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Dwelling "Where The Waters Rise And Fall:" The Historical Ecology Of Archaic Period Settlement In The Rappahannock River Valley

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ABSTRACT

This study examines long-term change in Indigenous settlement in Virginia's Rappahannock River Valley and its underlying causes during the Archaic Period (10,000-3000 BP). Previously-unstudied archaeological collections from two sites along the Rappahannock River provided evidence of demographic changes from the Middle Archaic to the Late Archaic period, and offered evidence of shifting settlement patterns. To evaluate why different locations were selected for Middle Archaic settlement versus Late Archaic settlement, the overall topography, hydrology and environmental settings of the two sites were evaluated by geospatial analyses of LiDAR images. The reasons for the changes were assessed further using the research framework of Historical Ecology to consider long-term environmental data in conjunction with paleoclimate, biological and archaeological information. Climate change, sea-level rise, formation of the Chesapeake Bay and the effects of embayment on the landscape of the tributary Rappahannock River were evaluated. I present a line of reasoning that links the Late Archaic choice of settlement location to the new riverine resources that became available as the Rappahannock River flow-rate slowed dramatically with Chesapeake embayment. A rationale and broad time-line for this transition are deduced. This information is coupled with analyses of the archaeological lithic assemblages to examine Indigenous actions and choices made relevant to settlement, subsistence and technology in the face of environmental change. These studies benefited from consultation with present-day members of the Rappahannock Tribe.

TABLE OF CONTENTS

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Dedicated to those who have gone before.

LIST OF TABLES

LIST OF FIGURES

Chapter One

Introduction

"What is ultimately learned about the past is relative to the system of inquiry" (Dent 1995:24).

The studies described here make use of archaeological collections from Virginia's Rappahannock River Valley that are considered along with landscape analyses and paleoclimate records to interpret long-term change in Indigenous peoples' settlement during the Archaic Period. I evaluate the reasons for those changes in light of the effects of sea-level rise and subsequent Chesapeake embayment on the landscape of the tributary Rappahannock River.

Virginia has a deep record of Indigenous presence including the Archaic Period, the Paleoindian Period and possibly earlier. From the early twentieth century, archaeologists have found the distinctive Clovis projectile points diagnostic of the Paleoindian period along the Rappahannock River's inner coastal plain (Bushnell 1934,1937). These fluted spear-points highlight Native American presence during the Paleoindian period (at least 10,000 to 17,000 years ago) in this area and across much of what is today Virginia. Even earlier occupations are indicated by findings at Cactus Hill, an inner coastal plain site in the Nottoway River Valley, south of the Rappahannock (Wagner and McAvoy, 2004). While the Paleoindian period has been studied throughout Virginia, the subsequent Archaic Period remains relatively unexplored, particularly in Virginia's mid-coastal plain, the area to be addressed in this thesis (Gardner 1987; Parker 1990; Wall 2018).

The Archaic Period

The Archaic Period spans approximately 7000 years between 10,000 and 3000 years ago. It coincides roughly with the onset of the Holocene epoch and during its early millennia saw continued temperature increases, glacial melt and ensuing sea level rise. In the Chesapeake region, the Archaic Period saw the establishment of a temperate ecosystem and the formation of the Chesapeake estuary (Anderson 2001; Dent 1995). It was a period of extensive climatic and environmental change. Landscape, precipitation levels, flora and fauna were altered substantially (Anderson 2001).

The concept of the Archaic Period as an archaeological entity is associated with Ritchie's (1932) work at Lamoaka Lake, N.Y. He applied the term "Archaic" to the remains at the Lamoaka site to indicate "a culture that was preceramic and prehorticultural, predicated on hunting, fishing and gathering" (Ritchie 1946:101). Recognition of the Archaic as the extensive time-period between the newly established Paleoindian period and the subsequent Woodland period did not occur in the Chesapeake region of Virginia until the 1950s (Dent 1995:149). Before that time, little was known about Virginia's Archaic period Indigenous culture history or chronology.

It is not easy to evaluate long-term human population demographics and reasons for their change over the broad time scale of the Archaic Period, with its background of dramatic environmental change. In the Virginia inner-coastal region, the destructive effects of the acidic soil on archaeological artifacts present an added difficulty. Few bone, wooden or plant-based items survive for millennia. As a result, stone tool assemblages are a major source of information. Additionally, the population size of hunter-gathers during the Archaic period in Virginia was relatively low, while residential mobility was high (Dent 1995). As a result, archaeological evidence of the Archaic period landscape remains elusive in Virginia. In fact, some of the richest evidence of Archaic period settlement strategies may be found in private collections of stone artifacts. Given the challenges of a systematic study of the Archaic period for archaeologists, a key question is how to make use of the extensive collections of artifacts gathered by non-professionals to understand shifts in settlement practices over time. This study seeks to address this question.

This thesis explores the use of large, previously-unstudied, private lithic surface collections to inform narratives of long-term Native American population demography and cultural change during the Archaic Period. Specifically, I investigate settlement choices made by hunter-gatherer communities in the face of landscape modifications driven by climate change at two sites along the Rappahannock River in the Virginia inner coastal plain (Figure 1.1).

Figure 1.1 Location of Sites 1 and 2 on Rappahannock River, Virginia

In entitling this thesis *Dwelling "Where the Waters Rise and Fall:" The Historical Ecology of Archaic Period Settlement in the Rappahannock River Valley*, I draw attention to the Indigenous term "Rappahannock," translated as "tidal, alternating, or rising and falling" river (Barbour 1971; Ragan 2006; Richardson 2017). The sites examined in this work are located where the tide rises and falls approximately two feet daily. The archaeological remains provide evidence of Indigenous occupation at these sites across the entire seven thousand years of the Archaic Period and into the Woodland Period, indicating attachment to place. Rappahannock is both the place-name for the River and the name of Rappahannock Tribe, the "people who live where the water rises and falls." The Rappahannock Tribe has a deep history of presence along the Rappahannock River; their community persists and in their resilience they recognize a strong connection to place and to the landscape. Rappahannock Tribe Chief Anne Richardson offered the perspective that their name also indicates the historical continuity of the tribe, at times rising to power to survive and at other times ebbing to live as a peaceful community among themselves (Richardson 2017).

In the work described below, I investigated first whether private lithic surface collections, an often-ignored archaeological data source, can provide reliable information for investigating the lifeways of Indigenous peoples. When that foundational question was answered in the affirmative, I next explored how such data sources could be interrogated to provide reliable evidence of the relationship between humans, their culture, and landscape through time. I use the framework of Historical Ecology that challenges views of culture change as an adaptation to the environment, which, previously were dominant in interpretation of Archaic Period archaeological findings (Sassaman 2010:xv). This research approach focuses on the recursive relationship between culture and the environment using data from multiple disciplines rather than approaching the issue solely from the viewpoint of adaptation of human beings *to* their environment (Balée 2006; Balée and Erickson 2006). Historical ecology seeks to comprehend temporal and spatial relationships of humans and local environments (Balée 2006; Balée and Erickson 2006). It recognizes and seeks to rectify the tendency of Cultural Ecology and environmental adaptation perspectives to downplay agency and the contingency of history.

Theoretical Considerations

Much Archaic Period archaeology in Virginia during the 1970s and 1980s was carried out and interpreted under the aegis of Cultural Ecology and the "New" or Processual Archaeology. Cultural Ecology, a concept developed by Julian Steward (1955), has the explicit goal of understanding the effect of environment upon culture. Steward emphasized the importance of individuality of different cultures. Environmental changes are not predictable hence, cultures change in multiple directions. Cultural ecology developed as a theoretical approach that attempts to explain similarities and differences in cultures in relation to environment; to provide causal explanation. However, explaining cultural similarities by adaptations to similar environmental conditions led some to criticize the approach as environmental determinism (Coombs and Barber 2005).

Steward's work strongly influenced the "New" or Processual Archaeology which emerged in the 1960s. Binford (1962) in reinforcing Willey and Philips' (1958:2) stance that "American archaeology is anthropology or it is nothing" expressed dissatisfaction that archaeology had contributed little to anthropology in explaining cultural similarities and differences. He voiced new aims for the field and enumerated ways archaeologists could further these aims by conceiving of data systemically rather than in a particularistic manner. Specifically, the "new" archaeology should be more scientific, it should have hypothesis formation and testing and it should include the ideas of cultural evolution, adaptation to the external environment, a stress on culture process to ask "why," and analytical methods to quantify variables. In articulating these themes, Binford was influenced also by his mentor Leslie White who stressed general cultural evolution (stages of cultural complexity) and who, in an extensive treatise (White 1959:8) concluded "culture is man's extra-somatic means of adaptation."

In subsequent work, Binford (1980), in a classic paper entitled "Willow Smoke and Dog's Tails," deduced that variation in hunter-gatherer behavior was determined by a relatively small number of environmental and demographic parameters. Binford (2001) and his students analyzed an even larger body of ethnographic and environmental data from around the world. They developed methods to monitor global variability in climate and vegetation and to use ethnographic data to project population, subsistence and social organization in varying environments. This work, *Constructing Frames of Reference* (Binford 2001), is a massive accumulation and analysis of information; its scope is difficult to assess. However, the data used have been reassessed recently using new methodology (Talavaara, et al., 2018).

An Update on *Constructing Frames of Reference* (Binford (2001); Origins of the theoretical ideas of Cultural Ecology and Processualism.

The question of environmental drivers of species distribution and abundance was re-addressed using the ethnographic and hunter-gatherer demographics analyzed by Binford (2001) and Kelly (2013) to inform on modern ecology (Talavaara, et al., 2018). In overview, this new work analyzed how net primary productivity, biodiversity and pathogen stress affected human population density using structural equation modeling to evaluate the context-dependence of environmental productivity, biodiversity and disease on the abundance and distribution of the hunter-gatherers that Binford (2001) and his student, Kelly (2013) had studied. The re-analysis of Talavaara, et al. (2018) showed productivity had a major role. However, the most important factors were dependent on environmental conditions. Biodiversity affected population diversity in low productivity regions, whereas pathogen stress was the major factor in high-productivity regions. Subtropical and temperate forest biomes had the highest carrying capacity for hunter-gatherers. In short, although in the face of complex cumulative culture, human populations may be considered less affected by the environment and not under the same ecological forces as other species, the analyses of Talavaara et al., (2018:1232) show "cultural evolution has not freed human hunter-gatherers from strong biotic and abiotic forcing."

In reviewing this work, I was interested to find that a seminal paper by biologist Theodosius Dobzhansky (1950) was published proposing the idea, based on his work in the tropics, that biological enemies such as competitors and predators are most limiting in areas of great biodiversity whereas abiotic constraints like temperature and aridity are most limiting at high latitudes with harsh physical environments. It was in the late 1950s that Binford (1964) did his dissertation work and began incorporating environmental factors into the larger archaeological picture. While Binford (1980) did not reference Dobzhansky (1950) in work introducing his similar ideas, he did so later in *Constructing Frames of Reference* (Binford 2001). I speculate that Dobzhansky's (1950) work stimulated new ideas in many fields, including archaeology. However, new concepts often take years to spread outside their immediate academic context due to academic fragmentation and relatively insular communication, as may have occurred in this case.

<u>Influences on Archaic Period Archaeology in the Chesapeake Region and its Interpretation.</u>

The influence of Cultural Ecology and the New Archaeology resulted in consideration of environmental factors becoming integral to interpretation of Archaic Period archaeology in the Chesapeake region. For example, Gardner's (1987) extensive settlement system studies across Virginia are dominated by a cultural ecological framework. This is understandable in light of the new findings by climatologists and palynologists that became available at increasing levels of detail showing that the Archaic period had undergone a sequence of distinct climatic episodes (Dent 1995; Anderson 2001). Large discontinuities were present in the Archaic period paleoecological record; it had been a dynamic time. With the focus on adaptive strategies, much of the region's Archaic period archaeological record saw cultural developments examined in relation to the substantial changes in Holocene climate and environment (Anderson 2001; Dent 1995). For example, Carbone's (1976:196) model of discontinuities in climate, precipitation and vegetation relative to material culture variation suggested that discontinuities in the paleoecological record correlated with discontinuities in the archaeological record. This approach saw human action or choice "ignored as agents of change" (Dent 1995:155), an attitude I hope to avoid by taking the broader, updated approach of Historical Ecology to aid in interpretation of archaeological findings as described below (Balée 2006; Balée and Erickson 2006).

Gallivan (2011:282) notes that pre-contact archaeology in the Chesapeake region has been "characterized as a parochial backwater where researchers have been reticent to join the discipline's epistemological debates" and that "much archaeology of the region has aimed at describing diagnostic artifacts and at understanding adaptive changes to environmental settings." Gallivan (2011:282) opines that while this work provided the underlying framework for material culture, settlement pattern and subsistence analyses, its interpretation has been limited. Only recently has engagement with later theoretical perspectives begun to emerge, for example Dent's (1995:277-284) analysis of social complexity emerging in what he terms the "intensification" period preceding the transition to chiefdoms. I note however, that change in interpretation and use of newer theoretical approaches in the Chesapeake region are confined predominately to the later Woodland periods, for example Gallivan's (2007) work at Werowocomoco. The Archaic Period still languishes.

Theoretical Considerations of Present Study

In considering how to evaluate Archaic Period findings in light of the overarching environmental change that occurred in the Chesapeake region during the Holocene, I have been guided by several considerations. Anderson (2001) points out that responses to environmental change can be varied and it is necessary to examine how and why people's responses occur and how such actions can change culture. His opinion is that one cannot ignore a major variable such as climate. "Climate should always be considered as a possible external source of change when examining past human societies" (Anderson 2001:147). A major reason for this is that climate shapes many other variables such as resource distributions and biotic structure.

However, even though high resolution indirect measures (proxy data) of past climate are now available from sources such as ice cores, dendrochronology, lake varve deposits, river sediment cores, and pollen profiles, one cannot simply determine association. *Correlation obviously is not causation*. The effect of climate on cultural systems should, if possible, be tested by assessing independent models of evidence; it should not be reduced to simplistic cause and effect explanations.

The discussion of cultural change as resulting from changes in environment, even the substantial changes recorded in the Holocene era Chesapeake region, fails to acknowledge hunter-gathers as people with the capability to respond to external circumstances in many ways, some of which may be actions or practices that change their culture. This issue is complex and has been the subject of extensive debate in the archaeological community (Dent 1995:14-15). Sassaman (2010) enumerates the many ways ecological approaches to interpretation of the archaeological record restrict an understanding of the role people play in making decisions and transformations. He (Sassaman 2010:xvi) and Dobres (1994:215) support consideration of social interactions as a basis for cultural variation, particularly by drawing from theories of agency, practice, and historical processualism. Sassaman and Holly (2011) examine hunter-gatherer archaeology as historical process and acknowledge hunter-gatherers as people with agency to shape history. They explain that "inspired by the theories of agency and practice, historical processualism is concerned with the *dynamic interplay between the actions people take in the structure that constrains and enables such actions*" (Sassaman and Holly 2011:3; emphasis mine).

Taken together, these considerations led me to select the framework of Historical Ecology to help assess the interactions between humans and their environment over the long time-periods of the Archaic. Historical ecology is an interdisciplinary research program that seeks to comprehend temporal and spatial relationships of humans and local environments (Balée 2006; Balée and Erickson 2006). It recognizes and seeks to rectify the tendency of Cultural Ecology and environmental adaptation perspectives to downplay agency and the contingency of history. It attempts to synthesize long-series data rather than concentrating on specific events, and to examine interactions across time and space for cumulative effects. It recognizes that humans adapt to and shape the environment, continuously contributing to landscape transformation, for example Erickson's (2010) analysis of extensive human modification of landscape in the Bolivian

Amazon. Historical ecology draws data from multiple disciplines: climate reconstructions, surveys of flora and fauna, archaeological research, and landscape analysis, among others. The idea of ecosystem is replaced with that of landscape. Historical ecology defines landscape as an area of interaction between human culture and the non-human environment, a perpetually changing, physical manifestation of history (Balée 2006:90-91). Landscapes are viewed as palimpsests of successive, multifactorial disturbances over time; they do not return to a state of equilibrium (Balée and Erickson 2006: 2).

Following is a summary of the major climatic and environmental changes during the Archaic Period that are the background for the archaeological studies to follow.

The Backdrop: Climate Change During the Archaic Period and Ensuing Effects.

Two major changes at the end of the Pleistocene era dramatically affected the Chesapeake region. These were pronounced global warming and glacial retreat. These two events and the many resulting effects that ensued, combined to bring significant changes to the Chesapeake landscape throughout the Archaic Period (Anderson 2001). Two of the most significant changes were that rising sea levels resulted in formation of the Chesapeake Bay, the largest estuary in America, and the other was the effects of climate alteration on flora and fauna.

Temperature Change.

The period of greatest extent of ice-sheet and intense cold in the last glacial cycle of the Pleistocene, around 21,000 years ago, saw sea levels approximately 100 m below current levels due to the extent of water in glacial ice. The onset of warming began about 15,000 years ago although there were brief cold reversals (Anderson 2001). The Initial Holocene, (~11,000-8500 BP), which corresponds roughly with the Early Archaic Period, runs from the end of the Younger Dryas to the onset of the Middle Holocene Hypsithermal or Climatic Optimal warming, approximately 7800 years ago (Figure 1.2).

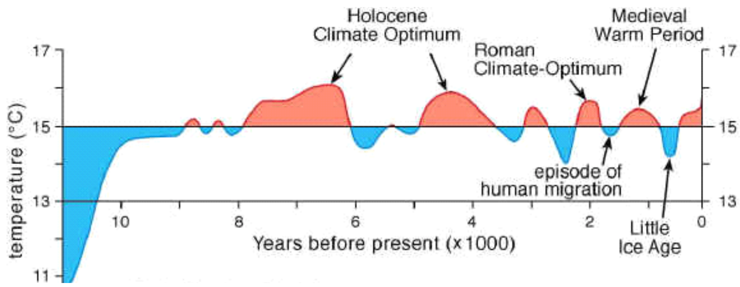

Figure 1.2. Average near-surface temperatures of northern hemisphere during past 11,000 years (after Schonwiese 1995).

Global temperatures rose dramatically in the initial period. Sea levels rose rapidly due to melting of glacial ice sheets with rates as high as 1-1.6 cm per year. The Middle Holocene from 8900 to 5000 years ago began with a minor cooling trend followed by a short abrupt cold event caused by the melting of the remnant Laurentide Ice Sheet, followed by sudden drainage of the Agassiz and Ojibway glacial lakes. The following middle Holocene period corresponded to the Hypsithermal, Atlantic or Climatic Optimum (Anderson 2001). During this time, overall temperatures rose to be similar to those of today. However, seasonal temperature extremes were greater; summers were much warmer and winters colder than at present in Eastern North America. The Middle Holocene climate was hotter and dryer than present (Cronin 2005).

Formation of the Chesapeake Bay

The Chesapeake Bay was produced by sea-level rise that began approximately 15,000 years ago when the Wisconsin Glacier began to melt. As the water locked in ice melted, the ocean's eustatic sea levels rose. Initially, sea level rose at a rate of about 1.6 m/century. Between 10,000 and 6000 years ago, sea level rose approximately 50 m Figure 1.3).

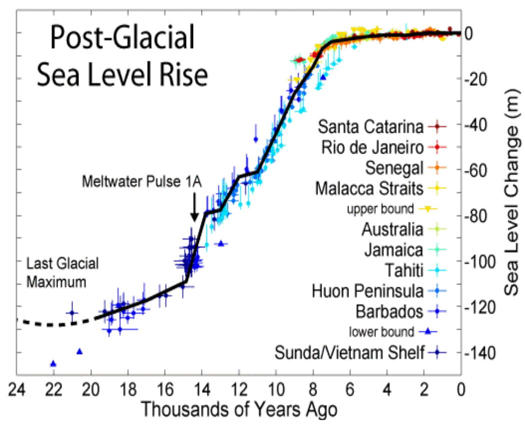

Figure 1.3 Post-Glacial Sea Level Rise (after Fleming et al.1998; Fleming 2000).

The rising sea flooded the ancestral Susquehanna River basin and transformed it into an estuary with sea water mixing with fresh water (Dent 1995; Tibert et al. 2012). Between 6000 and 3000 years ago, although the rate slowed, sea level rose another 6 m expanding the estuary to a large coastal bay. Flanking tributaries were turned into sub-estuaries of the bay. This transformation was not complete until about 3000 to 1000 years ago. The five major tributary rivers draining into the Chesapeake Bay are the Susquehanna, Potomac, Rappahannock, York and James. Sea level rise continues today; rates in the Rappahannock River are from 1.37-2.19 mm year^{-1} (Cronin 2019; Tibert et al. 2012).

Changes in Chesapeake Region Flora and Fauna.

Cores taken from areas in the Chesapeake coastal plain allowed vegetation reconstructions based on pollen analyses (Dent 1995). By approximately 10,000 to 9000 years ago Pleistocene boreal coniferous flora began to be displaced. Within another millennium, mixed deciduous forests with oak as the dominant species and hickory as codominant were in place. By approximately 5000 years ago pollen records indicate that the Chesapeake region had stabilized with regard to vegetation. Oak and hickory were codominant along with maple, birch, beech, ash, sweetgum and chestnut as well as over 60 species of understory plants. (Dent 1995; Overpeck and Webb 1992). Evidence for 63 plant species was recovered from an Archaic site in the Maryland coastal plain along with a pollen core from a peat deposit that allowed environmental reconstruction (LeeDecker and Koldenhoff 1991).

Significant changes in terrestrial and aquatic fauna began along with changes in vegetation and continuing marine transgression. Beginning around 9000 years ago, a temperate faunal community began to replace late Pleistocene animal populations. Estuarine species did not become established until approximately 5000 years ago, when sea-level rise had slowed significantly as described above (Dent 1995: 189).

Marine transgression also caused the creation of estuarine and interior wetlands as subterranean water tables were forced up. Wetlands became highly productive habitats for plants and animals. The changes to the landscape of the Chesapeake region affected animal populations over the course of the Holocene yielding a temperate fauna. These changes developed primarily throughout the first half of the Holocene, dependent on local environments. Deer, turkey, bear, small mammals, birds, reptiles and amphibians made up the new fauna. The establishment of mast-producing deciduous forests with understory browse provided increased favorable habitat yielding a higher biotic carrying capacity (Tallavaara and Seppa 2011). Developing interior wetland areas were highly productive and attracted migratory waterfowl (Anderson 2001; Dent 1995).

The Chesapeake region was inhabited by Indigenous people throughout these times of extensive climatic and environmental change as the data to be presented will show. The goal of the thesis outlined below will be to interpret the archaeological findings to gain insight into cultural responses made in the face of long-term environmental change and to query potential reasons for why and how Indigenous people responded and how their actions may have transformed their culture.

Overview: Thesis Organization

In Chapter 2, I begin by assessing whether private, surface-collected lithic assemblages, with specified provenience, made by repeated survey over many years, are reliable data sources. Analyses of two independently-made collections from the same site for frequency and composition over time showed a remarkable correspondence that was statistically significant. Once validated for reliability, surface collections from two distinct sites along the Rappahannock River in the Virginia inner-coastal plain (Figure 1.1) were used as archaeological proxy to derive relative population levels through time. These analyses showed that two sites separated by only 2 km had substantial differences in relative population levels through the Early, Middle and Late Archaic time periods. Based on these findings, in Chapters 3 and 4, I utilize the lithic assemblages from the two sites to address questions of Archaic Period settlement and culture change contingent on events driven by climate change and sea level rise.

In Chapter 3, I follow the work providing dates of site usage, with an analysis of the total tool assemblages from the two sites to query site function characteristics. These studies are considered in light of models developed characterizing hunter-gatherers as foragers or collectors based on how their cultural systems differed and what conditioned such differences (Binford 1980; Kelly 1983, Shott 1986).

In Chapter 4, I evaluate the overall topography and environmental settings of the two sites by geospatial analyses of LiDAR images. Then, I use the framework of Historical ecology to consider human settlement choices contingent upon long-term landscape and environmental change. I consider the environmental data in conjunction with paleoclimate and biological information and couple this with the archaeological findings analyzed in Chapters 2 and 3 to examine Indigenous actions and choices relevant to settlement, subsistence and technology.

Chapter 5 aims to join efforts in archaeology to gain Native-centered input on the meaning and relevance of archaeological research findings (Bruchac, Hart and Wobst 2010). The initial research questions described above were archaeologist-initiated, started before I was aware of the importance of Indigenous Archaeologies. In response to considerations raised by the field of Indigenous Archaeology, I requested consultation with descendant peoples. I am grateful to The Rappahannock Tribe for their interest in these findings and willingness to consider them with respect to their oral history. This chapter describes their questions of interest and interpretations of research findings.

Chapter 6. Conclusions

I conclude that a substantial reason for the transition from settlement in upland areas in the Middle Archaic to riverine locations in the Late Archaic was availability of new riverine and wetland resources. Assuming one of the major new riverine resources was anadromous fish, then, based on the evidence presented, its arrival was enabled not by a change in temperature, but by Chesapeake embayment acting as a brake to slow the velocity of Rappahannock River flow rate.

Chapter Two

Assessing Reliability of Abundance and Composition of Private Lithic Collections: Use as Archaeological Proxy of Relative Populations through Time.

Background, Rationale and Statement of Problem

Background

Characterization of long-term human demographic fluctuations and evaluation of its causes are key to understanding cultural and environmental change. The analyses described below investigate the potential of private lithic surface collections as an archaeological proxy for population demography during the Archaic Period, a time of hunter-gatherers. For this work, an indicator that marks both incidence and time is optimal. Early research in the North Carolina Piedmont demonstrated that formal bifaces, referred to as hafted bifaces or projectile points, and their typology were relatively sensitive chronological markers of the Archaic Period (Coe 1964). Since that time, suites of distinctive projectile point types have been recovered from stratified sites in Virginia and the wider middle Atlantic region. Date sequences for these projectile points across the Paleo, Archaic and Woodland Periods have been derived by radiocarbon analyses of closely associated organic material (Eglof and McAvoy 1990).

Paleodemography, or the demography of past populations that lack written records, generally relies on proxy data. Several types of archaeological proxies for estimating relative regional populations have been used: site counts, site sizes, and accumulations research (French 2015; Palisano 2017; Turner 1978, Wholey 2009). These approaches rest on the reasoning that the larger the population, the greater the archaeological signal will be, whether it is number of sites, site size or density of artifacts. The extent of chronological variation in the proxy should indicate variation in population size or density. French (2015) compared three types of archaeological proxies for demographic change: site counts, site size and accumulations research. Her work found that sheltered site numbers and quantities of stone tools were the most reliable population proxies of Paleolithic hunter-gatherers (French 2015).

Rationale

There are several reasons for assessing the utility of privately-made lithic surface collections. First, the mid-coastal plain of Virginia is understudied with respect to the Archaic Period. The acidic nature of the soil in the Virginia mid-coastal plain and its effects on preservation of biodegradable objects makes lithic artifacts a major source of information for the Archaic Period in Virginia. Few wooden, bone or plant-based artifacts survive and since the Archaic Period lacked a ceramic tradition, lithics are a predominant category of evidence.

Cultural Resource Management (CRM) as well as academic surveys have provided widespread settlement information on sites in the mid-coastal region of Virginia. However, the quantities of diagnostic lithics recovered from such surveys have often been too small to provide broadly interpretable information. For example, Turner's (1978) study of population distribution in the Virginia coastal plain examined 148 sites and recovered only 387 diagnostic projectile points from all 148 sites. CRM surveys carried out at the proposed Birchwood Power Facility site, (approximately ten miles from the current study location) recovered 10 diagnostic bifacial projectile points from survey of 5 sites and 24 archaeological locations over 41 acres (Blanton 1991). In contrast, private collections, in particular those lithic collections made by landowners who have collected repeatedly, year after year, following tillage of known fields, are often large, composed of hundreds or thousands of items. Although extensive, many such collections have not been taken advantage of for various reasons, including lack of documentation, concerns over lack of exact provenience, the fact that there may have been random or no survey design and the problem that archaeologists often are unaware of their existence.

Shott (2017) carried out a comparative examination of lithic collections made by University of Michigan professional survey from 20 sample units and approximately 30 private collections from the same locations made by the landowners. In those units, points from private collections outnumbered professional ones by a factor of 32. A notable finding was that the proportions of types of points in professional versus private collections were similar. On the basis of these findings, Shott (2017) concluded that large private collections of diagnostic projectile points should be documented and studied because their greater numbers provide large samples to refine definitions/types and they can illuminate population trends and patterns of assemblage variation across space and time. Nash (2009) sought private collections via citizen engagement to gain information in addition to professional surveys for her work on Native American settlement in the Virginia Blue Ridge.

In other studies, Shott (1995) investigated factors that affect the reliability of surface assemblages. By carrying out surveys in successive years, he showed that site surfaces are complex and different exposure conditions, such as wind and rain following tillage, significantly improve survey results. A single survey is not sufficient for adequate sampling; reliable surface survey requires numerous repeated surveys of a cultivated surface (Shott 1995).

Statement of Problem

Following from Shott's (2017) work, I investigate whether private landowner surface collections made from known fields along the Rappahannock River in the Virginia mid-coastal plain by repeated survey year after year can provide reliable data on abundance and composition of lithic artifacts. To investigate this question, I found and analyzed two different landowner surface collections that were made from the same location, sequentially. In both cases, the collections were made by repeated surveys following tillage. The goal of the study is to assess the reliability of the two independent collections from the same site with regard to their abundance and composition. The outcome of these analyses will determine whether other, large, private collections from the same region, made by similar repeated survey of known locations, are appropriate to use for comparative information on relative local and regional population patterns during the Archaic Period in the Rappahannock River Valley of Virginia.

Data Sources and Methods

Location.

Two lithic collections (designated A & B), made from the same field by two different landowners at different times, were made available for analysis. Both collections were made by repeated walking survey following tillage. Collection A was made over a 30-year period; Collection B over a 50-year period. The collections were from a field (Site 1) located near the junction of two tributaries well back from, but feeding into, the Rappahannock River in Virginia. A third collection (designated C) was made by repeat survey over ~50-years following tillage of another agricultural field (Site 2) approximately 2 km east of Site 1. Site 2 is also located on the north bank of the Rappahannock River however, it fronts the River at the point where Millbank Creek enters the river. Both sites are approximately 25 miles east of the fall-line and 86 miles west of the Chesapeake Bay (Figure 2.1).

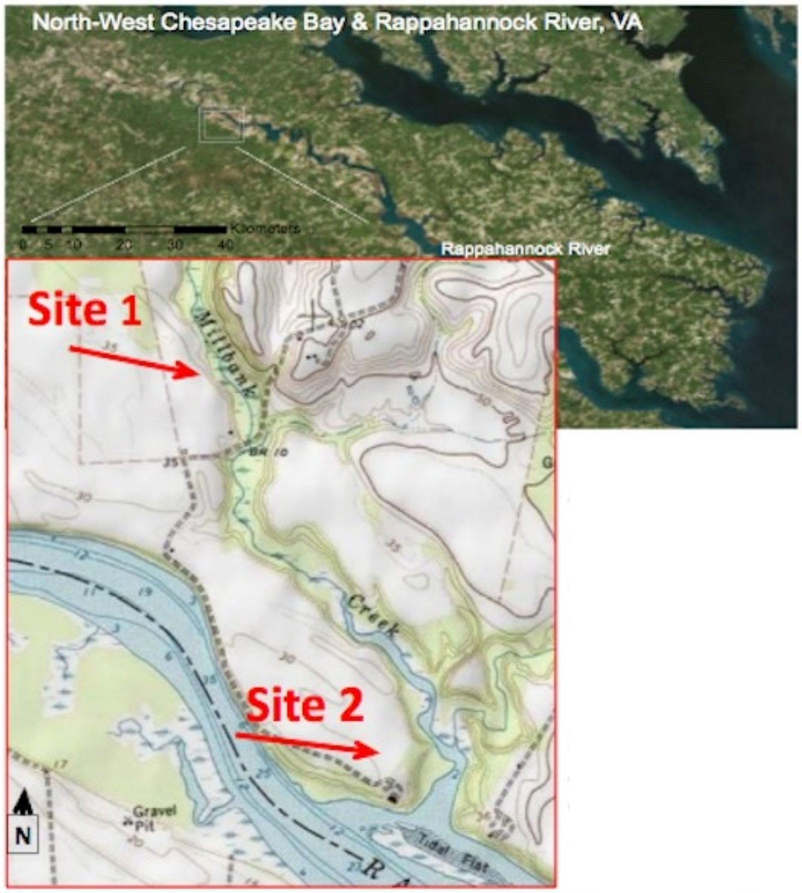

Figure 2.1. Map of Rappahannock River Valley and eastern Chesapeake Bay; Inset shows areas of investigation.

The three collections examined here were discovered by personal connections. The farmers who made the collections agreed to having them examined (two requested this be done on-site), but they prefer anonymity with regard to exact location. They were pleased to learn that their collections contained information of value to understanding Archaic Period Indigenous settlement and generously agreed to share that information. In general, the collectors were not aware of ethical issues surrounding collections made on private land. Indeed, there is no legal mandate to report collections made on private land (Silliman and Ferguson 2010). However, private collections that go unrecorded represent a lacuna in the knowledge base. Extensive private collections may impact subsequent professional survey by removing data (Shott 2017). A considerable problem is that rural farmers are often unaware of many of these issues and/or do not know whom to contact to report or share the collections. Pitblado (2014) makes a strong case for the ethical imperative of archaeologists engaging with collectors to prevent loss of data, something many archaeologists have been reluctant to do.

The data and conclusions deduced from analysis of the collections used here have been shared with the Rappahannock Tribe for use in their Oral History (see Chapter 5) and will be made available to the wider community by submission for publication. The author also made the collections known to Prof. Julia King for inclusion in her work on the Rappahannock River Valley Indigenous Landscape (Strickland et al., 2016).

Stone Tool Typology.

Bifaces, or stone tools worked on two sides that meet to form an edge may be worked to fit into a haft or handle. Such bifaces, called hafted bifaces or projectile points, are highly variable as compared to non-hafted bifaces which were hand-held. A haft element is where the biface is attached to a handle in contrast to the working blade (Andrefsky 2005). Haft elements are distinctive. They were often wrapped when being attached to a handle and thereby protected whereas the blade was exposed for use and may have been retouched and re-sharpened over its use-life. The haft element has a greater chance of retaining its original shape and size while the blade may well be modified over time. For this reason, variations among haft elements are a primary consideration in classification of projectile points (Andrefsky 2005:184; Binford 1963).

A typology of bifacial projectile points from each of the two collections was carried out based upon criteria of morphology as described by Andrefsky (2005). A brief summary of criteria includes: shape (lanceolate or triangular); presence of haft or stem (straight, contracting, square, expanding); stem (if notched: side, corner or basal notched) and edge shape (straight, excurvate, recurvate, combination) as well as surface treatments such as edge serration, basal grinding, notch grinding and salient dimensional characteristics. While referring to hafted bifacial stone tools as projectile points, it should be noted they also had other functions, such as knives as well as spear or dart tips (Andrefsky 2005).

In general, formal biface technology is accepted as a broad chronological marker throughout the Archaic Period and into the early Woodland period (Egloff and McAvoy 1990; Dent 1995). This does not mean there is a linear sequence of use with one type replaced by another; several types often were in use at the same or overlapping time periods. Dent (1995:10) refers to a type as "consisting of recurring groups of artifacts having constellations of similar attributes. Their diagnostic value...verified by independent non-artifactual data." Further, there is significant regional variability in types and time of use (Egghart, 2016; Egloff and McAvoy, 1990). While the work herein requires the use of time-sensitive markers, it hopes to avoid the "one type, one culture" idea that dismisses temporal variation and implies unilineal leaps of cultural change (Sassaman 2010:14). For the work described here, the current Virginia Department of Historic Resources (VDHR) projectile point typological characteristics and associated dates assembled for the region were used (https://www.dhr.virginia.gov/points/) in conjunction with Dent (1995), Egloff and McAvoy (1990) and Egghart (2014). The VDHR criteria and associated radiocarbon dates of individual types are based to a large extent on work showing chronological sensitivity as summarized in Egloff and McAvoy (1990) and (Dent 1995).

Point frequency was analyzed as a function of time, specifically the Paleo, Early, Middle or Late Archaic, or Early, Middle or Late Woodland sub-periods. Traditionally, the Archaic period is divided (roughly) into Early (10,000-8000 BP); Middle (8000-5000 BP); and Late (5000-3000 BP) periods (Anderson 2001, Dent 1995: 8-9). Egloff and McAvoy (1990: 64) argue for slight alterations based on the timing of contemporaneous climatic and cultural changes: Early Archaic (10,000-8500 BP), Middle Archaic (8500-4500 BP) and Late Archaic (4500-3200 BP). The latter dates have been used in the present work.

A listing of diagnostic projectile point types for Virginia with dates associated can be found at the VDHR website (https://www.dhr.virginia.gov/points/). Major categories only are mentioned here for ease of subsequent discussion as regional variation is extensive. The major chronological identifiers are as follow: for the Early Archaic, side and corner-notched projectile points assayed broadly between ca. 9850-8250 BP and bifurcate components from ca. 9380-7150 years ago. For the Middle Archaic, Kirk serrated or Stanly (8220-7015 BP), then Morrow Mountain followed with date ranges of ca. 8250-5380 BP and Guildford, ca. 6200-5500 BP. Side-notched Halifax-like groups followed with date ranges of ca. 5500-4280 BP (Dent 1995). The Late Archaic had numerous sub-regional traditions but generally is segregated to either narrow or broad-bladed stemmed types, such as the Savannah River series (ca. 4500-3200 BP). A variety of other stone tools assemblages were often associated with these groups; although some are broadly indicative of time, they are not considered diagnostic chronological markers.

Quantification.

Portnoy (1987) and Shott (2000) have experimentally addressed the question of how to quantify stone tools, by number or by weight, and how or whether to consider fragments. Shott (2000) found neither weight nor count was superior to the other for stone tools, which, unlike pottery do not suffer extensive fragmentation. Counts are used in the work described here. Since formal, bifacial projectile points have distinctive proximal, medial and distal zones, only intact points or points that retained at least 75-80% of the complete point including the haft and all unambiguous diagnostic features were included. This meant that, if broken, the points usually lacked only a portion of the tip, one of the most fragile elements. Projectile points that could not be typed with reasonable confidence were not included. As a result, as much as 30% of some collections could not be typed. Such points were quantitated and recorded as "non-diagnostic."

Non-hafted bifaces, such as knives and scrapers were recorded for each collection as were all macro-stone tools such as axes, adzes, grinding bowls, grinding stones, hammerstones and picks. These latter tool types, although important for informing on site activity, are not considered closely diagnostic of time. They are recorded in the overall list of bifacial stone tools (Table 5, Appendix I) and discussed in Chapter 3 in relation to settlement.

Reliability of Surface Collections with regard to Abundance Through Time.

The two surface-collected lithic assemblages, made independently from the same site (Site 1) by repeated collection, were interrogated for their reliability with regard to abundance through time. A typology of collections A and B identified forty different projectile point types (Table 1, Appendix I). These were grouped according to the chronological sequences obtained from dated, stratified excavations into those types characteristically observed in the Paleolithic, Early, Middle, and Late Archaic Period, and Early, Middle, and Late Woodland Period.

Collection A had points representative of the Early Archaic through the Late Woodland Periods; Collection B had points spanning the Paleo through Woodland Periods (Figure 2). The majority of points from both collections (over 50%) were associated with the Middle Archaic Period whereas just over 25% of both collections were characteristic of the Late Archaic. These data show that the frequency of points per sub-period of collections A and B, made by two independent collectors, by repeated yearly survey, is remarkably similar.

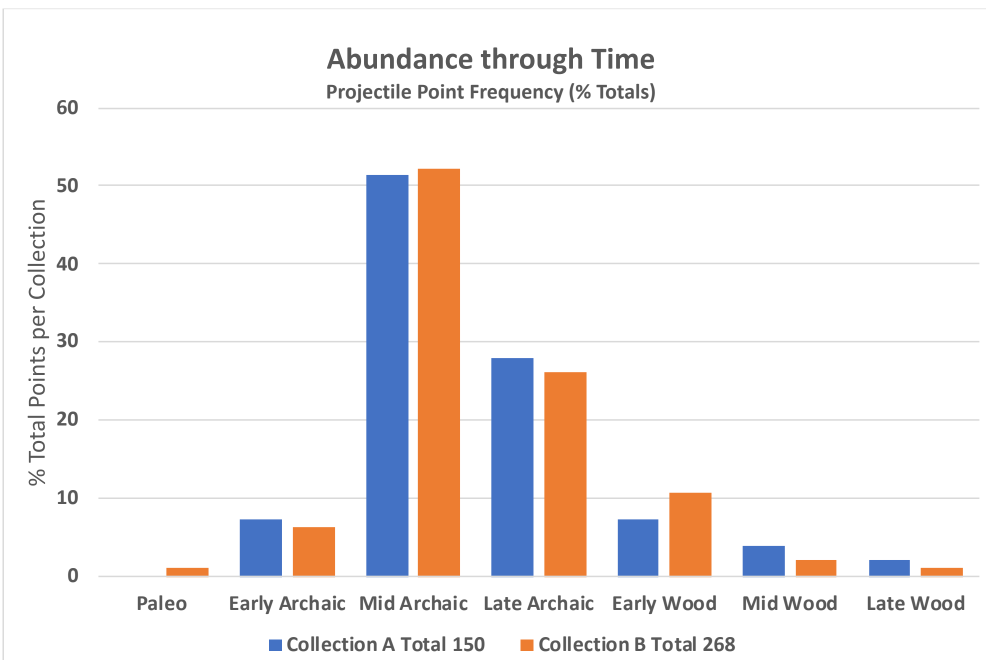

Figure 2.2. Comparison of projectile point frequency over time for Collections A & B from Site 1.

Statistical significance.

Since the initial data analysis of abundance per time period per collector indicated similarity (Figure 2.2), I tested the inferential statistical relationship of the point frequency data with regard to collector and abundance per time period using a non-parametric, 2 x 2, Chi-Square Test for Independence. The data met the assumptions of: being nominal, having independent random sampling, and were of the appropriate size (n = 418). Chi-Square analysis of the data was derived in Excel which gave a value of: p = 0.612. This result supported accepting the null hypothesis, H_0, that the two variables are independent and there is no relationship between collector and points per time period. The collections made from the same field by two independent collectors likely are representative samples of the underlying population of projectile points.

In summary, analysis of the two independent surface collections for reliability with regard to abundance through time, indicated that the collections were apposite samples of the larger population and appropriate for further study.

Reliability of Surface Collections with regard to Composition through Time

I examined the composition of collections A and B with a simple frequency analysis of all projectile point types identified in each collection, listed by characteristic time period as shown in Figure 3.

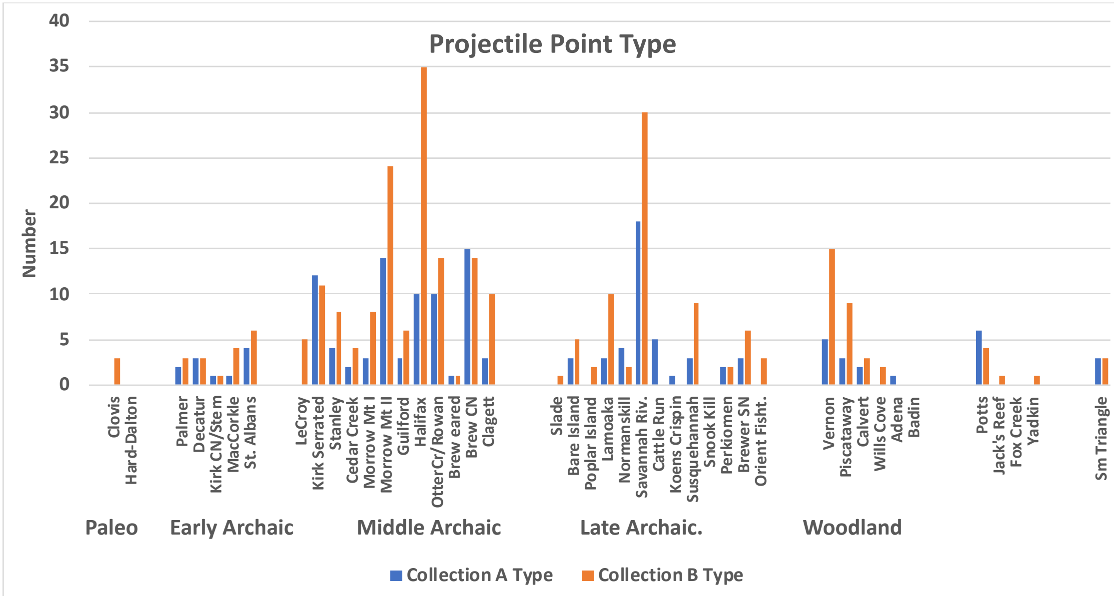

Figure 2.3: Projectile Point Type and Frequency for Collections A and B from Site 1.

I identified forty point-types in the two collections (Figure 2.3). Not all types were present in both collections. For example, there are three Clovis type points in collection B, but none in collection A. The overall pattern of point-type frequency in the two collections is similar, but not identical. Since the two collections differ in size (A = 150; B = 268) the numbers of points per type cannot be the same.

I also examined the composition of collections A and B by aggregate analysis according to major diagnostic attribute or "tradition" rather than individual type. Points were grouped according to the following major attributes or traditions as described previously for prehistoric lithic analyses in Virginia (Egghart 2016:69): Paleo (Paleo Fluted, Hardaway Dalton, side notched), Early Archaic corner-notched (Palmer, Kirk, Fort Nottoway, Decatur), Bifurcates (McCorkle, St. Albans, LeCroy), Mid-Archaic stemmed (Kirk serrated, Stanly), Morrow Mountain I & II, Guilford, Mid-Archaic Halifax-type side-notched (Halifax, Rowan, Otter Creek), Late Archaic stemmed (Slade, Popular

Island, Bare Island, Lamoaka), Late Archaic Broadspears (Savannah River types, Cattle Run, Coens-Krispin, Perkiomen, Susquehanna), Early Woodland Group (Orient Fishtail, Calvert, Wills Cove, Piscataway), Middle Woodland (Potts, Rossville). Grouping points by attribute or tradition, provides a more nuanced view of the collection and point usage over time than that given by simply segregating the points by time sub-period.

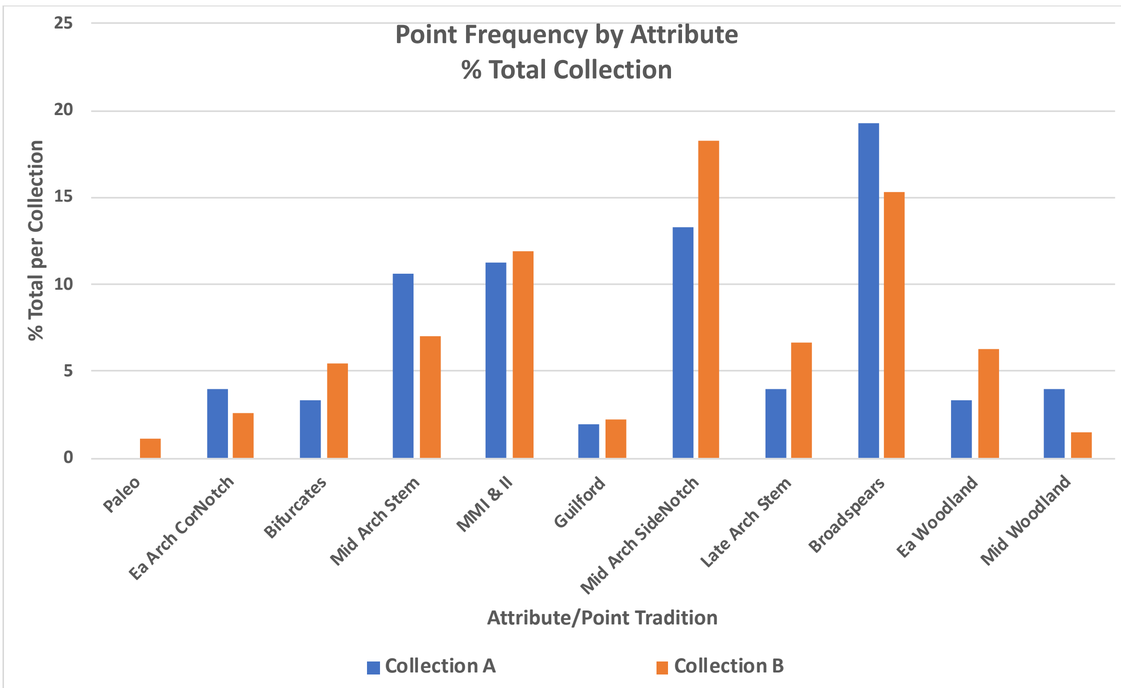

Figure 2.4. Point Frequency Compared by Attribute for Collections A and B from Site 1.

The data in Figure 2.4 show strong similarity between collections A and B when points are analyzed by attribute. The majority of points in both collections typed to three Middle Archaic groupings: stemmed and side notched points and the Morrow Mountain type. The next most abundant group in both collections was broadspears, in particular the Savannah River group, which is typically associated with the onset of the Late

Archaic Period. These data are in good agreement with that shown in Figure 2.2; both analyses indicate a preponderance of Middle Archaic point-types in both collections.

In summary, the abundance and composition of independent private lithic collections A and B were found to be similar whether points were analyzed by type or by attribute as a function of time. The frequency data were statistically significant. Together, these data indicate that the collections are valid samples of the larger population and appropriate for further study.

Point Frequency as a proxy indicator of Relative Population through Time.

Accumulations of prehistoric artifacts have been used as proxy indicators of relative population as discussed above (French 2015). Having found the independent private lithic surface collections made by repeated surveys were reliable as to abundance and composition of chronologically sensitive of projectile points, I examined point counts from the two collections, A and B, as proxy indicators of relative population at this location on the Rappahannock River over time. Since the traditional divisions of the Archaic and Woodland sub-periods differ in length, point frequencies from the two collections were converted to time-weighted point counts to examine relative population levels. Further, since the middle Archaic Period is approximately 4000 years using Egloff and McAvoy's (1990) suggested date frames, it was divided into mid-Archaic I and II, yielding two 2000-year time frames.

Time-weighted frequency analyses of collections A and B indicate low population use of Site 1 during the Early Archaic and Middle Archaic I Periods. This was followed by a sharp increase in relative population during the second half of the Middle Archaic (Figure 2.5; details in Table 2, Appendix I). Relative populations decreased slightly into the Late Archaic and the early Woodland Periods. Sharp declines in relative population levels occurred in the Middle and Late Woodland Periods. The presence of three Clovis-type points in Collection B from Site 1 show this location witnessed Paleoindian activity.

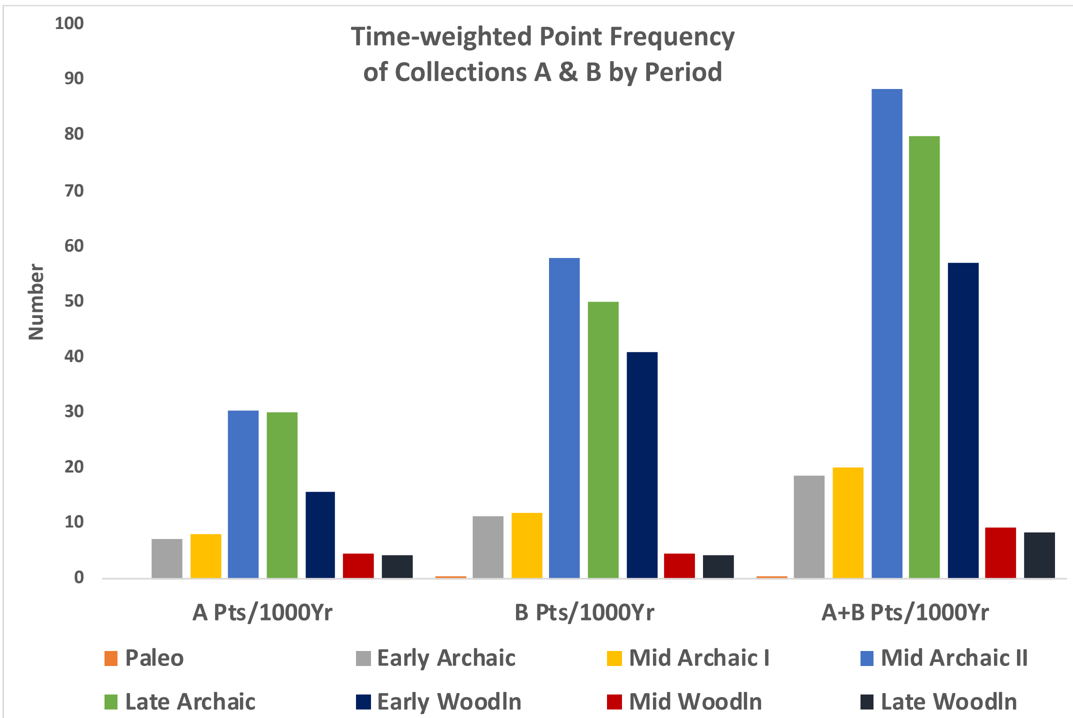

Figure 2.5. Time-weighted Frequency of Projectile Points from Site 1 Compared by Collection and Period

Combining the data from Collections A and B shows Site 1 was used across the Archaic Period with increasing frequency reaching a peak during the second half of the Middle Archaic Period and continuing into the Late Archaic and Early Woodland Periods before declining in the Middle and Late Woodland (Figure 2.5).

Summary

The results presented above show a remarkable similarity in abundance and composition through time when two independent lithic collections from Site 1 were compared. The results were similar whether points were analyzed by type or by attribute as a function of time. These findings indicate that private lithic surface collections, made by multiple repeated surveys over time, can provide reliable samples of the underlying population, and this conclusion was confirmed statistically. Analysis of artifact abundance as a proxy for population revealed substantial changes in relative population levels at Site 1 through time.

The consistency of the two collections indicates that private lithic surface collections made by repeated survey are appropriate resources for extracting data on relative local population demographics through time. Such collections may contribute to information on a local area and also be compared with a wider regional view. This finding is important in that it supports the use of privately-made artifact collections of reasonable proveniences in systematic archaeological analysis.

Comparative Analysis of a Private Lithic Collection from a Second Site with Regard to Abundance, Composition and Relative Population through Time.

A third lithic collection (Collection C) made by repeated survey over a 50-year period of a nearby, but distinctively different location (Site 2), was examined using the criteria and methods detailed above. Site 2 is also located on the north bank of the Rappahannock River, but it is located at the river's edge, is lower in elevation, and at the mouth of a tributary (Millbank Creek) entering the river (Figure 2.1). A typology of Collection C from Site 2 is shown in Table 1 (Appendix I).

<u>Abundance.</u>

Analysis of diagnostic projectile point abundance through time showed that almost half of Collection C from Site 2 was composed of points characteristic of the Late Archaic period (Figure 2 6).

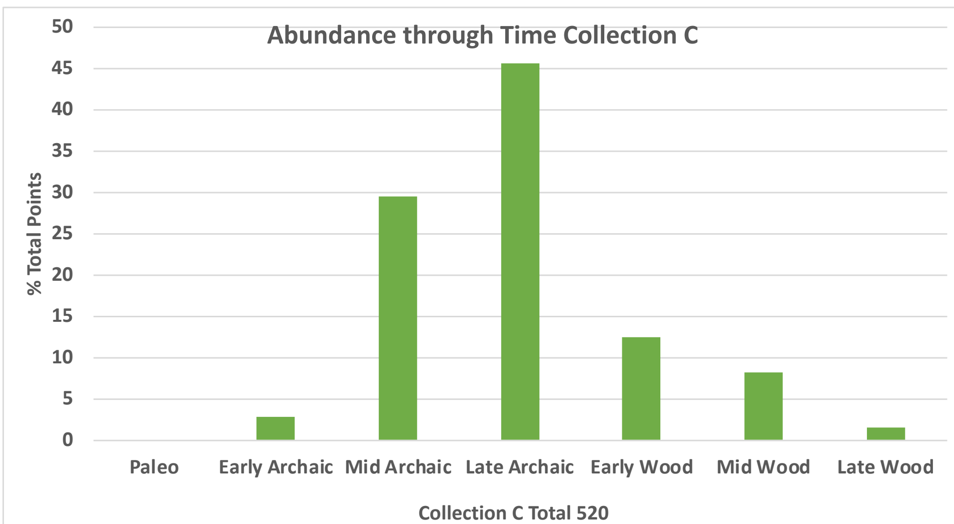

Figure 2.6. Projectile point frequency over time for Collection C from Site 2.

This finding contrasts with those of Collections A and B from Site 1 where over half of the collection contained points representative of the Middle Archaic Period (Figure 2.7).

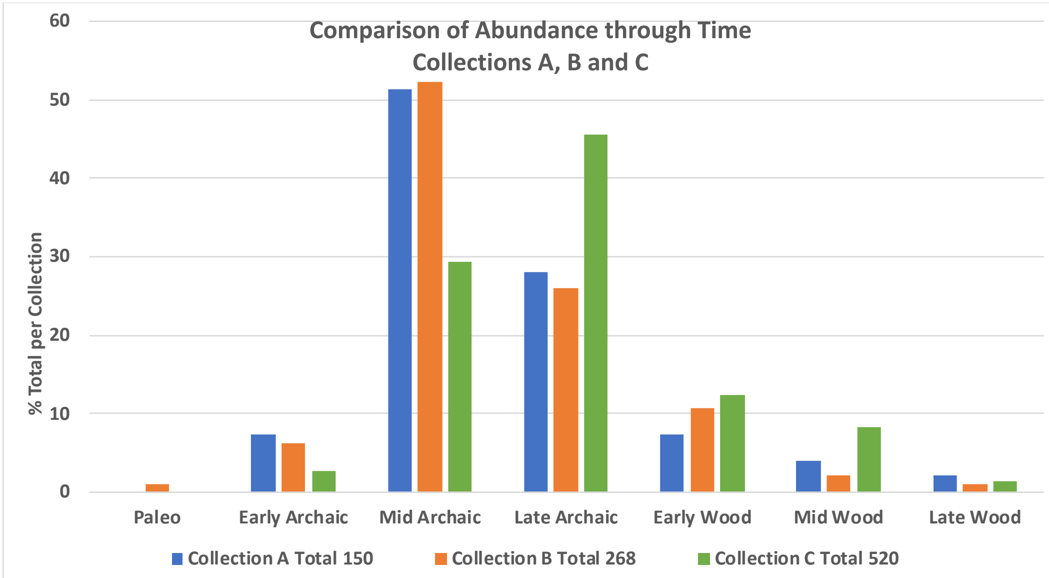

Figure 2.7. Comparison of Diagnostic Projectile Point Abundance through Time for Collections A, B, and C.

Composition by Attribute

Comparison of Collection C composition by attribute with Collections A and B showed that the largest proportion of points in Collection C from Site 2 was broadspears (Figure 2.8), which are considered indicative of the onset of the Late Archaic period (Egloff and McAvoy 1990; Dent 1995).

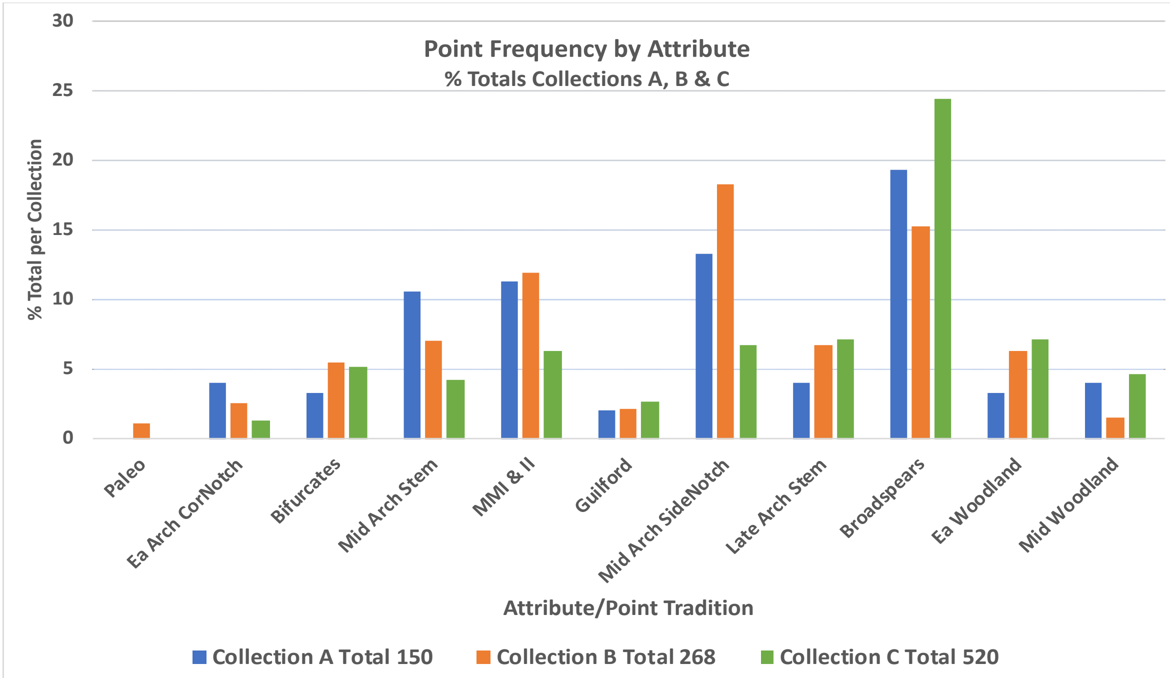

Figure 2.8. Comparison of Point Frequency by Attribute for Collections A & B (Site 1) vs C (Site 2).

This finding is consistent with the data in Figure 2.6 showing that the greatest abundance of points from Site 2 are those characteristically associated with the Late Archaic Period. Points that characteristically type to the Middle Archaic were present, but at levels approximately one-half that observed in Collections A and B. In general, Collection C reflected a point abundance and composition reflective of site use primarily during the Late Archaic Period.

Time-weighted analysis

A time-weighted analysis of the point frequency of Collection C from Site 2 was compared with that of collections A and B (combined) from Site 1 (Figure 2.9). A time-weighted frequency analysis of points as proxy for population showed the relative population levels at Site 1 rose sharply in the second half of the Middle Archaic, they then declined slightly in the Late Archaic Period and early Woodland Periods. In contrast, at site 2, while the relative population level first rose sharply during the second half of the Middle Archaic Period, it continued to increase, even more sharply, in the Late Archaic Period to almost triple the Mid-Archaic levels (Figure 2.9). Site 2 experienced its highest level of use in the Late Archaic Period; it did not experience a decrease in use during the Late Archaic Period as did Site 1.

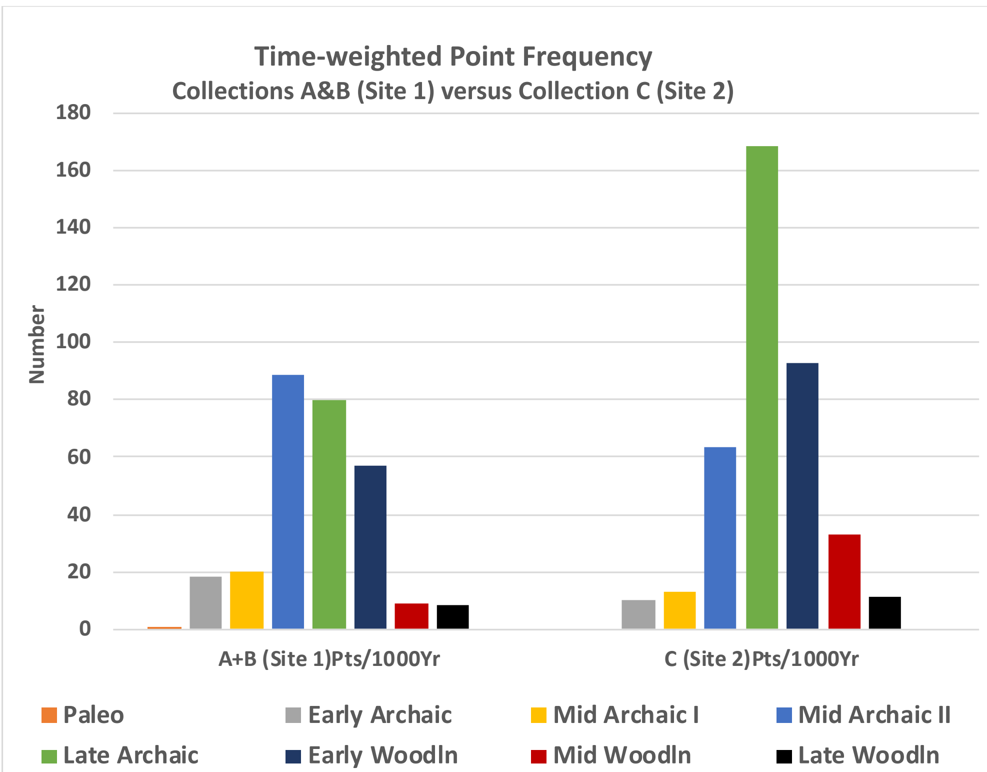

Figure 2.9. Time-weighted Frequency of Projectile Points from Sites 1 and 2 compared by Period.

Summary.

Taken together, diagnostic projectile point frequency, composition and time-weighted analyses used as a proxy for population, all combine to indicate Site 1 was used primarily during the second half of the Middle Archaic Period, with slightly declining use over the Late Archaic. Site 2 displayed a sharp increase in use during the second half of the Middle Archaic; however, it experienced its highest relative level of population during the Late Archaic Period.

Discussion & Problematic Issues.

The data presented have trends in common with reports from other sites near the fall line in Virginia indicating a substantial increase in Native American presence during the second half of the Middle Archaic Period (Egghart 2016; Egghart and Manson 2016; Egloff 1989). Egghart (2016) compares similar surface-collected data from several sites in Virginia and North Carolina, and there is similarity in the timing of major population shifts as measured by time-weighted lithic point frequency, although they vary in degree.

The use of projectile point frequency as a proxy indicator of relative population levels requires assumptions. Pertinent to the analysis presented here, which covers the Paleo, Archaic and into the Woodland Periods, is whether the functional role of projectile points remained the same over time. There is general overall agreement among archaeologists that the functional role of projectile points likely remained unchanged over the Early and Mid-Archaic Periods and that a correlation between point accumulations and relative population is fairly direct during those periods (Egghart 2016, Dent 1995). Because of shifts in subsistence mode and settlement patterns, Egghart (2016:134) suggests the correlation likely weakens in the Early and Middle Woodland periods, although he postulates it is still indicative of broad population trends. In the

Late Woodland Period, however, Egghart (2016) warns that the correlation between points and population may become problematic with a substantial shift in subsistence to agriculture.

Nevertheless, the relative population levels throughout the Early, Middle and Late Archaic Periods as determined here, based on private lithic collections, were found to be consistent and statistically significant in two independent collections examined from the same site. Comparison of these two collections with a third similarly-made collection from a second site revealed an interesting differential in time of occupation at the two sites only 2 km distant, but located in distinct environments.

The different temporal patterns indicated by this analysis raise questions concerning the social changes during the Middle and Late Archaic periods in Tidewater Virginia. Going forward in Chapter 3, the nature of these two sites and the activities of individuals peopling them are interrogated by analysis of their entire lithic tool assemblages. This work will be followed by analysis of the environment of the two different sites through time with regard to the effects of extensive climate change throughout the Middle and Late Archaic periods.

Chapter Three

Assemblage Diversity as a Characteristic Related to Site Function.

Background, Rationale, and Statement of Problem

Background and Rationale

One approach for inferring past human practices from the archaeological record centers on interpreting the activities carried out at an archaeological site. This is often done by identifying feature and artifact functions, but neither of these approaches is problem-free. For the Archaic Period, few features persist and thus information on site function most often is derived from analyses of the function of lithic artifacts (Andrefsky 2005). In this chapter I discuss and utilize several approaches to gain meaning from the large tool assemblages of Sites 1 and 2 to infer site functions.

Correlating stone tool function with form is not straightforward. Lithic artifact function cannot always reliably be attributed to morphology. Further, increasing evidence suggests that many lithic tools were multifunctional. Attempts to gain information on the functions of individual stone tools by analyses of residues left on tools have had varied success. Residues such as blood proteins have been examined by immunological techniques but often with unreproducible results (Downs and Lowenstein 1995). DNA is relatively labile and survival on surfaces over long durations is poor. Phytolith, pollen and starch grain analyses are viable approaches but have strengths and weaknesses with regard to specificity (Odum 2004:156-173; Messner 2011).

Andrefsky (2005: 201-204) suggests that it is best to use assemblages of stone tools instead of single stone tool functions to investigate site function; namely to use assemblage diversity. The question of stone tool function(s) has been controversial for many years as the counter opinions of Bordes (1979) and Binford (1972) show. Bordes (1979) believed variability was attributable to differences in prehistoric culture groups, whereas Binford (1972) saw variability as differences in functional tool varieties connected with differing activity areas.

The idea that stone tool morphological variability reflects functional constraints or functional and stylistic needs led to many studies of tool form and function. Not until Semenov (1964) pioneered use-wear and micro-wear analysis could some of these issues be addressed. For example, there is evidence that hafted bifaces or projectile points were indeed used as projectiles. However, micro-wear studies indicate that hafted bifaces also were used as cutting and butchering tools (Ahler 1971), a logical finding if someone were breaking down a carcass at a kill site and purposively hunted with a light tool kit.

<u>Approaches to Interpreting Site Function: Site Function Models</u>.

Macroscopic variability in stone tool form has been used to help interpret site function. The idea that one can make inferences concerning the kinds of assemblages expected with various site functions has been examined from several viewpoints (Binford 1980; Chatters 1987; Shott 1986). It rests to a large extent on Binford's (1980) work characterizing hunters and gatherers as foragers or collectors and investigating the reasons behind these two residential patterns. I review here the basis for this approach as I have chosen to use it to interpret site function from the stone tool assemblages of Sites 1 and 2.

Binford (1980:5) said that it was not possible to understand the causes of archaeological remains by a comparative study of them; one must understand the relationships between the dynamics of the past system and the materials forming the archaeological record. In other words, it is important to understand *how* cultural systems differ *and what conditions such differences*. To do this, Binford (1980) characterized hunters and gatherers by the strategy of foraging or collecting, which he defined on the basis of the kind of mobility each practiced. Residential mobility is movement of the entire group from one location to another. In contrast, logistical mobility is movement of small groups from, and back to, a residential location to perform a task. Foragers are defined as having high residential mobility, with logistical mobility playing a small role. Foragers "map onto" resources through residential moves and adjustments in group size. Collectors make few residential moves but many logistic moves. Logistically organized collectors acquire resources through organized task groups (Binford 1980:10).

Binford (1980) concluded different locations or sites exist because of different residential strategies. Foragers employed residential mobility; base camps were moved often to exploit available resources. Collectors' base camps were not moved often; logistical mobility and task-oriented camps were used to acquire resources located away from the base camp.

What Conditions Different Site Models?

Binford (1980; 2001) addressed the question of different site types at a deeper level by querying what factors favor a foraging versus a logistical strategy. He hypothesized that since systems of adaptation are energy-capturing systems, the strategies employed must be related to the energy structure of the environment. He analyzed case studies of residential mobility against environmental variability and global patterns of biotic production. This work indicated mobility was the greatest in equatorial settings with high production and Arctic settings with low production. In contrast, sedentary or semi-sedentary hunter-gatherers were in temperate and boreal environments. Mobility is a positioning strategy that Binford, and others (Kelly 1983; Shott 1986) concluded may be responsive to environmental properties other than food abundance. Foragers move consumers to goods with frequent residential moves; collectors move goods to consumers with few residential moves. The first strategy works if critical resources are within foraging range of the residential base. Collectors' logistical strategies resolve the problem of incongruous distribution of resources (Binford 1980:15). However, Binford (1980:12) did not imply "...two polar types of subsistence-settlement systems, instead...a graded series from simple to complex."

Linking Site Function Models to Assemblage Composition

Binford (1980) and Shott (1986) linked the generalizations of foragers and collectors back to the composition of assemblages and their patterning concluding mobility was a regulating factor. High mobility resulted in fine-grained or less diverse assemblages; low mobility resulted in more diverse or coarse-grained assemblages (Binford 1980:17). An assemblage that was the accumulated product of events over a year was coarse-grained in that the resolution between archaeological remains and specific events was poor; but this coarseness would increase the complexity and scale of assemblage content. Conversely an assemblage accumulated over a short period of time was fine-grained (less diverse) in resolution; variation between different fine-grained assemblages was likely.

The strategies of hunter-gatherer residences have been adapted further to predict the occurrence of artifact assemblages at differing locations or sites. Andrefsky (2005:212) described how site functions have been anticipated and assemblages inferred so that by working backwards one can use morphological artifact type as one way towards inferring site function. He discusses assays for "evenness" in assemblages as a measure of whether, for example, all morphological types are represented evenly at a site or only one or a few types are in the population. Residential and base camps should include a wide range of activities and might be predicted to have more diverse tool assemblages with greater evenness indicating a wider range of activities than logistical task sites. In summary, Andrefsky (2005) suggests lithic assemblage analysis should be used in conjunction with artifact functional information to aid site function interpretations.

Statement of the Problem

Following from Binford (1980), Shott (1986) and Andrefsky's (2005) work, I employ the approaches and considerations discussed above to gain meaning from the large tool assemblages of Sites 1 and 2. Specifically, I analyze the collections for artifact functions, and for assemblage diversity to ask whether they have the characteristics of tool assemblages made by highly mobile foragers or less mobile collector groups. This information is used to infer whether the sites may have been used as small or large base camps or foray camps. The archaeological analysis of tools to infer site functions described here in Chapter 3 will be considered together with overall site environmental evaluations as well as paleoclimate and biological data as I bring together these differing information sets within the framework of Historical ecology in Chapter 4.

Comparison of Assemblages from Site 1 and Site 2.

The analysis of the hafted bifacial stone tools, or projectile points, and their use as a proxy for relative population estimates over time at two sites along the Rappahannock River in Virginia has been described in Chapter 2. The non-hafted, bifacial blades and large (Macro)-stone tools that comprise the rest of the stone tool assemblages found at these sites (Sites 1 and 2) on the Rappahannock are quantitated as shown in Tables 4 and 5 (Appendix I). The large stone tools from the two sites were compared based on morphological assessment of function (Figure 3.1). The stone tool assemblages from both Sites 1 and 2 are diverse, or coarse-grained in Binford's (1980) terminology.

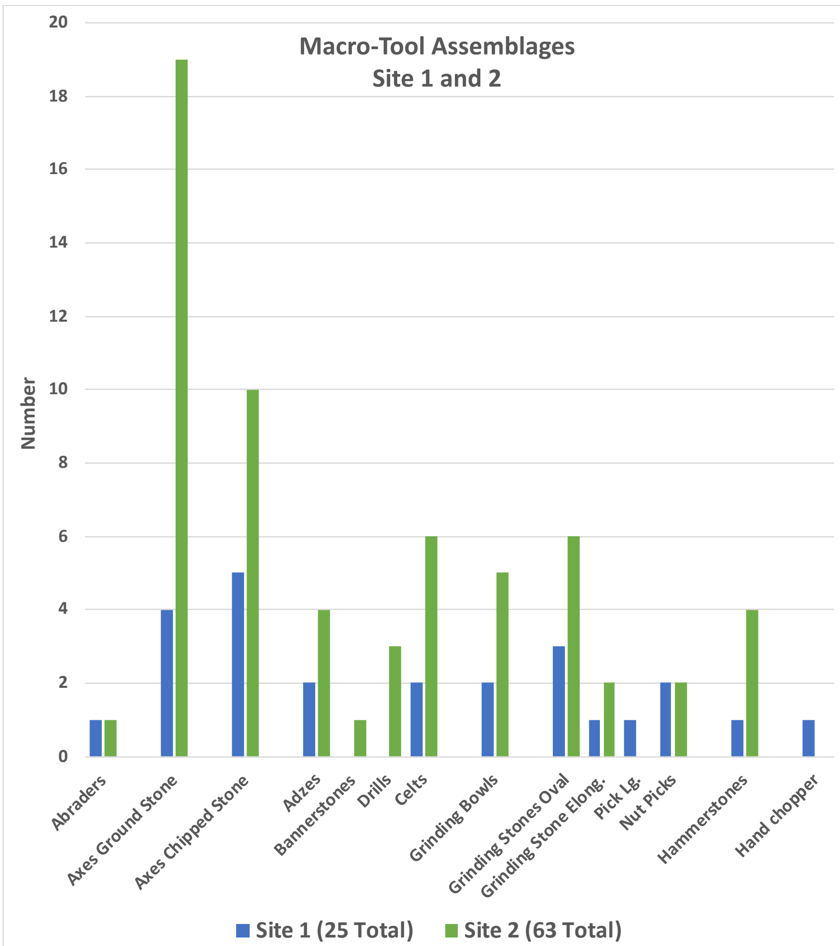

Figure 3.1 Comparison of macro-tool assemblages from Sites 1 and 2.

The assemblages offer evidence of numerous activities, inferred through function of the tools in the assemblage. Tool function was interpreted on the basis of morphology and reconstruction experiments as described by Adams 1996; Andrefsky 2005; Hranicky 1995; and Anderson and Hansen 1988.

Site 1. The tools types from Site 1 included nine axes (Figure 3.1, 3.2; Table 4, Appendix 1). These included five chipped-stone axes as well as four medium-sized ground-stone axes. Axes changed form over time in the Eastern woodlands with chipped-stone axes preceding ground-stone axes (Dent 1995: 182; Egloff and Woodward 2006: 19).

Figure 3.2 Chipped-stone (upper) and ground-stone (lower) axes from Site 1.

A small number of celts and adzes (implements with tapered faces to form cutting/chopping edges or bits) were also found at Site 1. Together with the axes, these suggest wood-working, perhaps to cut timber, build shelters or fashion wooden tools or hunting implements. There were also two large grinding bowls or mortars and both oval and elongated pestles or grinding stones. One of the mortars is unusual in having depressions for grinding on both sides, with the two surface depressions being of two different depths. These grinding bowls and grinding stones as well as two bifacial points characterized as "nut picks" are indicative of food milling and preparation. The hammerstones are indicative of tool making and maintenance. Consistent with hammerstones and tool-making, there is an area rich in lithic debitage that is disparate from the location where the mortars and most of the other large stone tools were found, suggesting Site 1 was used for lithic tool making.

Along with the macro-tools and the hafted bifacial projectile points, there was an array of eighty-two non-hafted bifacial blades, scrapers and choppers (Table 5, Appendix I). Many of the non-hafted bifacial tools were carefully made and are indicative of tasks such as butchering, food preparation or hide working. These were predominately made of locally available quartz and quartzite.

Site 2 had a diverse array of tool types (Figure 3.1). Tools included abraders, axes, drills, celts, adzes, and a bannerstone as well as grinding bowls, grinding stones, and hammerstones. Site 2 was notable for the presence of twenty-nine axes. There were ten large chipped-stone axes (Figure 3.1 and 3.3; Table 4, Appendix I). In addition, there were nineteen large, well-crafted fully-grooved or three-quarter grooved, ground-stone axes ranging in length from 80-225 mm and weighing up to 2 kg (Figures 3.1 and 3.3; Table 4, Appendix I). Ground-stone, grooved axes are associated with Late Archaic Period cultural activities (Dent 1995:182; Egloff and Woodward:19; McLearen 1991:99).

Fifteen of the axes were found together in a buried cache. The nineteen ground-stone axes are consistent with the relatively high Late Archaic population level at Site 2. In general, the ground-stone axes at Site 2 were larger and more well-made than the axes at site 1. The axes as well as 4 adzes and 6 celts (Figure 3.1; Table 4, Appendix 1) are tool types indicative of wood working, perhaps for constructing shelters, cutting trees and clearing ground to allow enhanced light for natural crops. As this site is adjacent to the Rappahannock River, these may have been tools involved in timbering for, or building of, watercraft such as dug-out canoes as will be discussed further in Chapter 4.

Figure 3.3. Chipped-stone (left) and Ground-stone (right) axes from Site 2.

The collection included four large and one small grinding bowls or mortars (Figures 3.1 and 3.4) as well as numerous grinding stones, flattened and smoothed by use, indicative of food milling. Two "nut picks" also indicated food preparation (Figure 3.4).

Figure 3.4. Grinding bowl and grinding stone (left); nut pick (right) from Site 2.

In addition to the collection of 520 hafted, bifacial projectile points described in Chapter 2, there were 139 non-hafted, bifacial knives, large blades, scrapers and choppers at Site 2. These tools could be associated with numerous tasks such as butchering, food preparation or hide working. The majority of the blades and scrapers were made of quartz and quartzite, both locally available. Many of the blades were well made, some of crystal or rose quartz. Quantities of non-hafted and hafted bifacial tools in assemblages from Sites 1 and 2 are compared in Figure 3.5. Examples are shown in Figure 3.6.

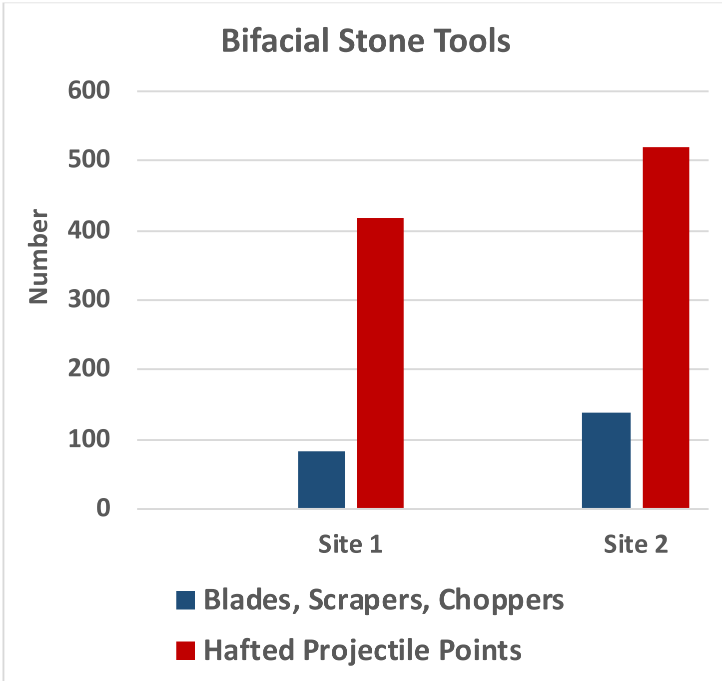

Figure 3.5. Comparison Site 1 & 2 Hafted versus Non-Hafted Bifacial Stone Tools.

Figure 3.6. Non-Hafted Bifacial Blades, Scrapers, Choppers, Site 2 (left) Site 1 (right).

<u>Diversity and Evenness of Tool Assemblages</u>

In considering site types, as discussed above, base camps or residential camps might be expected to include a range of activities and thus are predicted to have more diverse tool assemblages than logistical task sites (Binford 1980; Andrefsky 2005).

Further, Andrefsky (2005) suggests additional information to help infer site type can be obtained by using morphological artifact type to infer site function. The assemblages found at both Sites 1 and 2 are diverse. As discussed above, they include tools that could be involved in hunting, food preparation, food milling, butchering, hide-working, timbering, wood-working and lithic tool-making. The breadth of tool types suggests that both Sites 1 and 2 may have been used as base camps or perhaps in the case of Site 2, a larger residential camp. Site 2 is located directly adjacent to the Rappahannock River, and that, along with the high numbers of well-made ground-stone axes, celts and adzes combine to suggest a site at which extensive wood-working occurred. This will be discussed in more detail in Chapter 4 in relation to settlement choices and decisions taken by the inhabitants of Site 2 in the face of changing climate, environment and fauna and flora.

Evenness is another characteristic of assemblages that is indicative of site type. It measures whether many morphological types are represented evenly at a site or only a few types. Residential and base camps should include a range of activities and are predicted to have diverse tool assemblages with greater evenness indicating a wider range of activities than logistical task sites that might have one or a few tools and low evenness (Andrefsky 2005). Consistent with this, Shott (1986) found artifact diversity had an inverse relationship with residential mobility; as mobility increased, artifact diversity decreased.

I used the Shannon-Weaver equation (Shott 2010) to assess the evenness of the assemblages. The macro-tool assemblages of Sites 1 and 2 (Figure 3.1; Table 4, Appendix I) had high evenness indexes, 0.96 and 0.87 respectively (on a scale of 0 to 1). These findings are consistent with the diverse nature of the stone tool assemblages at both sites (Figure 3.1). The data suggest both Sites 1 and 2 were used as base or residential camps at some time. The slightly lower evenness score for Site 2 likely is related to the high proportion of ground-stone axes in the assemblage.

Based on the time-weighted analyses of diagnostic projectile points used as proxy for relative population levels, both Sites 1 and 2 are multi-component sites. Both may have been occupied and reoccupied many times through the millennia. Over time, site type and site use may well have changed. The Paleoindian and Early Archaic components at Site 1 and Site 2 may have been left by highly mobile hunting parties using the sites as short-term camps. Both sites had substantial population levels in the second half of the Middle Archaic Period. The assemblages of both sites have chipped stone axes which have been associated with Early and Middle Archaic occupations (McLearen 1991).

Both Sites 1 and 2 had sharp increases in relative population levels in the second half of the Middle Archaic Period, based on time-weighted frequency of projectile points (Figure 2.9). For Site 1, the second half of the Middle Archaic was the time of its highest relative population. Site 2, in contrast, had a further substantial (3-fold) increase in relative population in the Late Archaic Period.

In considering the macro-tools described here, axes were an important tool in the Eastern forest. They changed form over time. In general, chipped-stone axes preceded ground-stone axes (McLearen 1991:99). Sustained production of ground-stone, grooved axes and other ground-stone tools is associated with the Late Archaic Period (Dent 1995:182; McLearen 1991:99). The abundance of large, well-made ground-stone axes at Site 2, along with other wood-working tools suggests timbering and woodworking. Such activities may be associated with choices made by Indigenous inhabitants in response to environmental, landscape and biotic changes that occurred over time.

In the following Chapter 4, the archaeological assessment of site activities presented above will be considered together with geospatial site environmental analyses, as well as paleoclimate and biological data covering the Middle and Late Archaic periods. My goal is to bring these disparate information sets together within the framework of Historical Ecology to synthesize long-series data and infer interactions between humans and their environment.

Chapter Four

Geospatial Analysis of Sites 1 and 2: Settlement Choices and Riverine Environmental Change through Time.

Background

Much of the archaeological record of the Archaic Period in the Chesapeake region was interpreted by archaeologists influenced by Cultural Ecology and the New Archaeology, which emphasized a scientific approach to investigation coupled with a search for causal factors involved in cultural change (Dent 1995:156, Anderson 2001, Gardner 1987:52). Cultural change was examined in relation to the substantial changes in Holocene climate and environment. Adaptation, typically to local environmental conditions, was viewed as "responsible for cultural variation across space or through time" (Sassaman 2010: xv). The idea that environmental change conditioned cultural change led to examination of the nature of spatial patterns between social systems and the environment, referred to as settlement system studies (Dent 1995; Gardner 1987). These studies yielded useful detail on the distribution of communities and give indispensable background for the current studies.

However, discussion of cultural change as resulting only from adaptation to environmental change does not acknowledge hunter-gathers as people with agency to make decisions in the face of change. I agree with Anderson (2001:147) that climate should always be considered as a possible source of past societies' change because it conditions other variables such as resource distribution and biotic structure. It is inescapable that climate and environment shape many relevant variables. Nevertheless, when searching for explanatory frameworks, it is reasonable to consider the largest array of data available.

I begin this chapter with analysis of Sites 1 and 2 using a Cultural Ecological framework to assess the physical environment of the two sites. I compare them to previous Virginia settlement system studies. However, to this assessment I add the multi-scalar perspective of Historical Ecology (Balée 2006; Balée and Erickson 2006). I draw in recent paleoclimate and biological data to help characterize relevant large-scale historical events that occurred over the long duration of the Middle and Late Archaic Periods. I consider this information in light of archaeological findings at the two sites to enlarge and challenge the explanation of adaptation to environmental change with the idea that people did not simply react to changing environmental conditions in a preconditioned manner; they had choice in how to react to major historical events. They had agency.

<u>Statement of Problem</u>

Lithic collections from two sites along the north bank of the Rappahannock River in King George County, VA, separated by only 2km display a substantial difference in the proportions of temporally diagnostic projectile points through time (Chapter 2, Figure 2.7). Time-weighted analyses of point frequency used as a proxy for population, show Site 1 had the highest relative population level during the second half of the Middle Archaic Period, with slightly declining levels over the Late Archaic. In contrast, Site 2 had its highest relative population level during the Late Archaic Period (Chapter 2, Figure 2.9).

The goals of the following study were to compare the overall topography and hydrology of the two sites to evaluate why Site 1 might have been appropriate for settlement earlier than Site 2, and correspondingly, why Site 2 became a location appropriate for intensive Late Archaic settlement. The factors critical to Archaic Period settlement systems as reviewed immediately below will be examined. Specifically, using LiDAR images, I evaluate the topography of the two sites with regard to elevation, slope and aspect. Next, I compare the positions of the two sites relative to the Rappahannock River, tributary creeks, streams and adjacent marshlands.

Finally, I consider the changes that occurred to the overall landscape as a result of climate change and the effects of sea-level rise on the riverine environment through time. I draw in paleoclimate data and biological information. I explore how the archaeological tool assemblages from the two sites provide insight into the choices people made in addressing those changes. Specifically, I examine changes to practice and technology at the two sites through long-term paleoclimate, biotic and environmental change.

Background: Previous settlement system studies in Virginia

Many studies of settlement systems during the Archaic Period in Virginia have focused on the Piedmont, Ridge and Valley areas (Gardner 1987; Parker 1990; Wall 2018). Few archaeologists have studied the inner coastal plain, where Sites 1 and 2 are located (Gardner 1987).

Early and Middle Archaic settlement studies. Parker (1990:99) reviewed the factors important for developing a settlement pattern from the archaeological record. These included: knowledge of when the site was occupied, where the site was topographically in relation to key resources, and what were the characteristics relating to site function. For the Early Archaic, Gardner (1974) suggested a fission-fusion settlement system with three general types of sites: large base camps, small base camps and special procurement sites. The large camps were inhabited mainly in the summer by bands that would split up into smaller base camps in winter and fall. Custer

(1980) reinforced these conclusions from work in Augusta County, Virginia, suggesting large base camps were located mainly on floodplains, smaller base camps usually in uplands and procurement camps at sites of plentiful game or plants that occurred seasonally. Dent (1995:171) summarized Early Archaic sites as small and widely distributed across the landscape and expressed caution about the difficulty of determining whether sites were large or represented repeated occupation of the same location through many years.

Parker (1990) in reviewing early settlement system work noted that, in general, the Archaic Period was characterized by a system of seasonal movement from valley floodplain base camps in spring and summer to fall/winter hunting-gathering camps in mountains/uplands. Movement to uplands was by fission of a band to smaller groups. Both upland and lowland camps were associated with special procurement sites from which scattered resources were brought back to base camp. In general, the models were based on three criteria: site size, site location and artifact diversity.

Gardner (1987) introduced the idea of using a transect (surveys across differing physiographic areas) for Archaic Period work in Virginia. He examined an east-west transect across four physiographic provinces: Ridge and Valley, Blue Ridge, Piedmont and Coastal Plain. His theoretical framework was cultural-ecological, referring to interactions between social systems and environment (Gardner 1987:52). Site distribution was viewed in the context of the specific and general environment, local habitat and cultural context of technology. The totality of the site distribution equated with the settlement system. Variables that affected site distribution in each province were analyzed. Operative variables were: the distribution of lithic raw material, water, game-attracting habitats, zones of maximum habitat overlap/highest food/raw material potential, well-drained low relief, level topography, higher order streams/distance from these streams, and areas of maximum sunlight exposure. The studies of different provinces showed Virginia's extensive environmental setting differences were critical variables (Gardner 1987). Settlement systems were not homogeneous; they varied with time period and depending on environment. These and other studies showed a shift from expecting hunter-gathers to have similar settlement system properties, technology and organization, to recognizing they varied in different environments and under differing population levels (Johnson 2014: 21).

Gardner's (1987:76) examination of the inner Potomac Coastal Plain is relevant to the sites discussed herein, which are situated on the Rappahannock River inner Coastal Plain. He found the Potomac inner Coastal plain was exploited predominately during the Middle Archaic and zones of intense activity, the base camp areas, had the highest exploitable biomass. In all areas, sites were located where freshwater was available and habitats were maximized; near mouths of small streams, not randomly scattered across the floodplain. Transient camps occurred over the uplands in association with stream valleys.

Dent (1995) noted Middle Archaic settlement emphasized interior wetlands, near stream junctions and/or tributary floodplains: areas of resource concentration. Then again, Dent (1995:197) qualified his statement by saying "It is difficult to imagine any prehistoric settlement system that would ignore productive areas." He summarized a typical Middle Archaic site on the inner coastal plain as "on a promontory between two small streams not too distant from a wetland area" (Dent 1995:177).

<u>Late Archaic</u>. Mouer (1990; 1991) examined Late Archaic settlement along the James River and noted links between distinct adaptive strategies and settlement patterns for what was termed narrow versus broad-blade using people. The narrow-blade type (Halifax side-notched group) was viewed as an adaptation to a sylvan

environment, conditioned by a rather homogeneous resource structure with either riverine or upland location. Occupants of such sites focused on nut harvesting and deer and turkey hunting. Mouer (1991) considered the broad-blade complex (Savannah River point group, Perkiomen, Susquehanna) as a posited response to new regional conditions focused on estuarine resources (anadromous fish, shellfish) and resources from newly enlarged wetland areas. A slightly different settlement strategy ensued with increased site size and number, but still with an annual round of fusion and fission with settlements ranging from multiband base camps to band camps to foray sites. Most sites were near water.

Parker (1990) suggested that resource availability may not have been the only determining factor of settlement. To achieve risk mitigation in an unpredictable environment, perhaps widespread settlement of small camps was an effort to both feed and to integrate with other groups. Moving between several sites increased chances of interaction with others. Contact could lead to reciprocity and risk could be pooled by sharing of information and resources. Also, critical resources could be acquired through exchange networks, suggested by the presence of non-local lithics or other items. The environment could be exploited by information exchange through contact with other bands. Parker (1990: 114) noted that this concept is not widely-applied to hunter-gatherers, but he postulated that Early and Middle Archaic hunter-gatherers used interaction via exchange networks to provide social interaction as well as to give adaptive advantages.

In summary, settlement systems were not homogeneous but varied based on spatial and physical constraints of the environment as well as sociocultural factors including proximity to other groups. Environmental variables critical to Archaic Period settlement systems included: proximity to surface water, the overall character of the landscape: its slope, elevation, sunlight, and drainage, the nature and seasonality of fish, game and exploitable plants, and lithic raw materials.

<u>Methods</u>

Topography of two sites on the north bank of the Rappahannock River in the Virginia mid-coastal plain was analyzed with respect to elevation, slope, and aspect as well as distances to water and wetlands. I imported LiDAR (Light Detection and Ranging) images of the area surrounding Sites 1 and 2 from the Virginia Base Map Data Downloads site at: https://vgin.maps.arcgis.com. The LiDAR information was interrogated by geospatial analyses using Geographical Information Systems (GIS) program ArcGIS ArcMap 4 for elevation, slope, and aspect.

Topography and Hydrology at Sites 1 and 2.

<u>General Location.</u>

The locations of Sites 1 and 2 in relation to the Rappahannock River in the Virginia inner-Coastal Plain and their elevations are shown in Figure 4.1. Site 1 is on an upland terrace adjacent to a stream confluence. Site 1 lies at the base of a steeply rising bluff approximately 1 km north of the Rappahannock River. Site 2 is adjacent to the Rappahannock River. The overall landform of Site 2 is an elongated ellipse, resembling a fish, oriented west to east where its long (south side) forms the north bank of the Rappahannock River. Its north side is bounded along its length by Millbank Creek. The eastern end of Site 2 is at the mouth of Millbank Creek where this substantial fresh-water tributary decants into the Rappahannock.

Figure 4.1 Location of Sites 1 and 2 on the Rappahannock River in the Virginia inner Coastal Plain.

<u>Light Detection and Ranging (LiDAR) Analysis of Sites and Surrounding Environment.</u>

LiDAR data is available for most of Virginia. It uses light from pulsed laser to measure distances (ranges) to three different levels (treetop, mid-tree, and ground surface) to generate precise three-dimensional information about the earth's surface characteristics. These analyses can be used as the foundation to derive information on the slope and aspect of a site as well as to provide a direct picture of the surface that can indicate multiple features such as ditches, pits or former river or stream beds.

LiDAR survey of the area surrounding Sites 1 and 2 detects differences in site elevations (Figure 4.2). LiDAR detects the sharply rising terrain just northeast of Site 1. Such upland locations were favored early sites. Site 2 is predominately flat with minor undulations. The six square-appearing areas to the west of Site 1 are an area where gravel is being mined. While regrettable, as it has likely removed archaeological information, it may provide some information on past hydrology of the area.

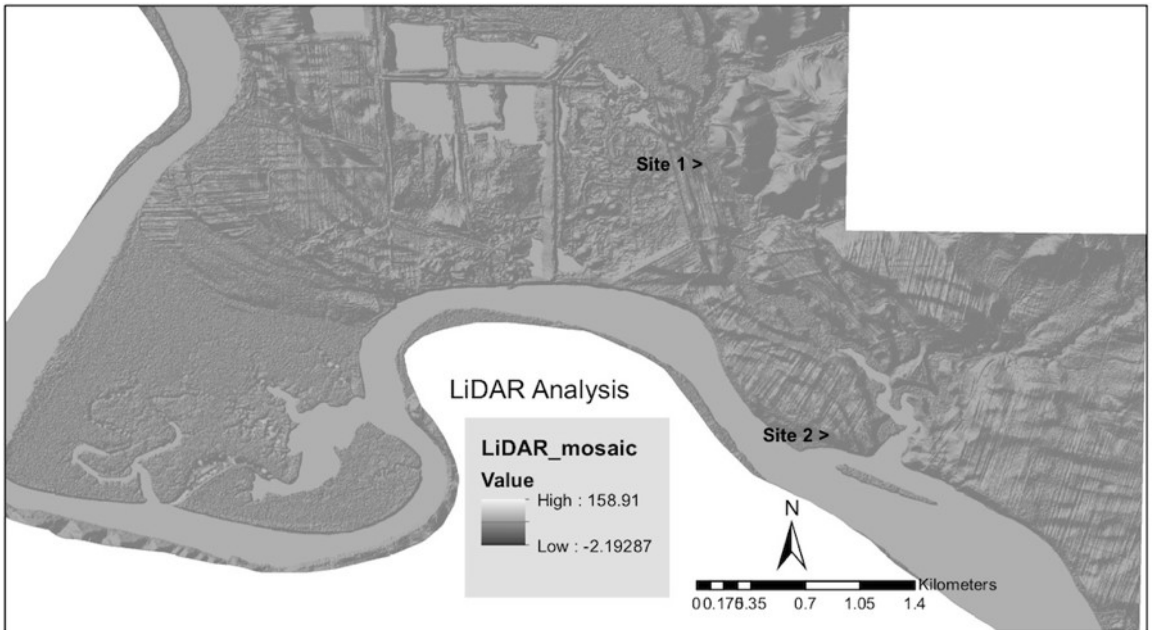

Figure 4.2 Lidar Image of Sites 1 and 2.

A notable feature of the LiDAR image shown in Figure 4.2, is the indication of an ancient river channel across the top of the horseshoe bend in the south-western corner of the figure. Before sea-level rise resulted in formation of the Chesapeake Bay, the Rappahannock River ran freely and decanted into the Susquehanna River. After the Chesapeake Bay formed, it acted as a brake to free exit of the tributary rivers. This caused them to slow, to broaden and begin to meander. The channel across the mouth of the horseshoe bend as shown in the LiDAR image in Figure 4.2, may represent the ancient river course prior to its slowing and meandering. The position of this ancient channel suggests that the slowing of river flow induced meandering. The former configuration may have influenced evolution of the site via natural levee formation with associated deposition of gravels that, as noted above, are currently being mined. Site 1 is rich in quartz cobbles.

Slope Analysis of Sites

Elevation data from LiDAR analyses can be used as the foundation for geographical information systems (GIS) reconstructions and spatial modeling to derive information on the slope of a site. This allows predictive modeling of site locations and settlement patterns. Slope analysis measures a gradient; each slope has a value. It is measured either in degrees (from 0º to 90º) or percent, in which case 0º is 0% but 90º is 100%; a vertical slope equals 90º (Wheatley and Gillings 2002). A slope map measures terrain steepness. Typically living areas occur on sites of less than 15% slope. The range of 0-5% is the most desirable land for domestic occupation; with 5-15% the maximum degree of slope for inhabitable domestic sites, with exceptions in mountainous regions (A. Horning, personal communication). On the other hand, other types of archaeological sites may occur in differing slope environments, for example, a stone quarry may occur in the 25% range.

Both Site 1 and Site 2 occur on areas of less than 5% slope (Figure 4.3). Site 1 is located on a terrace away from the river, alongside a substantial stream at the base of a steeply rising bluff of 15 to 45% slope. Thus, Site 1 is sheltered from north and northeastern winds. Site 2 is low, flat and oriented to the river and the mouth of the adjacent creek.

In summary, both sites fulfill the environmental predictive characteristic for settlement of location on level ground.

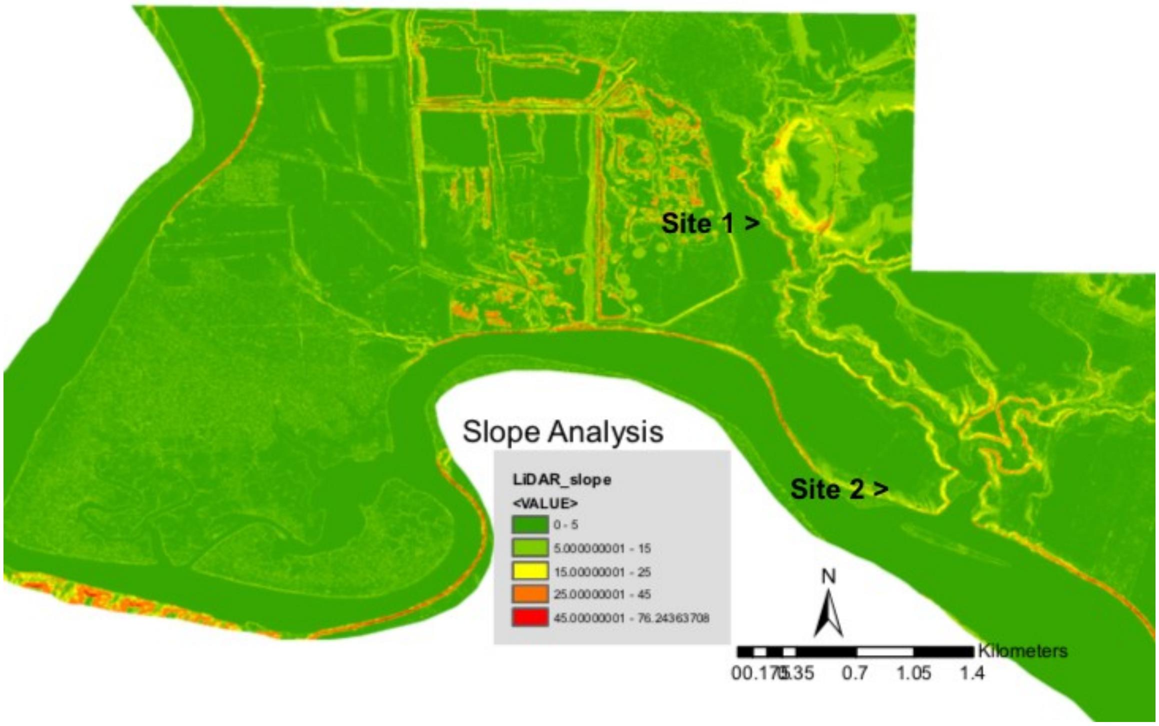

Figure 4.3 Slope Analysis of Sites 1 and 2.

Another feature of the landscape revealed by slope analysis is in terms of river access to and from the sites. The riverbank areas closest to Site 1 are 15 to 45 % and 45 to 75% slope, making direct river access difficult. The steep riverbanks, however, provide excellent observation points of the river, in both up and downstream directions there is a broad view. The access to almost two thirds of the length of river bank leading to Site 2 from upriver is 45% to 75%, almost cliff-like, making the river inaccessible on that long portion. The areas on the eastern end, nearer Site 2, slope more gently to the river with values of 5 to15 % and 15 to 25%.

The high cliff-like areas offer an expansive view of both up and down-river approaches to the site as well as extensive views across the landscape to the west, south-west and south-east. Extensive "viewsheds" such as that offered by this position have been noted as key features of some Indigenous sites and are suggested as important in offering "inter-visibility" between sites (Strickland et al., 2016).

In summary, these data show Site 1 is on level ground, inland from the river, at the base of a steep bluff providing protection from north winds. It appears to be focused on the surrounding upland resources and adjacent stream such that nearby river access was not critical. In contrast, Site 2 is on level ground that is adjacent to the river and creek, but it is positioned where the land slopes gently down to the river and to the mouth of the adjacent creek, giving easy access to both bodies of water.

Aspect Analysis of Sites

Elevation data from LiDAR analyses can be used also as the foundation to derive information on the aspect of a site. As described above, slope represents the steepness of the surface. Aspect is the downslope direction or "slope direction." Aspect is usually calculated in degrees with 0 or 360 (used here) representing North and is often reclassified into the eight main compass readings (N, NE, E, SE, S, SW, W and NW).

Aspect is useful in analytical modeling of site locations and settlement patterns as southward facing slopes will have strong solar radiation, advantageous for winter camps and horticulture. Aspect analysis shows both Sites 1 and 2 enjoy a predominately south, southwestward facing aspect (Figure 4.4). Further, Site 1 lies at the base of a southwestward facing hill that shelters from north and northeastern wind. Such a site would provide a protective fall or winter location.

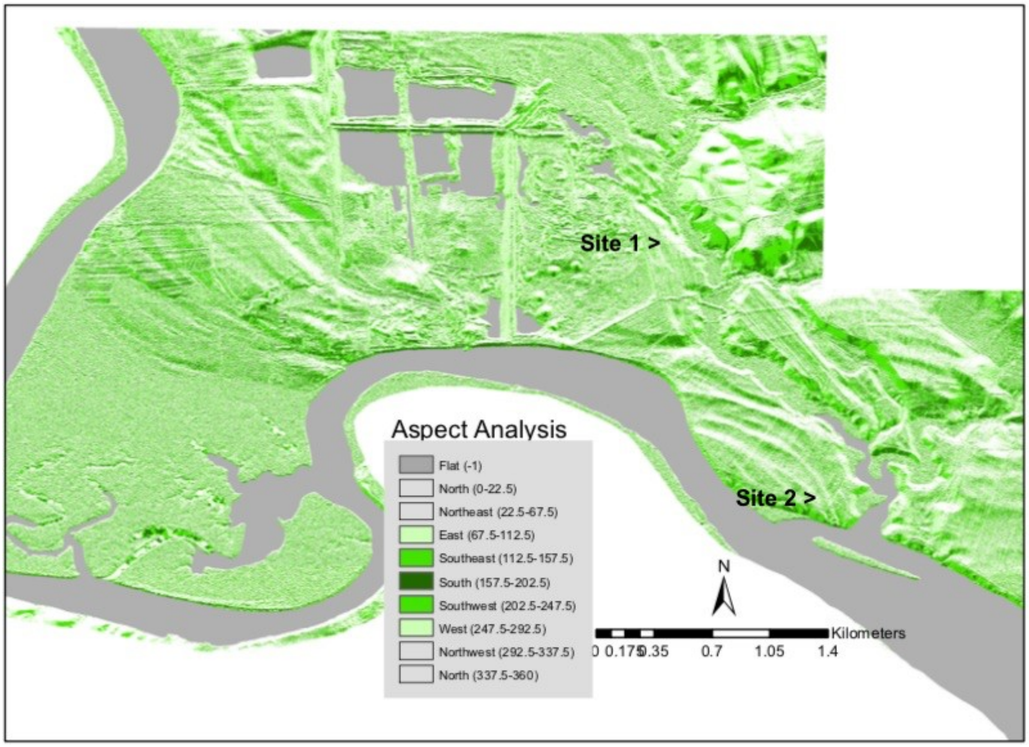

Figure 4.4 Aspect Analysis of Sites 1 and 2.

The importance of aspect is illustrated in the photograph in Figure 4.5. This photograph was taken from the North bank of the Rappahannock River near Site 2 looking to the southwest during the month of February. It shows that the location benefitted from excellent solar radiation, a factor that can be critical for survival during periods of extreme weather. This photograph and the locations of Sites 1 and 2 on the North bank of the Rappahannock River give evidence of Indigenous knowledge and choice in selecting beneficial landscapes for residence. It has been noted, based initially on Smith's (1612) map, that the most Indigenous villages on the Rappahannock River are located on the North bank. Rountree (2007) hypothesized that this was due to Tribes, such as the Rappahannock Tribe, wanting to distance themselves from Powhatan's reach and that the locations were politically motivated. In contrast, Strickland et al. (2016) used geospatial analysis of the Rappahannock River region to conclude that the location of the majority of villages on the North bank was due instead to the fact that the best agricultural soil is found on the North bank of the Rappahannock.

Figure 4.5. View of the Rappahannock River near Site 2

The data presented in Chapters 2 and 3 show that Indigenous groups had chosen to live on the North bank of the Rappahannock River during the Middle and Late Archaic periods. These times are well before a transition to intensive agriculture and before the Powhatan Chiefdom (Rountree 2007). I suggest that both of the above conclusions should be challenged with the idea that another factor in the choice to live on the North bank of the Rappahannock River may well have been made by people who knew and understood the powerful benefits of solar radiation to existence.

Comparison of Topography and Hydrology at Sites 1 and 2.

Site 1.

Topographic analyses show Site 1 is located on a terrace above the Rappahannock River at the base of a steeply rising bluff and hill area (Figure 4.1). By the most direct route, it is 0.8 km from the current riverbank, but river access is difficult at that point because of a steep, cliff-like slope as will be discussed below.

Site 1, however, is directly adjacent to a major stream junction with a smaller stream, a favored location for hunter-gatherer settlement during the Early and Middle Archaic Periods (Dent 1995; Gardner 1987). The streams provide a good source of fresh water. The upland environment to the north of the streams would likely have consisted of an Eastern deciduous forest environment rich in nut mast and a suitable habitat for deer, turkey and small mammals, a rich biotic area. The upland environment, coupled with its situation at the base of a south-west facing hill to block north/northeastern winds, a level situation and a southwestward facing aspect that would receive good solar radiation all combine to make Site 1 an ideal Middle Archaic fall/winter camp location. It is well-located to take advantage of the upland forest resources. Further, the presence of abundant quartz and quartzite cobbles throughout the area along with concentrated lithic debitage near the site, suggest the use of local lithic sources for tool raw material. Halifax and Halifax-like side-notched projectile points associated with the late Middle Archaic Period comprise a large proportion of the lithic collections from Site 1 (Figures 2.3 and 2.4). Approximately 95% of such side-notched points from Site 1 are made of quartz and these point types are consistent with use for upland game hunting.

In summary, the sheltered, level, upland nature of Site 1, with excellent solar radiation, positioned at a stream junction, surrounded by Eastern forest habitat, and having abundant lithic raw material are characteristics that combine to define an ideal site for Middle Archaic Period settlement (Gardner 1987; Dent 1995). Further its lithic tools are predominately Middle Archaic, side-notched projectile points consistent with upland game hunting. Macro-stone tool analysis (Figure 3.1) showed Site 1 has a diverse, evenly distributed assemblage including tools that could be used for hunting, food preparation, butchering, hide-working, wood-working and lithic tool-making. This diverse tool assemblage indicates Site 1 served as a base camp, where many activities took place and, combined with the other characteristics detailed above, was likely a fall/winter base camp.

As discussed in Chapter 2, Site 1 was multi-component, having occupations in the Early, Middle and Late Archaic Periods. It may have served during earlier periods as a base camp, foraging or resource supply camp that was occupied and re-occupied over time, reinforcing interpretation of Site 1 as having a favorable location and environment.

Site 2.

Topographic analyses show Site 2 is adjacent to and oriented to the Rappahannock River. It is on level ground with a generally south, southwest facing aspect, receiving excellent solar radiation. Site 2 is located on a terrace above the river that slopes down on its eastern end to provide access to the river and to the mouth of Millbank Creek at the point where it empties into the river. The site has direct access to the river for transportation and harvesting of riverine resources. It also has direct access to the adjacent Millbank Creek with its wetlands affording marshland plant and animal resources. Site 2 is ideally positioned to have access to spawning anadromous spring fish runs up Millbank Creek. Consistent with riverine and marshland resource exploitation, the largest proportion of Site 2 diagnostic bifacial tools are Savannah River projectile points, referred to as "broad-bladed" points and associated with the onset of the Late Archaic Period or a period transitional between the Late Archaic and Woodland

Periods (Mouer 1991). Although Site 2 is multicomponent having use during the Early, Middle and Late Archaic Periods, its highest relative population levels by far were during the Late Archaic Period (Figure 2.9).

The site characteristics, taken together with the large, diverse macro tool assemblage indicative of multiple activities (Figure 3.1), indicate Site 2 was a large base camp or residential camp, likely in use predominately during the spring /summer of the Late Archaic Period. The nature of the tool assemblage will be discussed below in conjunction with the site location and riverine access.

Climate and Landscape Change Relative to Differing Periods of Occupation at Site 1 versus Site 2.

<u>Climate and Landscape Change through Time: Statement of the Problem</u>

The archaeological evidence examined in Chapters 2 and 3 has shown that Sites 1 and 2, although both multicomponent sites, only 2 km distant from each other, had two different time periods of major occupation. Site 1 was occupied primarily in the second half of the Middle Archaic Period, whereas Site 2 had its highest relative population level during the Late Archaic Period, when it experienced a three-fold increase in population above that during the late Middle Archaic Period.

Geospatial analysis of the landscape and overall environment of Sites 1 and 2 described above in this Chapter, showed they differ in surrounding environment. Site 1 has the position, environmental characteristics and lithic technology associated with a Middle Archaic upland hunter-gatherer base camp (Gardner 1987; Dent 1995; Binford 1980). In contrast, Site 2 is adjacent to the Rappahannock River and the mouth of

Millbank Creek. It was occupied intensively during the Late Archaic Period (Figure 2.9) and its lithic technology (Figure 2.8) is consistent with this time frame.

Evaluation of Climate and Landscape Change

To evaluate why Site 2 became appropriate for use during the Late Archaic Period, I consider the overall environmental and landscape changes that occurred leading up to, and during this time. As described in Chapter 1, due to global temperature increase and glacial retreat, sea levels rose approximately 50 meters between 10,000 and 6000 years ago (Dent 1995:191). This increase in sea level flooded the ancestral Susquehanna River basin turning it into an estuary. The rate of sea level rise then slowed; between 6000 and 3000 years ago, sea level rose only another 6 meters. During this later time, the Chesapeake estuary expanded to become fully embayed. Tributary rivers, such as the Rappahannock River, became sub-estuaries of the Bay. As a result of sea level rise and formation of the Bay, the tributary rivers underwent a substantial transformation. It is estimated that the basic course of the Rappahannock River did not change much over the past 15,000 years (Dr. Leslie Reeder-Myers, personal communication). However, as sea levels rose, the river slowed down and broadened-out below the fall-line. This was due to it decanting into the fully embayed Chesapeake Bay, rather than into the free-flowing Susquehanna River.

Dr. Reeder-Meyers generated two models of the extent of sea level rise at 12,000 and 5000 BP (Personal communication: Figure 4.6). She cautioned that modeling highly dynamic estuarine environments is problematic; the models are included however, to show that sea level incursion would have affected only the eastern-most portion of the Rappahannock River adjacent to the Bay. The major effects of sea level rise and resulting Chesapeake embayment on the portion of the Rappahannock River where

Sites 1 and 2 are located in the inner coastal plain, were slowing of the river's rate of flow and broadening.

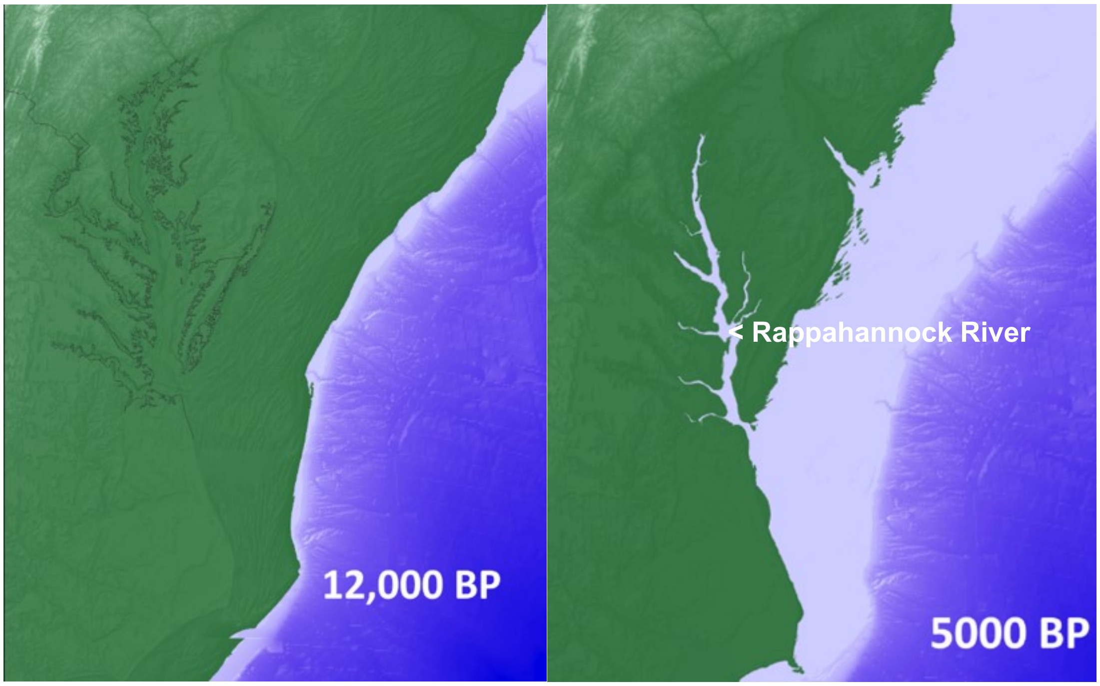

Figure 4.6. Models of rising sea levels into the Chesapeake Bay area at 12,000 BP and 5000 BP. Green, land; Dark blue, sea; pale blue, sea rise. Courtesy, Dr. L. Reeder-Myers.

One effect of the river slowing and broadening would have been that it began to meander. For example, horseshoe bends appeared, such as shown by the LiDAR image in Figure 4.2, where an ancient river course is visible cutting across the present-day horseshoe bend. Other substantial changes that ensued included the formation and expansion of wetlands (Dent 1995:85). These wetland and marshland environments became highly productive and offered new estuarine and rich plant resources.

Considering Changes in Settlement Location and Technology

In general, Late Archaic settlement patterns have been considered to display a more pronounced riverine focus than the Early and Middle Archaic Periods (Hodges 1991:223). Changes in settlement location and technology beginning at the end of the Middle Archaic and into the Late Archaic have been interpreted as evidence for a response to new conditions focused on estuarine resources such as anadromous fish and newly enlarged wetland areas. Mouer (1991:20-21) notes the locations of several major base camps of the Inner Coastal Plain suggest the importance of anadromous fish by their positions at the mouth of major spawning streams. Mouer (1991:22) however, discredits the idea that broad-blade technology, such as Savannah River type points, that were prevalent approximately 4800-3200 BP (Dent 1995:162; Egloff and McAvoy 1990:74) was linked to function, for example specialized fishing tools in response to new estuarine resources. Dent (1995:181) discusses this; his view is that these points are multifunctional. Savannah River points are widespread across Virginia, including in upland areas. Mouer's (1991) opinion is that Savannah River points should not be understood from a functional perspective, but rather as evidence of cultural change. Mouer (1991:22) suggests they imply changing social connections and distinct cultural traditions, likely achieved by long-range riverine connections. Mouer's (1991:22) opinion aligns with that of Bordes (1979) rather than Binford (1972) in the long-standing controversy over reasons for tool variability. As discussed in Chapter 3 (page 1), Bordes (1979) suggested that tool variability was due to cultural differences, perhaps identity factors, whereas Binford (1972) supported the idea that variability was associated with differences in functional tool varieties connected with differing activity areas. In re-evaluations of this question, some are of the opinion that both factors may be involved (Egghart 2014). Nevertheless, the origins of broad-blade technology are controversial;

import from other cultural groups is postulated; either from the North or up the southern Atlantic coast (Dent 1995:201).

The view that Late Archaic emphasis on riverine resource use was connected to anadromous fish runs is based upon scant hard evidence (Dent 1995:208). Faunal remains in the form of bones are sparse, but understandable considering the poor preservation conditions of acidic soil. Indirect evidence in the form of the remains of fish weirs has been found, but these have not been dated and could come from later periods. The presence of large hearths at Late Archaic riverine sites, possibly used to process catches, has been seen as suggestive evidence, as have small, notched cobbles also found at such sites and interpreted as net sinkers or weights. Alternatively, or in addition, these large hearths could have served as well as social gathering or group work spaces for the increasing population.

<u>Another Perspective on Resource Change and Anadromous Fish Presence in the Rappahannock</u>

To approach this question from a different perspective, I draw in paleoclimate and biological evidence to consider: 1) what were the environmental conditions in the tributary rivers that allowed development of conditions suitable for spawning of anadromous fish and 2) when did the rivers acquire such characteristics? Anadromous fish migrate from an ocean environment up rivers to fresh water sources to spawn. Bilkovic (2000) has enumerated the conditions for successful spawning and incubation of the American shad, *Alosa sapidissima*, in work on Virginia's Pamunkey and Mattaponi Rivers. Spawning takes place in upper to mid-river segments. Two abiotic factors, water temperature and water current velocity are important for a suitable spawning habitat. Eggs are deposited in freshwater portions of estuaries in spring beginning in March and ending in early June. Temperatures between 14C and 19C are optimal; below 12 C or above 21C-22C are not tolerated. Additionally, eggs require a water velocity between 0.3 to 1 meter per second. If the current is too slow, the eggs suffocate in the sediment; if it is too fast they are not retained in the system (Bilkovic 2000:74-75).

Cronin et al. (2005) has reconstructed paleoclimate patterns from oxygen and carbon isotope records from fossil benthic foraminifera and used ostracode magnesium and calcium (Mg/Ca) ratios from Chesapeake Bay sediment cores to estimate paleotemperatures in paired ostracode - foraminifera samples. Most adult ostracode secrete their shells during spring and summer giving a mainly warm season paleotemperature record. Early Holocene (7500-5900 BP) Mg/Ca-derived temperatures varied between 13C to 16C. Late Holocene temperatures were cooler 12.8C to 14.6C (Cronin 2005:Figure 7).

The data of Cronin et al. (2005:13-14) show that springtime water temperatures in the Chesapeake region were suitable for spawning of American shad for the majority of the Holocene, certainly from 7800 years ago onward. Therefore, it is likely that the critical change that allowed shad to begin to use the tributary rivers of the greater Chesapeake estuary for spawning was the slowing of river flow. I know of no sources for proxy data for river velocity during the Holocene, but modern Rappahannock River velocities (Chesapeake Research Consortium, Inc. 1981: Figure 10) fall within the acceptable ranges denoted by Bilkovic (2000:74-75). There is an annual shad run on the Rappahannock in late March (https://riverfriends.org/poor-mans-tarpon-the-rappahannock-river-shad-run/).

<u>Time Frames</u>

As described above, moderating climate during the Holocene and the resulting formation of the Chesapeake estuary combined to produce warmer, slower and broader tributary rivers entering the Bay. These changing conditions also gave rise to new resource-rich wetlands. The new conditions eventually resulted in the Rappahannock River attaining abiotic properties of temperature and flow rate that were compatible with American shad spawning (Cronin 2005; Bilkovic 2000).

The changes that resulted in formation of the Chesapeake Bay estuary occurred over an extremely long time-frame, one that covered essentially the entire Holocene era and the majority of the Archaic Period. In contrast, the changes that resulted in the slowing and broadening of tributary rivers and formation of new wetlands, took place over a relatively narrow (millennial) time span. Only *after* tributary rivers exited into the newly embayed Chesapeake did river flow-rate slow. This was because the embayed Chesapeake served as a "brake" on free-flowing exit. This did not occur until after 6000 years ago, by which time sea level had risen 50 m; the rate of rise then slowed, and levels increased only 6 m over the next 3000 years to yield full embayment (Dent 1995: 191). These levels, rising slowly to full embayment, would have affected the exit flow of the tributary rivers in a steadily increasing manner from 6000 BP onward. Based on the final embayment rate (6 m over 3000 years), it is likely that river flow levels had slowed somewhat by a millennium later, beginning approximately 5000 years ago. Thus, the convergence of river flow slow-down that could enable conditions suitable for shad spawning, and Late Archaic Period settlement emphasis on riverine sites can be considered as taking place in a *broadly* similar time frame.

Mouer (1991) and Dent (1995) have discussed the idea that Late Archaic changes in settlement to riverine locations in Virginia and the Chesapeake region were associated with the onset of substantial runs of anadromous fish and with use of newly-developed wetland resources. The archaeological evidence for this is suggestive, but not definitive. As discussed above, it is mainly a general correlation in time of settlement movement to riverine locations, many at the mouths of fresh-water streams appropriate for spawning; the presence of large, raised hearths, perhaps for processing; and notched cobbles interpreted as net-weights (Mouer 1991:20-21; Dent 1995:204-208). In locations outside the Chesapeake, the presence of fish weirs, bone fish-hooks and net weights are added evidence for the argument (Sassaman 2010:164-169).

<u>Summary</u>

In summary, to the preceding pieces of evidence indicating that the riverine focus of Late Archaic Period sites was due to anadromous fish runs, I add the information presented above, that the Rappahannock River, while having appropriate temperature for shad spawning for at least the past 7800 years, did not attain the appropriate rate of river flow to sustain shad spawning until after Chesapeake embayment caused the flow rate of tributary rivers to slow dramatically. I deduce that time to have initiated beginning approximately 5000 years ago.

<u>Conclusion</u>

I conclude, subject to new evidence, that a substantial reason for increased occupation of Site 2 during the Late Archaic Period, was availability of new riverine and wetland resources. Assuming one of the major new riverine resources was shad, then, based on the evidence discussed above, its presence was enabled not by temperature change, which had been appropriate for shad spawning throughout most of the Holocene (Cronin et al. 2005), but by the slowing of the Rappahannock River to yield the water velocity appropriate for successful spawning (Bilkovic 2000). It is likely that these conditions also favored the establishment of other estuarine species, such as sturgeon and striped bass. There is no evidence for oysters near Site 2; even today the salinity of the river at this point is too low to support their growth (Author's data; Certified Rappahannock River monitor). Similarly, new wetlands formed only after the river slowed and broadened. These events could not occur until after Chesapeake embayment, which was the brake that slowed the river's flow; it also allows a rough estimation of the time of river slow-down, approximately 5000 years ago.

In drawing this conclusion, I am well aware that it is based on a correlation of events with biological criteria and paleoclimate proxy data. As I cautioned in Chapter 1 (page 7), *correlation is not causation*. One needs to consider as many other aspects and pieces of evidence as possible.

Historical Ecological Perspective.

The major effects of Holocene climate change -- sea level rise and the ensuing formation of the Chesapeake estuary-- resulted in turn, in the transformation of the tributary rivers into sub-estuaries. Major effects of the tributary rivers decanting into the fully embayed Chesapeake were a slowing of river flow, broadening, the acquisition of a salinity gradient and progressively becoming tidal. The Rappahannock developed conditions appropriate to host spawning anadromous fish and other estuarine species. One premise of Historical Ecology is that historical events are responsible for major changes between human societies and their environments (Balée 1998:13). From the perspective of Historical Ecology, the slowing and broadening of the Rappahannock River to afford suitable conditions for anadromous fish, can be considered an historical event. The evidence discussed above indicates that the arrival of a major new resource for subsistence, anadromous fish, was contingent on the river's slowing.

Following the above events, Site 2 would have become an ideal location to harvest anadromous fish such as American shad on their way to spawn in freshwater reaches of the river, such as Millbank Creek, which enters the Rappahannock directly adjacent to Site 2. Spawning generally occurs beyond tidal influence (O'Leary and Kynard 1986). The Rappahannock became tidal gradually over time; it did not become tidal near Site 2 until approximately 1000 years ago (Reeder-Myers, personal communication). Site 2 would have had access also to the wetlands that formed along the Creek as the river broadened and slowed and to the new plant and animal resources afforded by the wetlands. These environmental changes afforded multiple new possibilities for human activities. In particular, opportunities for many new types of riverine and marshland subsistence resources would have become available.

To gain insight into what decisions the Indigenous population made in the face of these changes and opportunities, I turn to information provided by the archaeological record. I ask whether the archaeological evidence suggests that the Indigenous population decided to take advantage of these new resources, and if so, how?

<u>The Archaeological Evidence.</u>

How does the hypothesis that the occupation of Site 2 was due to increased riverine resources that were contingent upon the historical Late Archaic event of slowing river flow-rate, agree with the archaeological evidence from Site 2 presented in Chapters 2 and 3? The timing of major occupation of Site 2 was evidenced by analysis of time-sensitive, hafted bifacial tools. The most abundant single point type at Site 2 is the broad-bladed, Savannah River point (Figure 2.8), whose time of use dates broadly from 4800 to 3200 years ago (Egloff and McAvoy 1990; Egghart 2014).

Analysis of the Site 2 large tool assemblage gave an overview of site activities. The assemblage was diverse as described in Chapter 3 (Figure 3.1). It included tools for hunting, butchering, food preparation, food milling, hide-working, lithic tool-making and wood-working. The tools indicated in wood-working are of special interest. Twenty-nine axes were found at Site 2. Of these, nineteen were fully or three-quarter grooved, ground-stone axes. Twelve were of impressive size, 150-225 mm in length weighing up to 2 kg and seven were smaller, 80 to 150 mm (Figure 4.7).

Figure 4.7 Large (upper) and medium-sized (lower) grooved, ground stone axes from Site 2.

McLearen (1991:99) notes that grooved, ground-stone axes first appeared in the Virginia archaeological record in the Late Archaic Period. The ten chipped-stone axes in the Site 2 assemblage, are typically associated with the earlier Middle Archaic Period (McLearen 1991:99). Since chipped-stone axe technology had existed already for thousands of years, I question why axe technology changed in the Late Archaic Period and why there were large numbers of the new ground-stone axes at Site 2? Dent (1995:182) notes also an increased production of other ground-stone tools in the Late Archaic including celts, gouges and adzes that could have been used in woodworking in addition to grooved, ground-stone axes. Celts and adzes for wood working were also found at Site 2 (Figure 4.8). Together these indicate increased timbering and woodworking activities at Site 2.

Figure 4.8. Adzes and celts from Site 2.

How to Consider the Archaeological Evidence

I hypothesize that the presence of nineteen grooved, ground-stone axes along with adzes and celts, which are characteristic of the Late Archaic Period, indicate development/adoption of new technology by the Indigenous population to take advantage of the proximate arrival of anadromous fish in the Rappahannock River. A substantial new riverine subsistence resource, such as shad would have provided a strong incentive for Indigenous populations to decide to adapt existing, or adopt new, technology. There are several potential reasons for increased production of axes. A primary reason would be for tree-felling. Timber would be needed for multiple activities: traditional ones of shelter construction (perhaps for increased numbers of people) and/or new ones associated with arrival of new riverine resources. Timber could be required for woodworking to build new or additional watercraft. Watercraft could be used for travel on what was now a less rapidly flowing, more safely navigable river, or for gaining access to riverine resources such as large fish, harvested perhaps by harpoon or net. Timber may have been needed for construction of fish weirs to enable fish harvest. If fish harvesting was successful, wood would be necessary for fuel to process large quantities of fish before they spoiled. Processing may have occurred at large hearths noted previously at Late Archaic Virginia riverine sites as indicative of the importance of anadromous fish to site location (Dent 1995:205). Alternatively, fish could have been dried or smoked on wooden racks built above fires. John White's drawings illustrate some of these practices (Hariot 1590, republished 2007). One artifact from Site 2 not mentioned until now, is a grooved cobble that has the characteristics of a net-sinker (Figure 4.9). Since nets for fishing were likely made of reeds or rushes, the remaining evidence for the presence of these biodegradable entities is notched cobbles which may have been used as net-weights (Sassaman 2010:167; Dent 1995:204).

Figure 4.9. Small artifacts from Site 2: Net-sinker as indicated.

Net-making is a traditional practice of the Rappahannock Tribe, as will be discussed in the following Chapter 5, and the presence of a candidate net-weight at Site 2 adds another piece of evidence to the case for riverine location due to arrival of new resources.

Considering the Evidence as a Whole

The production of new technology, such as the new tool types, grooved ground-stone axes, celts and adzes and their potential use in timbering and woodworking as discussed above, has been considered previously predominately from the viewpoint of technology development as emerging from adaptation to new environmental conditions.

Sassaman (2010:xvi), Dobres (1994:215), Dent (1995:14-15) and others urge a change in this view. Dobres (1994:211-215) and Sassaman (2010) offer the opinion that technology is more than the means of making tools. It should be considered in terms of agency. They support consideration of social interactions as a basis for cultural variation and change since strictly ecological approaches restrict understanding of the agentive roles people play in making decisions and transformations.

Sassaman (2010:xvi) supports the use of theories "derived from observation of situated cultural practices." He suggests drawing from theories of agency, practice, and historical processualism. His view is that historical practice is the basis for group identity and action, processes "rooted in experiences of encountering and then rationalizing the unknown." Dobres' (1994:211-212) work supports the understanding of technology as an integral part of social reproduction and change. She defines technology as... "not only the material means of making artifacts, but a dynamic cultural phenomenon embedded in social action, worldviews and social reproduction." Pauketat (2001:74) furthers the perspective saying that 'practices,' people's actions and representations generate change. He sets the stage for this perspective by building from the idea that Bourdieu's (1977) practice theory and Gidden's (1979) agency theory are basically that "all people enact, embody or re-present traditions in ways that continually alter those traditions" (Pauketat 2001:79). Pauketat (2001:87-88) further states that "History is the process of cultural construction through practice." He explains that a theory of practice makes history; the idea of practice focuses on creative moments where change was generated. He views material culture as a dimension of practice that is causal as it is an act "that brings changes in meanings, dispositions, identities, and traditions."

Numerous considerations need to be melded together at this point. The first is that the archaeological evidence of time-weighted point frequency used as a proxy for population shows that the population at Site 2 on the Rappahannock River increased by 3-fold above its Middle Archaic level approximately 4500 years ago, roughly at the same time that the new forms of ground-stone technology appeared. These changes correlate with environmental changes that transformed the Rappahannock River into a sub-estuary and slowed its flow rate, an historical event. Further, contingent upon the change of flow-rate, the Rappahannock River was altered to form a habitat suitable for anadromous fish spawning. The analysis of site location, the new types of tools, and the reasons suggested for new tool technology combine to support the idea that increased occupation of the riverine location of Site 2 at the mouth of a freshwater creek was associated with arrival new wetland and riverine resources such as anadromous fish.

Changes to Practice and Landscape

The extensive nature of the new tool technology discussed above, the well-crafted nature of the axes, celts and adzes and their postulated roles in timbering for shelter construction, boat-building or weir construction along with development of methodology for harvesting and processing proposed fish harvests, all combine to indicate substantial technological innovation and change on the part of the population inhabiting Site 2. The extent of change in technology suggests purposeful decisions to alter or improve existing practices.

For example, consider the differences between the predominately Middle Archaic chipped-stone axes (Figure 3.2) versus the Late Archaic ground-stone axes shown in Figures 3.3. and 4.7. The even, sharply-ground cutting edges of the ground stone axes would have improved accuracy and felling efficiency and likely reduced overall timbering effort. I speculate that once the new ground-stone cutting edge had been produced and tested, that the practice of axe-making altered forthwith to producing axes with a hard, sharp, even cutting edges to reduce the work of tree-felling. It follows that the maker of that change would share the news and (proudly) share or demonstrate the method of production and that henceforth the practice of axe-making would be altered. In the terms of Pautekat (2001:79), the tradition of axe-making would be re-presented in a way that altered it. Production of ground-stone tools such as the axes at Site 2 was a time-consuming process (Adams 1996). I conclude that these tools were highly valued because fifteen of the axes found at Site 2 were found together in a cache. Likely such large, heavy tools were not carried when individuals undertook seasonal moves. Knowing that the tools functioned well and required much time and effort to make, they may have purposively been stored in a safe place against projected return at a later time. Alternatively, Sassaman (2010:98) points out that the Eastern Archaic has many different examples of symbolic expression in acts of making, gifting and depositing objects. Context of deposition has been used to infer if objects had value beyond practical, for example, as in burials. But, artistic refinement, labor investment, or rarity of material could all be relevant to deposition in a cache. It would be interesting to known why this cache of fifteen axes was not recovered until the 1970s.

Another aspect to infer from the increased production of a new type of axe relates to the effects that the decision to improve and increase timbering would have on the landscape. The timbering indicated by the sizeable axes alone would have resulted in an anthropomorphically altered landscape (Balée and Erickson 2006). The felling of large trees would have opened the landscape, allowed more light to reach the once-forest floor and new or existing types of plants could begin to flourish as has been noted before in anthropomorphically altered environments (Erickson 2010; LeeDecker and Koldehoff 1991). The landscape alterations resulting in new or increased plant species might also attract or support new species of animals.

These actions and their downstream effects represent extensive innovations; they represent far more than a minor, routine improvement on a current technology. Considered together, these changes appear to involve the institution of a new subsistence lifeway. They indicate purposeful decisions by the population to develop or adopt new technological practices that would allow them to take advantage of the new resources. Likely these cultural changes occurred gradually, over an extremely long, perhaps millennial, time-scale, as did the environmental changes. How decisions for change were made in a relatively egalitarian hunter-gatherer society, whether community-based or individual, is a question that is difficult to address based on the available evidence.

Did the technological innovations arise *de novo* or were they imported? Dent (1995:201-202) is of the opinion that at least a portion of the impetus came by importation or exchange of ideas between people, likely up the south Atlantic slope. He says "To my mind the intensification effort (his term for the Late Archaic changes preceding the time of increased sedentariness) was a lifeway whose foundation rested as much on new ideas as it was an adaptational system taking advantage of recently stabilized, ecologically productive coastal areas. This lifeway, in this perspective, was both *historical* and *ecological*" (Dent 1995:201, his emphasis).

Marquardt (2010:271) is of the opinion that the ways people chose to react to environmental challenges or opportunities had to do with their beliefs and histories and that "...knowledge of both sociohistorical and physical structures, in their dynamic interaction," will be necessary to understand the Archaic to Woodland transition.

I tend to agree with Marquardt; there is not enough evidence at this point to give a reliable opinion on whether the innovations and new lifeways were the original design and choice of the individuals who chose the site, or if they were influenced by exchange of ideas from other regions. The riverine location of Site 2 would afford excellent opportunities for travel and exchange of ideas, information, technology, mates and goods. However, the data presented and analyzed comes from only two sites in the same region. The people at these sites made their particular choices. Another aspect that emerges from these studies is that the occupation and re-occupation of Sites 1 and 2 over the Early, Middle and Late Archaic and on into the Woodland periods shows habitual use of these sites and suggests an attachment to place.

In summary, I conclude that the response of the people living along the Rappahannock River to the transition of the River from free-flowing to slower and meandering after Chesapeake embayment, which enabled arrival of new riverine resources and wetland areas, was not a mere adaptive stimulus response, but rather the product of agentive human choices and shared social knowledge. Evidence for trade networks based on non-local lithic materials for example, may be able to shed light on this question in future work.

In the following Chapter 5, I consult with the Rappahannock Tribe concerning how the ideas and conclusions presented above may be of use to their oral history.

Chapter Five

Indigenous Archaeology: Consulting with the Rappahannock Tribe

"In conducting research, we can sometimes forget the people behind the creation of the archaeological record and that the materials they left behind continue to inform the ways in which people and communities understand themselves today. The record is more than a static remnant of the past to study, it teaches us about the here and now" (Spivey 2018).

Introduction and Background:

The initial questions addressed in my thesis were formulated before I was aware of the importance and practical aspects of Indigenous archaeologies and the effects of colonialist methods on construction and interpretation of the archaeological record. A course in Indigenous Archaeology (W&M, Dr. Spivey) presented these issues and emphasized the importance of indigenous people's ability to have control over the archaeological and political use of their pasts (Bruchac et al. 2010). The work of anthropologists, such as Speck (1925, 1946), Hantman (2018), Gallivan and Moretti-Langholtz (2007), Spivey (2017), and Strickland et al. (2016) exemplify various approaches to practicing indigenous archaeology in Virginia. The work of these scholars prompted me to initiate and include here a conversation with The Rappahannock Tribe with regard to the research in this thesis.

Consulting in Relation to Thesis Research

There is a legal mandate to conduct government-to-government consultation with Indigenous descendants to comply with the National Historic Preservation Act (NHPA) of 1966 and the Native American Graves Protection and Repatriation Act (NAGPRA) of

1990, and other federal legislation affecting research in any areas that are Federally connected, managed, or affected by federal funding, or review.

In contrast, there is no legal mandate to consult with the descendants of sites that lie on private lands, such as the lands my research investigates. However, as an archaeologist, I have an ethical responsibility to do so. Silliman and Ferguson (2010: 48) point out that archaeologists have an ethical mandate (described in the SAA "Principles of Archaeological Ethics") to consult the descendants of the people who lived in the archaeological sites they investigate.

In addition to ethical considerations, I see substantial positive aspects to consulting and/or collaborating with descendant groups of the area where one works. Many of the articles in *Indigenous Archaeologies* (Bruchac et al. 2010) point out that failure to consult or collaborate with descendant communities often yields a one-sided, incomplete interpretation of data. Silliman and Ferguson (2010:52) say that archaeologists "in the participatory mode," invite descendant groups to be involved in research, and although they develop the goals themselves, they invite descendants to have a voice in interpretation. This develops a more nuanced understanding and interpretation; it works towards "multivocality." Silliman and Ferguson (2010: 52) also point out the view expressed by Colwell-Chanthaphonuh and Ferguson (2008), of collaboration as occurring on "a continuum of practice from resistance, to communicating research plans, to full-fledged involvement of descendent groups in the design, implementation and interpretation of results." However, in the situation where I sought input after designing the research, I kept in mind the opinion of Silliman and Ferguson (2008: 61) that they found archaeology could give back to descendant communities in a number of ways including simply direct sharing of knowledge resulting from archaeological studies. Knowledge, in their opinion could be used for "cultural preservation, resource management, site protection, alternative histories, repatriation efforts, economic incentives, political capital, education, and more" (Silliman and Ferguson 2008: 61).

Failure to consult or attempt to collaborate on archaeological research in light of the lessons from the Indigenous Archaeologies course, now seems to me to be an act of omission that fails in respect for the modern-day people who are descended from those who left a record of their past. I hesitated at first to make contact because I felt my project was too small to be of use to anyone. However, Silliman and Ferguson (2008: 60) address this question in the following statement. "Archaeologists should not assume that their research does not "do work" in the political and cultural world, and that they are powerless to silence or summon important histories and objects. Doing archaeology as anthropology necessitates paying attention to the living people descended from the past and not just to the past" (Silliman and Ferguson 2008: 60).

In evaluating how to make up for the lost opportunity to consult *prior to* designing and beginning my thesis research, it seemed that a logical option remaining was to seek input and involvement on my project at the level of interpretation of results.

The questions I investigated in my thesis work concern the deep history of the people who inhabited the Rappahannock River Valley during the Archaic Period. It is not possible to know with certainty which modern-day Tribes descended from the Archaic Period peoples who inhabited the mid-Rappahannock River area. I decided to contact the Rappahannock Tribe, whose name translates roughly to "People of the land where the waters ebb and flow," (Ragan 2006: 14). The sites that are investigated herein are in the mid-Rappahannock River tidal reaches at a point where there is an average two-foot rise and fall of the daily tides.

I contacted Chief G. Anne Richardson, Chief of the Rappahannock Indian Tribe, and requested an opportunity to gain Rappahannock Tribal input. She replied in the affirmative. On April 5th, 2019, I met with Chief Richardson and Tribal Council Chair, Barbara B. Williams at the Rappahannock Tribal Center in Indian Neck, Virginia. They were welcoming and extremely helpful and forthcoming.

I described the scope and goals of my project as an analysis of unstudied lithic collections from a small number of Rappahannock River sites to gain knowledge of settlement patterns and factors involved in site locations over time and space during the Middle and Late Archaic periods in the face of climate change and overall transformation of landscape, fauna and flora. I asked: "What might be the tribe's interests in learning more about their deep past? How might studies of Archaic Period settlement patterns along the Rappahannock River be of use to the Rappahannock Tribe?" and "What aspects of an archaeological study of Archaic Period settlement as considered in light of the extensive climatic and environmental changes through time might be of value to the Tribe?"

Chief Anne had only a short time to spare due to duties at an ongoing meeting, but Ms. Williams gave me a detailed and thoughtful interview. She provided valuable insight into what the Rappahannock Tribe would like to gain from archaeological investigations. In brief, after years of not being acknowledged in many archaeological studies, they now want to take advantage of the knowledge of modern archaeological studies. Their goal is to learn what scientific studies reveal of their past, in particular in relation to their oral history.

One reason for the Tribe wanting scientific knowledge of their past was particularly striking. Young people are reluctant to reveal to their friends and schoolmates that they are of the Rappahannock Tribe; they are often accused of "making it up" with regard to their deep history, or that elements of their past are not true. Modern archaeological confirmation of their past would provide the evidence to dispel such accusations.

Barbara Williams described a set of questions and explanatory comments that could be of use to the Rappahannock people in confirming their oral history. Her questions and comments follow (these are based on my notes; they are not direct quotations, so her questions are indicated by italicized type font). Her list was not ordered by subject; I grouped the questions and comments into related areas and indicated groups of questions on which my research might be able to shed light. I sent the list of questions back to Ms. Williams by email after I transcribed it and asked her to review the accuracy of my note-taking. She and Chief Anne both reviewed the questions and said they were accurate reflections of their interest.

General Overview of Questions my Research could Address

My research considered the environment and landscape topography of sites occupied during the Middle Archaic and Late Archaic Periods. I carried out geospatial analyses of the topography of sites used predominantly during the Middle Archaic or the Late Archaic and correlated site characteristics with changes that occurred in the environment over time to ask why sites were occupied at differing times. For example, would there have been an environmental advantage of one site over the other with regard to shelter, position relative to the river, streams, marshlands, or habitats for animals, plants, and aquatic life such as spawning anadromous fish? The work is based on archaeological analyses of lithic collections, combined with data on climate change, sea level rise, temperature, and their overall effects on the landscape at different time periods. The research described in Chapters 1 through 4 provides broad answers to the first eight of the environmentally-related questions in the following Group 1.

Questions of Interest to the Rappahannock Tribe

Group 1. Questions related to the environment and how its change through time may have influenced settlement.

1. Did early Rappahannock settle near dry land, by rivers or streams?

2. How did climate affect us?

3. What was available as far as marine life, animal life?

4. What sort of animals may have been abundant then?

5. What sort of marine and animal life occurred then versus now? What survived and did not survive?

6. There were more trees then; were the trees the same or different? How has the vegetation changed? What was available as far as types of plants, berries, herbs?

7. Can you correlate the influence of the environment and subsistence trees/animals /fish/mollusks over time and how it changed?

Comments regarding climate and change:

8. They are now are on their winter hunting ground. Previously Fones Cliff area was their summer location for fishing. Because of weather/climate they moved inland in the winter and hunted. Put it all together - how change affects life - come back to them to help verify their oral history.

Questions regarding early peoples that are outside scope of my research:

9. What's known about early people and what sort of location they moved from?

10. Did that location change so they had to move in order to survive?

11. Did early people bring things with them or find things to adapt to the area?

12. Did early Rappahannock grow things, cultivate things, bring seeds?

<u>Comments regarding early peoples:</u>

Young people want to know what were the steps that were taken to come to Virginia and the climate and how it affected the moves? They want verification of whatever is found as confirmation of what is known from oral history. They would like to verify who they are and where they came from and how they survived.

<u>Group 2. Comments relevant to confirming oral history.</u>

All these years and the Rappahannock people survived the colonial period. They had wanted the English to learn from them - how to survive - and, to learn from the English. They tried to teach them corn planting.

Now is the time for them to have the scientific knowledge of archaeologists to verify all that has been told to them. It is important for the next generation to see indicators and artifacts that inform on and substantiate their oral history.

They need to let others know they were not left behind; they've always been here and been part of the history. There used to be no property - they took care of each other and took care of the land and the land took care of them.

The history of the Rappahannock people was suppressed and one-sided. Now they need to get it (their history) out. They used to be afraid that if developers found out how nice their land was, it would be taken; they were afraid of developers, they tried to keep everything natural.

The Rappahannock people want to verify their history and tell their history the way it should be told and not altered. They feel people will be interested in how they do things and they would like to invite the public to understand their history from the beginning. They do not want to be afraid to talk about it.

<u>Group 3. Questions asked that my research cannot address.</u>

In general, questions related to the subsequent Woodland Periods are outside the scope of my project. They are however, within that of Dr. Julie King's ongoing work on the Rappahannock Indigenous Cultural Landscape study that is under way and actively involving the Rappahannock Tribe (Strickland et al. 2016).

How did earlier people make symbols? Did they write, put marks on anything -shapes or images?

What is known about spiritual life - a creator for all? They respect the land their creator provided; their ethic is to take care of the land and it will take care of them.

What was used for religious ceremonies-they use pipes and drums and dance now- what else?

What is known about crafts? They do bead work. Originally it (bead work) was all with shells because they were located by the river. However, once they started to trade with Europeans, they began to obtain beads.

Also, the Rappahannock people would like to know what kind and type of wares they had and where they found clay?

What sort of living quarters were used for shelter?

Ms. Williams' statement that the Tribe desired knowledge - archaeological evidence of their past - to evaluate with respect to their oral history and the questions of specific interest that she provided (above) gave valuable focus when evaluating my results. Many of the comments about the tribe's past resonated with the issues raised in *Indigenous Archaeologies* by Bruchac et al. (2010). Much of what they know about their past has come from colonial records and accounts. These records and views are one-sided; they do not give the Indigenous perspective. Archaeology offers what can be an unbiased perspective, especially if done collaboratively and interpreted with Indigenous perspective. They desire knowledge of their deep past; their oral history does not extend into the Archaic Period.

Communicating Research Findings

In considering how best to share my research results, I consulted with Barbara Williams and Chief Anne Richardson. I asked if they, and any other Tribal members would like a draft of the thesis or if they would like me to come to them and give a presentation describing the work? They opted for the latter, which hopefully, would maximize information transfer while minimizing the time in acquiring it.

On March 5, 2020, I met with Chief Anne Richardson and Tribal Council Chair Barbara Williams and presented the goals of the study, its background, the key data and then summarized and tied together the results and conclusions I inferred from the data. I tried to present the strengths as well as the limitations of the research. Staph and Burney (2002: 119) say that "Consultation is an enhanced form of communication which emphasizes trust, respect and shared responsibility. It is an open and free exchange of information and opinion among parties which leads to a mutual understanding and comprehension."

At the end of the presentation I reviewed the original questions Barbara Williams provided and together, she, Chief Anne and I discussed how the research addressed the questions. In brief, the work described in Chapters, 2, 3 and 4 was able to provide insight into the first eight of their questions that related to the effects of climate change on environment, flora, fauna, landscape and settlement over time. They were especially interested in my conclusions regarding the effects of sea level rise and Chesapeake embayment on river flow rate and the importance of flow rate in enabling the arrival of anadromous fish and the formation of wetlands. That information coupled with the fact that it could indicate a broad time-line for these events was new to them and the findings were relevant to understanding their past. Chief Anne asked for a copy of the thesis and whether she could use the information contained therein. I said I intended to make it all available to them and will provide the completed document. I mailed a copy of the slides containing the data and conclusions presented to Barbara Williams following our meeting.

Following the presentation and initial questions, I asked for their interpretations, insight, input or alternative ideas concerning the inferences made from the data. The following comments and recollections by Chief Anne Richardson and Tribal Council Chair Barbara Williams are based on my notes and a partial recording of the conversation that both agreed to me making. Both Chief Anne and Barbara Williams have reviewed this chapter and given written agreement to its contents and use in this thesis.

Based on her understanding of Tribal history, Chief Anne said life in their past had been cyclical; they occupied lands near the river early on (prior to European arrival) and fished in spring and summer and then moved inland to hunt in the winter seasons. They could offer little in the way of interpretation of stone tool uses. However, Chief Anne showed me fishing equipment such as she remembered her parents and grandparents making and using. The Tribe established a program called "Back to the River" which engages young people in learning traditional practices, for example, use of medicinal herbs or the construction and use of fishing tools such as fish weirs and nets (Figure 5.1). The weir shown in Figure 5.1 is small. Chief Anne said that in her youth such weirs were used to trap herring, not shad and she remembered these sorts of fish weirs as similar to computers today: "there was one in every home."

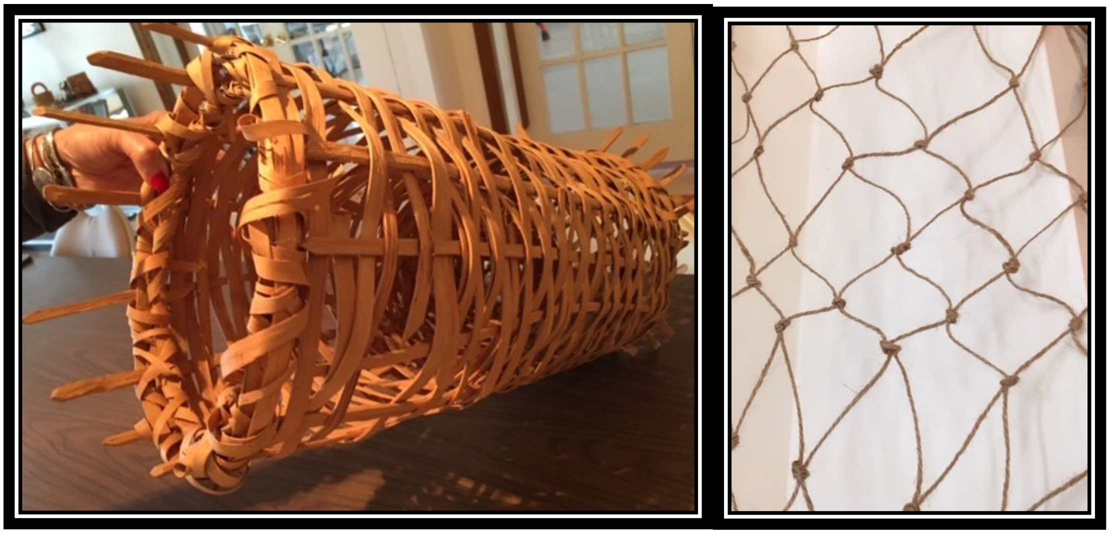

Figure 5.1. Fish weir made of willow bark strips, left, hand-woven net, right.

Chief Anne's recollection that the Rappahannock people were trapping small herring and not American or Hickory Shad in the 1900s was likely due to the Rappahannock River being dammed (Free Lance-Star 2004). It was dammed first in the early 1800s, in a failed attempt to make a canal connecting the Piedmont to Fredericksburg, and then again in 1855 to generate a canal through Fredericksburg. In 1910 the Embrey dam was built near the Fredericksburg fall line. The Embrey dam blocked anadromous fish from migrating upstream to the freshwater reaches of the river to spawn as they had previously. In 2004 the Embrey dam was blown up. Shad are now returning to the Rappahannock River. Prior to dam construction, shad had been abundant in the river and colonial-era reports indicated they were a substantial subsistence resource (Free Lance-Star 2004).

Chief Anne, Barbara Williams and I discussed the fact that over the time following English arrival, the Rappahannock people had moved their location of residence many times. I insert the following two-page summary of those moves based on historical records to give context to the rest of our conversation.

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<u>A Brief Summary of the Rappahannock Peoples' Responses to English Presence in the Rappahannock River Valley</u>

Speck et al. (1946: 1-3) spent time with Rappahannock families in the Indian Neck area during the first half of the 1900s and recorded ways of life and memories of past practices. At that time, and for an estimated three generations past, agriculture had become a major way of life for most of the Rappahannock people. However, they continued practices of trapping, hunting and fishing. Speck et al. (1946; 14-16) concluded on the basis of conversations, archaeological findings, maps, documents and place names, that the Rappahannock people, like the Mattaponi and Pamunkey Tribes, had a culture that had focused on the river prior to English arrival. He supposed their riverine location was lost by the preemption of the fertile, river lowlands by arriving English. Speck et al. (1946) reasoned, based on the location of 34 villages on the north bank of the Rappahannock, with only seven on the south bank and none located opposite major named villages, that this gave weight to the idea of Rappahannock hunting grounds lying on the south side of the river, roughly opposite their villages on the north side of the river. When pressure from increasing English presence threatened their way of life along the north bank of the river, the Rappahannock people removed to their traditional hunting grounds on the south side of the river (Speck 1946: 16).

Much of this scenario has been substantiated by colonial records (Beverley, 1947; Ragan 2006; Rountree 1990). The Rappahannock River Valley was relatively free of colonial invasion until the 1650s. In contrast, the James River Valley and areas surrounding Jamestown had been settled so heavily that Opechancanough, brother of the deceased Powhatan, let a major revolt in 1644 protesting the English usurpation of Native lands. In response to the revolt, Governor Berkeley enacted a Treaty of Peace in 1646 that demanded no English settle north of the York River; it was a felony to do so (Hening, Statutes of Virginia 1:323). However, England was in the midst of a civil war. Cromwell defeated the Royalists in 1645 and Charles I was beheaded in 1649. Royalist supporters fled to Virginia for safety. Approximately half of the new patents to Royalists were in the Rappahannock River Valley (Warner 1965). The Treaty of Peace of 1646 was repealed; English moved into the Rappahannock River Valley (Rountree 1990; Warner 1965).

During the 50-year period following the breaking of the Treaty of 1646 and the beginning of the influx of new English settlers, the Rappahannock Tribe reacted in several ways. Initially, they sold some of their land to the English and made a minor relocation, but subsequently, they relocated three more times (Warner 1965). In response to events catalyzed by increasing colonial expansion on the Rappahannock River, the Rappahannock Tribe relocated their place of residence four times between 1650 and 1699. There were a multiplicity of pressures and tactics used by the English in their efforts to gain the desirable, cleared agricultural land of the Native Americans (Ragan, 2006; Rountree 1990; Warner 1965).

A recurring feature of the Rappahannock moves in response to colonial pressure for their riverside lands, was to move to some of their other traditional lands. Three of the four moves they made involved movement to other parts of their own traditional lands. These were places where they could take advantage of their knowledge of the landscape and still use some of their seasonal rounds of subsistence practice (Ragan 2006).

In overview, it appears that the Rappahannock actions during the period of colonial invasion can be interpreted as a purposeful strategy to avoid dangerous conflict, to seek locations with adequate subsistence resources and to obtain seclusion and safety to the degree possible. For example, the Rappahannock did not participate with Opechancanough in his 1644 revolt against English expansion, nor did they take part in or sign the treaty of 1677 (Ragan 2006; Rountree 1990). While it is never possible to know and understand past events with certainty, a plausible case can be made for the Rappahannock taking initiative (as a tribe, or by a leader and her Council) to place themselves in sequestered locales and to purposely distance themselves from colonists and avoid conflict. This interpretation disagrees with some historic accounts of displacement or disappearance (Beverley, 1720; Rountree 1990). Instead, I consider the Rappahannock's relocations as a strategy to protect themselves from colonial invasion. This is consistent with the fact that the Rappahannock Tribe exists today and has their Tribal Center located at Indian Neck, VA on lands that were once a portion of their hunting grounds on the south side of the Rappahannock River. Today, they have been Federally recognized and are actively consulting and collaborating with archaeologists with the goal of gaining the evidence on their past.

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In our conversation on March 5, 2020, Chief Richardson referred to the Rappahannock's resilience and strategies for survival during extremely challenging and dangerous times. She said they have always been an independent tribe. They associated with other Tribes, but they were independent thinkers, they looked at their situation and what was best collectively for their people. Chief Anne said decisions about things like when to move at various times (referring to moves such as described above) would have been collective decisions by the Council, because that is how decisions are made. They always have been a close-knit group that listened to everyone. They made decisions based on what would be best for most people. Chief Anne and Tribal Chair Barbara Williams described the decision-making process currently in use by the Tribe and its leadership Council as follows: for major decisions, the Tribal Council considers the decision to be made in light of the effect it will have on seven generations of the tribe going forward.

With regard to survival as a Tribe within the past 150 to 200 years, Chief Anne and Barbara described that the tribe developed a strategy of scattering to different locations at different times for different reasons. For example, people moved when oppression became severe following the Civil War and Native Americans were being hunted down, or in the 1920s when racial prejudice increased and it became illegal to identify oneself as "Indian." When Native Americans were under stress of being erased as a people and there were no jobs locally, then some members of the Tribe would move north to find jobs. To survive they needed to have finances to fight for their rights as a tribe. They needed to be able to hire lobbyists and lawyers to present their case for recognition in Washington, D.C. and Richmond, VA.

At times like that, families came together and decided who was going to go north and get jobs to be able to send funds back so they could hire people to fight for them. Barbara Williams described this from first-hand knowledge. She grew up in New Jersey, the third generation of her family that had moved north to find work. Originally her grandfather on her father's side of the family had moved there when no jobs were available in Virginia. The family sent money back to help out with lawyers' fees in the fight for recognition. When her parents married, they lived in New Jersey and did the same thing. Barbara remembers her immediate family stayed in touch by coming back to Virginia and the community at Indian Neck for every holiday and vacation they could manage. Those visits helped her know her family and become involved with their community. A similar pattern happened with other families at other times, for example during and after the Civil War, families moved north for jobs and safety and these and other patterns and strategies for survival were repeated again and again over the years. They would divide up and then pool their resources to fight for everyone.

In summary, the Rappahannock have been a resilient and strong people who have employed a variety of strategies and decisions to maintain their existence as a Tribe in the face of extreme and uncompromising circumstances.

Chapter Six

Conclusions

The studies described above detect a change in Virginia mid-coastal plain population demographics at two sites along the Rappahannock River from an upland-type site in the Middle Archaic to a riverine associated location in the Late Archaic period. I assess the reasons for these changes using the research framework of Historical ecology by considering overall environmental data in conjunction with paleoclimate, biological and archaeological information. Specifically, I take into consideration long-term climate change, sea-level rise, its role in formation of the Chesapeake Bay and the resultant effects of embayment on the landscape of tributary rivers entering the Bay. I present a line of reasoning that links the change in choice of settlement location to the availability of new riverine and wetland resources. I also deduce a rationale and broad time-line for the transition. Then, I couple this information with the archaeological findings to examine Indigenous actions and the choices they made relevant to settlement, subsistence and technology in the face of environmental change.

The archaeological work described here was enabled by taking advantage of previously un-studied, privately-held lithic collections, lithics being a main source of information for the Archaic Period. These collections were from known sites and were made by repeated annual survey over three to four decades. The first question I addressed was whether such privately-made collections could yield reliable information. Private collections, often referred to as "avocational collections" (a regrettably pejorative term) often have not been used by archaeologists for fears that lack of exact provenience or survey design may compromise the evidence. Shott (2017) and Pitblado (2014) have addressed this and concluded, as I do here, that private collections can and should be considered and used *if* they are of reasonable provenience and made by multiple, repeated surveys. Failure to take such collections into account can result in loss of information.

In contrast to Shott's work (2017) addressing the reliability of private collections by comparing them with professional surveys, I addressed the question of private collection reliability by finding two collections from the same site in the mid-Rappahannock River Valley that were independently-made by repeated annual survey following tillage. The evidence presented in Chapter 2 shows that the abundance and composition of time-sensitive, diagnostic projectile points from two independent private lithic collections from the same site were similar whether points were analyzed by type or by attribute as a function of time. The frequency data were statistically significant. Together, these data indicated that the collections were valid samples of the larger population and an appropriate source for further study.

I used the combined information from the two collections (from Site 1) that had been examined for reliability and another large, similarly-made private collection from a second site (Site 2) also located on the north bank of the Rappahannock River, as the foundation for the subsequent studies described here. The collections were used first as archaeological proxy to determine relative population levels at the two sites over time. These analyses showed that collections from the two sites along the Rappahannock River, although separated by only 2km, displayed a substantial difference in the proportions of temporally diagnostic projectile points through time. Time-weighted analyses of temporally-sensitive point frequency showed that both Sites 1 and 2 were multicomponent, having occupation during the Early, Middle and Late Archaic Periods.

However, Site 1 had its highest relative population level during the second half of the Middle Archaic Period, with declining levels over the Late Archaic, whereas Site 2 had a sharp increase in population to its highest level during the Late Archaic Period.

To evaluate why Site 1 was appropriate for increased settlement earlier than Site 2, and correspondingly, why Site 2 became a location appropriate for intensive Late Archaic settlement, I compared the overall topography, hydrology and environmental settings of the two sites by geospatial analyses of LiDAR images. These studies showed Sites 1 and 2 differ sharply in surrounding environment.

Site 1 exhibited a sheltered, level, upland nature with excellent solar radiation. Positioned at a stream junction, at the base of a steep hill surrounded by Eastern forest habitat, and having abundant lithic raw material, Site 1 had the combined characteristics that define an ideal site for Middle Archaic Period settlement (Gardner 1987; Dent 1995). Further, its lithic tools were predominately Middle Archaic, side-notched projectile points consistent with upland game hunting. Macro-stone tool analysis showed Site 1 had a diverse, evenly distributed assemblage including tools that could be used for hunting, food preparation, butchering, hide-working, wood-working and lithic tool-making. This diverse tool assemblage, when interpreted in light of a collector-forager mobility site-function model, (Binford 1980; Shott 1986) indicated that Site 1 served as a base camp, where many activities took place. It was likely a fall/winter base camp to take advantage of upland forest mast and game.

In contrast, topographic analyses of Site 2 showed it is adjacent to and oriented to the Rappahannock River. It is on level ground with a generally south, southwest facing aspect, receiving excellent solar radiation. It is located on a terrace above the river that slopes down on its eastern end to provide access to the river and to the mouth of Millbank Creek at the point where it empties into the river. The site has direct access to the river for transportation and harvesting of riverine resources. It also has direct access to the adjacent creek with wetlands affording plant and animal resources. Consistent with riverine and marshland resource exploitation, the largest proportion of Site 2 diagnostic bifacial tools are Savannah River projectile points, referred to as "broad-bladed" points and associated with the onset of the Late Archaic Period (Mouer 1991). Although Site 2 is multicomponent, having use during the Early, Middle and Late Archaic Periods, its highest relative population levels by far, were during the Late Archaic Period. The site characteristics, considered together with its large, diverse macro tool assemblage that included hammerstones, knives, scrapers, grinding bowls, grinding stones, drills, twenty-nine large axes, celts and adzes for woodworking, give evidence of multiple activities such as lithic tool-making, butchering, food preparation, hide-working, and extensive wood-working at Site 2. It likely was a large base camp or residential camp in use predominately during the spring /summer of the Late Archaic Period.

I next considered the choices for settlement at Sites 1 or 2 in view of long-term climate, environmental and landscape change and drew in paleoclimate and biological information. Specifically, I examined how and when the effects of climate change, sea-level rise and formation of the Chesapeake Bay impacted the landscape of the tributary Rappahannock River.

The moderating climate of the Holocene and glacial melt that caused sea-level rise, resulted in flooding of the ancestral Susquehanna River basin and formation of the Chesapeake Bay, turning it into an estuary. The Chesapeake estuary expanded to become fully embayed. Tributary rivers, such as the Rappahannock River, became sub-estuaries of the Bay. As a result of sea level rise and formation of the Bay, the tributary rivers underwent a substantial transformation. The basic course of the Rappahannock

River did not change, but, critically, as sea-levels rose, the river slowed down and broadened-out below the fall-line. This was because the river now decanted into the fully-embayed Chesapeake, rather than the free-flowing Susquehanna River. The embayed Chesapeake served as a "brake" on free-flowing exit. The major effects of sea level rise and resulting Chesapeake embayment on the portion of the Rappahannock River where Sites 1 and 2 are located in the inner coastal plain, were slowing of the river's rate of flow and broadening. The changes that resulted in formation of the Chesapeake Bay estuary occurred over an extremely long time-frame, one that covered essentially the entire Holocene era and the majority of the Archaic Period. In contrast, the changes that resulted in the slowing and broadening of tributary rivers and formation of new wetlands, took place over a relatively narrow (millennial) time span. Only *after* tributary rivers exited into the newly embayed Chesapeake did river flow-rate slow. Based on analysis of the rate of sea-level rise and the time it took to reach embayment, I deduced that the exit flow of the tributary rivers was affected in a steadily increasing manner from 6000 BP onward. Based on the final embayment rate, it is likely that river flow levels had slowed substantially by a millennium later, approximately 5000 years ago.

In general, Late Archaic settlement patterns have been considered to display a more pronounced riverine focus than the Early and Middle Archaic Periods (Hodges 1991: 223). Changes in settlement location and technology at the end of the Middle Archaic and into the Late Archaic have been interpreted as evidence for a response to new conditions focused on estuarine resources such as anadromous fish and newly enlarged wetland areas. However, the view that Late Archaic emphasis on riverine resource use was connected to anadromous fish runs is based upon little hard evidence (Dent 1995:208). There are few faunal remains of bones and only indirect evidence in the form of large hearths, perhaps for processing or drying catches, notched cobbles that could have been net sinkers and the (undated) remains of fish weirs along with the location of many sites at the mouths of major spawning streams (Dent 1995: 208).

I approached this question from a different perspective, I draw in paleoclimate and biological evidence to consider: 1) what were the environmental conditions in the tributary rivers that allowed development of conditions suitable for spawning of anadromous fish and 2) when did the rivers acquire such characteristics? Anadromous fish, such as shad, migrate from an ocean environment up rivers to fresh water sources to spawn in spring. Two main conditions are required for successful spawning and incubation of the American shad: these are water temperature and water current velocity. Temperatures between 14C and 19C are optimal; below 12 C or above 21C-22C are not tolerated. Additionally, eggs require a water velocity between 0.3 to 1 meter per second. If the current is too slow, the eggs suffocate in the sediment; if it is too fast they are not retained in the system (Bilkovic 2000:74-75).

Cronin et al. (2005:13-14) showed that springtime water temperatures in the Chesapeake region were suitable for spawning of American shad for the majority of the Holocene, certainly from 7800 years ago onward. Therefore, I conclude that the critical change that allowed shad to begin to use the tributary rivers of the Chesapeake estuary for spawning was the slowing of river flow. As described above, I deduced that river flow rates did not begin to slow substantially until approximately 5000 years ago. Thus, the convergence of river flow slow-down that could enable suitable conditions for shad spawning, and Late Archaic Period settlement emphasis on riverine sites can be considered as taking place in a *broadly* similar time frame.

Therefore, to the existing pieces of indirect evidence suggesting the riverine focus of Late Archaic Period sites was due to anadromous fish runs, I add the information that the Rappahannock River, while having an appropriate temperature for shad spawning for at least the past 7800 years, did not begin to attain the required rate of river flow to sustain shad spawning until after Chesapeake embayment caused tributary river flow-rate to begin to slow dramatically. I deduce this time to have been approximately 5000 years ago. Based on this reasoning, I conclude that a substantial reason for increased occupation of Site 2 during the Late Archaic Period, was availability of new riverine and wetland resources.

One premise of historical ecology's understanding of the relationship between human beings and the biosphere is that historical events are responsible for major changes between human societies and their environments (Balée 1998:13; Balée and Ericson 2006). From the perspective of historical ecology, the slowing and broadening of the Rappahannock River to afford suitable conditions for anadromous fish spawning can be considered an historical event. The evidence discussed above indicates that the arrival of a major new resource for subsistence, anadromous fish, was contingent on the river's slowing. I consider the slowing of the Rappahannock River as a change in the landscape of the River.

Following the above environmental and landscape changes, Site 2 would have become an ideal location to harvest anadromous fish such as American shad on their way to spawn in freshwater reaches of the river, for example at Millbank Creek, which enters the Rappahannock directly adjacent to Site 2. It also would have access to the wetland resources along the creek. To gain insight into what decisions the Indigenous population made in the face of these changes and opportunities, I turn to information provided by the archaeological record; does the archaeological evidence suggest that the Indigenous population decided to take advantage of these new resources, and if so, how?

The timing of major occupation of Site 2 was evidenced by analysis of time-sensitive, hafted bifacial tools. The most abundant single point type at Site 2 is the broad-bladed, Savannah River point whose time of use dates broadly from 4800 to 3200 years ago (Egloff and McAvoy 1990; Egghart 2014). The large tool assemblage from Site 2 was diverse; it included tools for hunting, butchering, food preparation, food milling, hide-working, lithic tool-making and wood-working. The wood-working tools are of special interest. Twenty-nine axes, as well as ground-stone celts and adzes were found at Site 2. Nineteen of the axes were well-made, grooved, ground-stone axes of impressive size, some weighing up to 2 kg. Grooved, ground-stone axes first appeared in the Virginia archaeological record in the Late Archaic Period (McLearen 1991: 99).

I hypothesize that the presence of nineteen grooved, ground-stone axes along with adzes and celts, all characteristic of the Late Archaic Period, indicate development or adoption of new technology by the Indigenous population to take advantage of the arrival of anadromous fish in the Rappahannock River. A substantial new riverine subsistence resource, such as shad, would have provided a strong incentive to decide to adapt existing, or adopt new, technology. There are many possible reasons for increased production of axes; a primary reason would be tree-felling. Timber would be needed for shelter construction or for woodworking for purposes associated with the arrival of new riverine resources. For example, to build watercraft for travel on a less rapidly flowing, more safely navigable river, to gain access to resources such as large fish, or to deploy nets for fishing. Timber may have been needed for construction of fish weirs to enable fish harvest. If harvesting was successful, wood would be needed to preserve fish by drying or smoking.

The population at Site 2 increased by 3-fold above its Middle Archaic level approximately 4500 years ago, roughly at the same time that the new forms of ground-stone technology appeared. These changes correlate roughly with environmental changes that transformed the Rappahannock River into a sub-estuary and slowed its flow rate. Contingent upon the change of flow-rate, the Rappahannock River was altered to form a habitat suitable for anadromous fish spawning. The analysis of site location, the new types of tools, and the reasons suggested for new tool technology combine to support the idea that movement to the riverine location of Site 2 at the mouth of a freshwater creek was associated with arrival new wetland and riverine resources such as anadromous fish.

The extensive nature of the new tool technology discussed above, the well-crafted nature of the axes, celts and adzes and their postulated roles in timbering, shelter construction, boat-building or weir construction, all combine to indicate substantial technological innovation and change on the part of the population. The extent of change in technology suggests purposeful decisions to alter or improve existing practices.

Another aspect to infer from the increased production of a new type of axe relates to the effects that increased timbering would have on the landscape. The timbering indicated by the sizeable axes would have resulted in an anthropomorphically altered landscape. Tree-felling would have opened the landscape, allowed more light to reach the forest floor and new types of plants could flourish as has been observed in other anthropomorphically altered environments (Erickson 2010). The landscape alterations might also attract new species of animals.

The actions described and their downstream effects represent extensive innovations; they represent far more than a minor, routine improvement on a current technology. Considered together, I conclude these changes involve the institution of a new subsistence lifeway, but one that took place gradually over time. They indicate purposeful decisions by the population to develop or adopt new technological practices that would allow them to take advantage of new resources. These cultural changes may well have been incremental, occurring cumulatively over a long time-frame, likely millennial, as did the environmental changes.

In summary, the multiple lines of evidence presented link a change in choice of settlement location from an upland deciduous forest area to a riverine area due to the proximate availability of new riverine and wetland resources.

I shared the findings about the deep history of Indigenous peoples on the Rappahannock River with the Chief of the Rappahannock Tribe and the Chair of the Tribal Council. I had consulted them about what portions of the work described might be of value to them. After years of not being acknowledged in many archaeological studies, The Rappahannock Tribe now want to take advantage of the knowledge of modern archaeological studies. Their goal is to learn what scientific studies reveal of their past, in particular in relation to their oral history. Much of what they know about their past has come from colonial records and accounts. These records and views are one-sided; they do not give the Indigenous perspective. Archaeology offers what can be an unbiased perspective, especially if done collaboratively and interpreted with Indigenous perspective. The Rappahannock Tribe desire knowledge of their deep past; their oral history does not extend into the Archaic Period. The information I provided gave evidence of Indigenous presence on the Rappahannock River from Paleoindian times. Further, the lithic evidence from Sites 1 and 2 showed occupation, and likely reoccupation, of these sites through the Early, Middle and Late Archaic Periods and on into the Woodland Period. These data indicate an attachment to place. Chief Anne Richardson asked for access to this data to use in their ongoing struggle to preserve information and sites of importance to their culture. All information will be given to the Tribe.

Appendix I

Table 1. Typology of Bifacial Projectile Points in Collections A, B and C from Sites 1 and 2

Period	Type	Collection A (Site 1)	Collection B (Site 1)	Collection C (Site 2)
Paleoindian	Clovis	0	3	0
	Hard-Dalton	0	0	0
Early Archaic	Palmer	2	3	2
	Decatur	3	3	5
	Kirk CN/Stem	1	1	0
	MacCorkle	1	4	0
	St. Albans	4	6	8
Mid-Archaic	LeCroy	0	5	4
	Kirk Serrated	12	11	11
	Stanley	4	8	11
	Cedar Creek	2	4	1
	Morrow Mt I	3	8	11
	Morrow Mt II	14	24	22
	Guilford	3	6	14
	Halifax	10	35	27
	OtterCr/Rowan	10	14	8
	Brew eared	1	1	8
	Brew CN	15	14	31
	Clagett	3	10	5
Late Archaic	Slade	0	1	25
	Bare Island	3	5	11
	Poplar Island	0	2	10
	Lamoaka	3	10	37
	Normanskill	4	2	7
	Savannah Riv.	18	30	110
	Cattle Run	5	0	8
	Koens Crispin	1	0	1
	Susquehannah	3	9	7
	Snook Kill	0	0	10
	Perkiomen	2	2	2
	Brewer SN	3	6	4
	Orient Fisht.	0	3	4
Early Woodln	Vernon	5	15	28
	Piscataway	3	9	21
	Calvert	2	3	6
	Wills Cove	0	2	6
	Adena	1	0	0
	Badin	0	0	4
Mid-Woodln	Rossville	0	0	13
	Potts	6	4	11
	Fox Creek	0	0	2
	Yadkin	0	1	13
	Jack's Reef	0	1	4
Late Woodln	Sm Triangle	3	3	8
Totals		150	268	520

Table 2. Time-Weighted Frequency Analysis of Collections A and B (Site 1).

Period	Date Range BP	Years	A Pts/Per	A Pts/1000Yr	B Pts/Per	B Pts/1000Yr	A+B Pts/Per	A+BPts/1000Yr
Paleo	15,000-10,000	5000	0	0	3	0.6	3	0.6
Early Archaic	10,000-8500	1500	11	7.3	17	11.3	28	18.6
Mid Archaic I	8500-6500	2000	16	8	24	12	40	20
Mid Archaic II	6500-4500	2000	61	30.5	116	58	177	88.5
Late Archaic	4500-3100	1400	42	30	70	50	112	80
Early Woodln	3100-2400	700	11	15.7	29	41	40	57
Mid Woodln	2400-1100	1300	6	4.6	6	4.6	12	9.2
Late Woodln	1100-400	700	3	4.2	3	4.2	6	8.5

Table 3. Time-Weighted Frequency Analysis of Collections A & B (Site1) with Collection C (Site 2).

	Date Range BP	Years	A+B Pts/Per	A+B Pts/1000Yr	C Pts/Per	C Pts/1000Yr
Paleo	15,000-10,000	5000	3	0.6	0	0
Early Archaic	10,000-8500	1500	28	18.6	15	10
Mid Archaic I	8500-6500	2000	40	20	26	13
Mid Archaic II	6500-4500	2000	177	88.5	127	63.5
Late Archaic	4500-3100	1400	112	80	236	168.6
Early Woodln	3100-2400	700	40	57	65	92.9
Mid Woodln	2400-1100	1300	12	9.2	43	33.1
Late Woodln	1100-400	700	6	8.5	8	11.4

Table 4. Comparison of Large Stone Tool Assemblies Site 1 & Site 2

	Site 1		Site 2	
	Number	% Total	Number	% Total
Abraders	1	4	1	1.6
Axes Ground Stone	4	16	19	30.2
Axes Chipped Stone	5	20	10	15.9
Adzes	2	8	4	6.3
Bannerstones			1	1.6
Drills			3	4.8
Celts	2	8	6	9.5
Grinding Bowls	2	8	5	7.9
Grinding Stones Oval	3	12	6	9.5
Grinding Stone Elong.	1	4	2	3.2
Pick Lg.	1	4		
Nut Picks	2	8	2	3.2
Hammerstones	1	4	4	6.3
Hand chopper	1	4		
Totals	25		63	

Table 5. Comparison of Bifacial Stone Tool Assemblages at Sites 1 and 2

	Site 1		Site 2	
	number	% Total	Number	% Total
Bifacial blades, Scrapers, Choppers	82	16	139	21
Bifacial, hafted Projectile Points	418	83.6	520	79
Totals	500		659	

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