces, also found in stratigraphic contexts by Coe (1964), occur later than Kirk stemmed hafted bifaces. The hafting element of Stanley stemmed, is often contracting with a slightly notched base, while the blade is bifacially resharpened in a manner that reduces length faster than width. Like bifurcate and Kirk stemmed hafted bifaces, Stanleys are concentrated in the Northern portion of the state. One final Early-Middle Archaic type is Eva, a basally notched variety. Eva points were excavated and reported by Lewis and Lewis (1961) to occur within the later portion of the Early Archaic and beginning portion of the Middle Archaic. Eva hafted bifaces exhibit a large triangular blade shape with two parallel basal notches on either side of a short square stem. Their occurrence in South Carolina is infrequent, but is worth mentioning as several were observed within collections examined for this thesis.

Unifaces. Both expedient and formal unifacial tool forms were made and used throughout the Early Archaic time period. Unifacial tools are found within the technologies of both Paleoindian and Early Archaic cultures. This continuity is reflective of the similar strategies of mobility and subsistence between Paleoindian and Early Archaic cultures. Several types of formalized unifaces have been described for the Early Archaic, the most common being hafted endscrapers, oval or "turtleback" scrapers, and various end and sidescrapers (Coe 1964; Daniel 1998).

Hafted Endscrapers. The hafted endscraper is perhaps the most easily recognizable and in some cases most common unifacial tool form present among Early Archaic assemblages. Hafted endscrapers are generally made on thick flakes that have been
retouched along the flake margins to form a teardrop-shaped tool with a steep unifacial bit on the distal end. The haft is on the proximal end, where the striking platform is often left intact (Coe 1964:Figure 64; Daniel 1998). These endscrapers sometimes exhibit heavy use-wear polish on the bits. It is commonly accepted that this unifacial tool type was most commonly used for hide preparation (Seeman et al. 2013).

**Turtleback Scraper.** Turtleback scrapers (also known as round or oval scrapers) are circular, unifacial tools that are continuously retouched on all margins and have no evidence of a formal haft. They are most likely to have been handheld (Daniel 1998:102). This uniface type has been found in association with Hardaway (Coe 1964:79; Daniel 1998:Figure 4.42a-b), Dalton (Morse 1973:27), and Suwannee/Bolens (Daniel and Wisenbaker 1987:69-70) throughout the Southeast. One possible function for this uniface variety has been suggested, that they may have been utilized as small microblade cores which would explain the continuous and unrefined retouch around the uniface as well as the dome shaped dorsal surface (Al Goodyear personal communication).

**Bilateral Sidescraper.** The bilateral sidescraper exhibits steep unifacial retouch along nearly parallel margins on a thick blade-like flake blank, and retouched margins that often converge to a graver-like point on the distal end of the tool. Bilateral sidescrapers have been observed primarily in contexts geographically removed from quarry sources, and appear to represent a formal unifacial type that was curated for purposes of travel and use away from quarry locations. This unifacial variety is similar in form to Coe's (1964) type III sidescrapers, only differing in thickness (Daniel 1998:93-94), and the oblong scraper described by Daniel and Wisenbaker (1987:70-74, Figures 23-25).
**Edgefield Scraper.** A formalized tool type also examined within collections for this thesis that is known to occur with Early Archaic stone tool assemblages is the Edgefield scraper (Bridgman-Sweeney 2013; Bridgman-Sweeney et al. 2008; Goodyear et al. 1980; Michie 1968, 1972, 1973; Sassaman et al. 2002). The overall design of the Edgefield scraper exhibits a side notched hafting element with a unifacially resharpened blade margin. Edgefield scrapers are often made on large flakes which creates a robust unifacial edge. The opposing blade margin is often left unretouched, though it is on occasion either bifacially or unifacially retouched. The unifacial margin is most often present on the left margin of the tool, with retouch towards the dorsal face of the flake. It is commonly accepted to be contemporary with side notched bifaces due to its side notched hafting design with squared or rounded basal ear shapes, as well as its common distribution across the Southeast with Taylor side notched hafted bifaces, and contemporary side notched hafted bifaces in Georgia, Alabama, and Florida (Bridgman-Sweeney 2013; Goodyear et al. 1980; Michie 1972, 1973).

A variety of less formal unifacial tools have been observed within the collections examined for this thesis that do not fit within these two formalized types. They have been described objectively, and efforts to fit them within categories such as the types designated by Coe (1964), and by Daniel (1998), were not attempted. A few of these less formal unifacial tool types are: sidescrapers, side-endscrapers, endscrapers, and bilateral side-endscrapers.

**Drills.** Several types of drills are associated with Early Archaic technologies (Coe 1964:Figures 32, 62; Daniel 1998:Figure 4.44). The two primary types are "T-drills" and
"paddle" drills, many of which appear to have been fashioned out of hafted bifaces (Coe 1964:Figure 32a, 62a, 62c).

**T-Drills.** T-drills are long and carefully retouched drills with a hafting element that resembles a "T" shape. The hafting element does not exhibit stark perpendicular "ears" but rather a gradual expansion near the base. The base is straight and often basally thinned similar to the base of a Kirk corner notched hafted biface, and the bit is bifacially worked. An example of this kind of drill was excavated at the Hardaway Site (31ST4) by Coe (1964:Figure 62b far left), in associated with the Kirk and Palmer corner notched assemblages.

**Paddle Drills.** Paddle drills differ from T-drills primarily in that the proximal end resembles a paddle, and often has a convex basal shape. The proximal end can sometimes be very large, suggesting that it may have been hand-held rather than hafted. Paddle drills have been excavated by Coe at the Hardaway site (Coe 1964:Figure 62c second from left; Daniel 1998:Figure 4.44a-b) and are also associated with Kirk and Palmer corner notched hafted bifaces.

**Flake Tools.** Flake tool types associated with Early Archaic assemblages throughout the Southeast include assorted varieties of retouched flakes, retouched flake/sidescrapers, utilized flakes, gravers, perforators, and Waller knives (Anderson and Schuldenrein 1983; Claggett and Cable 1982; Coe 1964; Daniel 1998; Goodyear et al. 1979; Waller 1971). Retouched flakes often have bifacial and unifacial retouch, and are often retouched bifacial thinning flakes. Retouched flake/sidescrapers are thin flakes that have been unifacially retouched and are not as robust as other sidescrapers. Utilized flakes have
obvious use-wear that is visible to the naked eye. In large assemblages they are often recognized when other flake characteristics, such as being of an exotic or weathered raw material draw attention to them and single them out for closer analysis. Gravers are small, sharp spurs that have been isolated with delicate retouch on a tool margin. They have been noted when present on flake or other tool margins. Perforators, sharp, pointed edges that serves as a tool for puncturing organic materials, have been described in association with Early Archaic assemblages as well (Daniel 1998:Figure 4.44 c-d) but were not frequently observed in collections examined within this thesis. Waller knives are present among Early Archaic assemblages across the Southeast. Waller knives are flakes that have been notched for hafting and often possess retouch on the flake margins (Waller 1971).

Many flake tools have multiple worked edges which makes it difficult to describe flake tool assemblages. With a few exceptions, flake tools are examined together as one tool class within this thesis.

Eggstones. Eggstones (sometimes referred to as bolas or dimple stones) are an unusual and mysterious tool type present in the Early Archaic. Eggstones are ground into round egg-like ovoids and made from a variety of material types, and in their finished stages have a flat or dimple feature on one end of the stone (Bottoms and Painter 1972; Rachels and Knight 2004; Snow 1976; Tesar 1994). Eggstones are found across the Southeast often as isolated artifacts, but are also known to occur in caches with examples in several stages of manufacture present. A cache of eggstones was observed in a private collection along the Congaree River (38CL100), and other caches have been observed in other locations across the Southeast such as in nearby Owl Creek in Georgia (Al
Goodyear personal communication). Five eggstones have been excavated at the Topper Site (38AL23) in association with the Taylor side notched assemblage, though they were found individually across the site and not cached (Al Goodyear personal communication).

The functional purpose of eggstones as been widely debated, with no clear determinations having been made. Proposed functions include: bola weights (Bottoms and Painter 1972), weights for spreading nets for the procurement of waterfowl (Al Goodyear personal communication) or, club heads (Simpson 1948; Perino 1972; Rachels and Knight 2004:66; Tesar 1994). They may have had a symbolic function, and it has even been suggested that they represent human testes (Rachels and Knight 2004:66, Figure5; Tesar 1994). Given the significant investment in time needed to grind eggstones into the desired shape, it seems unlikely that these artifacts would have been used as net weights, bola stones, or any other activity where they might easily become lost, when unworked stones would have worked just as well. It is more likely, given the investment in time needed to make them, and the relatively rare rate of occurrence, that they were used in a context that anticipated a long use life.

Adzes. Adzes are commonly found in association with Early Archaic tool assemblages across the Southeast (Chapman 1975:16, 1978:68; Daniel 1998:Figure 4.13; Daniel and Wisenbaker 1987; Sassaman et al. 2002:Figures 3-9, 3-16). Sometimes referred to as Dalton Adzes, they have been found in association with Dalton points in places like Arkansas (Goodyear 1974; Morse and Goodyear 1973), and in Early Archaic contexts across the Southeast (Coe 1964; Daniel 1998; Daniel and Wisenbaker 1987). It is commonly accepted among archaeologists that the adze is a robust woodworking tool, and evidence has been found suggesting it was used with the char and scrape method for
reducing wood (Gaertner 1994). It is used in a downward motion that behaves almost like a chisel to removed wood chips. They are most often chipped and then ground on the haft margins and bit, but are occasionally ground from dense stone materials and can be similar to celts. They have been excavated in South Carolina at the G.S. Lewis East (38AK228) site with Kirk corner notched hafted bifaces, where chipped and ground examples were both found, one with an associated whetstone for refurbishing the ground bit, and at the Topper Site (38AL23) within the Taylor side notched hafted biface assemblage (Goodyear personal communication; Sassaman et al. 2002:Figures 3-9, 3-16). Nearby in North Carolina adzes were excavated by Coe, though initially unreported, at the Hardaway site (Daniel 1998:Figure 4.13). These adzes and adze preforms were identified upon a reexamination of the assemblage by Daniel (1998:63, 65-66), who noted a broken bit, whole but damaged adze, and several adze preforms. The association of these adzes with Dalton or later Kirk hafted bifaces was not clear, although they have been known to occur with both.

**Cores.** One class of artifacts that are not always discussed or noted in regional studies of Early Archaic technology, are the types of cores present in Early Archaic assemblages. In circumstances where well excavated Early Archaic assemblages have been analyzed, cores have been diligently recorded and discussed in terms of their placement and use at site specific locations (Anderson and Schuldenrein 1983; Claggett and Cable 1982; Coe 1964; Daniel 1998; Daniel and Wisenbaker 1987; Goodyear et al. 1979; Sassaman et al. 2002). When discussions of Early Archaic mobility and technological organization have been addressed cores have not always been acknowledged, though evaluations of the differences between expedient versus curated
cores have been considered (Anderson and Schuldenrein 1983; Anderson and Hanson 1988; Goodyear et al. 1979). Several core types mentioned here and observed within the collections presented in this thesis include bifacial and bipolar cores.

**Bifacial Cores.** Bifacial cores are present among Early Archaic assemblages and are noted to function both as flake-cores and as preforms for hafted bifaces and adzes (Coe 1964; Daniel 1998:59-66, Figure 4.11-4.13; Sassaman et al. 2002:51, 54-55, Figure 3-7). Bifacial cores have been classified previously into three types of bifaces, types I, II, and III, and evaluated in terms of their reduction stages as measured by a thickness to width ratio (Daniel 1998; Sassaman et al. 2002). In South Carolina these core types have primarily been evaluated in assemblages relatively close in proximity to raw material sources and major riverine environments (Sassaman et al. 2002), and thus far have not been evaluated in excavated contexts of significant Early Archaic assemblages in the inter-riverine zone of South Carolina, or away from major raw material sources. One excavated assemblage within the inter-riverine zone where their presence has been noted is at the Cal Smoak site (38BM4), but a sizeable assemblage of Early Archaic artifacts was not found to provide an adequate discussion of the condition of bifacial cores (Anderson et al. 1979).

**Bipolar Cores.** Bipolar cores, sometimes classified as *pieces esquillees*, are often present among Early Archaic assemblages, and a discussion of their presence is especially relevant to the goals of this thesis (Coe 1964; Daniel 1998:Figure 4.46; Goodyear 1993). Strategies of bipolar reduction are capable of making use of lithic raw material that occurs or otherwise exists in small packages, and is capable of producing flakes with sharp edges by placing the material on an anvil and splitting the material by
percussion from above. This approach introduces kinetic energy above with potential energy from below that together initiate fractures from opposing ends of the core. This strategy is implemented in many locations around the world, sometimes as a primary means for producing functional edges (Casey 2000; Jones 2006; MacDonald 1968:88).

The appearance of bipolar cores among Early Archaic assemblages that are otherwise organized around bifacial reduction strategies may imply several possibilities in terms of functionality. Old World interpretations of bipolar cores and *pieces esquillees*, have proposed their use as wedges for splitting wood, bone, or other organic materials (Daniel 1998:108; MacDonald 1968:88). Other interpretations suggest that bipolar reduction is just a simple method for producing usable flake edges from raw materials that occur in small package sizes, or are poor in overall quality and homogeneity (Casey 2000; Jones 2006). An additional interpretation was proposed by Goodyear (1993) when evaluating bipolar cores in Paleoindian contexts in the northeastern region of North America. Goodyear (1993) proposed that bipolar cores functioned primarily as a means by which usable flake edges could be produced from small raw material packages specifically at the end of the logistic curve of that raw material. This interpretation has relevant implications to the perspective of risk employed within this thesis, where bipolar reduction represents a strategy for extending the use-life of otherwise exhausted tools and packages of tool stone. Crystal quartz bipolar cores and *pieces esquillees* were excavated at the Hardaway site by Coe (1964) in a geographic location directly associated with a massive rhyolite quarry (Daniel 1998:107-110, Figure 4.46). Due to low raw material stress present at the Hardaway site, Daniel (1998:109) suggests that these crystal quartz bipolar cores may represent ritual or socially significant activities such as have been
observed ethnographically for cutting human flesh for scarification or other such ritual behaviors (Hayden 1980:4). It is the interpretation presented by Goodyear that will be emphasized in the discussion of Early Archaic assemblages analyzed within this thesis.

**Other Cores.** Other core types have been observed among Early Archaic assemblages that are primarily irregular in form and have been found in close association with quarry related behavior (Daniel 1998:107). Daniel (1998:107) describes a block core type as medium in size and amorphous in shape with flake scars originating from many different directions. These cores do not appear to be formalized and appear to be expedient in nature. An expedient intent would explain their presence in close association with a raw material quarry and low raw material stress.

Altogether these tool types reflect the wide range of technological diversity present among Early Archaic stone tool assemblages.

**Continuity with Paleoindians.** Paleoindian strategies of mobility and subsistence, their general technological organization strategies and even some tool forms, such as hafted endscrapers, continue into the Early Archaic. High mobility is evident in the Early Archaic toolkit, which is comprised of curated designs and is also reflected in foraging subsistence strategies that require frequent movement across the landscape (Anderson and Hanson 1988; Binford 1979a, 1980; Daniel 1996, 1998, 2001; Goodyear 1979). Unlike the Paleoindian period, however, the Early Archaic has new and much more diverse tool forms, indicating that there was a great deal of variation in mobility and technological strategies throughout the Early Archaic (Goodyear 2014; Wilkinson 2017).
Organizational approaches to technology have been useful for evaluating archaeological assemblages as they provide evidence of behavioral goals with regard to mobility, residence time, and resource exploitation. By evaluating differences in toolkit organization, archaeologists can better understand how far and how frequently people were moving, and how intensively they were exploiting resources in their local and regional environments. One of the resource types that directly influences technological organization is the relative quality and availability of lithic raw materials. Depending on which technological strategy is employed, this variability in quality and availability will influence technological organization in different ways. Archaeologists can gain insight into resource exploitation strategies by analyzing toolkit design and technological organization.

Many technological assessments operate under the assumption that toolkit design will seek to maximize efficiency while reducing the cost of maintenance and replacement (Andrefsky 1994; Bamforth 1986; Bamforth and Bleed 1997; Binford 1973, 1979a; Bleed 1986; Goodyear 1979; Torrence 1983). Andrefsky (1994) has noted that the availability of raw materials directly influences optimal technological organization where high availability will influence more expedient use, and low availability will influence more formalized approaches to technological organization. This aspect of availability has also been examined in terms of its predictability by Bleed (1986), who evaluated technological design from an engineering perspective. In situations of high predictability (or availability) toolkit designs will reflect durable, reliable, and under-stressed conditions. When unpredictability of raw material sources is present, or when
availability is low, toolkit conditions will reflect high degrees of maintainability, recycling, and repurposing as a result of coping with the lack of predictable replacement.

Expedient and curated technologies are two extremes on a spectrum of technological organization that varies with environmental and social influences. Expedient technologies are associated with high raw material availability (Andrefsky 1994), high degrees of resource availability and predictability (Bamforth 1986; Bamforth and Bleed 1997; Bleed 1986), and in situations of increased sedentism. Curated technologies are a system of negotiating low raw material availability (Andrefsky 1994; Bamforth 1986) or predictability (Bleed 1986), high degrees of mobility (Binford 1973, 1979a; Goodyear 1979; Torrence 1983), and are a means for negotiating variable and unexpected situations of toolkit stress (Binford 1973, 1979a; Bleed 1986; Goodyear 1979; Torrence 1983). In any given situation a full range of expectations may be present depending on geographic proximity to resources, unexpected influences, and as variability within the general toolkit design.

Raw material quality has a decisive effect on technological organization, toolkit condition, and archaeological residues. Raw material quality can directly affect the approach taken to technological design, but may also influence the condition of the toolkit design that is imposed on the exploitation of raw materials of differing quality. Flintknappers in the past, as in the present, would preferentially select raw materials of sufficient quality to produce desired designs (Goodyear 1979; Stout et al. 2005; Wilkinson 2014). Evidence for this preferential selection even exists among assemblages from the oldest periods of stone tool manufacture. Stout et al. (2005) found that early humans who produced Oldowan technology preferentially selected lithic raw materials of
a finer grained matrix and smaller phenocryst inclusions over materials of rougher texture and with larger inclusions. Experimentalists have determined that variable textures, package sizes, hardness (durability), and brittleness are useful for a variety of different tasks (Jones 2006, 2008, 2015). This variability also influences the condition of tools made from them (Jones 2015:56-65), a factor that has consequential implications for lithic analysis. Amick and Mauldin (1997) analyzed debitage breakage patterns in archaeological assemblages and found that some raw material characteristics, such as brittleness, cause debitage produced from those materials to break more frequently, influencing archaeological interpretation when comparing assemblages composed of different raw materials.

The idea of curation was first defined by Binford (1973, 1977, 1979a). Since then it has been defined and implemented in archaeological studies in many ways. Bamforth (1986) provides the following synthesis as a definition of curation:

Technologies based on curation comprise tools that are effective for a variety of tasks, are manufactured in anticipation of use, maintained through a number of uses, transported from locality to locality for these uses, and recycled to other tasks when no longer useful for their primary purposes. ... Curation should produce assemblages that are technologically sophisticated and probably formally distinct, with individual tools used for a variety of anticipated purposes (Bamforth 1986:38).

The nature of a curated technologies allow for high degrees of mobility and flexibility given variable circumstances that would be encountered both in environmental and social situations. Among highly mobile Paleoindian societies, for example, the selection of high quality lithic raw materials to make formal, curated tools allowed for greater degrees of flexibility in the maintenance of their toolkit, and therefore allowed for greater mobility and toolkit durability (Goodyear 1979). Early Archaic hunter-gatherers were
also highly mobile and would also have needed a formal toolkit made from high quality raw materials that could be curated (Anderson and Hanson 1988; Daniel 1998, 2001; Sassaman 1996; Sassaman et al. 1988).

THEORETICAL ORIENTATION

This research takes an ecological approach that seeks to understand the relationship between people and the environment. Unlike other organisms that adapt to changing environments over the course of generations, humans are able to quickly adapt to changing conditions with technology and new social and cultural practices. Also unlike other organisms, the human environment is social as well as natural, and relations with other people can also have a decisive effect on resource availability. It was Julian Steward (1955) who initiated the cultural ecological approach, which was based on the evolutionary concepts of adaptation and natural selection. Since then Cultural Ecology has branched in many directions that are united by neoevolutionary theory (Broughton and O'Connell 1999; Cronk 1991; Dunnell 1980; Foley 1985; Kantner 2010; Kuhn 2004; Lyman 2009; Lyman and O'Brien 1998, 2001; Murray 2002; Neff 2000; O'Brien 2005; O'Brien and Lyman 2000; Sahlins and Service 1960; Schiffer 1996; Shennan 2002; Shennan 2008; Smith 1987; Trigger 1971).

In this research I am specifically interested in models that draw on evolutionary theory to explain resource choice and utilization under different circumstances. For this reason I draw on optimal foraging theory, central place theory, and risk theory that model different aspects of human adaptation.
Optimal Foraging Theory. Optimal Foraging Theory (OFT) is an approach that predicts the optimal strategy for minimizing cost and maximizing energy yields from the acquisition of food resources. It can also be applied to the exploitation of other non-food resources by assessing the cost of acquiring the resource against the benefit gained. Anthropologists have applied OFT to the studies of hunter-gatherers to aid in predicting strategies for mobility and subsistence (Bettinger 1991:83-111; Dyson-Hudson and Smith 1978; Grimstead 2010, 2012; Hitchcock and Ebert 1989; O’Brien 2005; Shennan 2002; Smith 1979; Smith et al. 1983; Smith and Wishnie 2000; Winterhalder 1981).

Optimal foraging theory has its origins in biology in the analysis of the feeding patterns of animals, but has been adapted to more complex, human situations. It seeks to understand the optimal strategy in a given situation, by considering a number of factors. Optimal foraging has been modeled in several ways, including via diet breadth, patch choice, marginal values, and central place foraging (Bettinger 1991).

The diet breadth model seeks to evaluate the full range of exploitable resources within a specific environment and the costs of procuring those resources relative to the potential energy gained (Bettinger 1991:84-87). This perspective assumes that resources vary in quality, which implies the cost of acquisition and yield in energy vary in meaningful ways across resources types. The balance between ease of procurement and yields in energy varies, and requires negotiation. By evaluating the full range of exploitable resources and their variable qualities, diet breadth models illuminate this balance that human produced technologies are able to negotiate.
The patch choice model seeks to evaluate the optimal locations for exploiting resources by evaluating the "patches" that support the highest densities and diversities of resources (Bettinger 1991:87-90). The optimal approach in determining the best places to forage for resources is to evaluate the locations capable of supporting the resources that have been determined as optimal resources by the diet breadth model. The patch choice model determines where it is optimal to forage for resources as they can be widely dispersed.

Once the optimal resources and the optimal locations are understood, understanding the length of time that it is optimal to stay in those locations can be calculated by the marginal value theorem (Bettinger 1991:90-93; Charnov 1976). This equation evaluates the rate at which resources of optimal determination are depleted within the selected environment against the amount of energy gained from those resources. The point in time that resources become too depleted for continued benefit will determine the rate at which movement to a new "patch" will be necessary. This implies that locations with higher resource yields will support foraging for longer periods of time, or by larger groups of individuals, and therefore reduce the rate of mobility that is necessary. The marginal value theorem determines the degree of time-stress that influences foraging strategies within a locality based on the quantity and quality of resources against the rate at which they are depleted (Bettinger 1991:90; Charnov 1976; Torrence 1983).

Central place foraging approaches evaluate a spatial dimension to the evaluation of optimal foraging in a locality (Bettinger 1991:93-98). The determination of resource exploitation per unit of distance cost expended in exploiting the resource determines the optimal resource in which to exploit in a given foraging trip. If great energy is expended
in distance traveled, then resources of lower energy yields will likely be overlooked in favor of resources that provide higher energy returns. This higher return compensates for the energy expended in the foraging trip. This implies that a central location with equal distances in terms of efficiency to multiple resources would be the optimal location within a patch to centralize foraging efforts.

These models of evaluating optimal foraging strategies explain the evaluation of different factors of resource availability, efficiency, and durability within given environmental settings. These approaches do not incorporate social factors that influence decisions made about resource exploitation, the negotiation of social factors, or the determination of the value of specific resources. These models do however, evaluate environmental conditions that social decisions would have to incorporate in their negotiations of desired resources.

Central Place Theory. Central place theory has its origins in the field of Geography. It attempts to explain geographic patterns of people and resources in urban environments and the organization of people and goods around central locations. The concept has primarily been used in modern contexts to model business success in terms of its proximity to appropriate markets (Christaller 1966; Beavon 1975, 1977; King 1984), but it has also been incorporated into models of human resource negotiation in the past. In the past, as in modern contexts transportation would have had a decisive effect on resource procurement and use. Houston (2011) discusses many different formulas for calculating the cost of central placement within foraging ranges and includes an evaluation of the cost of transporting foraged resources to central places. In these discussions he also includes the concept of critical distance, which has been used by both
archaeologists and ecologists in studying the maximum distance that either humans or animals can obtain resources without spending more energy than those resources provide (Ames 2002; Kelly 1995; Pennycuick et al. 1984). One implication of this concept is that optimal locations for central places are situated equidistant to multiple resources, a strategy that limits the costs of obtaining multiple resources and increases the energy gained from foraging efforts.

Groups of people were also very likely to have organized themselves around resources. Anderson and Hanson (1988) suggest that central place foraging strategies were especially important during the winter months when biological resources would have been more unpredictable. They propose that Early Archaic winter base camps would allow them to rely on predictable resources, such as lithic raw material sources, while exploiting less predictable ones. During warmer seasons when biological resources are more abundant, Anderson and Hanson propose that the scale of the central place increases. The major river drainages then became the central places around which Early Archaic people focused their exploitation of resources.

*Risk Theory.* According to Wiessner (1982: 172) “In any society, economic strategies are twofold: those aimed at bringing in the mean subsistence income needed to sustain a household throughout the average year, and those aimed at reducing the variance around the mean.” In Archaeology the concept of risk is used to evaluate the ways in which people negotiate natural and social resource variability. When studying hunter-gatherer behavior, risk can be viewed as the cost of performing an activity versus the benefit that results from it. The higher the cost without an increase in benefit, the higher the risk. With regard to resources, optimal strategies of mobility around those resources must
negotiate risk in order to minimize cost and increase the yields in benefits. The currency of this evaluation varies and is determined by the resource or situation examined. In most instances of OFT, the currency is caloric, though not exclusively.

When archaeologists examine hunter-gatherer negotiations or management of risk, they look for optimal patterns of behavior that would minimize the effects of risk in different environmental and social contexts. In probably the most cited archaeological work ever, Binford’s (1980) discussion in “Willow Smoke and Dogs Tails” of foraging and collecting patterns offer models of optimal negotiation of risk around natural distributions of resources. His approach is environmentally deterministic and states that the predictability and relative homogeneity of resources will determine the optimal distribution and kinds of socially generated sites.

Wiessner (1982) extends the forager-collector continuum proposed by Binford beyond environmental determinism and includes hunter-gatherer social strategies for subsistence security by using risk theory. These strategies range on a scale from individualized pooling of risk, to long-term storage of resources in order to relate to Binford's (1980) argument concerning the predictability of resources (Wiessner 1982: 174). This scale would be expressed in the social exchange of goods which could be viewed as risk sharing. Risk management could also be investigated by studying the internal structure at sites, and the designs of individual shelters. An open structure would indicate that resources were readily visible to the community for the purpose of the communal distribution of resources, while a closed or isolated structure would indicate that individually obtained resources were not readily distributed. This argument rests on the cultural theory of signaling, in which abundant resources would be put on display as a
marker for status or wealth which could be shared, and limited resources hidden so as to protect them for individual use (Bird and Smith 2005). On a larger scale, the distribution and exchange of resources would also be indicators of social interaction and the sharing of risk.

Technological organization has been assessed in terms of time stress by Torrence (1983) where time stress is negotiated in the time it takes to complete a task, and in scheduling. In time to completion situations, technological characteristics that encourage or allow speed and efficiency are seen as optimal strategies, while scheduling stress can be managed by organizing the procurement of new raw materials around other more important subsistence activities. Such scheduling concerns result in "embedded" procurement strategies where the procurement of lithic raw materials and the production and maintenance of lithic tool kits are undertaken in conjunction with other subsistence activities, as witnessed by Binford (1973, 1977, 1979a, 1979b) among the Nunamuit (Torrence 1983:12).

Technological reorganization can also be a risk management practice. In an example from Late Stone Age South Africa, Bousman (2005) found that periods of drought that decrease the density of wild game encouraged the Late Stone Age hunter-gatherers to reorganize their technology for the purpose of exploiting smaller game. This reorganization also influenced the maintenance of toolkits causing a more intensive system of tool repair and repurposing. When risk in the environment was low, a more expedient approach to toolkit organization was preferred. When risk was high strategies of intense curation, maintenance, and repurposing were preferred (Bousman 2005, Torrence 1983). Technological risk can also be negotiated with regard to raw material
provisioning. When availability of raw material is scarce, strategies of caching have been implemented to offset the risk of exhausting the toolkit (Moore et al. 2012).

**SOUTH CAROLINA GEOGRAPHY**

South Carolina is geographically situated on the Atlantic Slope of the United States of America. Its terrain ranges from the Appalachian Mountains to Atlantic coastal beaches and is cross cut by river drainages providing variability in topographic relief across the state that influenced Early Archaic strategies of mobility and subsistence. The Northwestern most portion of the state exhibits a portion of the Appalachian mountain range that extends nearly the full length of the eastern United States. Progressing to the Southeast from these mountains across South Carolina terrain ranges from the rolling hills of the Piedmont, to ancient beaches that form the Sandhills along the Fall Line, and out onto the Upper, Middle, and Lower Coastal Plains before reaching the modern day shore line. These topographic zones have their own geological and biotic resources. Geologically, the Carolina Slate Belt extends across the Piedmont and possesses a variety of lithic raw material resources that outcrop sporadically across the very old weathered soils found there. High variability in elevation increases the rates of erosion such that soil depletion is relatively higher and water retention relatively low compared with flatter terrain. Below the Fall Line, where ocean levels once reached their peaks several million years ago, the Coastal Plain is increasingly flat and the soils are composed of a great deal of sand and transported organic and mineral deposits from the Piedmont. In some places, marine sediments possess silicate materials suitable for the manufacture of chipped stone tools. The flat terrain of the Coastal Plain encourages greater sinuosity in drainage systems. Here river floodplains widen dramatically, water flow slows, and the rivers
deposit minerals and organics from the Piedmont into Coastal Plain habitats and enhance
densities of biotic resources. While much has changed across South Carolina's
geography over millions of years of climatic fluctuations, within the majority of human
experiences here these general descriptions have remained true.

RAW MATERIAL TYPES AND DISTRIBUTIONS

The lithic raw materials from which prehistoric peoples made their tools are a
primary means by which archaeologists are able to identify human movement and
interaction across ancient landscapes. Stone tools are among the most frequently
observed artifacts in prehistoric contexts because of their ability to survive
decompositional processes that remove other materials from archaeological sites.
Identifying lithic raw material types and their locations of availability in geologic
exposures, allows archaeologists to evaluate both the cultural exploitation of
geographically separated raw materials, and their movement away from and between
these different sources. South Carolina possesses a variety of lithic raw material types
that are visually distinctive, and often occur in geographic isolation from one another.
Lithic raw materials that are best suited for flaked stone technologies are
cryptocrystalline materials that exhibit high concentrations of silica in their composition.
This silica composition creates predictable fractures that can be controlled for the
manufacture of stone tools. Materials which possess higher concentrations of silica along
with a homogenous matrix, as can be found which many varieties of chert, allow for
greater control and flexibility in manufacture than other materials of less homogeneous
composition.
Lithic raw materials that will be described here include Allendale, Black Mingo, Wyboo, and Ridge and Valley cherts, Western Piedmont and varieties of Uwharrie and Pee Dee rhyolites, Orthoquartzite, Phyllite, Quartz and Metaquartzites, and Petrified Palm Wood.

*Allendale Chert.* Allendale chert is a limestone replaced silicate found in marine sediments within the Flint River formation that stretches across a considerable portion of the southeastern Coastal Plain (Goodyear and Charles 1984, Upchurch et al. 1982; Upchurch 1984). The northeastern most occurrence of this formation is found in Allendale County, South Carolina, and was exposed and extensively utilized by people throughout prehistory as evidenced by numerous quarries that have been archaeologically surveyed (Goodyear and Charles 1984). The limestone matrix of which Allendale chert is composed, provided a fine-grained and homogeneous foundation for the crystallization of groundwater transported silica from deteriorated diatoms (Goodyear and Charles 1984:2). This material is distinctive in appearance from other materials across South Carolina, but is similar to exposed cherts found throughout the Flint River formation, particularly across the Savannah River into Georgia.

Although culturally transported examples originating from this formation on the Georgia side are likely to occur in archaeological assemblages across South Carolina, they are difficult to differentiate. Given the additional distance raw materials would need to travel, it is assumed that the majority of chert present among archaeological assemblages throughout the state of South Carolina originate from the Allendale County exposures. Cultural exploitation of this material in South Carolina has been evaluated in order to examine the scale at which Paleoindian and Early Archaic settlement patterns
extended (Anderson and Schuldenrein 1983; Daniel 1998, 2001; Daniel and Goodyear 2017; Goodyear 1979, 2014; Sassaman 1996), the reduction in ranges of mobility throughout prehistory (Sassaman et al. 1988), and in evaluating differing patterns of exploitation by cultures throughout prehistory (Charles and Moore 2017). Allendale chert, and other cherts within the Flint River formation, are rendered glass-like, more brittle, and extremely colorful with bright reds and pinks when heat treated (Purdy and Brooks 1971), a strategy extensively utilized beginning in the Middle Archaic to enhance the ease of workability. When untreated by heat, a distinctive yellow patina develops over time from chemical deterioration when deposited in acidic soils, which is very useful in identifying the relative age of tools and debitage generated from this material. When deposited in an anaerobic environment, such as when submerged in water or deposited in saturated soils, this distinctive yellow patina does not develop leaving tools translucent and in appearance as though they have been freshly broken.

*Black Mingo Chert.* Found on the central Coastal Plain of South Carolina in Calhoun and Sumter counties, Black Mingo chert is highly fossiliferous and is more susceptible to chemical weathering due to its chemical instability relative to Allendale cherts (Goodyear and Charles 1984:2; Upchurch 1984). This chert is a part of the Black Mingo formation and was formed in deposits of marine shell, such as can be seen today on beaches where fine fragments of shells are tumbled by the waves and accumulated into thick deposits. This shell "hash" is easily distinguished upon examination of the cortical material, and the fingernail-like remnants of shells in the matrix of the silicified chert can be seen in most cases with the naked eye (Goodyear and Wilkinson 2014). So far only one quarry of this material has been examined archaeologically where a substantial collection of
hafted bifaces was examined in order to determine the relative degrees of exploitation throughout prehistory (Goodyear and Wilkinson 2014).

Surface exposures of this material have been noted by flintknappers and rock and mineral enthusiasts in Sumter County, as well as noted by archaeologists eroding out of the Congaree River bank in Calhoun County (Steen and Taylor 2002: 28). Other varieties of this chert have been identified by other names due to variations in color and fossil content. Manchester chert has been described as a fossiliferous material with a deep purple color and a fine grained matrix (Anderson et al. 1982:128; Cantley and Swanton 2003). Other varieties that have been given distinct names by Cantley and Swanton (2003:31-34) such as Cemented Shell, White Fossiliferous Silicate chert, White Fossiliferous Isotropic chert, Bluish-Grey Fossiliferous chert, Brown/Tan Fossiliferous Silicate chert, Brown/Tan Fossiliferous Isotropic chert, Brown-White Modeled Silicate chert, and Corroded Limestone, are said to come from both the Black Mingo and Santee Limestone formations within the central South Carolina Coastal Plain. These distinctions were not made during analysis of the collections analyzed within this thesis, and have been identified universally as Black Mingo chert. This was done for several reasons: an inability to identify material color and specific fossil contents with the naked eye or due to substantial weathering, a lack of knowledge concerning these distinctions during the analysis of relevant artifacts, and the general assumption that these distinctions had little effect on cultural exploitation of exposed materials often found in close association with one another and of relatively equal quality in terms of package size and workability.

Wyboo Chert. Another material local to the central Coastal Plain of South Carolina is Wyboo chert. This material is fossiliferous and poorly cemented in most cases, and is
extremely susceptible to corrosion and chemical weathering. The distinctive fossil types present that are characteristic of Wyboo chert, are bryozoans. The formation in which this chert is formed was first recognized by Cooke in 1936 (Costello and Steffy 2013:84). The chert was named "Wyboo Chert" by Costello and Steffy (2013:84) after observing a significant concentration of the material in the Wyboo Swamp area of Clarendon County. The exposure of the majority of this formation is now likely submerged underneath the surface of Lake Marion. One quarry has been archaeologically identified in the region at 38CR33, where a significant number of large early stage debitage and debris have been recovered (Costello and Goodyear 2014). Other high concentrations of the material have been observed in private collections along Wyboo Creek in the Wyboo Swamp vicinity lending credence to the observation made by Costello and Steffy (2013).

*Ridge and Valley Chert.* Often found among archaeological assemblages in South Carolina are lithic raw materials originating from the Ridge and Valley province of Tennessee and North Georgia (Sweat 2009). These highly homogenous cherts, are very distinctive and are commonly found among assemblages particularly in northwestern South Carolina, but occasionally appear in assemblages throughout the state. Varieties of these Ridge and Valley cherts occur in a range of colors that are unlike other materials in South Carolina. Knox chert occurs in jet black, grey, and grey-blue colors with occasional white streaks or speckles within the matrix (Sweat 2009). These varieties are found to be transported over into South Carolina more often than other Tennessee raw materials such as Fort Payne, Dover, or St. Louis cherts as sources likely occur at greater distances away from the state.
It should be mentioned, however, that although the vast majority of this material is exposed in southeastern Tennessee and North Georgia (as well as perhaps the western most portion of North Carolina), there is some archaeological evidence suggestive of an isolated exposure in South Carolina. Archaeological collections of artifacts from 38MC13, also known as Black Island, have yielded unusually high densities of artifacts made from a very similar material as Knox black chert (Charles 1981:58; Novick 1978:432). Artifacts recovered from 38MC13 made from this material are primarily Kirk corner notched hafted bifaces (Charles 1981:58), and debitage from this site is said to have a reddish pitted cortex (Novick 1978:432). Whether or not these artifacts are representative of exploitation of a local source, or cultural transportation of lithic raw materials in their original raw material package form significant distances from their geologic origins have yet to be determined, but represents a significant curiosity among archaeologists interested in lithic raw material sourcing in the state.

Western Piedmont Rhyolite. Sources of metavolcanic materials have been identified in South Carolina's western Piedmont in the Edgefield and Saluda county area that have been extensively utilized in prehistory (Moore 2010; Charles and Moore 2017; Southerlin 2012). Numerous quarries within this locality have been identified in United States Forrest Service compartments in Edgefield and Saluda counties (Southerlin 2012). These rhyolites occur in large package sizes as evidenced by large boulders and extensive deposits of quarry debris (Moore 2010; Southerlin 2012). The texture and consistency of the matrix of these rhyolites appear homogenous, but are softer in hardness than other rhyolites particularly those from the Uwharrie mountains. They are especially susceptible to chemical corrosion and weathering, as Paleoindian and Early Archaic
hafted bifaces found to be made of these materials are especially weathered to the point in most cases where flakes scars are no longer discernible. It is this characteristic of significant weathering that lends this material recognizable in most cases from rhyolites originating from other localities.

_Uwharrie Rhyolites._ The Uwharrie mountain range has long been known to be full of metavolcanic raw materials that were exploited extensively throughout prehistory, and have had significant influence on archaeological assemblages across South Carolina (Coe 1964; Daniel 1998, 2001; Daniel and Goodyear 2017; Novick 1978; Steponaitis et al. 2006; Wilkinson 2014, 2017; Young 2013). These materials range in visual appearance from: aphanitic (fine grained), to aphyric (banded or flow-banded), and also porphyritic (speckled inclusions of quartz and feldspar) (Daniel 1998; Steponaitis et al. 2006; Young 2013). Perhaps the most famous of these materials is aphyric, or flow-banded, rhyolite known to originate from Morrow Mountain where arguably one of the largest prehistoric lithic quarries in the Southeast exists (Coe 1964; Daniel 1998; Steponaitis et al. 2006). The distinctive flow-banding present on weathered artifacts from this vicinity is visually distinctive from other metavolcanics found within South Carolina, and is said to be relatively rare throughout the Uwharries away from the Morrow Mountain vicinity (Daniel 1998:42). While it is impossible at this time to say conclusively that all flow-banded rhyolites come from this vicinity of the Uwharrie Mountains, an experienced eye can differentiate this material from other similarly banded rhyolites. Until other sources of this flow-banded material are identified away from the Morrow Mountain vicinity, it will be assumed that materials of this appearance originated there.
Perhaps the most abundant of rhyolites from the Uwharrie mountain exposures are porphyritic in appearance exhibiting varying degrees of quartz or feldspar inclusions in the matrix (Daniel 1998:42). Also present are materials that are fine-grained in appearance without any taphonomic or inclusive structures present. These materials are often very homogenous and are more resistant to chemical weathering than the above discussed Western Piedmont rhyolites. This chemical stability enables identification of Uwharrie rhyolites from Western Piedmont varieties possible. Altogether these metavolcanic materials were extensively utilized and have significantly influenced the compositions and raw material frequencies in archaeological assemblages across South Carolina (Daniel 1998, 2001; Daniel and Goodyear 2017; Steponaitis et al. 2006; Novick 1978; Wilkinson 2014, 2017).

_Welded Vitric Tuff._ Another metavolcanic lithic raw material associated with the Uwharrie mountain range in the vicinity of Asheboro, NC is a material type commonly referred to among archaeologists as Welded Vitric Tuff. This material type occurs in a few distinct colors such as green and dark blue, and is so fine grained it has been mistaken for chert. The dark blue variety of Welded Vitric Tuff sometimes weathers differentially leaving speckles of the appearance of porphyritic inclusions. Bedrock sources of these materials have been identified in the vicinity of Asheboro, NC, where local flintknappers have brought the material to the attention of professional archaeologists. A material by this name has previously been described by Novick (1978:428) as having quartz veins running through the matrix, and this description is believed by the author to actually describe a lithic raw material found in the South.
Carolina Piedmont described below called Phyllite. Plans for work on differentiating these two materials chemically are underway at the time of this writing.

**Pee Dee Rhyolites.** The origin of the Pee Dee River begins in the heart of the Uwharrie Mountains, and travels through the northwestern portion of South Carolina until it reaches the Atlantic Ocean. Given its point of origin, significant deposits of fluvially transported lithic raw materials are present throughout the main channel of the Pee Dee drainage in South Carolina. Porphyritic rhyolite is one distinct raw material type present in the South Carolina Pee Dee that has been significantly exploited throughout prehistory. It is distinguishable by its dark blue or black matrix that contain quartz and feldspar phenocrysts visible with the naked eye (Young 2013). It was first observed by a private collector to often have a high enough iron content as to render a reaction from a magnet. This information was shared with SCIAA archaeologists and has become a method for providing provenience for metavolcanic materials in the state as so far no other sources have had significant frequencies of reacting to a magnetic (Al Goodyear personal communication). High concentrations of this material occur in the river in Darlington County where local archaeological sites have significant frequencies present (Young 2013). One such site is the Kolb Site (38DA75) that possesses significant evidence of frequent occupation throughout prehistory, and certainly during the Early Archaic (Wilkinson 2014). The occurrence of this material type along the river has not been accurately delineated, though it has been observed in numerous locations by both flintknappers and archaeologists (Sean Taylor personal communication). Also present among these fluvially transported materials are various fine grained and banded rhyolites
often found within the Uwharrie mountain vicinity, and an abundance of Quartz (Sean Taylor personal communication).

*Orthoquartzite.* Orthoquartzite is a sandstone cemented together with a silica matrix that is known to form in marine sedimentary deposits. It is often light to dark brown in color, and have been observed as having light or bluish grey or blue hues, and yellow and yellowish brown hues. Sand grains are readily visible in most examples with the naked eye. This material is found across the central Coastal Plain of South Carolina and in high concentrations closer to the coast in Berkeley and Williamsburg counties where extensive prehistoric utilization is present (Moore and Brooks 2012:Figure II-9). An exposure of Orthoquartzite has been observed and noted to have influenced local archaeological assemblages in Calhoun County, though no specific quarries in this vicinity have yet been identified (Goodyear and Wilkinson 2015). Orthoquartzite is noted to be present in significant frequencies along the Santee River drainage where it has been observed frequently among archaeological assemblages and sometimes occurring in close geologic association with Black Mingo cherts. It has also been observed to occur geologically in Allendale County in close proximity to exposures of the Flint River formation, but archaeological evidence of any significant prehistoric exploitation of these exposures is so far lacking (Goodyear and Charles 1984; Upchurch 1984).

*Phyllite.* Phyllite is a silicate that is present in isolated locations throughout the Slate Belt in the South Carolina Piedmont. Little is known so far about this raw material type and its distribution, though it has been examined by Upchurch (1984) who gave a geologic description of its composition from archaeological samples. The material is often green or grey-brown in color and exhibit distinct shear scars within the materials.
matrix that have been healed or resilicified by quartz and has the appearance of quartz veins running often in straight lines through the matrix (Goodyear and Charles 1984; Upchurch 1984:136-137). Higher concentrations of archaeological examples of this material in the form of hafted bifaces and debitage have been observed among private collections in Richland County, as well as a large collection along the Wateree River in Kershaw County (Al Goodyear personal communication). Efforts are underway at the time of this writing, to assess this material chemically, and to compare it with other known materials of similar appearance.

**Quartz and Metaquartzites.** Perhaps the most abundant lithic raw material in South Carolina is Quartz. It is found ubiquitously throughout the Piedmont, and also in alluvial contexts across the Coastal Plain. Archaeological survey of the Piedmont have found Quartz quarries as often as every mile, as the abundant exposures of Quartz were utilized extensively throughout prehistory (Goodyear et al. 1979). Quartz cobbles have also been noted in abundance transported and tumbled into cobble form down the Savannah, Santee, and Pee Dee drainage systems, and have even been found by the author in the Edisto River as far away from the Piedmont as Colleton county. The most common form of Quartz, vein Quartz, forms in hydrothermal vents and has been uplifted as flot in Piedmont soils (Novick 1978:433). Also occasionally discovered and utilized by prehistoric people are Quartz crystals which form in pockets that allow for the crystals to fully form within being abutted against one another as is found in vein Quartz. Less frequently utilized for flaked stone tool manufacture is Metaquartzite, which is a metamorphosed Quartz that is particularly harder and much less brittle than vein or crystal Quartz. It is also found throughout the Piedmont and in alluvial deposits where it
has been utilized prehistorically primarily as a durable material for hammerstones (Novick 1978:431).

_Petrified Palm Wood._ Another raw material for which very little is known is Petrified Palm Wood. The highest concentrations of this material observed by the author among private collections are present in Sumter and Clarendon counties on the central Coastal Plain. One example of an Early Archaic Taylor side notched hafted biface has been reported among the Early Archaic assemblage at the Kolb Site (38DA75) in Darlington county (Wilkinson 2014), which is not far removed from the locations of other observed archaeological examples in the Black River drainage of Sumter and Lee counties. Other archaeological examples have been noted in collections along the north shore of Lake Marion, though much more infrequent, and as far West as Calhoun county were small frequencies of debitage have occurred at 38CL100, an assemblage to be discussed in the analysis presented in this thesis and also the location of a Black Mingo Chert quarry mentioned above. A deeply buried example of Petrified Palm Wood has been brought to the attention of the author by private collectors. This example was found in a since closed mining operation run by the Becker Sand and Gravel company in Sumter County, and is relatively close in proximity to the archaeological examples observed in private collections. Photos of large chunks of the material were shared with the author, and although the material has not been examined personally or tested for internal silica, the materials texture and visible petrified fibers render it the closest geologic samples observed yet. Efforts to procure samples and test for internal silica are underway. This deeply buried example does not conclusively identify the location of prehistorically
exploited Petrified Palm Wood, but this knowledge gives archaeologists an idea of where to begin looking for such exposures and perhaps associated quarry locations.

**SUMMARY**

A significant number of works have influenced this thesis and laid a foundation upon which this work rests. Cumulative archaeological works have created cultural context for the variety of stone tools found across the state of South Carolina and provided a means by which archaeological materials found in disturbed context may be placed into chronological units. An understanding of the environmental setting in which these peoples found themselves also allows us to better understand the technological strategies they used to cope with and survive in it. Geological investigations of silicate materials used to make the tools found to be Early Archaic in age allow archaeologists to measure cultural movement across the landscape. The landscape of South Carolina, though variable, provided a suitable environment for human habitation in the past where people thrived over the millennia. While most archaeological works are influenced by certain theoretical assumptions, this work is no different. The theoretical foundation for this thesis has significantly influenced both the history of previous investigations into the topic of Early Archaic mobility and subsistence (a detailed account of which will be presented in the following chapter) and the work of this thesis for which there is much that would remain un-interpreted without theoretical guidance.
CHAPTER THREE

PREVIOUS MODELS OF EARLY ARCHAIC SETTLEMENT, MOBILITY, AND SUBSISTENCE IN SOUTH CAROLINA

Models of prehistoric hunter-gatherers during the Early Archaic in South Carolina have utilized many theoretical perspectives and empirical approaches to evaluate and explain different aspects of the archaeological record. Each work has its own merits, having utilized existing datasets and theoretical perspectives in creating plausible explanations of visible residues across differing geographic scales and spaces. As each of these works have made unique contributions, and provided insights into numerous datasets, this chapter will discuss each approach in light of several subjects relevant for consideration in this thesis. These works will be discussed in order by date of publication and in regards to the following characteristics: the geographic location of the study; the geographic environment in which the data was derived and on which the theoretical arguments are imposed; the extent from which the data was derived and evaluated; the social and environmental factors examined in regards to the data or theoretical arguments and the assumptions made concerning those factors; the manner in which Early Archaic technology and technological organization have been assessed; the conclusions each approach makes concerning Early Archaic settlement, mobility, subsistence, and social organization, if discussed in the study; and the merits each work have that contribute to this thesis.
The Laurens-Anderson report produced by Goodyear et al. (1979) investigated archaeological sites that were surveyed as the result of a highway construction project from Laurens County to Anderson County in the Northwestern Piedmont of South Carolina. The transect of sites following the highway crossed drainages of differing sizes and associated floodplains and upland ridges. Given the geographic variability in which archaeological sites were located during the survey, Goodyear et al. (1979:131) defined the differences between riverine and inter-riverine/upland environments in order to understand potential relationships between site location and condition with the density and quality of resources associated with each. Previous distinctions had discussed the differences in "riverine" versus "inter-riverine" zones in which "riverine" was meant to refer to the river, as identified by geomorphologists, being the main trunk of the drainage system (House and Wogaman 1978). Goodyear et al. (1979) found this distinction difficult to apply to the Piedmont setting in which their transect was located as it crossed many rivers of variable sizes and orientations. It is for this reason that the riverine-upland distinction was made in order to avoid ambiguity between riparian and terrestrial environments.

Goodyear et al. (1979:132-145) discuss in great detail many properties of the Piedmont river systems in the locality of their study and evaluate these systems in several significant ways. First they evaluate the size and point of origin of all the streams within their study area and local region. Distinguishing between mountain originating streams and streams dependent entirely on localized precipitation directly affects the size and quality of the drainage. Incorporating the Strahler system of flow accumulation allowed
the authors to also assess the stability of streams, where streams of higher average volumes of flow are seen to be more stable and last to go dry when compared to streams of lower average volumes of flow.

A comparison of Piedmont river systems and Coastal Plain river systems were also noted as the differences in topographic relief affect the behavior of the river systems and also the size and characteristics of associated floodplains (Goodyear et al. 1979:137). As a part of this discussion the authors also include generalized information concerning soil types and their distributions across the landscape. Soils affect surface water runoff and penetration which directly affect the rate at which streams accumulate and transport rainfall in local environments. The authors attempt to quantify and evaluate the floodplain size and quality in river systems local to their study area using topographic maps. The results of their floodplain measurements demonstrated variability in size between sequentially ranked streams of up to 25% (Goodyear et al. 1979:138-139, Table 11). Goodyear et al. have the following to say concerning this change:

One implication pertaining to resource densities that may be tied to floodplain substrates is that density would increase in a linear manner by stream rank. If this is true it would mean that the potential for hunted, gathered, and cultivated foods on the next highest rank would be greater but not tremendously so. The higher flood potential of the largest rank streams might offset this regular progression, especially as it might relate to disturbed ground species (1979:138).

The significance of this evaluation is the recognition of the relationship between abundant surface water and related biological resource density.

When analyzing the archaeological residues from this transect the authors evaluated spatial patterns of site location and cultural patterns across the landscape. In regards to
the Early Archaic residues, formalized hafted bifaces and unifaces were evaluated along with presumed expedient unifaces without hafting elements (Goodyear et al. 1979:187-189). Geographic distributions of unifacial tools were examined along the transect, and a pattern of upland occupation was identified. Expedient Early Archaic unifaces were most abundantly located along upland ridge tops, and increasingly so along major watershed divides. While the authors acknowledge that surface collections gathered during this survey may have adversely produced sampling error due to the potential for increased erosion and artifact exposure along ridge tops, they propose that the location of Early Archaic sites along ridge tops may have implications into their travel and habitation habits in regards to utilizing higher elevations and continuous ridges across the landscape (Goodyear et al. 1979:197). The abundance of Early Archaic sites in the upland/inter-riverine zone impressed upon the authors that this zone was frequently, though perhaps expediently, utilized.

The authors also evaluate the lithic raw material diversity among the Early Archaic hafted bifaces. While the majority of hafted bifaces collected are made of locally available quartz, several examples of extra-local materials are present. The authors acknowledge Binford's (1979a) (Goodyear et al. 1979:199) assertion that "...the presence of exotic cherts may simply be a fair measure of the mobility scale of the adaptation appearing as a consequence of the normal functioning of the system with no extra effort expended in their procurement." They state that the high frequency of locally utilized raw materials are an indication of increased residence time by mobile Early Archaic groups. When comparing this statement to unpublished data residing within the South Carolina Institute of Archaeology and Anthropology collections at the time, the observed
pattern was said to remain true, that "...the proportions of raw materials made into Palmer points are always dominated by locally available stone" (Goodyear et al. 1979:199).

The predictions set forth by their approach expected to demonstrate that "...basecamp-like activities should tend to occur in the riverine zone, and extraction/procurement activities should be related to the upland inter-riverine areas" (Goodyear et al. 1979:33). The geographic pattern of Early Archaic artifacts evaluated in this report indicate that an abundance of expediently utilized landforms in the upland/inter-riverine zone suggests infrequent exploitation. In regards to the relationship between riverine and inter-riverine environments as distinguished by House and Wogaman (1978), more data are needed.

This early work provides several crucial arguments to this thesis which are worth highlighting here. First, the authors' attempt at evaluating river systems in the Piedmont of South Carolina is perhaps the first acknowledgment and evaluation of the relationship between surface water quantity and relative biological resource density. Secondly, they note that sites present along major watershed divides and along ridge tops within the upland/inter-riverine zone are indicative of a behavior of infrequent and expedient terrain utilization. This is important to consider in regards to a site's proximity to resources and potential cultural negotiations of environmental variables. Thirdly, Early Archaic utilization of locally available lithic raw materials occur in high frequencies given the proximity to the materials source, while extra-local raw materials are indications of group mobility ranges. These evaluations and observations have significant influences on this thesis, as it did on the works that will be discussed next.
Although not an investigation within South Carolina, the model proposed by Claggett and Cable (1982) is worth briefly mentioning due to its direct impact on several following investigations. Building on the assertions proposed by Binford (1980) concerning hunter-gatherer subsistence strategies in relation to environmental resource predictability, Claggett and Cable propose that a warming climate during the Archaic would increase sedentism and a gradual adaptation of general foraging would be increasingly expected. As the Ice Age ended and climate warmed, a more homogenous environment would be expected where hunter-gatherers would experience less risk and unpredictability regarding resources, and strategies of general foraging would become increasingly prevalent throughout the Archaic. The expectation of decreased risk and increased reliability of available resources has influenced modeling in South Carolina. These ideas are also important in regards to the model proposed by this thesis.

Archaeological investigations at the Rucker's Bottom Site (9EB91) in the central Georgia Piedmont along the Savannah River floodplain produced a significant Early Archaic occupation that has inspired further discussions about the Early Archaic utilization of riverine versus inter-riverine localities. Anderson and Schuldenrein (1983) evaluated the relatively high density of formalized and expedient tools found within the early Holocene layers at Rucker's Bottom, and placed it within a regional context of landscape utilization. This site is found along the banks and floodplain margin of the
Savannah River, a major mountain originating stream with significant volumes of flow and increased stream stability.

The Rucker's Bottom Early Archaic assemblage is compared to many different assemblages available from excavated data and surface collections across the Southeastern Atlantic Slope, as well as differing environmental zones in the Southern Piedmont (Anderson and Schuldenrein 1983: Tables 3-4). These data are evaluated in terms of tool types (formalized versus expedient forms) and by raw material (extra-local versus local) in order to assess settlement mobility and utilization of differing environmental zones (i.e. riverine vs. inter-riverine). While data are utilized from upland/inter-riverine collections, such as data published in the Laurens-Anderson report (Goodyear et al. 1979) and others, a riverine focus seems apparent due to data available at the time of this publication.

The authors evaluate these data in regards to the previously discussed models of Early Archaic settlement: the Goodyear-House (Goodyear et al. 1979) model, and the Clagget-Cable (1982) model. Theoretical assumptions adopted by the authors include the collector-forager dichotomy presented by Binford (1980), as well as Binford and Binford's (1966) maintenance/extractive task dichotomy. Evaluating the movement of lithic raw materials among the collections studied, the authors note a similar observation previously noted by Goodyear et al. (1979:199) that locally available tool stone dominates assemblages specifically in upland/inter-riverine collections. Anderson and Schuldenrein (1983) also observe that higher frequencies of extra-local materials appear along riverine sites, and conclude that this movement is an indication of frequent mobility along riverine localities.
The nature of the assemblages examined indicated relative homogeneity in terms of expedient versus curated tools present, and the most significant variability was found in the size of assemblages present in different localities. Given the homogeneity in tool kit design regardless of location, the authors conclude that sites of higher densities more likely represent palimpsests of multiple occupations in line with the predictability expectations presented in Claggett and Cable's (1982) model. Due to no significant differences in tool kit designs expected within the Goodyear-House (Goodyear et al. 1979) model, the authors suggest that residential mobility along dense riverine environments is a more likely representation of Early Archaic settlement practices. These conclusions have direct implications to the arguments presented in this thesis.

*Anderson and Hanson 1988*

Arguably the most well-known model of Early Archaic life ways in South Carolina, as well as the broader Southeast, the Band-Macroband model proposed by Anderson and Hanson (1988) is perhaps the most theoretically inclusive model that incorporates ecological, demographic, environmental, and ethnographic perspectives. This model has proposed that Early Archaic people focused their mobility along major drainages which they negotiated during seasonal fluctuations of resource densities and predictabilities. Cross-drainage movement during the Early Archaic was suggested to only occur periodically for social purposes of information and goods exchange.

An evaluation of seasonal fluctuations in temperature and biological resource predictability between the Piedmont and Coastal Plain led the authors to conclude that the optimal negotiation of those fluctuations would be to organize their mobility between the
Coastal Plain and the Piedmont seasonally. The Coastal Plain would have longer growing seasons and maintain a more homogeneous environment for longer periods of time than the Piedmont. In the late Fall, when whitetail deer mating season arrived, Fall-Winter base-camps are proposed to be located along the Fall Line where Early Archaic hunter-gatherers could exploit resources from both the Piedmont and the Coastal Plain, and perhaps take advantage of the dense, mast producing forests of the Piedmont for deer hunting excursions. The authors mention several dense sites known along the Fall Line as examples of this such as Manning (38LX50), Taylor (38LX1), Thom's Creek (38LX2), and Nipper Creek (38RD18). These dense sites are also proposed to represent seasonal aggregations of neighboring bands for social purposes such as information exchange, mate exchange, and for the mass processing of deer kills as evidenced by large frequencies of hafted endscrapers.

By incorporating excavated data from numerous sites along the Savannah River Valley, Anderson and Hanson (1988) evaluate their proposed seasonal movement by quantifying curated versus expedient tools and by calculating relative artifact densities at different sites. The highest curated-to-expedient ratios, as calculated by the author based on the total number and types of curated versus expedient tools present at each site, are present at G.S. Lewis (38AK228) and Pen Point (38BR383) which would "...appear to reflect longer occupations than is suggested at the other sites in the sample" (Anderson and Hanson 1988:278). While several sites present unique patterns of artifact residues, such as the Gregg Shoals site which had a very low artifact density and no reported expedient unifaces, several sites are interpreted to be representative of short duration and
infrequently visited on the basis of low artifact densities and low frequencies of expedient tools.

The authors begin their paper by stressing that their arguments are exploratory in nature. The arguments within this paper have proven to be very influential in the study of Early Archaic populations in South Carolina, and have been evaluated on numerous occasions with different datasets that have in most cases confirmed the predictions set forth by this model (Gillam 2015; Rigtrup 2009; Sassaman et al. 1988; Sassaman 1996). The assertion that resource density and predictability are highest along major river drainages has significantly influenced the approach and assumptions within this thesis. As will be discussed below, one artifact pattern not explained by this model is the significant cross-drainage movement of artifacts, and therefore people, throughout the Early Archaic.

*Sassaman, Hanson, and Charles 1988*

This investigation of Early Archaic hunter-gatherer ranges of mobility utilized geographically dispersed private collections of hafted bifaces existing in the South Carolina counties bordering the entirety of the Savannah River drainage. These collections were used by the authors to make general comparisons of the raw material distributions throughout the Archaic, and compared these ranges with raw material availability along the Savannah River. The largest range of raw material movement in the Archaic was found among Early Archaic hafted bifaces, where movement of up to 350 kilometers was observed spanning the entire length of the Savannah River.
Sassaman et al. (1988) consider several potential explanations of social practices which might influence patterns of raw material dispersion across the landscape, such as might be found within systems of exchange (Gould 1980), or as embedded within settlement mobility (Binford 1979a). Considerations of toolkit design and negotiations of raw materials costs, as discussed in terms of distances from sources, are mentioned in view of explaining the vast distances raw materials such as Allendale Chert traveled along the Savannah River drainage after overlapping sources of locally available raw materials. The authors suggest that expedient use of locally available raw materials in the Piedmont, such as is suggested by Goodyear et al. (1979) in the Laurens-Anderson investigation and by Anderson and Schuldenrein (1983) at Rucker's Bottom, would be a strategy to mitigate the stress that would otherwise be imposed on curated tools of extra-local materials (Sassaman et al. 1988:86). This is offered as one explanation of a negotiation strategy which allowed Early Archaic hunter-gatherers to transport extra-local raw materials over such great distances.

In evaluating Early Archaic mobility along the Savannah River drainage, the authors evaluate the conditions of Early Archaic assemblages excavated at Rucker's Bottom (Anderson and Schuldenrein 1983), Pen Point (Sassaman 1985), and G.S. Lewis East (Sassaman et al. 2002). Stages and conditions of the toolkit reduction of tools made from Allendale chert are briefly compared in regards to the distance the sites are located from Allendale chert quarries. Indications of early reduction stages are more prevalent at Pen Point which is closest to the source, and later stages of reductions are found at G.S. Lewis East and Rucker's Bottom. It is within this brief discussion that the authors note the acceleration of reduction stage with distance from source, where extra-local materials are
expected to be increasingly reduced with more advanced signs of attrition. Formalized tools of extra-local raw materials found at Pen Point and G.S. Lewis East are said to "...exhibit a high rate of attrition and tool maintenance" (Sassaman et al. 1988:86). As mentioned above, expedient utilization of locally available raw materials (once geographically removed from sources of high quality extra-local raw materials) allowed for Early Archaic hunter-gatherers to briefly negotiate and decelerate the rates of reduction and attrition of transported tools of extra-local materials.

This investigation demonstrates that Early Archaic hunter-gatherers were extensively mobile and negotiated raw material stress by incorporating strategies of stress reduction within their technological organization. The distribution of lithic raw materials along the Savannah River valley indicate rapid mobility such as suggested by Anderson and Schuldenrein (1983) and Anderson and Hanson (1988), and did not suggest any indications of social boundaries present along the Savannah River drainage. Although it was the intentional design of the study, a limitation of its results lie with its focus on the Savannah River, and with the unfortunately low sample of site specific collections for discussion. While it successfully utilized private artifact collections in demonstrating its purpose (to evaluate differing ranges of mobility throughout the Archaic) an accurate evaluation of Early Archaic assemblages require a greater sample of site specific collections, as well as geographically dispersed collections.

*Sassaman 1996*

A previous investigation of Early Archaic data from the South Carolina Coastal Plain synthesized evidence for Early Archaic settlement patterns and incorporated numerous
datasets to evaluate the scale and direction of settlement mobility (Sassaman 1996:59). The largest dataset examined was the state-wide collector database compiled primarily by Tommy Charles of the South Carolina Institute of Archaeology and Anthropology that included counts of Early Archaic point types by raw material across the majority of the state. The second dataset examined included site specific excavated data primarily from the Savannah River Site.

The author justifies his investigation of the Coastal Plain with several arguments worth mentioning in light of this thesis. The first reason is a claim by the author that the Coastal Plain "...forms a boundary of sorts between two distinct cultural traditions: the Carolina Piedmont tradition to the north and the side-notched point tradition to the south and west that included the Big Sandy, Bolen, and Taylor types" (Sassaman 1996:59). This cultural division is at best an arbitrary one, based on vague opinions of geography, raw material utilization, and differentially distributed cultural hafted biface styles. The second reason the author gives is the unique geology of the province, lacking ubiquitous lithic raw material distributions. Raw materials across the Coastal Plain occur in specific localities with distinct characteristics making it easy to distinguish differing patterns of movement. Lastly, the author states that the Coastal Plain witnessed some significant floral changes during the early Holocene that were not witnessed in other geographical provinces such as the Piedmont (Sassaman 1996:59). The author states: "...the early and quick expansion of pine after 8000 B.P. (Watts et al. 1996) apparently diminished the resource potential of the Coastal Plain and precipitated settlement reorganization, perhaps partial abandonment" (Sassaman 1996:59). This statement regarding abandonment is
reflected in the distribution of Bifurcate types that do not extend beyond the Santee river basin (Sassaman 1996:Figure 4.1).

The hafted biface distribution maps presented by Sassaman (1996:Figure 4.1) demonstrates varied patterns of distribution across the state. The hafted biface distributions that encompass the entirety of the state's geography, Palmer and Kirk corner notched hafted bifaces, are the focus of the author's series of transects both along and across multiple drainage basins and the different geographic provinces of the state. By evaluating the movement of lithic raw materials the author attempts to test the previously proposed Anderson and Hanson (1988) model of riverine centered mobility. The graphical representations of the raw material distributions by transect (Sassaman 1996:Figures 4.3-4.6) illustrate the differing distances that lithic raw materials travel from their source locations, and the variable frequencies in which they occur with proximity to various source localities. Comparing raw material distribution patterns along the Savannah River drainage and across the lower Coastal Plain (Sassaman 1996:Figure 4.6) show comparable distributions and fall off curves of raw material by distance to source.

The author also evaluated existing excavated data from riverine and upland/inter-riverine contexts in order to synthesize previously proposed patterns of site function by geographical location (Sassaman 1996:71-81). The datasets first discussed come from compliance related archaeology on the Savannah River Site, where the highest degrees of lithic raw material diversity were found along the confluence of major streams in the upland drainage divide. This pattern is proposed by the author to be representative of small group interaction on sites of infrequent exploitation (Sassaman 1996:80). Sites
with the highest density of artifacts were found along the Savannah River riverine zone. These comparisons rely on many of the same datasets previously examined within the same geographic vicinity (Anderson and Schuldenrein 1983, Anderson and Hanson 1988).

The synthesis of Early Archaic settlement across the South Carolina Coastal Plain presented by Sassaman (1996) acknowledges a key pattern that differentiates from expectations proposed by the Anderson and Hanson (1988) model, that of the cross-drainage movement of artifacts of specific lithic raw materials. While data examined within this study do lend support to the expectations of the Anderson and Hanson (1988) model, the author does acknowledge that unknown processes are responsible for the cross-drainage movement of Allendale chert on the Coastal Plain (Sassaman 1996:65). In conclusion, the author calls for more geographically and theoretically expansive evaluations of Early Archaic settlement patterns to be proposed in order to enhance our understanding of social structures and interactions across the landscape.


The most significant challenge to the arguments proposed by the Anderson and Hanson (1988) model, has been presented in various works by Randy Daniel (1996, 1998, 2001) who argues that lithic raw material availability was a much more influential resource on Early Archaic strategies of mobility than had been previously acknowledged.

In perhaps the first acknowledgement of a pattern noted above, Daniel (1996:87) highlights the gradual decline in Allendale chert distribution both along and across drainages as being near equal in its rate of decline by distance from sources. This
observation is in contrast to the expected step-like rate of decline that would expected as a result of the predictions proposed by the Anderson and Hanson (1988) model of mobility focused on major river drainages. Sassaman (1996:65) noted that an unknown process of movement created the observed cross-drainage pattern, which is discussed by Daniel in light of various resource acquisition strategies (1996:85-86). Direct acquisition versus trade among social groups is indistinguishable due to the problem of equifinality (Daniel 1996:85; Meltzer 1989:26, 30) and cannot be explained accurately.

Daniel proceeds to collect data from Kirk corner notched hafted bifaces in two transects across different geographical provinces along and across drainages in both South Carolina and North Carolina (Daniel 2001: Figures 3-4). The raw material distribution patterns are compared to the transects studied by Sassaman (1996) and found to be comparable in the gradual decline of raw material frequencies by distance from source locations. The near equal rate of decline by distance of raw materials both along and across drainages, specifically high quality Uhwarrie rhyolites and Allendale chert, led Daniel to propose that predictable lithic raw material sources had an equally important influence on Early Archaic strategies of mobility as compared to the availability and density of food related resources along major river drainages are argued to have had by the Anderson and Hanson (1988) model. While Daniel does agree with the significant influences that ecological and demographic evaluations have on Early Archaic hunter-gatherer life ways, he believes that the predictability of lithic raw material availability allowed Early Archaic peoples to negotiate larger areas of the foraging landscape (Daniel 2001:260-261). The distinction made by Daniel that distinguishes his model from previous "lithic determinism" models (Gardner 1974, 1977, 1983, 1989) is
the proposal that utilization of specific high quality lithic raw materials is seen as an adaptation rather than a necessity (Daniel 2001:260).

The adaptation of raw material acquisition in the cross-drainage manner as proposed by Daniel also has social implications. If large macrobands negotiated their mobility around geographical static and dispersed lithic raw material sources, then social interaction and aggregation would most likely occur at the outer most range of their mobility. Macrobands focused on different raw material sources, such as Uhwarrie rhyolites and Allendale chert, would easily be able to visually identify people affiliated with either system by the differences of lithic raw materials within their tool kit. With this regard, sites of potential aggregation are argued to be represented by site with high diversities of lithic raw material types, such as can be found in major Fall Line sites like the Taylor and Manning sites (Daniel 2001:258).

A major contribution to this thesis is the acknowledgment by Daniel (2001) in the differential patterns of raw material utilization. Daniel (2001) argues that high quality and predictable lithic raw materials allow for more flexibility in strategies of landscape mobility and scales of social interaction (Goodyear 1979). Utilization of raw materials in localized contexts, such as materials found local to the South Carolina Coastal Plain, are seen as "embedded" within Early Archaic patterns of mobility and therefore would be infrequently utilized without extra expenditures of energy in their acquisition (Binford 1980:259; Daniel 2001:254). Differential treatment of lithic raw materials is evident in the raw material distributions presented by Sassaman (1996) and Daniel (2001), and is argued to be less visible in the archaeological record of the Early Archaic by Daniel (2001:254) due to reliance on higher quality materials found in the Uwharrie and
Allendale vicinities. This assertion will be tested and reevaluated in light of a new argument concerning raw material quality within this thesis, and will be compared across Early Archaic hafted biface traditions beyond corner notched bifaces as examined by Daniel (1996, 2001).

Daniels (1996, 1998, 2001) work demonstrates that lithic raw material availability was also a crucial influence on Early Archaic strategies of mobility and subsistence. Geographically static and dispersed lithic raw material sources crucial to Early Archaic tool kits, at least the residues of tool kits still present in the record for study, prove to be significant and worthy of consideration. The data and arguments presented by Daniel significantly contribute to the new approach presented by this thesis.

*Rigtrup 2009*

A previous master's thesis completed a technological assessment of Early Archaic debitage assemblages and attempted to test competing models of Early Archaic mobility and land use strategies (Anderson and Hanson 1988; Daniel 1998, 2001; Rigtrup 2009). Existing excavated assemblages from seventeen sites located on the Savannah River Plant, allowed the author to evaluate technological organization across varied portions of the landscape including assemblages along the Savannah River floodplain, as well as upland/inter-riverine sites along smaller tributaries. By completing aggregate/mass and flake attribute analyses across these debitage assemblages, the author was able to challenge previous predictions regards technological organization and stages of reduction and use in different geographic locations.
By incorporating a technological organizational approach, the author was able to utilize debitage analyses to explain site function in regards to the predictions of previous models. Debitage, which the author explains does not tend to be moved from site to site, offers a more accurate measure of site function than hafted bifaces might given their curated nature with long use-lives (Rigtrup 2009:135). An evaluation of the condition of these debitage assemblages concluded that activities consistent with tool maintenance and resharpening occurred more frequently in upland sites where relatively smaller assemblages were found. While the author notes that these evidences of later stages of reduction may also be a function of being a further distance from the main source of lithic material (Allendale chert), it also may represent infrequent exploitation of upland/inter-riverine localities. Sites of higher debitage densities of earlier stages of reduction were found among the sites located along the Savannah River terrace. The author also notes that this pattern does not necessarily represent residential sites as proposed by the Anderson and Hanson (1988) model, as they also represent palimpsests of unknown numbers of site visits.

This work evaluating debitage assemblages illustrates the differing conditions and densities of stone tool residues across the landscape. By evaluating differences in the stage of reduction and assemblage densities the author has demonstrated that specific locations across the landscape were differentially utilized by Early Archaic peoples. The data presented here creates new questions requiring new investigations of artifact assemblages that include the full range of archaeological residues available to researchers, and a better understanding of resource distributions, both something the
author proposes should be done. Rigtrup's (2009) work sets the stage for the present thesis.

_Bridgman-Sweeney 2013_

The dissertation work of Kara Bridgman-Sweeney investigated systems of social interaction and learning across the lower Southeastern United States in South Carolina, Georgia, Eastern Alabama, and Florida. By evaluating the basal configurations of side notched hafted bifaces and unifaces along specific drainage basins, the author was able to differentiate large areas of potential territorial influence suggestive of highly mobile and dispersed macrobands.

Evaluating social connectivity across broad geographic space necessitates the investigation of arguments of social learning and influence on material culture and its geographic distributions. By quantifying variations in basal configurations and other characteristics, Bridgman-Sweeney (2013) differentiated certain stylistic attributes to be associated with certain river drainage clusters. Evaluating side notched hafted bifaces on one lithic raw material type, Coastal Plains Chert, the author eliminated one variable that may have affected stylistic characteristics.

This work's contribution to this thesis is the observation that social networks extend far greater in range than previously proposed, and do cross a considerable number of drainage systems. Understanding that social connectivity occurred over great distances and that people extend themselves beyond immediately available resources, is important to remember and consider in the course of evaluating social negotiations of those resources. Remembering the significant social factor that affected Early Archaic decision
making and strategies of mobility and resource negotiation is important when attempting to produce potential models of their life ways.

Moore and Irwin 2013

Another model geographically positioned outside of South Carolina but relevant to this thesis, examines the distribution of Early Archaic sites within the North Carolina Sandhills region situated on Fort Bragg. Well surveyed and documented sites from Fort Bragg were included in this study, specifically including those sites that possessed all Early Archaic hafted bifaces from Dalton to Bifurcate varieties as well, as hafted endscrapers. This examination tests the arguments presented by the Band-Macroband (Anderson and Hanson 1988) and the Uwharrie-Allendale (Daniel 1998, 2001) models.

The examination of site distribution within this vicinity found that an upland/drainage divide focus was prevalent for many Early Archaic sites and high artifact concentrations were noted at proposed upland base camps. Though situated outside of the geographic focus of this thesis, it is important to note that the Sandhills region of North Carolina is complementary to a similar geographic province across South Carolina's Fall Line. The cultural use of this region in the Moore and Irwin (2013) investigation appear to reflect that drainage divides served as least-cost pathway corridors from high quality Uwharrie rhyolites in the Carolina Slate Belt, out towards the Coastal Plain. The use of these corridors corresponded with historically rumored Indian trails, and also with several major highways.

The unique physiographic situation examined within this investigation led the authors to conclude that specialized hunting and processing activities likely occurred along the
drainage divide, as historically described grasslands in the locality likely supported migratory animals such as bison, and other browsers such as white tail deer. Decreased costs in traversing along such ridgelines likely served as a funnel for the migration of such animals, as well as facilitated the movement of local bands of people within the locality.

This investigation serves as a great example of land-use strategies on a local scale that also represents unique deviations from both the Band-Macroband (Anderson and Hanson 1988) and Uwharrie-Allendale (Daniel 1998, 2001) models. The results of this investigation also complement other investigations of inter-riverine localities that exhibit intensive and frequent exploitation (Goodyear et al. 1979). Variability is also demonstrated for different hafted biface distributions within the locality as well. Proposed aggregation sites would be located at the confluences of stream systems where ridgelines end. The findings suggest that neither the Band-Macroband (Anderson and Hanson 1988) or the Uwharrie-Allendale (Daniel 1998, 2001) models adequately explain cultural strategies of mobility and subsistence, though the author notes there are strong affinities towards the Uwharrie-Allendale (Daniel 1998, 2001) model.

Goodyear 2014

Goodyear (2014) attempted to test the implications of the Daniel (1998, 2001) model on Paleoindian and Early Archaic archaeological residues in the Congaree-Wateree-Santee (COWASEE) river basin in the middle Coastal Plain of South Carolina. By studying private artifact collections within twenty kilometers of either side of the river drainage, a distance argued to be the maximum distance a hunter-gatherer could walk in a
Goodyear's (2014) evaluation of private collections along the COWASEE basin represents a quantitative test of previously proposed settlement models. While his data represents an evaluation of zonal data along a major Piedmont originating drainage basin, his distinction of local versus exotic lithic raw material utilization evaluates the scale and
frequency of cultural settlement mobility throughout Paleoindian and Early Archaic periods. His observations suggest that Daniel's (1998, 2001) proposed settlement model for Kirk does not accurately explain patterns of settlement mobility for other periods of time such as late-Paleoindian Dalton, Early Archaic side notched, or Post-Kirk assemblages. These differing patterns of settlement mobility, both of geographic range and frequency, suggest significant changes in social structure and subsistence strategies. Differences that are important to consider when modeling Early Archaic cultural residues.

Gillam 2015

One last model of relevance to this thesis studied Early Archaic site locations across the Savannah River Site in Aiken, Allendale, and Barnwell counties. The collections examined are the result of decades of compliance oriented archaeology completed for the Department of Energy by a division of the South Carolina Institute of Archaeology and Anthropology (SCIAA), the Savannah River Archaeological Research Program (SRARP). Gillam (2015) examined the location of sites containing Early Archaic artifacts in relation to their proximity to stream networks calculated using Digital Elevation Models (DEM) within Geographic Information Software (GIS). These sites were located along the Savannah River Floodplain and along smaller tributaries and their associated floodplains and uplands. This geographic sample allowed for another comparison between riverine and immediate inter-riverine collections.

Other analyses attempted by Gillam (2015:4) included site location in regards to ten different landform characteristics: "...land elevation, percent-slope of land, slope-
direction (aspect) of land, tributary streams, navigable streams, the Savannah River, upland Carolina Bay wetlands, upland trails, major landforms, and chert stone quarries."

Each sub-period of the Early Archaic as defined by different hafted biface types, were examined statistically using the analysis of variance technique (ANOVA) in order to "...establish whether or not these components represent a single statistical population " (Gillam 2015:4). Determinations of seasonal occupation of sites located on different landforms, such as the expectation that winter base camps would be located on southward facing slopes (Gillam 2015:5), were decided inconclusive.

Evaluating the distribution of Early Archaic sites across the Savannah River Site tested the argument proposed by both the Anderson and Hanson (1988) model, as well as the Daniel (1998, 2001) model. Gillam's (2015) analyses determined that proximity to surface water was an important factor regarding site location, while also demonstrating that raw materials and sites were distributed across lower ranked drainages. Evaluating the lithic-centric model presented by Daniel (1998, 2001) was noted to be inconclusive due to the study being confined to a localized scale (Gillam 2015:6). Inspiration for this study was drawn from the Anderson and Hanson (1988) model, and although the Gillam's (2015) analyses do not challenge all of the hypotheses proposed by the Anderson and Hanson (1988) model, the "biocultural" arguments previously presented are said to "...remain a strong contribution" to Early Archaic investigations (Gillam 2015:5).

Although this study did not determine conclusively the association of certain landform characteristics with site location in regards to seasonal mobility, it did quantify a pattern that has been observed for many years among archaeologists. The relationship between proximity to surface water and site location was quantified effectively using GIS
software, and provided further evidence of the value GIS systems can have in evaluating archaeological residues. While social and technological considerations were not evaluated, Early Archaic utilization of the landscape was evaluated at a high resolution. Quantifying stream networks and the proximity of site locations, are seen in regards to the work of this thesis, as a significant contribution.

*Wilkinson 2017*

Ongoing work by the author prior to this thesis has studied Early Archaic artifacts and assemblages in a transect across the Middle Coastal Plain of South Carolina from the Savannah River drainage beyond the Santee and into the Black River drainage. This ongoing work has evaluated both professional and private artifact collections from specific sites and localities in a variety of landscape locations ranging from major riverine settings through the inter-riverine drainage divides. This work has also evaluated as much of the Early Archaic toolkit both in terms of temporally distinct hafted bifaces ranging from late Paleoindian to early Middle Archaic types, and in terms of confidently identified diagnostic artifacts of the Early Archaic period such as various unifacial, flake, and ground tools. As a significant portion of this ongoing work is presented within this thesis, including both data and discussions of previous results, great detail will not be expanded on here.

**SUMMARY**

In light of the work presented in this thesis, the previously discussed investigations of Early Archaic mobility and subsistence strategies have highlighted many different perspectives and datasets utilized in previous interpretations of Early Archaic life ways.
Models have previously been proposed that have emphasized the degrees of influence that specific resource types and distributions have had on Early Archaic decision making, and tested using numerous datasets of variable geographic distributions and diagnostic categories. While each proposed approach has acknowledged its short-comings, each has made valuable contributions to our continuously growing understanding of the Early Archaic in South Carolina. It is the goal of this thesis to take the accumulation of the observations and conclusions of these previous investigations and join them in a new approach evaluating environmental influences in tandem, while also seeking to explain a variety of social processes as they "map on" to variable geographic scales.
CHAPTER FOUR
MODELING METHODS AND PREDICTIONS

Previous models of Early Archaic mobility and subsistence strategies have evaluated the influence of specific resource types, and proposed specific strategies of negotiating them. These evaluations have involved the negotiation of resources that are geographically static, and concluded that each specific resource type was a primary influence on optimal strategies of mobility and subsistence. Data exists to support the claims of many of these models, but there are data that also require more adequate explanations than the arguments proposed in previous models can provide. Technological advancements in recent years, specifically in the efficiency of modern computers, now make it possible to assess environmental resources in ways not previously attempted. Two resource types that have remained relatively static across the landscape of South Carolina are surface water drainage systems and lithic raw material sources. While drainage systems are by no means completely static, with fluctuations in flow volumes and specific channel paths, their behavior relative to their different segments has remained constant at least since the end of the last great Ice Age. The geologic beds containing lithic raw materials sources are static unless some large scale geological event has moved or concealed them, and there is no evidence for such an event in this part of the Southeastern United States since the end of the Pleistocene. Evaluating these resource types in tandem, and assessing the influences each would have on optimal patterns of mobility and subsistence, is the goal of the Risk Landscape Model presented
here. Logical assumptions, methodological approaches, results, and broader implications are discussed within this chapter.

**DRAINAGE RISK**

River drainage systems are an important focus on hunter-gatherer subsistence activities because they attract and sustain the plants and animals on which they rely. River drainages vary in the amount of water they hold, and consequently in the biota living within them, and this has a decisive effect on the ways in which they are exploited by humans. The model that is being developed in this thesis relies on the correlation between drainages and their attendant flora and fauna. To be explicit, the model is founded on two basic assumptions: biological resources vital to hunter-gatherer subsistence are tied to available surface water, and the volume of available surface water positively correlates with the relative abundance of biodiversity and biological resource densities. Understanding where surface water is available across the landscape, and the relative accumulation of water within specific exposures can then be used as a relative proxy for expectations regarding relative biodiversity and biological resource densities across the landscape. Just because more available surface water is capable of supporting more biological resources such as plants and animals, does not mean that they always do. Thus, this resource type is an unpredictable one that is influenced by many different variables that would be impossible to completely account for. Given this unpredictable nature, the perspective of risk is applied to the negotiation of movement around and between such variability in drainage systems. The application of a relative evaluation of drainage systems identifies localities that are more likely to support an abundance of
wildlife, and therefore allows for an evaluation of optimal exploitation of biological resources across the landscape.

**Drainage Risk Methods**

Understanding the variability in biological resources that are tied to surface water requires an understanding of the locations where surface water is concentrated. Rainfall and groundwater behave in the same ways and are both guided by gravity, which is to say that all water and especially surface water always flows downhill in search of the lowest point. Quantifying variability in the topography of the landscape can allow for an approximation of natural stream locations, paths, and the accumulations of flow volume.

In order to evaluate the distribution and accumulation of surface water in drainage networks across the state of South Carolina, the ArchGIS Geographic Information System (GIS) was utilized to manipulate landscape elevation data in a Digital Elevation Model (DEM) format in order to calculate the movement of water across the landscape surface. In order to keep this evaluation computationally simple, DEM data of a thirty meter resolution were utilized and other variables such as soil penetration, soil retention, bedrock exposures, vegetation qualities, and seasonal fluctuations were assumed consistently equal across the landscape. This assumption also allows for a uniform approximation of relative surface water conditions across the landscape based on present data elevation data which has certainly been affected by modern construction and land use strategies. The precise conditions of the landscape in the distant past is unknowable, and a precise evaluation of each landscape variable is highly problematic. The use of a thirty meter resolution DEM (a landscape model based on average elevation
measurements in 30x30 meter cells across the landscape) also minimizes some of the
influence that modern day construction and highway surfaces would have on drainage
accumulation and the precise location of stream networks.

The thirty meter resolution DEM data is available as a raster based dataset. Raster
based datasets are of a grid-like nature where individual cells hold a single value. The
value for cells within an elevation raster is the average elevation for that cell's area on the
landscape. These DEM raster datasets are produced from Light Detection and Ranging
(LiDAR) imagery produced with a laser return system mounted onto aircraft that fly at
known elevations over the landscape. Lasers are emitted from the LiDAR equipment
towards the landscape surface and the laser return times are calculated to determine the
distance between the aircraft and the landscape surface. By calculating these returns
millions of times from multiple lasers at set intervals an elevation surface can be created.
This data is reduced by averaging return results by set intervals of the landscape surface,
such as the 30x30 meter resolution dataset used for this model.

The DEM data used for this models calculations were obtained from the United States
Department of Agriculture clearinghouse where such data is available upon request. The
geographic extent of South Carolina was selected with data from the landscape
surrounding South Carolina's boundary up to several hundred kilometers North and West
of the border. This was done to incorporate surface water accumulation in stream
networks that originated outside of the South Carolina landscape. The data was available
as an accumulation of distinct raster datasets that needed to be normalized by creating a
raster mosaic. This step equalizes the display of elevation data within the ArchGIS
software. Once the mosaic was created, a shapefile that projected the border of South
Figure 4.1 Digital Elevation Model Surface of South Carolina.

Carolina was used to create a fifty kilometer buffer around the state in order to reduce computational stress in further calculations. The DEM data was then clipped to this buffer to remove excess and unneeded data. Next a shapefile with the United States border was used to clip surface data present off the present day coastline where major drainage systems eventually lead. Figure 4.1 illustrates this elevation surface.

With the data reduced, the next step necessary was to fill sinks in the elevation data. When calculations of stream networks are created across an elevation surface, there are often places on the landscape where the movement of water flowing downhill reaches a "sink" where it continually flows into itself. When all the surrounding cells are of a
higher elevation value, water runoff is trapped in the sink and no longer flows downhill. By digitally filling these sinks, surface water runoff can continue into determined stream networks.

Once elevation sinks are filled, the direction in which surface water flows can be calculated by evaluating the elevation of an individual cell with the elevations of all the cells surrounding it. When this is calculated for each cell in the dataset, a stream network is created that displays the direction that surface water flows across the landscape at the resolution of the sizes of each cell. With this calculation it is then possible to calculate the accumulation of surface water within this network across the landscape. As water moves from one cell to another it accumulates within the network, and new values are assigned to each cell within a new raster dataset. These accumulation values represent the accumulation of water volume as it drains across the landscape.

Accumulation values provide the relative change in drainage systems across the landscape and the assumed relative change in biological resource densities. Running further calculations with the DEM model at this resolution are computationally demanding. In order to reduce this computational demand further, and to provide geographic separation at the scale of the state of South Carolina, map algebra was used to reduce the stream networks to a minimum of 150,000 cells of accumulation. This is to say that the headwaters of the stream networks were not displayed until a value of 150,000 cells of accumulation were present. Accumulation within the stream network still increased downstream of this point, but reducing the stream network with this method allows for visual separation of localities across the landscape. Figure 4.2
Figure 4.2 Stream network of 150,000 cells of accumulation.

illustrates what this network looks like after it is converted into a stream feature and clipped to the South Carolina boundary.

There are two common methods of calculating stream accumulation that have been used that are in need of mention here. The Strahler system and the Shreve system were both used to create stream networks for the evaluation of South Carolina's drainage systems by calculating stream order. Because the locations where stream flow originates within these networks varies across both the landscape and due to fluctuations of input (e.g. rainfall) either seasonally or otherwise, the evaluation of stream networks is never exact but merely a relationship of constant relativity. This is to say that precise
approximations of stream networks are not possible as their locations and origins widely vary across both time and space however, the relationship between their segments with regard to flow accumulation (stream order) remains the same.

The Strahler system of flow accumulation assigns value to segments of the stream network feature (which is a linear representation of the stream network still in a raster format) which are calculated into stream order, or ranks. Stream order begins at order one at the headwaters of the stream network feature, which in this case is the point where 150,000 cells of surface runoff accumulation occurs. Stream order only increases when a stream of an equal order converges within the stream network. Thus, two order one streams converging create an order two, and two order two streams converging create an order three, and so on. This is perhaps the most common system as it is also computationally simple, especially with regard to the era in which it was created prior to efficient computers.

The Shreve system of flow accumulation operates in a very similar manner as the Strahler system in which orders are assigned to segments of the drainage system. The distinctive difference lies with the computationally demanding manner in which stream orders are calculated. Stream orders change value in much the same way that the original cell accumulation values were created, by an accumulation of the number of stream segments that have accumulated. This method was computationally demanding prior to efficient computers, but is now available as a tool for more accurately calculating the rate at which water volume accumulates within drainage systems. The Shreve system is perhaps a better representation of reality as it more accurately approximates the accumulation of water volume within stream networks.
With both systems of stream order calculated into separate stream features, these raster datasets were then converted into point layers where the individual cells within the raster stream features were converted to points that held a weighted value as calculated by the respective system of stream order. This step was included for the purpose of creating an interpolated surface across the landscape around the weighted values of stream order.

The final step in calculating the relative risk of hunter-gather movement around and between drainage systems across the landscape is to incorporate the kriging tool of interpolation with the weighted values within the converted layer of points. Interpolation tools in general are applied with the purpose of calculating unknown values in spaces void of data by incorporating known values from fixed points and calculating the expected changes within the void spaces between the known points. For example, an approximation of temperature for a given location can be estimated if temperature data exists in locations surrounding it. The interpolated surface created from this calculation is a three dimensional representation of the changes in temperature across the landscape. The kriging tool of interpolation incorporates weighted values in its calculations which increases the influence of those values in the calculation of the values for unknown locations. Within the temperature analogy, a known point for which multiple values exist within close proximity will have a higher weighted value than points with fewer values that are geographical more dispersed. The higher concentration of values would then have greater influence on the interpolation as the resolution of those values is greater. By utilizing the kriging interpolation tool, approximations of relative shifts in risk by
Figure 4.3  Risk Landscape as calculated by Strahler system of flow accumulation.

proximity to variably ranked streams can be calculated around the stream features created by both the Strahler and Shreve systems of flow accumulation.

Interpolation Results

The results of this interpolation method can be seen for the Strahler system of flow accumulation in Figure 4.3, and the Shreve system of flow accumulation in Figure 4.4. These illustrations demonstrate the relative changes in biological resource densities by associated drainage systems. The larger river systems such as the Savannah, the Santee, and the Pee Dee, are major mineral transporting Piedmont originating rivers that have dramatically superior flow accumulations over Coastal Plain originating river systems.
Figure 4.4 Risk Landscape as calculated by Shreve system of flow accumulation.

such as the North and South Edisto Rivers and the Black River. By revisiting Figure 4.1 an illustration of the dramatically increased floodplain sizes can also be seen for the major rivers once they have breached the Fall Line locality and begun to meander. These features enhance the quality of the environments in close proximity to them as it has been argued by the Anderson and Hanson (1988) model.

While there is a subtle difference between the results of interpolating both systems of flow accumulation, the overall relative differences in drainage environments are obvious as the larger Piedmont originating systems possess dramatically decreased degrees of risk. This is to say that hunter-gatherers in close proximity would have relatively
increased densities and larger diversities of biological resources to exploit over smaller drainage systems. The results of these interpolations are complementary with the expectations of the influence of large rivers proposed by the Anderson and Hanson (1988) model.

Model Refinement

The resulting interpolations are adequate for demonstrating relative changes in the drainage systems at the scale of the state, but lack refinement that would be necessary at evaluating locations on the landscape at a closer resolution. It should also be noted that the way in which the kriging interpolation tool works also detracts from the associated risk of a location when a stream of much lower rank feeds into a much larger one. This can be seen in both Figures 4.3 and 4.4 when a smaller stream feeds into a major river the risk around it is increased because of the value of the lower stream. The argument poised with this model is that proximity to abundant surface water would enhance the associated biological resources, not detract from it. A step needs to be added that will incorporate the added value or decreased risk of close proximity to converging streams rather than minimize value or increase risk. Such as step may be the creation of buffers at a set distance interval around the points used to run the kriging tool. A formula could be created in the attribute table of the layer to generate new weighted values that are increased by the added weights of points from higher order streams that fall within the buffer of lesser weighted points. These new values would enhance the visualization of an environment and its associated risk.
This portion of the model has been manipulated to show changes in the larger streams across the scale of the state of South Carolina. When scale is reduced to evaluate local environments, smaller order streams will need to be incorporated and the choice of accumulation cut off is at the discretion of the researcher and the intended research question. As the original stream networks display surface water runoff at the scale of the cell resolution, it is also not likely that this unrefined stream network represents reality. When evaluating localized environments it is important to compare the digitally generated stream network with reality and find the best fit.

**RAW MATERIAL COST**

Another important environmental resource around which hunter-gatherers would negotiate movement is lithic raw materials. This resource type is geographically static and predictable in occurrence and relative quality. Given the nature of preservation in South Carolina soils, stone tools are the vast majority of the surviving material culture for most of prehistory and especially from the Early Archaic time period. Evaluating the distribution and relative qualities of lithic raw material sources across the state will allow for a more accurate understanding of the influence that this resource type would have on hunter-gatherer decision making, as well as the condition of their toolkits.

The evaluation of raw material distribution and relative quality here utilizes an empirical dataset that contains Early Archaic hafted biface types and raw material data from private artifact collections across the state of South Carolina. This dataset has been compiled from years of recording collections by Tommy Charles, formerly of the South Carolina Institute of Archaeology and Anthropology (SCIAA), and others. The data has
been consolidated by Christopher R. Moore and volunteers into a normalized and more manageable format of raw material frequencies of the total sample by county. This data was provided to me graciously by Tommy Charles and Christopher Moore who have been using it for their own research (Charles and Moore 2017). All the credit and thanks for this dataset are owed to them.

The foundation of this portion of the Risk Landscape Model rests on a set of assumptions about raw material distribution and availability, and the evaluation and influence of relative raw material quality. These assumptions are as follows: First, lithic raw materials of higher qualities will be more flexible and durable within the toolkit as they may occur in larger package sizes, be more homogeneous and fine-grained in nature, and allow for increased manipulability. Second, these qualities will allow the material to travel farther and/or be used longer within the toolkit before becoming exhausted and discarded or replaced with more local raw materials. Third the relative distances that each raw material type travels are the result of constant and equal pressures of manufacture, use, retouch, and eventual discard. The distribution of each type of raw material across the landscape will be an accurate measure of the range of utility that each material is capable of reaching.

Raw Material Cost Methods

Determining the relative degrees of cost incurred upon movement around and between raw material sources requires an understanding of raw material distribution and availability across the landscape, and the relative quality of each raw material type. Both of these can be determined by utilizing GIS software when manipulating the relative
frequencies of raw material occurrence within Early Archaic assemblages across the state. By taking raw material frequency data of a specific tool type, in this case Early Archaic hafted bifaces, it is possible to evaluate the locations where specific raw materials occur in the highest densities (assumed to represent the approximate locations of that raw materials exposure and quarry related activity) and the relative distances which the raw materials travel across the landscape (assumed to represent the range of utility or relative quality of that material type).

Distribution maps of six raw material classes have been generated for the evaluation of the distribution and relative qualities of each material. While many more than six raw material types have been observed within the data, many of these raw material types, such as various metavolcanic rhyolites, have previously been grossly identified and not split into respective categories. This was done primarily for two reasons: one being a concern for the quality and consistency of raw material identification across the collections recorded, and second being that multiple varieties of some raw material types can co-occur within the same environments and be somewhat equally distributed. The six raw material classes used for the creation of these distribution maps are: Allendale chert, Black Mingo chert, Metavolcanics, Orthoquartzite, Ridge and Valley chert, and Quartz. Detailed descriptions of these materials and others occurring within these classes can be found in Chapter Two.

In order to create the distribution maps from data of raw material frequencies consolidated to the county level, the points around which the interpolations are generated need to be created in a way that normalizes spatial differences between county sizes. This was done by calculating the central most location within each county by creating a
centroid, or fixed central point within the ArchGIS software. Each centroid was assigned a percentage value for each raw material type as it occurred in the accumulation of all hafted bifaces from collections within that county. The raw material distributions were created by executing kriging interpolations with these centroids using a shapefile of South Carolina as a mask to contain the interpolations spatially within the state. While higher degrees of resolution could be obtained by splitting the collections by specific sites, the scale of the evaluation of raw material movement is such that meaningful conclusions can be drawn from the data without such refined provenience. However, it should be noted that because the interpolations are created from the county centroids, the highest densities of raw materials are centered on those centroids and do not necessarily portray accurate locations for individual quarries, but merely an approximate identification of the locality in which a specific raw material is exposed and was likely exploited in prehistory.

Raw Material Cost Results

The distribution interpolations show very different raw material origins across the state, as well as very different distances that some materials travel compared to others. Several raw material classes show increased ranges of movement (Allendale chert, Metavolcanics, and Quartz) over materials with much smaller ranges (Black Mingo chert, Ridge and Valley chert, and Orthoquartzite).

Once the interpolations were generated, approximate source locations were noted and the ruler tool in ArchGIS was used to measure the distance from the approximate source location to the point within which ninety percent of the respective material was
Table 4.1  Average distances traveled per raw material.

<table>
<thead>
<tr>
<th>Raw Material</th>
<th>Average Distance (KM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allendale Chert</td>
<td>160</td>
</tr>
<tr>
<td>Black Mingo Chert 1</td>
<td>10</td>
</tr>
<tr>
<td>Black Mingo Chert 2</td>
<td>10</td>
</tr>
<tr>
<td>Black Mingo Chert 3</td>
<td>10</td>
</tr>
<tr>
<td>Pee Dee/Uwharrie Rhyolites</td>
<td>160</td>
</tr>
<tr>
<td>Orthoquartzite 1</td>
<td>70</td>
</tr>
<tr>
<td>Orthoquartzite 2</td>
<td>40</td>
</tr>
<tr>
<td>Quartz 1</td>
<td>160</td>
</tr>
<tr>
<td>Quartz 2</td>
<td>120</td>
</tr>
<tr>
<td>Quartz 3</td>
<td>180</td>
</tr>
<tr>
<td>Ridge and Valley Chert 1</td>
<td>90</td>
</tr>
<tr>
<td>Ridge and Valley Chert 2</td>
<td>80</td>
</tr>
<tr>
<td>Western Piedmont Rhyolite</td>
<td>40</td>
</tr>
</tbody>
</table>

contained. Measurements to that point in multiple directions were averaged to provide an approximation of the distance that each raw material travels and provide a measure by which the range of utility for each raw material could be evaluated and compared. These average distances are discussed by raw material below, and listed in Table 4.1.

**Allendale Chert.** The distribution of Allendale chert across the state is illustrated in Figure 4.5. Allendale chert has been noted prominently in collections in excess of one hundred and sixty kilometers before decreasing to minimal frequencies. The Eastern most known exposures and quarries of Allendale chert are known to occur in Allendale and Hampton counties in close proximity to the Savannah river floodplain. The dominance of Allendale chert farther south down river towards the coast is likely due to the lack of any other raw material source in relatively close proximity to that locality. This likely has caused a skew in the determination of Allendale chert quarry locations as no other material is close enough to influence the composition of prehistoric assemblages.
farther down river. These assemblages also have the potential to have been influenced by Allendale or similar Coastal Plains chert varieties that are located on the Georgia side of the Savannah River.

**Black Mingo Chert.** The interpolation of the distribution of Black Mingo chert had somewhat problematic but interesting results. The distribution illustrated in Figure 4.6, shows that Black Mingo chert was not extensively distributed very far from its sources. Because the interpolation was run around the county centroids, the distribution seems to show that Black Mingo chert has three different quarry localities, which is not an accurate representation of reality. The three counties with highest concentrations
Figure 4.6 Black Mingo Chert Distribution Map.

(Richland, Sumter, and Orangeburg) represent the locations of archaeological assemblages that contain the highest frequencies of Black Mingo chert. Known exposures were noted in Chapter Two as occurring most frequently throughout Sumter county, along the Congaree River floodplain on the Calhoun and Richland county border, and even noted to have occurred on the Northern end of Lake Marion (a man-made lake along the Santee River). The concentration of Black Mingo chert noted in Orangeburg county was likely influenced by collections found along or in close proximity to the Santee River and Lake Marion. A more accurate location for Black Mingo chert exposures may be determined to be the central location between the three highlighted
county centroids. A Black Mingo chert quarry was noted in Chapter Two to have been archaeologically evaluated on the Congaree River floodplain boundary in Calhoun county (Goodyear and Wilkinson 2014). Given the noted concentrations, the movement of Black Mingo chert was estimated to only travel on average roughly ten kilometers from the county centroids, but given the problematic nature of this interpolation it is likely that the actual distribution may be closer to thirty or forty kilometers.

**Metavolcanics.** Metavolcanics from the Eastern portion of the state as seen in Figure 4.7, also are present prominently in collections up to one hundred and sixty kilometers from the point of highest concentration along the Pee Dee river. As described in Chapter
Two, there are many varieties of metavolcanic materials known to occur naturally in the Pee Dee river drainage. These materials have been transported fluvially from the Uwharrie mountain range where the majority of geological activity that generated these materials took place. This reality also has likely influenced a skew in the concentration of metavolcanics to the Northern portion of the state. In the Western portion of the state the interpolation also highlights the known presence of Western Piedmont rhyolites in the Edgefield and Saluda county area. The concentration of utilization of these rhyolites appear to be greatly diminished during the Early Archaic over metavolcanic materials originating North of the state and in the Pee Dee drainage in the Eastern portion of the state. The Western Piedmont rhyolites appear to be present prominently in collections up to forty kilometers away from the source. Macroscopic inspection of Early Archaic tools made from this variety appear to be highly weathered, an indication that this material is softer and of lesser quality than Uwharrie and Pee Dee varieties.

Orthoquartzite. Another Coastal Plain originating material that is widely present in prehistoric toolkits is Orthoquartzite, which is illustrated in Figure 4.8. The interpolation shows two concentrations in Berkley and Orangeburg counties. It was noted in Chapter Two that a known exposure is located in the locality of Beaver Creek in Calhoun county, as well as exposures along the Santee River where Lake Marion is currently. This interpolation seems to indicate that there are more frequently exploited exposures farther out on the Coastal Plain towards the coast. The distances measured for the movement of Orthoquartzite were taken from both concentrations separately. The Berkley county concentration showed movement up to seventy kilometers away and the Orangeburg concentration showed movement at roughly forty kilometers away. As noted above, the
different exposures of Orthoquartzite that are geographically separated appear to have influenced exploitation differently. This difference in distance is either the result of proximity to other raw materials, such as Allendale chert to the West, or the result of a difference in the quality of Orthoquartzite present in each concentration.

*Ridge and Valley Chert.* Ridge and Valley cherts are known to occur geologically outside of the South Carolina boundary, the nearest confirmed exposures in the Eastern most portions of Tennessee (Sweat 2009). While exposures have been suspected to occur in South Carolina, they have not yet been confirmed. Despite this, Ridge and Valley chert has been noticeably present in Early Archaic assemblages in the Northwestern
portion of the state as illustrated in Figure 4.9. The concentrations highlighted in the interpolated map likely do not represent source locations as data has not been incorporated from counties exterior to South Carolina. Having this reality in mind, measurements were still taken from the concentrations in order to measure the relative distance that Ridge and Valley cherts moved into South Carolina, which appears to represent roughly eighty kilometers. This is only an approximation of the distance within which ninety percent of the points made of this material that occur in South Carolina have traveled. This material has been noted in collections much further than this, and seems to suggest that this material was high in quality and traveled great distances similar
to Allendale chert and Metavolcanics, though its influence in South Carolina's Early Archaic assemblages has been minimized due to great distances from exposed sources of the material.

Quartz. The distribution of Quartz across the state is illustrated in Figure 4.10, where a significant presence in the Piedmont is noted. As described in Chapter Two, Quartz is ubiquitously present throughout the Piedmont where it has been extensively exploited prehistorically. A significant concentration is noted in Fairfield and upper Richland counties were the void between Allendale chert and Metavolcanic materials seems to have been filled with the utilization of Quartz. Fluvially transported cobbles of Quartz
have been noted below the Fall Line in most river systems, but the results of this interpolation appear to suggest that they were minimally utilized. Several points of heavy concentrations of Quartz were used to take measurements, and measurements of over one hundred kilometers have been noted for the distance that Quartz may have traveled. This determination is problematic as Quartz is perhaps the most difficult raw material to source, as it is likely impossible to macroscopically or chemically differentiate. The many varieties and textures of Quartz often occur in the same environment and their exposures are widespread. Therefore the determination of the movement of Quartz does not seem to be an accurate measure of its relative quality using this method. This interpolation instead illustrates the significant influence of abundant availability on cultural exploitation.

*Cost Surface*

An attempt to create an interpolated surface was made by creating points within the concentrations of each raw material type and given a weighted value equivalent to the values presented in Table 4.1. Technical difficulties and time constraints prevented the successful completion of this three dimensional interpolated surface to illustrate the shifts in raw material cost by proximity to variably ranked lithic raw material sources. In place of the ideal three dimensional surface, two dimensional representations of the logic behind how the surface might look are presented here in order to express the expectations presented in this model.

First, the logic behind the cost surface is in need of explanation. Just as risk has been evaluated by proximity to variably ranked streams by water accumulation, raw material
cost is evaluated by proximity to variably ranked raw materials. The closer a location is to a raw material source, the lower the cost of being in that location due to the reduced time and energy required to acquire new raw material. However, being the same distance away from two or more different raw material sources is influenced directly by the quality of each raw material. If the raw materials are equal in quality, then the location of highest raw material cost would be the location that is directly between them with equal distances to all sources. This logic is illustrated two dimensionally in Figure 4.11 and three dimensionally in Figure 4.12 where raw material cost and raw material frequencies are inversely related by distance from each source. If one raw material is of greater quality than the others, than the logic would suggest that the point of highest cost would be shifted farther away from the high quality source and closer to the lesser quality one.
Figure 4.12. The raw material frequency and cost distribution between three raw materials of equal quality.

This shift is illustrated two dimensionally in Figure 4.13 and three dimensionally in Figure 4.14 and demonstrates the shift in distance that different quality materials would travel.

These illustrations of course assume that the optimal toolkit design and use strategy employed by hunter-gatherers would be one that lasts just long enough to reach a new raw material source where the toolkit could be replenished. The point of highest cost represents the location on the landscape where use of the toolkit costs the most. This assumption is based solely on the location of highest distance and energy necessary to replenish the tool kit. The optimal negotiation of this raw material cost would be to minimize the use of the lithic toolkit until proximity to another raw material source is reached.
Figure 4.13  The raw material cost and frequency distribution of materials unequal in quality.

Figure 4.14  The raw material frequency and cost distribution between three raw materials of unequal quality.
The point of highest stress for a given toolkit is expected to be at the end of the logistics curve (Goodyear 1979), or the end of the raw materials range of utility. As the logic within this model implies, materials of higher quality will be capable of traveling farther and will not experience high degrees of stress as quickly. Upon reaching the end of a materials range of utility within a specific toolkit design, high degrees of recycling and toolkit maintenance would be expected to optimize the utilization of the remaining lithic raw material.

A hypothetical cost surface is presented in Figure 4.15 that demonstrates the approximate degrees of overlap that each raw material type and the variability in each
raw materials movement across the landscape as was demonstrated in Figures 4.5 - 4.10. Raw material cost is highest between raw material resources with a skew towards materials of lesser quality as was demonstrated in Figures 4.13 and 4.14.

**MODEL EXPECTATIONS**

The evaluation of both drainage risk and raw material cost produce a set of expectations regarding the condition of archaeological assemblages in certain locations. The relative degree of risk and cost encountered in a given locality will influence the decisions made by prehistoric hunter-gatherers assuming an optimal approach is taken. These optimal expectations are discussed here in order to place into context the manner in which this model will be tested and evaluated against collections analyzed in the following chapter. An illustration of the relationships between the model predictions and archaeological assemblage expectations can be seen in Figure 4.16.

*Site Density*

Predictions of site density result from the assumption that localities that possess the lowest resource risk or cost, would be visited more frequently, would support larger aggregations of people per visit, and would be occupied for longer periods of time per visit. Due to the problem of equifinality, and relatively poor preservation of organic material culture, and high resolution temporal separation of the remaining lithic technology during the Early Archaic in South Carolina, determinations of individual visits cannot be determined. This problem is characteristic of most Early Archaic sites in South Carolina, however when evaluating large scale geographic and temporal patterns of
mobility it is sufficient to assume that site density reflects the quality of the environment in terms of resource availability and risk.

Artifact Density

This argument applies equally to artifact density as it is assumed that relative artifact density positively correlates with site density at least on a zonal level. Specific sites with high artifact densities are also predicted to correspond with specific locations of low risk and low cost for the same reasons described above.
Toolkit Condition

Predictions of tool kit design will need to be considered separately as it pertains to the cultural period being studied and based on a general understanding of the average toolkit of that period (Sassaman et al. 1988). The Early Archaic lithic toolkit in South Carolina is considerably more diverse than those of either the earlier Paleoindian cultures and especially the later, Middle Archaic. High mobility often requires strategies for tool curation and toolkit maintainability (Goodyear 1979). These strategies are reflected by techniques of reconditioning and recycling which prolong utility (Goodyear 1974, 1979).

As lithic raw material cost is negotiated, toolkit condition is expected to reflect changes in the stages of reconditioning and recycling. Bleed (1986) has applied an engineering design perspective to material culture in which he proposed that material culture can be designed to optimize availability in two different ways. Maintainable toolkit designs would emphasize flexibility in unpredictable situations, whereas reliable toolkit designs would be over-engineered and under-stressed in situations of predictability. This applies directly to a perspective of cost, in that locations of high lithic raw material cost would expect to contain evidence of maintainable toolkit designs that were under higher stresses than the predicted reliable toolkit designs at locations in close proximity to low lithic raw material cost. Hafted bifaces, for example, would be less likely to be reconditioned or heavily resharpened in close proximity to high quality lithic raw material sources, whereas in a situation of high cost at the end of a raw materials range of utility, these same tools would be reconditioned or recycled on a much more frequent basis. Precise linear reduction of the toolkit does not need to be demonstrated to prove this point, as movement away from raw material sources would
have a different discard, loss, and reconditioning pattern than return trips, and due to equifinality, determinations of site occupation with regard to this two-way movement cannot be determined. Also, in situations of high raw material cost the optimal strategy of toolkit maintenance would be to reduce the use of stone tools until proximity to sources is reached. However, as will be discussed later, deviations from expected predictions can be evidence of socio-cultural negotiations.

**Raw Material Frequency**

One further prediction that this model can provide is raw material diversity, or simply put raw material frequencies as calculated by percentages of the total assemblage. By taking the distribution maps and the interpolated surface generated from the distribution data, a diversity index can be calculated to predict the relative frequencies to be present at a specific location. In doing so, a specific tool type such as hafted bifaces or curated unifaces such as the hafted endscraper, can be considered for large scale movement around geographically dispersed raw material sources. Expedient flake tool use of low quality local materials is expected to alter raw material frequencies if local scale predictions are not calculated in order to identify local sources. These relative frequency predictions have already been calculated at the county level for the state of South Carolina by Moore and Charles (in press) and were used in the production of the raw material distribution maps.

**Broader Implications**

This model has the potential to bring about a better understanding of the influences that geographically static resources have on hunter-gatherer strategies of mobility and
subsistence. Quantifying those influences is one thing, but what can it tell us about the people who lived with them?

Quantifying the influences of resource distribution and relative qualities is a necessary first step in order to climb a ladder towards higher understanding of past cultures (Hawkes 1954). Poor preservation during early prehistory has limited the material culture available for study. Stone tools withstand the test of time, and drainage patterns have not dramatically changed over the past ten thousand or so years, certainly not in the way flow accumulates across the landscape. A quantified understanding of optimal strategies of resource negotiation allows us to begin identifying socio-cultural deviations from the optimal model. Anomalies imply that people had social or other reasons for going to places that are not ideal for resource extraction. It is possible that there were available resources that are now invisible to us in the archaeological record. Analyses of stone tool assemblage conditions might then provide us with insights that would otherwise not be recognized. These anomalies also represent an opportunity for applying ethnographic observations to explanations of prehistoric mobility and subsistence strategies, as well as social organizations.

Evaluating the distribution densities of resources by quality will perhaps also provide us with a better understanding of the landscape on which prehistoric peoples lived. The perspective of central place theory can be applied to localities of low risk and low cost, which can then be compared to stylistic markers for the division of cultural influence (Christaller 1966; Beavon 1975, 1977; King 1984). Several studies have evaluated social interaction across the landscape as identified by stylistic variation in hafted biface attributes (Bridgman-Sweeney 2013, Thulman 2014, 2015). Social aggregation would
most likely occur in places of low biological risk which would provide relatively large
groups of people with adequate food, but what about lithic raw material cost? The Santee
river basin in South Carolina, for example, has been proposed to be an aggregation zone
during Paleoindian and Early Archaic cultural periods due to the blending of high quality
exotic lithic raw materials (Daniel and Goodyear 2015, 2017; Goodyear 2014; Wilkinson
2017). If Early Archaic hunter-gatherers did centralize their movements around high-
quality lithic raw materials as the Daniel (2001) model suggests, perhaps zones of high
raw material cost represent potential buffer zones between cultural groups.

In order to continue climbing the ladder of inference, quantifying lithic raw material
quality, or the average range of utility, will allow archaeologists to identify the movement
of raw materials outside of their normal range. Arguments concerning the mechanism of
transporting those exotic raw materials could include exchange between groups, social
migration of individuals from one group to another, or even aspects of stone tools such as
Binford's (1962) "sociotechnic" category. With the limited state of preservation of non-
lithic artifacts during early prehistory, classifications such as Binford's could serve as a
useful tool for evaluating markers of social status and organization, which could aid
archaeologists in answering other relevant questions about culture during the Early
Archaic.

SUMMARY

It should be understood that this proposed approach is not meant to be a static model.
The parameters for calculating risk or cost can and should be adjusted in a number of
ways and can be applied to a variety of resource types. Quantifying resource
distributions across the landscape is just one step towards understanding their influences. Additional landscape analyses should build on this approach by incorporating other characteristics present across the landscape. Least-cost pathway analysis could be helpful in explaining optimal paths of movement between resources and could play a significant role in identifying potential social aggregation sites (Moore and Irwin 2013). Quantitative environmental analyses will contribute to our understanding of other significant influences on early Holocene hunter-gatherers, such as the loss of foraging landscape due to unstable sea-levels, or periods of drought. This model is only meant to be one step higher on the ladder.
CHAPTER FIVE
DATA ANALYSIS AND RESULTS

In order to evaluate the effects of resource distribution and variability in quality on archaeological reality, geographically extensive samples of well provenienced and well collected archaeological assemblages are needed. The collections sampled require continuous data stretching across and between multiple resource types and locations. Evaluations of biological resource risk and lithic raw material cost are presented here utilizing extensive data derived primarily from the study of private artifact collections, which offer great potential for landscape archaeology. These private artifact collections allow for the consolidation of geographically extensive and continuous datasets with large sample sizes of different artifact classes, and for more complete samples from site specific assemblages than extensive excavations often provide. Presented here are the methods implemented for testing the Risk Landscape Model predictions, an introduction to the collections examined and their geographic locations, and the manipulation of that data to answer specific questions regarding the influence of resource availabilities on Early Archaic hunter-gatherers.

ANALYSIS METHODS

The approaches taken to test this model involve the analysis of site specific assemblages in locations that vary in relative risk, as well as collections widespread enough to evaluate the movement of lithic raw materials and associated changes in toolkit
conditions with changing proximity to lithic sources of variable qualities. The collections incorporated into this analysis form two transects across South Carolina. The first transect extends across the Middle Coastal Plain and crosses river drainages. It begins in Allendale County along the Savannah River, crosses several Coastal Plain originating rivers before crossing the Santee River, and extends as far as Sumter and Lee counties where the Black River drainage system is located. The second transect utilizes collections along the Saluda, Congaree, and Santee river drainage stretching from the Western portion of Lake Murray in Saluda County to the lower end of Lake Marion in Clarendon County.

Zonal Divisions

In evaluating site specific locations across the South Carolina landscape, arbitrary zones were established that corresponded with relative changes in risk as calculated by the drainage system analysis presented in the previous chapter. Figure 5.1 illustrates the designation of six zones in a transect across the Coastal Plain where significant changes in relative risk were identified. Zones 1 and 5 correspond with localities of very low risk along the major river systems the Savannah and the Congaree/Santee respectively. These localities have been designated as major riverine localities, and are ranked highest as they are the most optimal to visit and exploit. Zones 3 and 6 correspond with localities of moderate risk where the Coastal Plain originating black water river systems the North and South Edisto rivers, and the Black River are found respectively. These localities have been designated as coastal riverine, and are ranked as the second most optimal localities for exploitation. The remaining two zones, 2 and 4, correspond with localities of high risk where smaller drainage systems are found such as the Salkahatchie River in
zone 2, and the headwaters of the Four Hole Swamp drainage system in zone 4. These localities are designated as inter-riverine localities, and are ranked the lowest as they represent localities of the highest degrees of risk and least optimal for exploitation.

**Raw Material Transects**

Two transects of data have been compiled to evaluate the movement of lithic raw materials across and along major river drainages. These data are in complement to data previously presented by Sassaman (1996), Daniel (2001), and Wilkinson (2017), and are presented here in order to evaluate the range of movement of lithic raw materials, predicted frequencies of the different materials expected in certain localities, as well as
Figure 5.2 Zone determinations along the Saluda/Congaree/Santee River drainage.

The influence of proximity to variably ranked raw material sources. The cross-drainage transect consists of data derived from the zonal analysis just described above, and correspond with each zone. Though the zone determinations are not equalized for distance, the relative proximity at the scale examined is sufficient to examine gross trends in raw material movement. For more precise illustrations of these movements, refer to Figures 4.5-4.10 in the previous chapter.

The second transect of data examined follows the Saluda, Congaree, and Santee river drainage. This transect is illustrated by Figure 5.2 which shows the localities where collections were examined. This transect also complements data presented by Sassaman
(1996) and is presented here to evaluate the gross changes in raw material frequency and movement in comparison to the cross-drainage transect. Zone 7 consists of collections that correspond with the Western half of Lake Murray where site specific collections have been consolidated for a gross analysis of raw material percentages. Zone 5 data is also used here where the transects intersect. Zone 8 consists of collections that have been consolidated from the upper portion of Lake Marion. Lastly, zone 9 consists of consolidated collections from the lower portion of Lake Marion. This transect is also not equalized for distance but instead seeks to illustrate gross changes in raw material frequencies by proximity to sources.

**COLLECTIONS ANALYZED**

This thesis has utilized a great deal of data primarily existing in the hands of private artifact collectors. In order to obtain geographically extensive datasets, private artifact collections that have been thoroughly and responsibly collected represent tremendous potential for evaluating cultural mobility and technological organization across the landscape. While the quality of data that can be derived from private collections is not always ideal for specific research questions, the evaluation of cultural mobility and utilization of the landscape relies on geographically dispersed datasets that often can only be obtained through collaboration with private collectors. General proveniences are adequate in evaluating cultural mobility and general patterns of landscape utilization, and specific proveniences are not needed to discern overall variability. Care was taken to only include private collections that had been thoroughly collected, where the potential for bias was somewhat reduced. This thesis seeks to be an example of the quality of research, and research potential, that such collaboration can produce.
This thesis has utilized existing data in the hands of fourteen different private collectors, as well as three collections that have been curated with the Southeastern Paleoamerican Survey (SEPAS) at the South Carolina Institute of Archaeology and Anthropology (SCIAA). Some of these collections are representative of specific sites, while some represent data from specific localities. The use of data with this regard is explained with each evaluation of the data, as some data is useful for gross evaluation as well as site specific.

Site specific collections from 111 unique sites have been evaluated in the transect that crosses the drainage systems of the Middle Coastal Plain. These site locations have been approximated by zone in Figure 5.3.

**Zone 1**

Two site specific collections were examined within zone 1 as illustrated in Figure 5.1, both of which reside with the SEPAS program at SCIAA. These sites are the Charles Site (38AL135) and the Big Pine Tree Site (38AL143), which were both evaluated by the SEPAS program periodically over the past few decades. Both sites are associated with Allendale chert exposures and quarry related activities, and are located in close proximity to the famous Topper Site (38AL23) as all three sites are owned and protected currently by the Archroma chemical company. Charles and Big Pine are situated only a few hundred yards apart on the associated banks of Smith Lake Creek which feeds into the Savannah River. These sites are situated within the floodplain of the Savannah River, and exist in a low risk-low cost location according to the Risk Landscape Model predictions.
Figure 5.3  Locations of site specific collections examined in the cross-drainage transect.

The sites have been investigated by professional archaeologists and excavations have been undertaken there, more extensively at the Big Pine site, and extensive dredging of the creek have accumulated an extensive number of artifacts from all time periods. These sites have partially eroded into the creek, but still possess portions of intact deposits. As extensive as the collections are from these sites, many data were not collected from them for this thesis. The data collected from this thesis consisted of hafted bifaces and Edgefield scrapers. A significant effort needs to be made to completely analyze the collections present there from Early Archaic deposits, portions of which have already
Table 5.1 Artifacts analyzed in Zone 1 by collection. (* denotes more were observed)

<table>
<thead>
<tr>
<th>Collection</th>
<th>SCIAA</th>
<th>SCIAA</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sites</td>
<td>1 (38AL143)</td>
<td>1 (38AL135)</td>
<td>2</td>
</tr>
<tr>
<td>Hafted Bifaces</td>
<td>124</td>
<td>19</td>
<td>143</td>
</tr>
<tr>
<td>Unifaces</td>
<td>Present</td>
<td>Present</td>
<td></td>
</tr>
<tr>
<td>Adzes</td>
<td>Present</td>
<td>Present</td>
<td></td>
</tr>
<tr>
<td>Drills</td>
<td>Present</td>
<td>Present</td>
<td></td>
</tr>
<tr>
<td>Edgefields</td>
<td>1*</td>
<td>2</td>
<td>3*</td>
</tr>
<tr>
<td>Eggstones</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Waller Knives</td>
<td>Present</td>
<td>Present</td>
<td></td>
</tr>
<tr>
<td>Flake Tools</td>
<td>Present</td>
<td>Present</td>
<td></td>
</tr>
<tr>
<td>Gravers</td>
<td>Present</td>
<td>Present</td>
<td></td>
</tr>
<tr>
<td>Bifacial Cores</td>
<td>Present</td>
<td>Present</td>
<td></td>
</tr>
<tr>
<td>Bipolar Cores</td>
<td>?</td>
<td>?</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>Present</td>
<td>Present</td>
<td></td>
</tr>
</tbody>
</table>

been attempted and demonstrate the extent of data present at these sites (Lindeman 1990).

Table 5.1 lists the data that was collected for this thesis.

Zone 2

Eight site specific collections have been examined in zone 2, as illustrated in Figure 5.1, from five different private collectors. Five of these sites are located along Toby Creek which feeds into the Salkehatchie River, one along Hercules Creek, one in association with a Carolina Bay, and one in close proximity to a section of Lower Three Runs Creek. Seven of the eight sites were surface collected in plowed fields, and one has been excavated by the landowner as well as investigated professionally (38BR1373). The artifacts analyzed in this zone are presented by collector in Table 5.2.

Zone 3

Examined within zone 3 are 49 site specific collections by two individuals. The majority of these sites are located along the floodplain boundary of the South Edisto River in Bamberg and Orangeburg counties, three of the sites are associated with the
Table 5.2 Artifacts analyzed in Zone 2 by collection.

<table>
<thead>
<tr>
<th>Collection</th>
<th>Dennis Hendrix</th>
<th>Lorene Fisher</th>
<th>Harrold Keel</th>
<th>Jerry Morris</th>
<th>Pickens Williams</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sites</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>Hafted Bifaces</td>
<td>14</td>
<td>17</td>
<td>21</td>
<td>7</td>
<td>8</td>
<td>67</td>
</tr>
<tr>
<td>Unifaces</td>
<td>24</td>
<td>8</td>
<td>3</td>
<td>0</td>
<td>1</td>
<td>36</td>
</tr>
<tr>
<td>Adzes</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Drills</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Edgefields</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Eggstones</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Waller Knives</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Flake Tools</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>Gravers</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Bifacial Cores</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Bipolar Cores</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Other</td>
<td>4</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>5</td>
</tr>
</tbody>
</table>

floodplain boundary of the North Edisto River, and one site is near the headwaters of Tampa Creek which feeds into the South Edisto River (38OR358). All of these collections were made from surface collecting plowed fields. All but one of the sites examined were collected by Dennis Hendrix, who diligently labeled artifacts from different sites with his own arbitrary numbers. He did not collect a number of these fields exclusively, however, as he had several friends who collected with him. These known collections have not been analyzed as a part of this thesis, but are mentioned to disclose that the artifacts examined do not represent complete samples. This considered, his collection represents a good relative sample of what is typical of sites in this zone, at least as far as has been observed so far. The remaining site, the Peele Site (38OR358), was collected by Steve Williams who diligently collected every artifact disturbed in the plowed field. The total artifacts examined within this thesis from these sites are presented in Table 5.3.
Table 5.3 Artifacts analyzed in Zone 3 by collection

<table>
<thead>
<tr>
<th>Collection</th>
<th>Dennis Hendrix</th>
<th>Steve Williams</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sites</td>
<td>48</td>
<td>1 (38OR358)</td>
<td>49</td>
</tr>
<tr>
<td>Hafted Bifaces</td>
<td>99</td>
<td>32</td>
<td>131</td>
</tr>
<tr>
<td>Unifaces</td>
<td>136</td>
<td>31</td>
<td>167</td>
</tr>
<tr>
<td>Adzes</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Drills</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Edgefields</td>
<td>11</td>
<td>0</td>
<td>11</td>
</tr>
<tr>
<td>Eggstones</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Waller Knives</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Flake Tools</td>
<td>27</td>
<td>1</td>
<td>28</td>
</tr>
<tr>
<td>Gravers</td>
<td>6</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>Bifacial Cores</td>
<td>5</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Bipolar Cores</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Other</td>
<td>15</td>
<td>0</td>
<td>15</td>
</tr>
</tbody>
</table>

Zone 4

A total of two sites were examined within zone 4 from two different collectors. One site (38CL101) is located in close proximity to Murph Mill Creek in Calhoun County and was made by myself and my family surface collecting our plowed garden which is located on a high, sandy, and well drained ridge top in association with a seep spring on its slope. The second site was diligently collected by Steve Williams from a location near the headwaters of the Four Hole Swamp drainage system. Upon request of the collector, the specific location of this site has been withheld here, but is on file at SCIAA where it was given the site number of 38CL102. This site, named the Island Site by the collector Steve Williams, was extensively surface collected in a plowed field where a very dense concentration of artifacts were found. This is worth highlighting here with its introduction as it will be the focus of considerable discussion throughout this chapter. The artifacts examined within this zone from these two sites are presented in Table 5.4.
Table 5.4 Artifacts analyzed in Zone 4 by collection.

<table>
<thead>
<tr>
<th>Collection</th>
<th>Wilkinson</th>
<th>Steve Williams</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sites</td>
<td>1 (38CL101)</td>
<td>1 (38CL102)</td>
<td>2</td>
</tr>
<tr>
<td>Hafted Bifaces</td>
<td>11</td>
<td>122</td>
<td>133</td>
</tr>
<tr>
<td>Unifaces</td>
<td>4</td>
<td>52</td>
<td>56</td>
</tr>
<tr>
<td>Adzes</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Drills</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Edgefields</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Eggstones</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Waller Knives</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Flake Tools</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Gravers</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Bifacial Cores</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Bipolar Cores</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Other</td>
<td>0</td>
<td>10</td>
<td>10</td>
</tr>
</tbody>
</table>

Zone 5

Among the collections studied, three were located within zone 5 which is situated along the Congaree River, a part of the Santee drainage system. One site (38CL17) was investigated by SCIAA archaeologists James Michie and Tommy Charles many years ago, and excavations by Michie and Charles revealed that Early Archaic and Paleoindian artifacts remains buried underneath an extensively cultivated bluff overlooking the Congaree River floodplain. Records indicate that a wide variety of artifacts were found ranging from a Suwannee point through Woodland and Mississippian ceramics were all present at the site. The artifacts examined for this thesis were among James Michie's artifacts left with SCIAA and it is unclear if they were from any of the fourteen five foot square test units that Michie and Charles dug, or if they were surface collected. Regardless, the artifacts examined appear to represent only a fraction of the total number of Early Archaic artifacts observed at the site, and knowledge of the whereabouts of other artifacts have not been pursued. The artifacts that were examined are listed in Table 5.5.
Located in close proximity to the Buycke's Bluff Site is High Creek Plantation (38CL100) which is privately owned by the Salley family, this property is also situated on the bluff overlooking the Congaree River floodplain. Two sites are present on this property that have been diligently collected over the past decade. One site is situated on the bluff itself where artifacts have been collected eroding out of the soil in a dirt road, and the other site exists in the floodplain of an adjacent creek that runs into the Congaree River. The second site has been surface collected in approximately seventy acres of plowed fields adjacent to this creek where an abundance of artifacts have been recovered. It is not clear whether or not this second collection represents one or multiple sites in close proximity, but it is probable that there is continuity in the distribution of artifacts across this space. The artifacts examined in this thesis from these two sites are also presented in Table 5.5.

Table 5.5 Artifacts analyzed from Zone 5 by collection.

<table>
<thead>
<tr>
<th>Collection</th>
<th>Kat Salley</th>
<th>Jane Salley</th>
<th>SCIAA</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sites</td>
<td>1 (38CL100a)</td>
<td>1 (38CL100b)</td>
<td>1 (38CL17)</td>
<td>3</td>
</tr>
<tr>
<td>Hafted Bifaces</td>
<td>168</td>
<td>25</td>
<td>16</td>
<td>209</td>
</tr>
<tr>
<td>Unifaces</td>
<td>113</td>
<td>11</td>
<td>14</td>
<td>138</td>
</tr>
<tr>
<td>Adzes</td>
<td>5</td>
<td>1</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Drills</td>
<td>4</td>
<td>0</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Edgefields</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Eggstones</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Waller Knives</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Flake Tools</td>
<td>31</td>
<td>0</td>
<td>11</td>
<td>42</td>
</tr>
<tr>
<td>Gravers</td>
<td>6</td>
<td>0</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>Bifacial Cores</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Bipolar Cores</td>
<td>8</td>
<td>0</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>Other</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>5</td>
</tr>
</tbody>
</table>
Table 5.6 Artifacts analyzed in Zone 6 by collection.

<table>
<thead>
<tr>
<th>Collection</th>
<th>Andy Shull (Black River)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sites</td>
<td>47</td>
</tr>
<tr>
<td>Hafted Bifaces</td>
<td>260</td>
</tr>
<tr>
<td>Unifaces</td>
<td>320</td>
</tr>
<tr>
<td>Adzes</td>
<td>4</td>
</tr>
<tr>
<td>Drills</td>
<td>5</td>
</tr>
<tr>
<td>Edgefields</td>
<td>2</td>
</tr>
<tr>
<td>Eggstones</td>
<td>0</td>
</tr>
<tr>
<td>Waller Knives</td>
<td>1</td>
</tr>
<tr>
<td>Flake Tools</td>
<td>79</td>
</tr>
<tr>
<td>Gravers</td>
<td>8</td>
</tr>
<tr>
<td>Bifacial Cores</td>
<td>5</td>
</tr>
<tr>
<td>Bipolar Cores</td>
<td>4</td>
</tr>
<tr>
<td>Other</td>
<td>4</td>
</tr>
</tbody>
</table>

Zone 6

Zone 6 is situated along the Coastal Plain originating Black River drainage system where artifacts from 47 sites were examined. These collections were made over a number of years from cultivated fields by Andy Shull. A significant portion of the artifacts collected from these sites were diligently labeled by site location, which were carefully mapped. The many artifacts examined in this zone are listed in Table 5.6.

Zone 7

Also collected by Andy Shull were a number of artifacts from sites present along the shores of Lake Murray, specifically the Western most third of the lake, in the lower Piedmont of South Carolina. The analysis for this dataset was done for the totality of the artifacts, though it should be noted that the arbitrary site designations made by Andy Shull exceed 160 unique sites. Given the current levels of the lake, it is likely that many of the sites exposed at the water's edge may represent upland contexts as described by
Table 5.7 Hafted bifaces analyzed in Zone 7 by collection.

<table>
<thead>
<tr>
<th>Collection</th>
<th>Andy Shull (Lake Murray)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Hafted Bifaces</td>
<td>142</td>
</tr>
<tr>
<td>Dalton</td>
<td>5</td>
</tr>
<tr>
<td>Side Notched</td>
<td>62</td>
</tr>
<tr>
<td>Corner Notched</td>
<td>41</td>
</tr>
<tr>
<td>Post-Kirk</td>
<td>28</td>
</tr>
<tr>
<td>Fragments</td>
<td>5</td>
</tr>
<tr>
<td>Preforms</td>
<td>1</td>
</tr>
</tbody>
</table>

Goodyear et al. (1979) in other Piedmont contexts. The hafted bifaces included in this thesis are tabulated in Table 5.7.

**Zone 8**

This zone is located around the upper portion of Lake Marion where surface collections have been made along the north shore lake edge by several diligent collectors. Precise provenience is known for many of the artifacts due to the diligence of one collector, Dr. Bob Costello, who collects GPS points for each diagnostic find.

Approximate provenience information is known for the other artifacts as the collectors collected known sections of the lake shore. The artifacts from these collections have been consolidated for the evaluation of overall percentages, but are listed by collector in Table 5.8.

**Zone 9**

Several of the collectors who collected locations within zone 8, also collected portions of the lake shore at the lower end of the lake, located along Wyboo Creek which feeds into the Santee River and has become a part of Lake Marion. These collections have been separated from the collections from the upper portion of the lake for the
Table 5.8 Hafted bifaces analyzed in Zone 8 by collection.

<table>
<thead>
<tr>
<th>Collection</th>
<th>Bob Costello</th>
<th>Greg Walls</th>
<th>Fuzzy Furse</th>
<th>David Wielicki</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Hafted Bifaces</td>
<td>145</td>
<td>91</td>
<td>13</td>
<td>9</td>
<td>258</td>
</tr>
<tr>
<td>Dalton</td>
<td>13</td>
<td>7</td>
<td>1</td>
<td>0</td>
<td>21</td>
</tr>
<tr>
<td>Side Notched</td>
<td>61</td>
<td>35</td>
<td>6</td>
<td>4</td>
<td>106</td>
</tr>
<tr>
<td>Corner Notched</td>
<td>53</td>
<td>27</td>
<td>5</td>
<td>3</td>
<td>88</td>
</tr>
<tr>
<td>Post-Kirk</td>
<td>4</td>
<td>21</td>
<td>1</td>
<td>2</td>
<td>28</td>
</tr>
<tr>
<td>Fragments</td>
<td>13</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>14</td>
</tr>
<tr>
<td>Preforms</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 5.9 Hafted bifaces analyzed in Zone 9 by collection.

<table>
<thead>
<tr>
<th>Collection</th>
<th>Fuzzy Furse</th>
<th>David Wielicki</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Hafted Bifaces</td>
<td>14</td>
<td>63</td>
<td>77</td>
</tr>
<tr>
<td>Dalton</td>
<td>0</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Side Notched</td>
<td>7</td>
<td>23</td>
<td>30</td>
</tr>
<tr>
<td>Corner Notched</td>
<td>6</td>
<td>26</td>
<td>32</td>
</tr>
<tr>
<td>Post-Kirk</td>
<td>1</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>Fragments</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Preforms</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

purpose of extending the raw material transect further down the Santee River. The hafted bifaces analyzed for this thesis from zone 9 are presented by collector in Table 5.9.

**SITE DENSITY**

The evaluation of site density is a difficult one. It require two things, a strict definition of what is determined as a site and how to delineate boundaries between sites, and also extensive surveys of the different localities of interest within this model.

The definition and delineation standards of archaeologists to most would seem pretty straight forward. The determination of different sites is perhaps most often approached from a spatial perspective. Sites are delineated due to the spatial separation of artifacts, either by a void of artifacts between spaces or by a natural boundary of some sort.
However, in terms of conducting analysis, many view sites with regard to events, culturally or temporally specific occupations, or in regards to place. Both approaches have merit for their intended purposes. Spatial delineation is important for management, and the evaluation of place is important for understanding human behavior and experience. A site that is separated by a small creek may be assigned two different site numbers, but the people who experienced life at that location may very well have been responsible for the artifacts found on both sides of it.

Evaluating site density requires an understanding of these distinctions and a clear explanation of the way in which it is evaluated, and the quality of the data used. The data that was accumulated for this thesis, though extensive, does not adequately fulfill the distinctions made here for each zone. While zones 3 and 6 each have an extensive number of sites, often several sites as recorded by the collectors could be argued to be a part of the same site. Both collectors Dennis Hendrix (zone 3) and Andy Shull (zone 6) have created arbitrary numbers to delineate their different sites. While most of the distinct sites are obviously separated spatially, many have been given the same number with a suffix that delineates the area where certain artifacts were collected at a place. Both the location and place oriented approaches were recognized by both collectors as they used the same number to identify the artifacts, but used a suffix to delineate the different locations where concentrations of artifacts occurred (e.g. 5a, 5b, 5c, 5d). These delineations were honored as distinct sites as it is possible that professional survey and carefully observing artifact distributions would have resulted in distinct site numbers being assigned. However, it should be understood that such delineation does not exist for
the data examined here and the determinations of distinct sites are not wholly accurate, though a relative degree of accuracy confidently exists.

It should also be noted, that some collections, such as the site described on High Creek Plantation along the creeks edge, has not been delineated in the manner described for sites in zones 3 and 6. The collection made in this location, though extremely thorough and wholly adequate for an evaluation of place, does not adequately delineate spatial boundaries for artifact distributions that would ordinarily be needed for site determinations. Because such delineation does not exist for this collection, it has been treated as one site (though separate from the site described on the bluff above) within this thesis.

It is this dilemma that requires this question left unanswered in this thesis. Despite the inadequacies of the data presented here in answering this question regarding site density, datasets do exist that may allow for such a test in the future. Long term compliance archaeology has been carried out in different geographic locations that might allow for such a determination to be evaluated. Compliance related work on the Savannah River Plant by the Savannah River Archaeological Research Program (SRARP) represents a vast dataset along a major riverine environment and associated upland and inter-riverine localities similar to the space segregated into zone 2 within this thesis. United States Forest Service (USFS) properties in Edgefield and Saluda counties and elsewhere, have also been extensively surveyed for compliance purposes over a long period of time and represents very useful data from the lower Piedmont where extensive rhyolite quarries also occur. Archaeological survey at Fort Jackson represents an extensive dataset in the lower Piedmont and Fall Line that are capable of providing useful
information not only about site density, but also land-use strategies within that locality. Such datasets will one day prove useful in evaluating site density in relation to localities with variable degrees of risk as determined by this model.

The high numbers of sites delineated and collected in zones 3 and 6 are worth discussing here, as Figure 5.3 illustrates that an apparent high density of sites occur there. Discussed in the next section, artifact density by site appear to be greatly diminished within these zones when compared to averages found at sites in locations of lower relative degrees of risk. Both of these points indicate a potential explanation that is contradictory to this models expectations regarding site density. While this model assumes that localities of decreased risk will have higher site densities due to the increased benefit of visiting that locality, in localities of higher risk the optimal strategy of exploiting biological resources may require patterns of frequent movement (Bettinger 1991:89-90). This frequent movement would be made necessary by the increased time-stress (Torrence 1983) of exploiting biological resources in the immediate vicinity. In a zone of higher relative risk biological resources would be depleted at a much more rapid pace due to lower relative biological resource densities. This would require frequent movement to not only obtain new resources, but also avoid completely depleting resources in any specific location. Such a strategy may produce an abundance of sites in close proximity, thereby increasing site density. However, the one difference would be the density of artifacts found at each site, as occupation time at each location would be expected then to be diminished. This potential result may then lend the evaluation of site density as an inadequate test of this model's predictions altogether.
ARTIFACT DENSITY

The evaluation of artifact density represents perhaps the most compelling test of this model's predictions by determining the locations of highest artifact concentrations with regard to artifact type by site in each of the zones of variable risk. The argument presented in this thesis, and indeed most optimal foraging models, is that optimal locations for subsistence are visited more frequently, occupied for longer periods of time, and are capable of supporting more people per visit. With this expectation the result of artifact deposition in given locations would be expected to be reflective of the frequency of visits, time spent at the location per visit, and the number of individuals present. Equifinality prevents us from accurately determining the number of visits, duration of visits, and occupancy, but it is a good assumption that such depositional patterns are reflective of the environmental condition. Optimal locations would thus have higher artifact densities per site as a reflection of the intensity of occupation and use of that location.

All Early Archaic Artifacts Per Site

The evaluation of Early Archaic artifact totals per site demonstrates some significant differences by zone. Table 5.10 lists the artifact totals per zone and the calculations of artifacts per site across those zones. It should be noted again that this calculation was not done for zone 1 as all artifact classes were not evaluated at the two sites examined there. Both sites were situated on high quality Allendale chert outcrops and quarry related activity was abundant. The observed artifact densities at these sites are very high, especially when compared to sites significant distances from these quarries such as are found in the remaining zones.
Table 5.10 Total Early Archaic tools analyzed per zone and per site averages. (* denotes more were observed)

<table>
<thead>
<tr>
<th>Sites</th>
<th>ZONE 1</th>
<th>ZONE 2</th>
<th>ZONE 3</th>
<th>ZONE 4</th>
<th>ZONE 5</th>
<th>ZONE 6</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sites</td>
<td>2</td>
<td>8</td>
<td>49</td>
<td>2</td>
<td>3</td>
<td>47</td>
<td>111</td>
</tr>
<tr>
<td>Artifact N</td>
<td>146*</td>
<td>125</td>
<td>370</td>
<td>229</td>
<td>421</td>
<td>641</td>
<td>1932</td>
</tr>
<tr>
<td>Per Site</td>
<td>15.63</td>
<td>7.55</td>
<td>114.5</td>
<td>140.33</td>
<td>13.64</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The zone with the highest artifact densities observed is zone 5, which has a significantly high number of diagnostic Early Archaic artifacts per site. Also high in density are the sites observed in zone 4, or more specifically the Island site where a great number of artifacts were observed. Zone 3 is seen to have the lowest density of artifacts per site. In introducing the sites studied in zone 3 it was noted that the majority of these sites were collected by Dennis Hendrix, who had friends who collected with him. One friend in particular collected these sites very often and is known to have a comparable collection from these sites that are also labeled by arbitrary site numbers. This collection has not been examined at the time of this writing, but is interesting to note given the relative degree of artifacts per site being approximately half the density of artifact per site in zones 2 and 6. Zone 6 is the other coastal riverine locality that has a comparable number of sites observed. It suggests that the sample size has been cut in half and may be missing in zone 3, and the addition of the other known collection may render the densities nearly equal across these three zones.

The relatively low artifact densities across the zones away from the major rivers is very interesting given the calculations of higher risk for these areas. Low numbers of sites in some zones perhaps create a biased influence on these artifact density calculations, though it has been demonstrated that a significant number of sites have been
examined in four zones away from the major rivers with only one site thus far that match the densities observed at sites in major riverine zones. Never-the-less, the zones with the highest observed artifact densities per site are indeed the zones with the fewest sites examined. This is problematic, and the relative frequencies of artifact densities will likely change with increased samples, however, the impressively dense sites along the major rivers do make a significant statement regarding cultural utilization of such localities. These impressively dense sites are not matched by any sites in any of the other zones, with the exception of the Island site, despite significantly more sites examined.

Table 5.11 Hafted bifaces per site, per zone.

<table>
<thead>
<tr>
<th></th>
<th>ZONE 1</th>
<th>ZONE 2</th>
<th>ZONE 3</th>
<th>ZONE 4</th>
<th>ZONE 5</th>
<th>ZONE 6</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sites</td>
<td>2</td>
<td>8</td>
<td>49</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>111</td>
</tr>
<tr>
<td>Hafted Bifaces</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>143</td>
<td>67</td>
<td>131</td>
<td>133</td>
<td>209</td>
<td>270</td>
<td>953</td>
</tr>
<tr>
<td>Per Site</td>
<td>71.5</td>
<td>8.38</td>
<td>2.67</td>
<td>66.5</td>
<td>69.67</td>
<td>5.74</td>
<td>8.59</td>
</tr>
<tr>
<td>Dalton</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>15</td>
<td>1</td>
<td>5</td>
<td>6</td>
<td>8</td>
<td>6</td>
<td>41</td>
</tr>
<tr>
<td>Per Site</td>
<td>7.5</td>
<td>0.13</td>
<td>0.1</td>
<td>3</td>
<td>2.67</td>
<td>0.13</td>
<td>0.37</td>
</tr>
<tr>
<td>Side Notched</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>46</td>
<td>28</td>
<td>38</td>
<td>40</td>
<td>71</td>
<td>103</td>
<td>326</td>
</tr>
<tr>
<td>Per Site</td>
<td>23</td>
<td>3.5</td>
<td>0.78</td>
<td>20</td>
<td>23.67</td>
<td>2.19</td>
<td>2.94</td>
</tr>
<tr>
<td>Corner Notched</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>51</td>
<td>22</td>
<td>57</td>
<td>50</td>
<td>80</td>
<td>117</td>
<td>377</td>
</tr>
<tr>
<td>Per Site</td>
<td>25.5</td>
<td>2.75</td>
<td>1.16</td>
<td>25</td>
<td>26.67</td>
<td>2.49</td>
<td>3.4</td>
</tr>
<tr>
<td>Post-Kirk</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>24</td>
<td>10</td>
<td>18</td>
<td>18</td>
<td>21</td>
<td>41</td>
<td>132</td>
</tr>
<tr>
<td>Per Site</td>
<td>12</td>
<td>1.25</td>
<td>0.37</td>
<td>9</td>
<td>3</td>
<td>0.87</td>
<td>1.19</td>
</tr>
</tbody>
</table>

*Early Archaic Hafted Bifaces Per Site*

Perhaps the most significant artifact class, in terms of temporal diagnostics, are hafted bifaces which allow for more precise temporal separation. Hafted bifaces are often the artifact class that is given the most analytical attention due to the great potential they offer us for identifying social interaction and influence across time and space. Table 5.11
shows the total consolidated number of hafted bifaces, fragments, and late stage preforms per zone, the number of hafted bifaces per cultural period as previously defined, and the calculation of hafted bifaces per site by each class determined by dividing the total number present by the total number of sites examined.

The results of the hafted bifaces per site show an interesting pattern across all types and with regard to the differences in each zone. Hafted biface densities are highest overall in zones 1 and 5 which are situated on the major rivers for almost every hafted biface type. The exceptions to this pattern are found among Dalton and Post-Kirk hafted bifaces in zone 4. As previously introduced, the Island site (38CL102) stands out as a very rich and dense site located in zone 5 which is not matched by any sites found away from a major river. All six Daltons observed in zone 4 were found at the Island site.

Returning to Table 5.5 will demonstrate the totality of artifacts across all types that were recorded from this site. This exception aside, the other inter-riverine locality zone 2, shows a significant drop in early archaic artifacts per site away from the Savannah River. The coastal riverine zones 3 and 6 show an interesting difference. The number of sites per zone are nearly identical, yet the patterns of hafted bifaces per site in zone 3 are approximately half across each class. As explained in the previous section, the samples examined in zone 3 may represent half of the artifacts recovered from those sites due to at least two diligent collectors visiting nearly each site. The density of hafted bifaces in zone 3 is interesting to note given the relative degree of hafted bifaces per site being approximately half the density of hafted bifaces per site in zone 6. It again suggests that half the sample may be missing, and the addition of the other known collection may render the densities nearly equal.
Comparing the hafted bifaces per site between zones 1 and 5 show that the frequencies of hafted bifaces per site are nearly equal, with slight increases of hafted bifaces in zone 1 which is located on a quarry of high quality Allendale chert. Low sample sizes of sites in each zone is problematic, though the very dense sites observed in each zone have only been matched by the Island site as previously mentioned.

Table 5.12 All unifaces by type, by zone, and per site.

<table>
<thead>
<tr>
<th></th>
<th>ZONE 1</th>
<th>ZONE 2</th>
<th>ZONE 3</th>
<th>ZONE 4</th>
<th>ZONE 5</th>
<th>ZONE 6</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sites</td>
<td>2</td>
<td>8</td>
<td>49</td>
<td>2</td>
<td>3</td>
<td>47</td>
<td>111</td>
</tr>
<tr>
<td>All Unifaces N</td>
<td>Present</td>
<td>34</td>
<td>167</td>
<td>59</td>
<td>133</td>
<td>320</td>
<td>713</td>
</tr>
<tr>
<td>Per Site</td>
<td>4.25</td>
<td>3.40</td>
<td>29.5</td>
<td>44.33</td>
<td>6.81</td>
<td>6.42</td>
<td></td>
</tr>
<tr>
<td>Hafted Endscraper N</td>
<td>Present</td>
<td>13</td>
<td>68</td>
<td>27</td>
<td>105</td>
<td>243</td>
<td>456</td>
</tr>
<tr>
<td>Per Site</td>
<td>1.63</td>
<td>1.39</td>
<td>13.5</td>
<td>35</td>
<td>5.17</td>
<td>4.11</td>
<td></td>
</tr>
<tr>
<td>Bilateral Sidescraper N</td>
<td>Present</td>
<td>6</td>
<td>2</td>
<td>0</td>
<td>5</td>
<td>18</td>
<td>31</td>
</tr>
<tr>
<td>Per Site</td>
<td>0.75</td>
<td>0.04</td>
<td>0</td>
<td>1.67</td>
<td>0.38</td>
<td>0.28</td>
<td></td>
</tr>
<tr>
<td>Sidescraper N</td>
<td>Present</td>
<td>12</td>
<td>65</td>
<td>26</td>
<td>14</td>
<td>31</td>
<td>148</td>
</tr>
<tr>
<td>Per Site</td>
<td>1.5</td>
<td>1.33</td>
<td>13</td>
<td>4.67</td>
<td>0.66</td>
<td>1.33</td>
<td></td>
</tr>
<tr>
<td>Turtleback N</td>
<td>Present</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>8</td>
<td>12</td>
</tr>
<tr>
<td>Per Site</td>
<td>0</td>
<td>0.02</td>
<td>1</td>
<td>0.33</td>
<td>0.17</td>
<td>0.11</td>
<td></td>
</tr>
<tr>
<td>Other N</td>
<td>Present</td>
<td>3</td>
<td>31</td>
<td>4</td>
<td>8</td>
<td>20</td>
<td>66</td>
</tr>
<tr>
<td>Per Site</td>
<td>0.38</td>
<td>0.63</td>
<td>2</td>
<td>2.67</td>
<td>0.43</td>
<td>0.59</td>
<td></td>
</tr>
</tbody>
</table>

Unifaces Per Site

An evaluation of unifaces per site is illustrated in Table 5.12 and show similar trends that are observed in the calculations of hafted bifaces. Hafted endscrapers are the most abundant uniface type observed across the collections, and are found most abundantly at
sites in zone 5, with a significant presence again at the Island site. While unifaces in zone 1 were not examined as a part of this thesis, a previous thesis has evaluated a sample of unifaces from the same sites studied in this thesis from zone 1. Lindeman's (1990) sample reached 198 unifaces at a time that was still early in the archaeological investigations of the Big Pine Tree (38AL143) and the Charles (38AL135) sites. While these unifaces likely included types also associated with Paleoindian occupations, this example is sufficient to make the point that there is a significant presence of unifacial tools at these sites related with quarry related exploitation of the high quality Allendale chert source present there.

Other Tools Per Site

A number of other tool types were present, though less in frequency, worthy of mentioning with regards to site density. Several long life tool types such as adzes and eggstones were observed, presumed expedient tools like the Waller knife and flake tools, as well as formalized drills and Edgefield scrapers.

Adzes. The presence of adzes among Early Archaic assemblages suggest that heavy duty woodworking was taking place among the activities undertaken by Early Archaic peoples. The occurrence of long life tools like the Dalton adze across different environmental localities also speaks to the strategies of mobility and subsistence that such peoples may have undertaken. Dalton adzes were observed in every zone except zone 4, and are listed in Table 5.13. Though precise provenience was lost for three adzes in zone 6, the only location where more than one adze occurred at a single site is High Creek Plantation (38CL100) where five adzes were found among the cultivated fields along the creek. The abundant presence of Dalton adzes found at High Creek speak to the quality
Table 5.13 Dalton Adzes per site.

<table>
<thead>
<tr>
<th>ZONE 1</th>
<th>ZONE 2</th>
<th>ZONE 3</th>
<th>ZONE 4</th>
<th>ZONE 5</th>
<th>ZONE 6</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sites</td>
<td>2</td>
<td>8</td>
<td>49</td>
<td>2</td>
<td>3</td>
<td>47</td>
</tr>
<tr>
<td>N</td>
<td>Present</td>
<td>1</td>
<td>3</td>
<td>0</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Per Site</td>
<td>0.13</td>
<td>0.06</td>
<td>0</td>
<td>2</td>
<td>0.09</td>
<td></td>
</tr>
</tbody>
</table>

Table 5.14 Drills per site.

<table>
<thead>
<tr>
<th>ZONE 1</th>
<th>ZONE 2</th>
<th>ZONE 3</th>
<th>ZONE 4</th>
<th>ZONE 5</th>
<th>ZONE 6</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sites</td>
<td>2</td>
<td>8</td>
<td>49</td>
<td>2</td>
<td>3</td>
<td>47</td>
</tr>
<tr>
<td>N</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>5</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td>Per Site</td>
<td>0.13</td>
<td>0.02</td>
<td>1.5</td>
<td>1.67</td>
<td>0.11</td>
<td></td>
</tr>
</tbody>
</table>

of the environment, just as the abundance of all other tool classes present there. It should be noted that all six adzes observed among the two sites at High Creek are made from exotic raw materials, and one adze fragment was turned into a bipolar core. Also, adzes have been observed at the quarry sites in zone 1 but were not analyzed.

Drills. Formalized drills were also infrequently observed in each zone across this transect, and are listed in Table 5.14. The highest densities of drills were observed at High Creek (38CL100) and the Island (38CL102) sites.

Edgefield Scraper. The Edgefield scraper is a unique Early Archaic tool that has been observed across the Southeast into Florida and as far west as Alabama (Bridgman-Sweeney 2013; Goodyear et al. 1980). The northeastern most extent of this tool's distribution is found in the transect evaluated here. The presence of Edgefield scrapers per site in each zone is listed in Table 5.15, and echo again the same pattern of density per site observed for all other artifact types. The sites in zone 1 have a high density of Edgefield scrapers listed, though it has been brought to the attention of the author that
Table 5.15 Edgefield Scrapers per site. (* denotes more were observed)

<table>
<thead>
<tr>
<th>ZONE</th>
<th>ZONE 1</th>
<th>ZONE 2</th>
<th>ZONE 3</th>
<th>ZONE 4</th>
<th>ZONE 5</th>
<th>ZONE 6</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sites</td>
<td>2</td>
<td>8</td>
<td>49</td>
<td>2</td>
<td>3</td>
<td>47</td>
<td>111</td>
</tr>
<tr>
<td>N</td>
<td>3*</td>
<td>6</td>
<td>11</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>28</td>
</tr>
<tr>
<td>Per Site</td>
<td>1.5</td>
<td>0.75</td>
<td>0.22</td>
<td>1.5</td>
<td>1</td>
<td>0.04</td>
<td>0.25</td>
</tr>
</tbody>
</table>

several more were recovered that were not recorded as a part of the analysis for this thesis (Al Goodyear personal communication 2017). This observation at these sites reflect the expectations of this thesis, that the location of highest artifact densities will be found in localities with low biological resource risk, and low raw material cost such as are both found at the sites examined in zone 1. The second and third highest densities of Edgefield scrapers are found in zones 4 and 5 between the Island and High Creek sites.

Table 5.16 Eggstones per site.

<table>
<thead>
<tr>
<th>ZONE</th>
<th>ZONE 1</th>
<th>ZONE 2</th>
<th>ZONE 3</th>
<th>ZONE 4</th>
<th>ZONE 5</th>
<th>ZONE 6</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sites</td>
<td>2</td>
<td>8</td>
<td>49</td>
<td>2</td>
<td>3</td>
<td>47</td>
<td>111</td>
</tr>
<tr>
<td>N</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Per Site</td>
<td>0</td>
<td>0.13</td>
<td>0</td>
<td>0</td>
<td>1.33</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

Eggstones. The eggstone, often called bola or dimple stones, are a presumed long life artifact with a currently undetermined function. The proposed functions for this artifact have been described in chapter two. Their morphology and infrequent presence suggests a long life purpose and its presence at specific sites would be reflective of that fact. The eggstones observed in this transect of sites are listed in Table 5.16. Though no eggstones were observed at the sites examined for this thesis in zone 1, it should be noted that the nearby Topper site has yielded approximately five eggstones from excavations of the
Early Archaic deposits. This high density is matched only by the cache of four eggstones found at High Creek (38CL100). Only one other eggstone was observed among these sites, and was found in zone 2.

Table 5.17 Waller knives per site.

<table>
<thead>
<tr>
<th>ZONE</th>
<th>ZONE</th>
<th>ZONE</th>
<th>ZONE</th>
<th>ZONE</th>
<th>ZONE</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sites</td>
<td>2</td>
<td>8</td>
<td>49</td>
<td>2</td>
<td>3</td>
<td>47</td>
</tr>
<tr>
<td>N</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>Per Site</td>
<td>0.13</td>
<td>0.04</td>
<td>.5</td>
<td>1.33</td>
<td>0.02</td>
<td></td>
</tr>
</tbody>
</table>

Table 5.18 Flake tools per site.

<table>
<thead>
<tr>
<th>ZONE</th>
<th>ZONE</th>
<th>ZONE</th>
<th>ZONE</th>
<th>ZONE</th>
<th>ZONE</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sites</td>
<td>2</td>
<td>8</td>
<td>49</td>
<td>2</td>
<td>3</td>
<td>47</td>
</tr>
<tr>
<td>N</td>
<td>Present</td>
<td>21</td>
<td>139</td>
<td>48</td>
<td>72</td>
<td>79</td>
</tr>
<tr>
<td>Per Site</td>
<td>2.63</td>
<td>2.84</td>
<td>24</td>
<td>24</td>
<td>1.68</td>
<td></td>
</tr>
</tbody>
</table>

Waller Knife. The Waller knife is another tool type that has been infrequently observed across the sites examined and are listed by zone in Table 5.17. The only location where more than one occurs is High Creek, where four such tools were recorded.

Flake Tools. The occurrence of various flake tools have been consolidated and listed in Table 5.18, and evaluated for their density per site. Describing the occurrence of specific flake tool types has proven to be difficult given the wide variety of tool edges, shaping strategies, and assumed varied applications of use. Per site, they occur in highest frequencies again at the Island site within zone 4, and sites found within zone 5. Flake tools per site are present in zones 2, 3, and 6 though much less frequent per site.
Gravers. Gravers were observed in every zone, often fashioned on the edges of a variety of other tool types and not always as lone tool edges on flakes. They were often fashioned on unifaces as well as flake tools, and are listed in Table 5.19. Their occurrence was highest in zone 5, and lowest in both zones 3 and 6 where the highest numbers of sites were examined.

Bifacial Cores. Bifacial cores were often indistinguishable from early stage preforms, and were observed at sites often distantly removed from the source. Table 5.20 lists the bifacial cores identified as such, though it should be noted others were likely observed and not recorded due to a lack in certainty of their age given the disturbed contexts that the majority of these assemblages are from. This problem in mind, it should also be mentioned that an abundance of such cores have been observed in association with the sites in zone 1 where quarry related behavior took place, as well as in zone 5 where a quarry of Black Mingo chert was investigated at High Creek (Goodyear and Wilkinson 2014). The evaluation of bifacial cores is problematic throughout this transect, however, as their form often lack diagnostic traits indicative of Early Archaic
technology, especially when observed as fragments. The presence of chemical weathering does render some identifiable, though the calculation of bifacial cores per site would prove inadequate in this case due to inconsistencies in data collection with regards to these concerns.

*Unifacial Cores.* The presence of unifacial cores is highly infrequent as only four were observed all which were located among sites examined in zone 6. Each of these cores were made of metavolcanic materials, and some may represent heavy duty scrapers for wood working. Their presence is noted, though their very infrequent nature render determinations of artifact density as a lone category meaningless.

<table>
<thead>
<tr>
<th>Table 5.21 Bipolar Cores per site.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ZONE</strong> 1</td>
</tr>
<tr>
<td>Sites</td>
</tr>
<tr>
<td>N</td>
</tr>
<tr>
<td>Per Site</td>
</tr>
</tbody>
</table>

*Bipolar Core.* The presence of bipolar cores, though also infrequent, represents a unique and arguably meaningful portion of the Early Archaic toolkit. The bipolar cores observed in this transect are listed in Table 5.21, where they are found to only occur in zones 5 and 6. All nine bipolar cores observed in zone 5 are made of Allendale chert, four of which are recognizable fragments of curated tools. Three of these are cores made from biface fragments, and one is made from a Dalton adze bit. It is reasonable to assume that all nine bipolar cores present here are products of recycled curated tools. This is also true of the four bipolar cores observed in zone 6, where they are again made on exotic raw materials. Two of these cores are of Allendale chert, and two are of flow
banded rhyolite. One is a recycled hafted endscraper, and another is a utilized flake from bipolar reduction. The presence of these cores, and the raw materials they are made of, will be discussed in the next section as a consideration of toolkit condition.

**TOOLKIT CONDITION**

An examination of artifact densities by tool class per locality is insightful regarding the influence of variable biological densities across the landscape, but what influence does proximity to lithic raw material sources have on the condition of lithic tool kits? The approach taken here evaluates the change in mass, measured by weight, between different tool classes with the movement away from sources. Due to the low sample sizes of many tool classes examined in each locality, this analysis has been restricted to hafted bifaces and hafted endscrapers for which sufficient sample sizes were observed in each locality to render reliable mean measurements. Mass is a good indicator of overall tool condition as it takes into account all tools within a class regardless of completeness. This consideration is important given the condition of toolkit maintenance by proximity to sources. Average length measurements are also included for some of the tools examined but only incorporate measurements from tools that are complete, so in many cases this causes the sample to decrease in size and therefore reliability. Due to the abundance of tools made from Allendale chert, and the geographic location of the transect studied being centered in the distribution range of this material type, the size condition of tools made of this material were specifically evaluated as a subset of the overall totals.

*All Early Archaic Hafted Bifaces*

In order to see if there are any overall trends apparent in the data, all Early Archaic hafted bifaces, fragments, and late stage preforms were consolidated by zone and average
weights were calculated across all lithic raw material types. Table 5.22 illustrates the hafted biface totals by category and the results of these calculations. The results show that there is variability in the overall size of hafted bifaces per zone. The zone with the largest average weight for hafted bifaces is zone 1, the location of high quality Allendale chert quarries. Overall there is a general trend of size reduction with distance from the Savannah River, though it is not precisely linear with some fluctuation throughout. It is interesting that overall size is smallest in zones 5 and 6 where more local raw materials such as Quartz and Black Mingo chert are available in the Congaree/Santee Rivers and perhaps in exposures in Sumter County.

All hafted bifaces made of Allendale chert were then evaluated across the zones in order to see if there is also a general trend of size reduction with distance away from the source. Table 5.23 demonstrates this with only one zone, zone 2, deviating from the trend of decrease in overall size. As expected, the largest average sizes were observed at the source in zone 1, and the smallest average sizes were observed in zone 6 which is the farthest distance from the source.

Table 5.22 Hafted biface quantity by type and zone.

<table>
<thead>
<tr>
<th></th>
<th>ZONE 1</th>
<th>ZONE 2</th>
<th>ZONE 3</th>
<th>ZONE 4</th>
<th>ZONE 5</th>
<th>ZONE 6</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dalton</td>
<td>15</td>
<td>1</td>
<td>5</td>
<td>6</td>
<td>8</td>
<td>6</td>
<td>41</td>
</tr>
<tr>
<td>Side</td>
<td>46</td>
<td>28</td>
<td>38</td>
<td>40</td>
<td>71</td>
<td>103</td>
<td>326</td>
</tr>
<tr>
<td>Corner</td>
<td>51</td>
<td>22</td>
<td>57</td>
<td>50</td>
<td>80</td>
<td>117</td>
<td>377</td>
</tr>
<tr>
<td>Post-Kirk</td>
<td>24</td>
<td>10</td>
<td>18</td>
<td>18</td>
<td>21</td>
<td>41</td>
<td>132</td>
</tr>
<tr>
<td>Fragments</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>15</td>
<td>22</td>
<td>0</td>
<td>51</td>
</tr>
<tr>
<td>Preforms</td>
<td>2</td>
<td>2</td>
<td>8</td>
<td>3</td>
<td>7</td>
<td>3</td>
<td>25</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>143</strong></td>
<td><strong>67</strong></td>
<td><strong>131</strong></td>
<td><strong>133</strong></td>
<td><strong>209</strong></td>
<td><strong>270</strong></td>
<td><strong>953</strong></td>
</tr>
<tr>
<td>Avg. Wgt.</td>
<td>8.55g</td>
<td>7.09g</td>
<td>8.16g</td>
<td>6.88g</td>
<td>6.3g</td>
<td>6.07g</td>
<td></td>
</tr>
</tbody>
</table>
Table 5.23 All Allendale chert Early Archaic hafted bifaces, average weights per zone.

<table>
<thead>
<tr>
<th></th>
<th>ZONE 1</th>
<th>ZONE 2</th>
<th>ZONE 3</th>
<th>ZONE 4</th>
<th>ZONE 5</th>
<th>ZONE 6</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>All EA</td>
<td>126</td>
<td>61</td>
<td>92</td>
<td>76</td>
<td>80</td>
<td>37</td>
<td>472</td>
</tr>
<tr>
<td>ACP</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Avg. Wgt.</td>
<td>8.9g</td>
<td>7.37g</td>
<td>8.69g</td>
<td>7.12g</td>
<td>6.5g</td>
<td>6.68g</td>
<td></td>
</tr>
</tbody>
</table>

Table 5.24 Dalton hafted biface average weights per zone.
(* denotes incomplete data was averaged)

<table>
<thead>
<tr>
<th></th>
<th>ZONE 1</th>
<th>ZONE 2</th>
<th>ZONE 3</th>
<th>ZONE 4</th>
<th>ZONE 5</th>
<th>ZONE 6</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Dalton N</td>
<td>15</td>
<td>1</td>
<td>5</td>
<td>6</td>
<td>8</td>
<td>6</td>
<td>41</td>
</tr>
<tr>
<td>ACP Dalton N</td>
<td>11</td>
<td>1</td>
<td>4</td>
<td>5</td>
<td>2</td>
<td>0</td>
<td>23</td>
</tr>
<tr>
<td>Avg. Wgt.</td>
<td>7.59g</td>
<td>7.53g</td>
<td>4.44g*</td>
<td>6.8g</td>
<td>3.51g*</td>
<td>6.81g</td>
<td></td>
</tr>
<tr>
<td>Avg. Wgt.</td>
<td>8.42g</td>
<td>7.53g</td>
<td>5.09g*</td>
<td>6.73g</td>
<td>2.24g</td>
<td>0g</td>
<td></td>
</tr>
</tbody>
</table>

Dalton Hafted Bifaces

The sample size of Daltons in most zones were low, and the mean weights are not wholly reliable because of it. However, Table 5.24 shows that there is variability in size across the zones for all Daltons and for Daltons made of Allendale chert. It should be noted that some data was consolidated from old records for these collections and weights were not consistently recorded, specifically for zones 3 and 5. Only two of the five Daltons observed in zone 3 have recorded weights, and only five of the eight Daltons recorded in zone 5 have weights recorded. Despite the low sample sizes in averaged weights there is still an overall trend of size reduction with movement away from zone 1. The largest average weights for Dalton are found in zone 1, and the smallest are found in zone 5. Zone 6 does not possess the smallest weighted Daltons however, all six present
are made of metavolcanic materials and are under the influence of different raw material sources.

*Side Notched Hafted Bifaces*

When examining the average size of side notched hafted bifaces an interesting pattern appears. Table 5.25 illustrates the overall size calculations of all side notched hafted bifaces, all Allendale chert side notched hafted bifaces, and all Allendale chert Taylor side notched hafted bifaces per zone. The location of largest side notched hafted bifaces remains in zone 1 across all three categories. The smallest average sizes however, are found in zone 3 across all three categories. This may speak to a change in exploitation strategies within zone 3 for people during this period. The calculations of average length do not show a clear linear pattern of reduction, but the longest side notched points are still present in zone 1. While there is variability, there does not seem to be a direct linear reduction in size overall.

*Corner Notched Hafted Bifaces*

The pattern of size reduction observed for corner notched bifaces show some interesting changes. Table 5.26 illustrates the averaged measurements for length and weight for all corner notched hafted bifaces, all Allendale chert corner notched hafted bifaces, and all Allendale chert Kirk corner notched hafted bifaces. Consistently across all three categories the location of the largest average weights are found in zone 3, and is true for length only with Allendale chert Kirk corner notched hafted bifaces. The reduction of weight across the transect is not clear with corner notched hafted bifaces, though there is variability across the categories. Average size appears more consistent across the zones here examined with one noticeable change. The average size of corner
Table 5.25 Side Notched hafted biface average lengths and weights per zone.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ZONE 1</td>
<td>46</td>
<td>43.02mm</td>
<td>6.23g</td>
<td>37</td>
<td>46.16mm</td>
<td>6.69g</td>
<td>33</td>
<td>45.59mm</td>
<td>6.53g</td>
</tr>
<tr>
<td>ZONE 2</td>
<td>28</td>
<td>23.73mm</td>
<td>5.48g</td>
<td>24</td>
<td>44.07mm</td>
<td>5.73g</td>
<td>17</td>
<td>44.72mm</td>
<td>5.07g</td>
</tr>
<tr>
<td>ZONE 3</td>
<td>38</td>
<td>33.69mm</td>
<td>4.16g</td>
<td>26</td>
<td>34.97mm</td>
<td>4.27g</td>
<td>15</td>
<td>33.19mm</td>
<td>3.43g</td>
</tr>
<tr>
<td>ZONE 4</td>
<td>40</td>
<td>34.7mm</td>
<td>4.38g</td>
<td>17</td>
<td>36.21mm</td>
<td>4.26g</td>
<td>7</td>
<td>37.71mm</td>
<td>6.24g</td>
</tr>
<tr>
<td>ZONE 5</td>
<td>71</td>
<td>33.39mm</td>
<td>4.45g</td>
<td>20</td>
<td>38.12mm</td>
<td>4.93g</td>
<td>11</td>
<td>35.92mm</td>
<td>4.55g</td>
</tr>
<tr>
<td>ZONE 6</td>
<td>103</td>
<td>31.14mm</td>
<td>4.4g</td>
<td>14</td>
<td>32.75mm</td>
<td>4.8g</td>
<td>10</td>
<td>31.11mm</td>
<td>4.51g</td>
</tr>
<tr>
<td>Total</td>
<td>326</td>
<td></td>
<td></td>
<td>138</td>
<td></td>
<td></td>
<td>83</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5.26 Corner Notched hafted bifaces average lengths and weights per zone.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ZONE 1</td>
<td>51</td>
<td>45.78mm</td>
<td>9.32g</td>
<td>49</td>
<td>45.98mm</td>
<td>9.37g</td>
<td>44</td>
<td>45.98mm</td>
<td>9.66g</td>
</tr>
<tr>
<td>ZONE 2</td>
<td>22</td>
<td>41.66mm</td>
<td>7.55g</td>
<td>20</td>
<td>41.51mm</td>
<td>7.84g</td>
<td>12</td>
<td>47.94mm</td>
<td>9.01g</td>
</tr>
<tr>
<td>ZONE 3</td>
<td>57</td>
<td>44.19mm</td>
<td>9.49g</td>
<td>42</td>
<td>45.23mm</td>
<td>9.96g</td>
<td>32</td>
<td>48.67mm</td>
<td>10.93g</td>
</tr>
<tr>
<td>ZONE 4</td>
<td>50</td>
<td>42.63mm</td>
<td>7.38g</td>
<td>30</td>
<td>45.02mm</td>
<td>7.48g</td>
<td>25</td>
<td>48.59mm</td>
<td>8.53g</td>
</tr>
<tr>
<td>ZONE 5</td>
<td>80</td>
<td>40.68mm</td>
<td>7.12g</td>
<td>41</td>
<td>43.73mm</td>
<td>7.88g</td>
<td>34</td>
<td>44.42mm</td>
<td>8.22g</td>
</tr>
<tr>
<td>ZONE 6</td>
<td>117</td>
<td>33.72mm</td>
<td>5.82g</td>
<td>21</td>
<td>39.57mm</td>
<td>8.26g</td>
<td>13</td>
<td>41.94mm</td>
<td>8.26g</td>
</tr>
<tr>
<td>Total</td>
<td>277</td>
<td></td>
<td></td>
<td>203</td>
<td></td>
<td></td>
<td>160</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
notched hafted bifaces are smallest in all but one measurement across all three categories in zone 6. The only average measurement that is not the smallest here is the average weight of Allendale chert Kirk corner notched hafted bifaces, where the difference between the zone 6 average is only 0.04g larger than the average found in zone 5 for this category. The apparent consistency throughout appears to be the result of two things that will be discussed later in more detail: the frequency of mobility and raw material selection. The noticeable decrease in size found in zone 6 may also be the result of the influence of raw material diversity found there among the assemblages examined.

*Post-Kirk Hafted Bifaces*

The results of Post-Kirk hafted biface analyses are somewhat problematic. Table 5.27 illustrates the calculations of average size and length for all Post-Kirk hafted bifaces, all Allendale chert Post-Kirk hafted bifaces, all Allendale chert Kirk stemmed hafted bifaces, and also the very small sample sizes present for some of these sub categories. In seven cases the subdivisions have sample sizes of less than five hafted bifaces present, and for length measurements often fewer examples still. Some of the variability present may also be due to the very different morphologies of Post-Kirk hafted bifaces across specific types, and low sample sizes influence the bias of certain types over others. Specifically for Allendale chert Kirk stemmed hafted bifaces, not one zone reaches ten total examined across this transect. Due to these low sample sizes very little confidence can be placed on these results, and with no clear pattern of overall changes in condition this assessment must wait for larger datasets in order to evaluate it adequately.
Table 5.27 Post-Kirk hafted bifaces average lengths and weights per zone.

<table>
<thead>
<tr>
<th></th>
<th>ZONE 1</th>
<th>ZONE 2</th>
<th>ZONE 3</th>
<th>ZONE 4</th>
<th>ZONE 5</th>
<th>ZONE 6</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Post-Kirk N</td>
<td>24</td>
<td>10</td>
<td>18</td>
<td>18</td>
<td>21</td>
<td>41</td>
<td>132</td>
</tr>
<tr>
<td>Avg. Length</td>
<td>50.31mm</td>
<td>49.9mm</td>
<td>45.36mm</td>
<td>47.43mm</td>
<td>46.23mm</td>
<td>42.3mm</td>
<td></td>
</tr>
<tr>
<td>Avg. Wgt.</td>
<td>11.77g</td>
<td>8.15g</td>
<td>9.93g</td>
<td>11.44g</td>
<td>10.93g</td>
<td>10.2g</td>
<td></td>
</tr>
<tr>
<td>All ACP Post-Kirk N</td>
<td>22</td>
<td>10</td>
<td>7</td>
<td>9</td>
<td>1</td>
<td>2</td>
<td>51</td>
</tr>
<tr>
<td>Avg. Length</td>
<td>38.96mm</td>
<td>49.9mm</td>
<td>46.27mm</td>
<td>55.38mm</td>
<td>51.16mm</td>
<td>51.85mm</td>
<td></td>
</tr>
<tr>
<td>Avg. Wgt.</td>
<td>12.06g</td>
<td>8.15g</td>
<td>11.65g</td>
<td>12.93g</td>
<td>9.79g</td>
<td>15.54g</td>
<td></td>
</tr>
<tr>
<td>ACP Kirk Stem N</td>
<td>4</td>
<td>9</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>20</td>
</tr>
<tr>
<td>Avg. Length</td>
<td>52.72mm</td>
<td>51.46mm</td>
<td>47.98mm</td>
<td>51.16mm</td>
<td>51.85mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Avg. Wgt.</td>
<td>14.76g</td>
<td>8.54g</td>
<td>10.65g</td>
<td>7.54g</td>
<td>9.79g</td>
<td>15.54g</td>
<td></td>
</tr>
</tbody>
</table>

Table 5.28 Hafted endscrapers length and weight assessment per zone.

<table>
<thead>
<tr>
<th></th>
<th>ZONE 1</th>
<th>ZONE 2</th>
<th>ZONE 3</th>
<th>ZONE 4</th>
<th>ZONE 5</th>
<th>ZONE 6</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Hafted Endscrapers</td>
<td>Present</td>
<td>13</td>
<td>68</td>
<td>27</td>
<td>105</td>
<td>243</td>
<td>456</td>
</tr>
<tr>
<td>Average Length</td>
<td>36.66mm</td>
<td>30.21mm</td>
<td>31.9mm</td>
<td>32.14mm</td>
<td>28.97mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Weight</td>
<td>12.27g</td>
<td>6.2g</td>
<td>8.18g</td>
<td>8.16g</td>
<td>7.93g</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ACP Hafted Endscrapers</td>
<td>Present</td>
<td>13</td>
<td>62</td>
<td>16</td>
<td>59</td>
<td>46</td>
<td>196</td>
</tr>
<tr>
<td>Average Length</td>
<td>36.66mm</td>
<td>30.11mm</td>
<td>30.32mm</td>
<td>31.82mm</td>
<td>28.24mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Weight</td>
<td>12.27g</td>
<td>5.89g</td>
<td>7.25g</td>
<td>8.14g</td>
<td>6.62g</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Hafted Endscrapers

Hafted endscrapers were observed consistently across the transect and were found in relative abundance in each zone. A significant number of hafted endscrapers have been observed at the Allendale chert quarries examined in zone 1, but were not analyzed for this thesis. Table 5.28 lists the number of hafted endscrapers observed in zones 2 through 6, average length and weight calculations for all hafted endscrapers, and the calculations of size for all Allendale chert hafted endscrapers. Overall the largest hafted endscaper averages for length and weight are found in zone 2 which is the closest in proximity to the quarries in zone 1, though it should be noted the sample size is also the smallest. The smallest average of weight is found for both categories in zone 3, though smallest averages in length are found in zone 6. The assessment of length reduction with all Allendale chert hafted endscrapers seems to be linear with movement away from the source, though there is some fluctuation between zones 3, 4, and 5. Weights averaged in parallel to this length reduction are not consistent, though the largest is in zone 2 and the smallest in zone 6 at the farthest point from the source. Though these patterns are not directly linear, it appears the influence of proximity to high quality Allendale chert does influence larger averages while the influence of raw material diversity in zones farther away create smaller average tool sizes.

An observation regarding hafted endscaper morphology should be mentioned here. The occurrence of hafted endscrapers made on flakes of bifacial retouch increased in frequency with distance away from raw material sources such as Allendale chert and metavolcanics. The expectation of toolkit maintainability in areas of increased raw material costs would explain this flexibility in the morphology of tools within the toolkit.
Table 5.29 Hafted endscraper thickness by zone.

<table>
<thead>
<tr>
<th></th>
<th>ZONE 1</th>
<th>ZONE 2</th>
<th>ZONE 3</th>
<th>ZONE 4</th>
<th>ZONE 5</th>
<th>ZONE 6</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Hafted Endscrapers</td>
<td>Present</td>
<td>13</td>
<td>68</td>
<td>27</td>
<td>105</td>
<td>243</td>
<td>456</td>
</tr>
<tr>
<td>Average Thickness</td>
<td>11.31mm</td>
<td>8.67mm</td>
<td>9.71mm</td>
<td>9.54mm</td>
<td>9.37mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ACP Hafted Endscrapers</td>
<td>Present</td>
<td>13</td>
<td>62</td>
<td>16</td>
<td>59</td>
<td>46</td>
<td>196</td>
</tr>
<tr>
<td>Average Thickness</td>
<td>11.31mm</td>
<td>8.48mm</td>
<td>9.93mm</td>
<td>9.78mm</td>
<td>8.97mm</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Though the frequency of occurrence was not quantified, a calculation of average thickness by zone offers an evaluation of this observation. Table 5.29 illustrates that there is, with the exception of zone 3, a linear reduction of hafted endscraper thickness across all raw material types and with Allendale chert. The deviation found in zone 3 may be the result of similar patterns of use within this zone such as was found with side notched hafted bifaces. Decreases in hafted endscraper thickness correlates with the decrease in weight across the zones, and implies that raw material cost influenced the overall condition of this tool in the toolkit.

Occurrence of Bipolar Cores

As was mentioned previously when evaluating the densities of artifacts per site, the occurrence of bipolar cores in specific locations may be an indication of raw material stress due to high raw material cost. The presence of bipolar cores made from recycled tools and raw materials that are exotic to the zone, such as the Allendale chert bipolar cores examined in zone 5, and the Allendale chert and flow banded rhyolite bipolar cores observed in zone 6, appear to be evidence of high degrees of raw material cost. This cost
Figure 5.4 The raw material frequencies of all Early Archaic hafted bifaces present in zones 1-6.

appears to have influenced the decision to recycle tools into cores when sharp edges were needed in a geographic location where toolkit replacement was costliest.

RAW MATERIAL FREQUENCIES

An assessment of raw material movement has been presented in the previous chapter that illustrates the various ranges which raw materials travel. Given this variability, it is expected that proximity to different sources will affect the frequencies in which they occur in specific assemblages.

The cross drainage transect with zones 1 through 6 corresponds with the overall distribution area of Allendale chert. Figure 5.4 illustrates the pattern of raw material
Figure 5.5 The raw material frequencies of all Early Archaic hafted bifaces present along the Saluda/Congaree/Santee river drainage transect.

frequencies across all six zones for all Early Archaic hafted bifaces, fragments, and preforms. This graph illustrates the predominate use of high quality Allendale chert all the way across the transect until crossing the Santee River, where metavolcanic materials replace Allendale chert for the most frequently utilized raw material group. Other expectations include an increase in Black Mingo chert, which shows an increase in frequency in zone 5 where a Black Mingo chert quarry is located. The great distance from Ridge and Valley chert sources are demonstrated by the consistently low to non-existent presence across the transect. The increase in Quartz in zone 5 also demonstrates the utilization of localized cobbles in the river.
Figure 5.6 The raw material frequencies of all Side Notched hafted bifaces present in zones 1-6, the cross-drainage transect.

The drainage oriented transect also illustrates expected trends in raw material movement as predicted by the distribution maps presented in the previous chapter. Figure 5.5 illustrates the linear decline in Quartz percentages as the transect leaves the Piedmont and moves out onto the Coastal Plain. A suggestion of this decline is also noted for Ridge and Valley chert, although the overall frequencies are still very low for this raw material given its distance from sources. Metavolcanics also see a significant increase in zone 7 in the Lake Murray vicinity and is evidence of the influence of Western Piedmont rhyolites on archaeological assemblages in this locality. The category "other" includes Coastal Plain cherts such as Wyboo chert that are located primarily in
Figure 5.7 The raw material frequencies of all Corner Notched hafted bifaces present in zones 1-6, the cross-drainage transect.

zone 9. Also located in the vicinity of zone 9 and closer towards the coast are Orthoquartzite sources, which are apparent by the predominate frequencies in zones 8 and 9 with decreasing frequencies dramatically with movement towards the Piedmont.

An evaluation of raw material utilization by each hafted biface type may also provide significant insight into strategies of negotiating movement around them through time. Side notched hafted bifaces from zones 1-6 are illustrated in Figure 5.6, corner notched hafted bifaces in Figure 5.7, and Post-Kirk hafted bifaces in Figure 5.8. Side notched raw material utilization shows an increase in utilization of materials locally available such as is demonstrated by the increase in the use of Orthoquartzite and Quartz when reaching proximity to sources in zones 4 and 5 respectively. Corner notched hafted bifaces show a
Figure 5.8 The raw material frequencies of all Post-Kirk hafted bifaces present in zones 1-6, the cross-drainage transect.

similar increase in the use of Quartz in zone 5, but overall maintain a dependence on extra-local raw materials such as Allendale chert and metavolcanic varieties, as well as the consistent presence of Ridge and Valley cherts in zones great distances from sources. It should be noted for both of these raw material distribution patterns that the shift in predominant raw material use from Allendale chert to metavolcanics can be found between zones 5 and 6. This change is the location where raw material cost was proposed as being highest. Post-Kirk hafted biface raw material frequencies show a sporadic fluctuation of raw material use. This is likely due to low sample sizes observed with this hafted biface class. A noticeable increase in raw materials such as Black Mingo chert and Orthoquartzite in close proximity to sources in zones 5 and 4 respectively are...
observed. This increase appears to be more substantial than was observed with side notched hafted bifaces. It should be noted that the location where highest cost would be expected given the raw material distribution has shifted to between zones 4 and 5, but is likely due to low sample sizes.

Hafted endscrapers were also evaluated for raw material movement and exploitation across zones 1 through 6. Figure 5.9 illustrates the expected trend of significant exploitation of high quality raw materials such as Allendale chert and the metavolcanic varieties. There is an increase in locally available raw materials in zones 4, 5, and 6 where an increase in Quartz and Black Mingo chert are observed.
SUMMARY

Testing the Risk Landscape Model requires a thorough examination of multiple variables that fluctuate due to the variation of environmental conditions. The data presented here have been applied to the four main predictions proposed with this model: site density, artifact density, toolkit condition, and raw material frequency. While this data has proven inadequate for testing predictions regarding site density, it has proven adequate in evaluating the frequencies with which artifacts occur per site in different localities, the variability of toolkit condition with proximity to sources, and the occurrence of variable frequencies of lithic raw materials in archaeological assemblages. Variability has been demonstrated to exist between hafted biface types and other tools, both in their overall condition by zone and with the utilization of local versus exotic raw materials. The frequencies with which tools occur across the landscape also suggest that different localities were visited more frequently than others, and perhaps supported longer periods of occupancy.
CHAPTER SIX

DISCUSSION AND CONCLUSIONS

The model presented here has evaluated the distribution and relative qualities of two resource types in tandem: river drainage systems and their associated biological resources, and lithic raw materials. The influence of these resources on human exploitation during the Early Archaic has also been tested by evaluating several characteristics of geographically dispersed archaeological assemblages. The results of these evaluations are here discussed in order to place into context their implications, their short-comings, and the future directions this model's approach may take within archaeological research.

Model Prediction Results and Implications

Results from testing the Risk Landscape Model have demonstrated variability in archaeological assemblages across South Carolina. This variability has been observed in multiple aspects of these assemblages and imply that localities across the state were exploited in a variety of ways. Applying this variability to the model's predictions allow for an interesting discussion concerning the broader implications of such an approach.

Site density has been discussed briefly in place of an adequate test of the prediction that site density will increase as biological resource density and lithic raw material availability increase. As previously explained, the evaluation of site density requires extensive and thorough examination of broad areas of the landscape. While this thesis
has not met these conditions, datasets do exist and are being continuously compiled that may prove adequate for testing this prediction.

The variability in artifact densities observed per zone suggest that some localities were frequented more often than others, a result that deserves explanation. The Risk Landscape Model proposes that localities with lower relative degrees of biological resource risk will experience more frequent exploitation and occupation, an expectation that appears to be validated by the high artifact densities that were frequently observed within major riverine localities. The occurrence of higher frequencies of artifacts across all classes within these zones, including tools with presumed long use lives, suggest that these localities were frequented often.

The overall evaluation of toolkit condition has also demonstrated variability that is argued to be the result of proximity to lithic raw material sources. The identification of size reduction across multiple tool classes with distance away from high quality Allendale chert sources reflect the expectations of raw material cost that Early Archaic hunter-gatherers negotiated. Toolkit condition appears to have reached its point of exhaustion between zones 5 and 6 where the raw material frequencies of exotic Allendale chert and various metavolcanics reach their lowest frequencies of occurrence. This location on the landscape holds locally available lithic raw materials such as Black Mingo chert and Quartz which both see significant increases in their occurrence within the toolkit. However, as it has been demonstrated that these materials likely represent examples of relatively low quality lithic raw materials, their inclusion within the toolkit does not appear to greatly defer the exhausted condition of the overall toolkit. This overall condition does not appear to be mitigated by the use of local raw materials as the
overall size evaluations of tools within this locality do not increase, but instead continue the overall trend of tool reduction. The presence of bipolar cores of high quality exotic raw materials and recycled curated tools between zones 5 and 6 also imply that this locality on the landscape is a costly one to visit. The prediction proposed by the Risk Landscape Model that toolkits examined within localities of high raw material cost will exhibit high degrees of maintainability (Bleed 1986), appears to be a prediction worthy of further evaluation as the sites examined within this thesis offer positive results.

Overall, the composition of toolkits observed in different zones suggest also that different localities were utilized in different ways. Long life tools such as Dalton adzes and eggstones are most frequently observed in locations determined to be low in biological risk, such as High Creek Plantation (38CL100) in zone 5. The increase in artifact density of the Dalton adze, and the occurrence of eggstones at High Creek Plantation suggest that zone 5 represents a locality that was frequented often and for extended periods of time over the coastal riverine and inter-riverine localities where fewer adzes and only one eggstone were observed. The sample sizes of these artifacts were significantly reduced over other tool classes such as hafted bifaces, and further studies of these tool classes may also provide interesting insights into Early Archaic patterns of mobility.

Lithic raw materials were observed to have significant variability in the ranges that they traveled as was illustrated with the raw material distribution maps in Figures 4.5-4.10. The changes in frequencies of local versus exotic raw materials throughout the sub-periods of the Early Archaic also implied that the frequency of mobility shifted through time as certain hafted biface types were observed to utilize locally available materials.
more often. Corner notched hafted bifaces appear to have a much higher dependence on extra-local raw materials than side notched and Post-Kirk hafted bifaces. Evaluations of extra-local lithic raw material movement and occurrence in high frequencies does not only represent the range of mobility, but it is argued here to also represent the frequency of movement.

A concern with the identification of notched points is important to mention here, as it is suspected that notched points made from Quartz which occurs in smaller package sizes and varies in quality may render accurate identification. As Jones (2015) has discussed with experimental results, brittle materials such as quartz often exhibit great morphological variability with attrition and reconditioning that renders hafted bifaces difficult to accurately identify. Increases in the utilization of presumed localized Quartz in zone 5 for example, may bias local versus exotic raw material utilization if identification of hafted biface type was not accurate. Side notched hafted bifaces in zone 5 exhibit a significant increase in Quartz hafted bifaces that is not matched by any other hafted biface type. If some of the Quartz hafted bifaces identified as side notched were actually made by people later in time who desired corner notched varieties, then the evaluation of Quartz utilization would skew the results. This concern aside, other locally available raw materials argued to be lower in quality than Allendale chert or Metavolcanics, such as Orthoquartzite, appear to be utilized more frequently for side notched hafted bifaces than corner notched. This is another indicator that perhaps the frequency of mobility was somewhat decreased during the time side notched hafted bifaces were primarily produced.
Comparison to Previous Models

A discussion of this model in view of previous approaches is warranted here in order to explain the merits each have contributed as well as the short-comings. As it was introduced, the Risk Landscape Model sought to evaluate the influence of two resource types, river drainage systems and lithic raw materials, in tandem in order to evaluate the effects of both on hunter-gatherer mobility and subsistence strategies. Both of these resource types have been evaluated by previous models in proposing various degrees of dependency on, or negotiations of both resource types. Two previous models have primarily influenced this model given their assertions that either resource type were primary influencers of Early Archaic strategies of mobility and subsistence (Anderson and Hanson 1988; Daniel 1998, 2001). This thesis has demonstrated that both resource types had significant influence on Early Archaic cultures and have affected the variability of the condition of archaeological assemblages across South Carolina.

The evaluations of artifact density has previously been evaluated in different localities and has been explained as palimpsests of multiple occupations (Anderson and Schuldenrein 1983; Anderson and Hanson 1988; Goodyear et al. 1979; Rigtrup 2009). The evaluation of artifact density within this thesis has built on the assumption that frequent occupation will generate higher frequencies of artifacts at specific sites, and has evaluated gross changes in densities by locality. Anderson and Hanson (1988) evaluated artifact density from a perspective of spatial concentrations of artifacts rather that the frequencies of occurrence within different places. This evaluation of site specific functionality is useful, but does not adequately evaluate the utility of general locations within the overall purview of Early Archaic mobility and subsistence. Artifact spatial
densities at specific sites may more likely represent the use of specific landform types rather than the functionality of that location. Anderson and Hanson (1988) did evaluate the ratios of curated versus expedient tools present at different sites, which represents a more adequate evaluation of the function of that location. With this regard, private artifact collections can offer archaeology more complete samples of toolkit composition of numerous sites if the quality of the collection is ideal, as the collections examined within this thesis represent.

Artifact density as examined within this thesis has also reflected the significant influence that high accumulations of surface water across the landscape had on the frequency and duration of Early Archaic occupations within those localities. As the Anderson and Hanson (1988) model has proposed, the dense concentrations of biological resources around major river systems likely served as primarily localities of exploitation. The significant presence of artifacts present in the Coastal riverine and inter-riverine localities however, demonstrate that Early Archaic hunter-gatherers often exploited these localities and frequently moved across them. The influence of major river systems on Early Archaic hunter-gatherers is supported by this thesis, but is not argued to be the only resource they frequently negotiated.

Lithic raw material selection and use within the data examined here overall appears to reflect similar trends in the ranges of raw material movement and the frequencies utilized in different localities that have been observed by previous investigations (Anderson and Sassaman 1996; Sassaman 1996; Daniel 2001). The evaluation of raw material movement and utilization by different sub-periods within this thesis has also been previously examined and demonstrate variability indicative of fluctuations in both
strategies of mobility and subsistence and overall social structure (Goodyear 2014; Wilkinson 2017). As previously mentioned, the variability in local versus exotic raw material use is a reflection of not only the range of mobility but also the frequency with which people moved between different localities. Previous investigations have suggested that Kirk corner notched hafted bifaces reflect similar patterns of mobility to Clovis patterns during the Pleistocene due to their dependence on high quality Allendale chert and Uwharrie Metavolcanics (Daniel 2001; Daniel and Goodyear 2015, 2017; Goodyear 2014). This observation implies that significant social restructuring during the time of corner notched hafted bifaces occurred. This restructuring is observed not only with patterns of raw material utilization, but also with the apparent consistency of hafted biface condition across great distances. While corner notched hafted biface conditions were variable, the apparent consistency in size until reaching the point of highest raw material cost also may represent consistent and frequent movement across many different localities, with consistent toolkit use, reconditioning, and discard along the way.

The extensive cross-drainage movement of lithic raw materials also reflects that Early Archaic hunter-gatherers were not tied directly to major drainage systems. Previous investigations have evaluated lithic raw material movement and found that lithic raw material distributions exhibit gradual declines in frequencies rather than the expected step-like decline expected of riverine focused mobility (Daniel 1996, 2001; Sassaman 1996; Wilkinson 2017). Daniel (1996, 1998, 2001) in evaluating Kirk corner notched hafted bifaces distributions state that locally utilized raw materials were likely the result of embedded procurement within the overall circuit of mobility that focused on predictable high quality lithic raw material sources. This explanation of the infrequent
use of locally available raw materials seems adequate for Kirk corner notched hafted biface, but inadequate in explaining the raw material selection patterns exhibited by other sub-periods (Goodyear 2014; Wilkinson 2017). The significance of this variability lies with social structure and variability that should be the focus of archaeological investigations. While the scale of mobility and social interaction between side notched and corner notched hafted bifaces for example is often accepted as equal, without a means by which the frequency of mobility can be determined some social processes would remain unidentifiable.

Social Negotiations

This model has proposed a means by which Early Archaic strategies of mobility and subsistence may more adequately be explained and evaluated for variability. By quantifying the variability of natural resources both in their distributions and relative qualities, social negotiations of assumed optimal patterns of resource exploitation can be identified and contribute to the broader understanding of Early Archaic social structures and life-ways. For example, the lithic raw material movement far beyond a material's range of utility potentially represents social processes beyond utilitarian use and discard of a specific tool. The significant distances which Ridge and Valley chert was transported and observed to be present within Kirk corner notched assemblages for example, represents not only a significant range of mobility but also social interaction over geographically extensive areas in relatively frequent intervals of time. Lithic raw materials transported far beyond their range of utility in this example may be the function of exchange, inter-group movement, or even as markers of social status (Binford 1962).
By evaluating resources and generating expectations about the relative degrees of the optimal exploitation of biological resources across the landscape, can also provide identification of now invisible resources that Early Archaic hunter-gatherers were perhaps exploiting. The Island Site in zone 4, for example, represents an anomaly within the inter-riverine zone as it is far more dense that would be expected for its location. The high densities of artifacts overall, and of tools such as sidescrapers and drills observed there over other sites in the inter-riverine localities of zones 2 and 4, suggest that there was perhaps a significant concentration of a prized organic resource that is now invisible to us on the landscape. A low sample of sites in this zone render this a lone example, but with more extensive evaluations of collections more sites of this nature may be identified. This identification may be overlooked if quantified evaluations of resources are not generated in the manner proposed by this thesis.

Model/Data Strengths and Weaknesses

The model proposed here and the data used to test it are not without their flaws and short-comings. This model is not proposed as a static one, but as a general approach by which resources may be evaluated and applied to expectations regarding the condition of archaeological assemblages. A great deal of refinement in the techniques and datasets used to generate the predictions is possible, both at the scale of the state and also at a more localized scale. The overall approach should also be applied to different resource types and used to generate new predictions and expectations of their effects on archaeological assemblages.
The data used to test this model also exhibit weaknesses primarily in the form of low sample sizes for certain datasets. While the data presented here is extensive, when specific artifact classes are examined low sample sizes often rendered percentages and averages somewhat unreliable. Certain hafted biface types for example, such as Dalton and Kirk Stemmed hafted bifaces, were so infrequently present that evaluations of raw material frequencies and overall size were problematic. The infrequent presence of different hafted biface types itself is interesting information to consider for broader scale evaluations of population and demographics across the Southeast and the broader Eastern region of North America (White 2016). Never-the-less, these low sample sizes do render certain evaluations inadequate.

The data regarding site specific assemblages also are in need of refinement and larger sample sizes for the purpose of rendering more accurate results. Several localities examined had very few sites represented, and the zonal evaluation results presented here are likely to fluctuate with more extensive datasets. With this point in mind, artifact densities identified within the major riverine zones were extremely high despite low numbers of sites evaluated, and were only matched by the Island Site in zone 4 despite a significant number of sites examined away from the riverine zones. As with many archaeological investigations, the concern of samples sizes always leave some room for doubt in the results of analyses. The extensive data presented here may have weaknesses with regards to specific sub-datasets, but overall represents a gross evaluation of geographically and temporally extensive patterns that have not been previously attempted for the Early Archaic in South Carolina.
Future Directions

The approach proposed here should certainly be both expanded and added to. Evaluations of resources across the landscape is important, but certainly not the only thing that would have influenced Early Archaic hunter-gatherer behavior. An analysis of least-cost pathways across the landscape may also render useful information about the optimal paths of movement between resources densities (Moore and Irwin 2013). Understanding where resources are concentrated does not explain how people moved between them, and further analysis of the landscape can render useful results to that end. Evaluations of broader environmental pressures are also important to incorporate. The rapid encroachment of sea levels across the lower Coastal Plain at the end of the Pleistocene certainly presented a unique environmental pressure on Early Archaic societies (Anderson et al. 2013). Understanding pressures of this nature will also generate sets of expectations regarding social structures, and evaluating their effects will perhaps benefit from the use of the Risk Landscape Model.

CONCLUSIONS

This thesis has proposed a new model for evaluating the influence of resource distributions and relative qualities on Early Archaic strategies of mobility and subsistence. Variability has been identified in many aspects of Early Archaic archaeological assemblages across different localities identified with variable degrees of biological risk and lithic raw material cost. The movement of lithic raw materials and toolkits across a variable landscape demonstrates that Early Archaic hunter-gatherers were in many cases not exclusively tied to specific resources, but instead negotiated their
mobility and strategies of subsistence around many resource types. Understanding the
effects of various resource types in tandem allow for significant increases in interpretive
potential and opens doors capable of answering broader anthropological questions
regarding social structure, interaction, and behavior in deep prehistory. The Risk
Landscape Model presented here evaluates resources and optimal strategies of exploiting
them during the Early Archaic at the scale of South Carolina, but should be applied to
many geographic and temporal scales as well. Identifying variability in resource
exploitation on these different scales will allow for a more extensive understanding of the
human past, and will perhaps allow us to better understand the direction we are currently
headed.
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