ABORIGINAL USE OF PLANT FOODS AND EUROPEAN CONTACT IN THE NORTH CAROLINA PIEDMONT

by

Kristen Johnson Gremillion

A thesis submitted to the faculty of the University of North Carolina at Chapel Hill in partial fulfillment of the requirements for the degree of Master of Arts in the Department of Anthropology.

Chapel Hill

1984

Approved by:

Richard A. Yarnell
Advisor

Roy Dickens Jr.
Reader

Bruce Winterhalder
Reader

ABSTRACT

KRISTEN JOHNSON GREMILLION. Aboriginal Use of Plant Foods and European Contact in the North Carolina Piedmont (Under the direction of RICHARD A. YARNELL).

Problems of interpretation of archaeological plant remains are discussed, and recommendations made concerning their collection and the manipulation of resulting data. Suggested methods are applied to the comparison of plant remains assemblages from three sites in the North Carolina Piedmont. Changes in aboriginal plant food subsistence during the Historic period are assessed using these data. It is concluded that the degree of utilization of some foods changed, although the most important resources retained their primary role. Ways are suggested in which interactions between European and aboriginal populations may have influenced the cost-benefit functions of various subsistence activities.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF TABLES (CONTINUED)

Table Page

LIST OF FIGURES

ACKNOWLEDGEMENTS

Thanks are due to a number of people for their help and encouragement during the course of this project. I owe a great deal to my advisor and friend, Dick Yarnell: without the benefit of his expertise, I would probably still be working on my first ethnobotanical sample. He also deserves thanks for the many discussions which guided my interpretations, and for tempering my many fears, both imagined and real.

Dr. Roy Dickens and Dr. Bruce Winterhalder, my other committee members, I would like to thank for their careful reading of my work, and for stimulating me to think and write more precisely.

The Research Laboratories of Anthropology at the University of North Carolina, Chapel Hill provided the opportunity to work with rewarding material. Dr. Dickens and the field crew of the 1983 summer field season were essential to making this material available to me.

To my fellow ethnobotanists, Gayle Fritz, Paul Gardner, and Julie Hammett: Thanks for the many profitable discussions, for questioning and contributing to my ideas, and for being such pleasant office mates.

Steve Davis was kind enough to draft the map which appears on page 5.

To Peter, my husband, I can only say: Thank you for all your encouragement, for discouraging talk of giving up, for allowing me time and space, and for simply being there.

And to all the friends and colleagues not mentioned by name who contributed to the completion of this project, directly or indirectly, knowingly or not: Many thanks.

CHAPTER I. INTRODUCTION

Issues in Piedmont Siouan Archaeology

Archaeological research in the Piedmont of North Carolina has been especially successful in providing information about artifact typology and chronology (e.g. Coe 1952, 1954), settlement patterns (Ward 1980), and mortuary practices (Navey 1982). With the exception of recent work by J. Wilson (1977, 1983), questions about subsistence have generally received less attention; this situation constitutes a serious gap in archaeological knowledge of aboriginal Piedmont groups (Ward 1983:76).

Archaeological research recently begun by the Research Laboratory at the University of North Carolina at Chapel Hill is utilizing an approach in which all available data sets are being applied to questions of culture change, particularly during the Late Prehistoric and Historic periods. Within this context, subsistence data are an important component of a broadly conceived research design. Collection and analysis of archaeological plant remains and their interpretation are being undertaken with the general goal of discerning changes in subsistence, and linking these changes to others in the realms of social organization, demography, ideology, and technology.

Archaeological and ethnohistorical research on aboriginal cultures of the Southeast during the contact period indicates that change was rapid and pervasive for some groups (see for example Dobyns (1983) on depopulation and social organization). However, most acculturation studies have focused on interior peoples, such as the Creeks and Cherokees, who survived longer than did those groups in the North Carolina Piedmont. For the former, a process of acculturation led ultimately to partial assimilation into Euroamerican society. Eastern Siouan groups, on the other hand, only participated in the initial stages of acculturation, and most of them disappeared before assimilation could take place, or the process could be documented in written records. Consequently, our knowledge of culture change in the Piedmont area is limited, which requires the development of a distinctive set of theoretical orientations and research methods.

Therefore, rapid change should not be assumed, and it must be recognized that not all aspects of aboriginal culture changed at the same rate. A particular goal of this study is to use plant remains data to address the following questions:

1. How rapid was change in plant food subsistence among Piedmont groups during the Historic period?
2. Which resources were utilized more frequently, and which less frequently? Which patterns were maintained and which lost? What Old World plants were incorporated into existing subsistence systems?
3. How might both change and stability be explained with reference to changing cost/benefit ratios for different subsistence activities?
4. What effects might have interaction between European and aboriginal populations had upon these cost/benefit relationships?
5. How does subsistence change in the Carolina Piedmont compare with change in other aspects of Piedmont aboriginal culture,

and with subsistence change among groups in other regions of the Southeast?

Using these questions as guides, subsistence change can be viewed in its wider cultural and historical context.

From what is known about the effects of contact, population decline was one aspect of change and was brought about in part by the introduction of Old World diseases (Dobyns 1983). Social re-organization and disintegration, shifts in subsistence activities, increased participation in trade with Europeans, and erosion of traditional ideological systems all certainly played a role in the transformation of the aboriginal cultures. In historic times, most of the tribes of the Piedmont are thought to have spoken dialects of the Eastern Siouan language, an assumption used for the purposes of this study (Dickens 1984:1). However, the magnitude and internal structure of the social aggregates which occupied archaeological sites in the region is often unclear, as is the nature of their interactions with each other and the extent to which they participated in a shared system of knowledge and behavior.

Attempting to bound past cultural units in unambiguous fashion may in many cases be futile; as Wolf (1984:395) has argued, many of the entities (often designated as "tribes") studied by anthropologists are partly the products of processes originating outside of them and owe their existence to interaction with such processes. For example, the Ojibwa as an identifiable group dates back only to the advent of the fur trade, and developed as Algonquin-speaking lineages coalesced on their way west (Wolf 1984:394). It might be advisable to work instead with "fields of relationships within which cultural sets are put together and dismantled" (Wolf 1984:397).

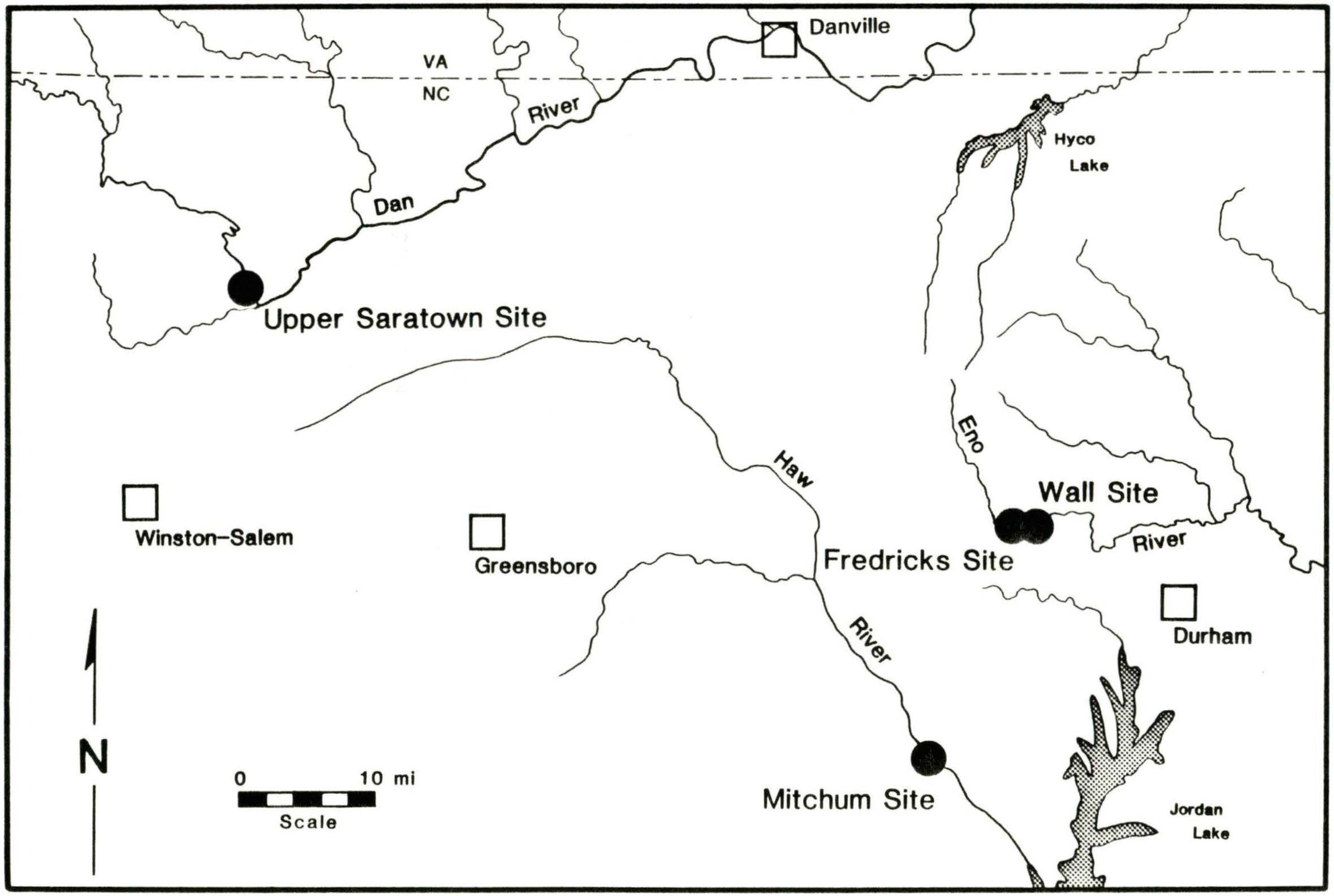
Certain limitations must therefore be recognized for the interpretation of changes in subsistence which is based upon data from several sites. The discussion of changing subsistence refers to changes within a particular environmental setting (the northeastern Piedmont of North Carolina). It is assumed that all aboriginal human groups in this area whatever their size and level of organization would have had similar subsistence adaptations. This assumption is strengthened by recent discoveries that indicate a common tradition of pottery styles for the primary sites considered here.

For this study the relevant "fields of relationships" can as yet only be vaguely defined. Each site represents a community that existed over a different period of time. Consequently actual social interaction cannot be assessed, nor can degree of political integration. However, consideration of separate communities as a unit in order to assess change can be justified on the grounds that they shared a similar environment and the same general range of subsistence options; a common (at least in part) historical and cultural background; and perhaps a common language.

The Sites

This study focuses on data from three aboriginal sites excavated during the summer of 1983 by the Research Laboratories of Anthropology (Figure 1). The Wall site (31Or11) was first investigated by Joffre Coe between 1938 and 1941. The site is located on the Eno River near present-day Hillsborough. Part of the Occaneechi tribe was thought to have moved to a village on the Eno in the 1680s from a site on the upper Roanoke River near the Virginia-North Carolina border. Because of its location in the vicinity of the 1701 placement of Occaneechi Town by the traveler John Lawson, Coe (1952) concluded

Figure 1. Map of the Study Area Showing Sites Discussed in the The Text



that the site was the remains of this settlement. The paucity of trade goods at the Wall site in conjunction with ceramics data and three radiocarbon dates with a corrected average of A.D. 1545 ± 80 (GX 9718, GX 9719, GX 9834) bring this designation into question and suggest instead a mid-sixteenth century occupation. The Wall site is a small palisaded village with burials, house patterns, and midden all representing a single occupation of relatively short duration (Davis 1984:3).

The Fredricks site (31Or231) is also located on the Eno River, only 150-200 yards west of the Wall site. Analysis of European trade goods indicates a temporal placement of late seventeenth to early eighteenth century; this site probably represents Lawson's Occaneechi Town. Excavation in 1983 revealed a linear posthole alignment and four burials. Excavations in 1984 have located additional burials, several square structures, and a round structure centered on a large circular pit.

The Mitchum site (31Ch452) is located on the Haw River about 17 miles southwest of Hillsborough. The few European trade items associated with the site points to occupation in the third quarter of the seventeenth century (Davis 1984:6). A total of 14 features and one burial were excavated in 1983; an oval structure was also revealed. The occupation of the Mitchum site is placed temporally between those of the Wall and Fredricks sites, which is a fortunate situation for purposes of assessing subsistence change.

The three relevant site occupations can be placed according to a chronology developed for the Carolina/Virginia Piedmont (Roy Dickens, personal communication 1984). The Wall site occupation dates to the Protohistoric period (ca. A.D. 1525-1625), that of the

Mitchum site to the Early Historic (A.D. 1625-1675), and that of the Fredricks site to the Middle Historic (A.D. 1675-1710).

Environmental Setting

The Fredricks, Mitchum, and Wall sites all lie within the Piedmont Plateau, a region of gently rolling hills that have been shaped by the downward cutting of numerous streams. The region as a whole has a humid temperate climate, with annual rainfall averaging 40 to 50 inches, and with a mean annual temperature of about 60°F. The frost-free season averages 200 days. Piedmont soils in general are acidic and low in organic content; nutrients are rapidly leached by rainfall and high humidity. Exceptions are the alluvial soils along major streams, which provide a fertile substrate for vegetation; often, however, these soils are poorly drained and subject to flooding (Moore 1973; Moore and Wood 1976).

Of particular relevance to this study are the kinds of plant communities that probably existed around the three sites in question. The composition and distribution of plant communities have changed today from what they were between ca. A.D. 1550 and A.D. 1700 because of human disturbance in the form of removal of vegetation and modification of topography through timbering, farming, and construction. However, a brief survey of vegetational communities found in the area today can help in establishing what kinds of associations of plants, if not the particular distribution of communities, would have been available for exploitation by aboriginal inhabitants. It is reasonable to assume (with the obvious exception of recently introduced taxa) that most of the same species occurring today were present in the recent past, although perhaps not with the same relative frequencies. For the purpose of providing background information, data will be abstracted from two recent vegetational analyses, one of the Jordan Lake area on the Haw River and one of the Falls area in the upper Neuse drainage (Moore 1973; Moore and Wood 1976), both located near the sites in question. The two areas share most community types, and it is assumed that the upper Haw River and Hillsborough localities were composed of similar habitat mosaics during the periods of site occupation. Differences in local environment that may be significant for interpreting archaeological data cannot be discerned without more focused and detailed environmental analyses. In any case, anthropogenic communities were probably more important for human subsistence.

Forest communities are found in both bottomland and upland habitats. Alluvial bottomland forest occupies well-drained stream banks and terraces; poorly drained soils behind terraces support swamp forest. Both forest types have a canopy that includes red maple, sweetgum, American elm, and species of oak and hickory. Hawthorn, viburnum, and ironwood are some of the species that make up the subcanopy. Alluvial forest has especially high species diversity.

Mesic forest types occur on gentle, well-drained slopes adjacent to bottomlands. Because of their somewhat restricted habitat, however, these forests are not very extensive. Beech is common in hardwood and mixed mesic forest, and the canopy also includes sweetgum, tuliptree, red maple, and southern sugar maple. Mast producers found in this community type include white oak and red oak as well as shagbark hickory, mockernut hickory, and bitternut hickory. Mesic pine forest is a transitional community type which occurs on poor soils after timbering or cultivation.

Higher, well-drained soils support hardwood or mixed upland forests. Today pines are often important components of second-growth forests because of timbering. The upland forest canopy includes red maple, sweetgum, post oak, red oak, black oak, scarlet oak, blackjack oak, pignut hickory, and mockernut hickory. The understory is typically less diverse than that of the mesic forest, but does include fleshy fruit producers such as blueberry, huckleberry, viburnum, and grape. Oak-hickory forest, generally considered the Piedmont climax, is rare today but is found in the Falls project area (southeast of the Wall and Fredricks sites) on steep upland slopes. This forest type is a more xeric community than those of the bottomlands. The canopy is in part composed of white oak, black oak, and red oak, along with shagbark hickory and mockernut hickory. The oak-hickory community type, with its high potential for human exploitation, was more extensive in the Piedmont before large-scale timbering and cultivation destroyed the original mature forests. In the East, most regions previously occupied by mature forest remain today still in various stages of succession (Gleason and Cronquist 1964:307).

In addition to these typical, relatively undisturbed community types, successional communities were probably common in both study areas. Although anthropogenic disturbance was certainly less prevalent during the Late Prehistoric and early Historic periods than it is today, aboriginal agriculture required the removal of some forest cover. The fire drive, a hunting technique involving controlled burning of large wooded areas, was also used by some groups in the Southeast (Hudson 1976:276). Initiation of secondary succession by such means, short of wholesale destruction of local forests, can be beneficial for human foraging by increasing community productivity and creating habitats for heliophilic plant species, among them prolific producers of edible grains and fleshy fruits. This latter consequence of anthropogenic influence also results in increased forage potential for game animals (Yarnell 1982; Margalef 1968). The following summary of successional communities found today near the Fredricks, Wall, and Mitchum sites will indicate some of the effects of human disturbance on exploitation potential.

Several types of scrub community develop as a result of timbering (which removes the canopy layer) or field abandonment (which results in a transitional community containing juvenile trees not yet old enough to form a canopy). Pine scrub occurs on former pine forests or old fields; the immature pines are closely spaced, often excluding most herbaceous species. Abandoned fields on bottomlands and mesic sites sometimes support a hardwood scrub community, if adjacent seed sources do not include pines (sun-loving pine seedlings usually precede hardwoods in secondary succession). Mixed scrub communities are the most common to appear after timbering of bottomland, upland, and mesic communities, and occasionally also occur on bottomland old field sites. Blueberry, blackberry, and huckleberry are all likely to be understory components of scrub communities.

Before succession has proceeded far enough to include tree seedlings, fields and pastures support herbaceous vegetation which changes in composition in somewhat predictable fashion. The most common pioneer species today, crabgrass and Bermuda grass, are European introductions. However, many other early successional species are indigenous, and some produce edible seeds, fruits, and/or leaves. Typical field weeds of this kind are knotweed (<u>Polygonum</u> spp.), lambsquarters (Chenopodium spp.), poke (Phytolacca americana L.), and fescue (Festuca spp.). Bramble (Rubus spp.) may also be a component of the herbaceous communities of early succession on Piedmont old fields (Crafton and Wells 1934).

Whereas the actual distribution of anthropogenic communities in the Protohistoric and Historic periods (ca. A.D. 1525-1740) can only be estimated, their presence then can be inferred simply from the knowledge of human settlement, which implies a certain amount of environmental disturbance. Some detailed information is offered by John Lawson's (1967) account of travel through the Carolina Piedmont and Coastal Plain. On several occasions, he notes the presence of extensive treeless areas which he refers to as "savannas". The Congaree village visited by Lawson and Keyauwee Town on the Uwharrie River were both adjacent to "savannas", which Lawson's imagination populated with herds of English swine and cattle (Lawson 1967:34,56). Lawson's savannas occupied both low and high ground, in both piedmont and coastal plain; what they all had in common was a predominantly herbaceous vegetation (perhaps mainly grasses, considering their perceived potential as cattle range) with few and scattered trees. Since the naturally occurring modern vegetation for most sites in both piedmont and coastal plain is forest, Lawson's savannas must have resulted from disturbance of forest communities through field abandonment and/or fire. Shelford (1963:56) suggests that savannah-like vegetation in some of the valleys of the Southeast resulted from burning of lowland and gentle slopes to encourage presence of herbivore prey. In at least one case, Lawson recognized an Indian old field ("plantation") by its "excellent Soil, now well spread with fine bladed Grass, and Strawberry-Vines" (1967:38).

Inhabitants of the Mitchum, Fredricks, and Wall sites had access to several kinds of forest and non-forest plant communities (see Table 1 for a summary). Abandoned fields and other disturbed areas in various stages of early succession would have been productive habitats for some fleshy fruits and weedy species producing edible grains and/or greens. Edges between recently cleared areas and relatively mature forest, as transitional zones incorporating typical members of both community types, may have had particularly high exploitation potential. Bottomland forest communities have high species diversity but no concentration of the economically important oaks and hickories; these communities are, however, supported by a rich alluvial soil with high agricultural potential. Mesic and upland hardwood or mixed forests, within which oak and hickory species are more common, would have been potential targets for mast collection. Finally, the practice of plant husbandry resulted in creation of an artificial kind of community requiring human maintenance. The resulting fields or gardens, along with forested areas and the clearings within them together make up the array of plant communities available for exploitation by local aboriginal populations.

Table 1. Summary of Plant Community Types of the North Carolina Piedmont[1]

Community Type	Relative Elevation	Soil Characteristics	Topography	Common Components
Alluvial bottomland forest	low	well-drained	banks and terraces	red maple, sweetgum, elm, oak, hickory, hawthorn
Swamp forest	low	poorly drained	behind terraces	"
Hardwood and mixed mesic forest	medium	well-drained	slopes adjacent to bottomland	beech, sweetgum, tupiptree, maple, oak, hickory, (pine)
Hardwood and mixed upland forest	high	well-drained	higher slopes	maple, oak, hickory, (pine)
Oak-hickory forest	high	well-drained	steep slopes	oak, hickory
Pine scrub	variable	variable	former pine forests and old fields	immature pines
Mixed scrub	variable	variable	bottomland old fields, upland sites after timbering	herbs and vines; pine and hardwood seedlings

Table 1 Continued

Community Type	Relative Elevation	Soil Characteristics	Topography	Common Components
Hardwood scrub	variable	variable	bottomland old fields, mesic sites after timbering	herbs and vines; hardwood seedlings
Fields and pastures	variable	variable	variable	herbs, (crops)

---

[1]Abstracted from Moore(1973) and Moore and Wood(1976).

CHAPTER II. METHODOLOGICAL ISSUES

The problems inherent in acquiring and interpreting paleoethnobotanical data are many and varied. Although these difficulties are in principle the same as those which face the archaeologist seeking to make sense out of other kinds of data sets (Yarnell 1982:3), interpretation of archaeological plant remains is subject to many sources of error which are peculiar to the nature of the material itself and its manipulation in past cultural contexts. Progress has been made in transforming paleoethnobotanical data into information about human behavior. Still, in many cases the most appropriate course a researcher can take involves making the difficulties of interpretation as explicit as possible and finding ways to minimize the perpetuation of unjustified assumptions. To accomplish this in the context of the present study, currently recognized problems in the interpretation of archaeological plant remains will be reviewed before discussing the study's results.

The most fundamental epistemological question facing the paleoethnobotanist is the same one confronted by all students of the past, namely, how can behavior be inferred from things (artifacts or subsistence remains) and their present-day context? For the ethnobotanist, the relevant materials are plant remains associated with other archaeological evidence of human occupation, considered within the context of their spatial relationships to other cultural deposits. The series of recorded observations about plant remains constitutes data, the information with which the paleoethnobotanist works directly in problem-solving and hypothesis testing. By manipulating these data (quantifying, comparing, extrapolating) it is sometimes possible to decide what kind of subsistence-related behavior created the archaeological record of plant remains. Through this process of examination, data manipulation, and careful inference, the following kinds of questions are asked: what kinds of plant food products were used during a given time period, and in what proportions? What kind of seasonal variation was there in procuring plant resources? What kinds of ecological relationships were maintained between people and the plant species they exploited? These questions and others can be profitably addressed by paleoethnobotanists, despite the lack of many kinds of information which would have been accessible to an ethnographer of the past community. Factors which complicate the reconstruction of subsistence behavior on the basis of information about plant remains include preservation, context, and methods of recovery.

Preservation

The likelihood of a particular class of plant remains being preserved long enough for the archaeologist to recover some quantity of it depends on both physical attributes of the items and their environment, as well as behavioral factors operating when the site was occupied. At open-air sites, where moisture and oxygen are sufficient for aerobic decomposition of plant remains, the probability of survival until the time of excavation is extremely small. Experimental studies of preservation of various organic materials after burial within earthworks have shown that decay of wood and cotton cloth can be very rapid, in both chalk and acid soils. After only a year, buried cotton cloth was not found, and wood billets were recovered only with difficulty after two years (Dimbleby 1978:98). The most common way in which plant material is preserved given normal conditions of decay is through carbonization, a process which occurs under certain conditions of combustion in a reducing atmosphere.

Because of their physical makeup, certain kinds of plant remains are more likely than others to become carbonized, given similar temperature and atmospheric conditions. Relatively durable structures such as hickory nutshell, fruit pits, corn cob, and some kinds of seeds and fruits have a good chance of surviving burning in recognizable form. More fragile seeds, leaves, flowers, tubers and rhizomes, and fleshy fruits are more likely to be either destroyed completely in combustion or converted to an unrecognizable form. Thus there are whole classes of plant remains that may not be represented on archaeological sites except under very special (arid or waterlogged) conditions. Materials like cucurbit rind and acorn shell are fairly amenable to carbonization, but they fragment more easily than dense nutshell, possibly to such an extent that they become in large part unrecognizable.

Behavioral factors also play a significant role in determining the kinds and proportions of plant remains that are finally available for collection by the archaeologist. There are various ways in which plant parts are transferred from a systemic to an archaeological context, to use Schiffer's (1976, 1977) terminology. Some knowledge of the nature of and reasons for this transfer of artifacts and food remains from active behavioral (Schiffer's "systemic") to non-behavioral or archaeological context is essential for adequate assessment of the subsistence significance of plant foods. For example, processing practices vary depending on the type of plant part involved. Grain seeds are often parched to remove adherent bracts, sometimes resulting in their overrepresentation relative to that of other foods. In contrast, plant parts crushed in preparation become unrecognizable, and are unlikely to become carbonized before processing unless they are manipulated near a fire. Preservation of fruit seeds depends to a great extent on whether they are ingested along with the fruit, and on the existence of processing methods such as drying over a fire. The use of some items as fuel also significantly effects the probability of their preservation; dense nutshell such as hickory is likely to be used in this way (Yarnell 1982). With reference to Historic period Indians of the Carolinas, Lawson (1967:105) describes the preparation of hickory nuts by pulverizing them without removing the shell; the crushed nutmeat dissolves in the mouth, and the shell is spit out. In this case, processing and consumption result in a high probability of preservation for hickory nutshell, while nutmeat not consumed is crushed beyond recognition.

This consideration of processing and consumption practices raises the important epistemological question of whether different kinds of archaeological plant remains represent food. If not all food remains have the same chance of becoming carbonized, it is also true that not all plant parts preserved in this way can be assumed to represent food. Dennell (1976) has observed that the most frequently preserved indicators of subsistence practices are not remnants of food itself (which is consumed for the most part), but rather waste products derived from it. In the case of nutshell, the waste product is certainly an indirect indicator of some quantity of food actually consumed, particularly if it appears in large quantities. Parts such as seeds should be interpreted more carefully, particularly those of weedy species. Presence of weed seeds may indeed indicate use as food; a strong association with human-disturbed habitats is good evidence of a symbiotic relationship which might include consumption of some part of the plant by humans. However, occurrence of small numbers of weed seeds may be a fortuitous consequence of their presence on or near a site, and must be interpreted with appropriate caution.

Context

Plant parts thus are transferred into an archaeological context by different kinds of behavior, and occasionally without human assistance. Once carbonized, plant remains at open-air sites are most commonly found in deposits formed by discard of unwanted material. Waste products (indirect indicators of food use) are probably intentionally deposited, while originally edible parts may have been lost during collection, processing, or consumption. Attention should be directed toward questions about why and how such deposits were formed. Equally important for interpreting plant remains data is the question of when a deposit was formed, specifically over how long a period of time, and during which season or seasons of the year.

In the case of specific, bounded deposits such as trash-filled pits, the season or seasons of deposition may have a significant effect on the kinds and proportions of plant remains contained therein. Deposits from the same site representing the same episode of occupation but created during periods of availability of different types of plant foods may produce contrasting results. Taken individually and considered in isolation, each feature or feature zone might be taken to represent a pattern of plant food exploitation distinctly different from the others. For purposes of simplifying comparison between sites, data from all features may be combined, as long as such seasonal factors are recognized and considered as a part of interpretation.

Determining the period within the seasonal cycle during which a deposit was created can be extremely difficult if the inference must be based on the presence of certain kinds of plant remains. Nuts, as well as corn and some other kinds of grains, are likely to have been stored over seasons of food scarcity and could potentially have been consumed and deposited during any time of the year (taking the limits of effective storage into account). Grain seeds are good seasonal indicators if it is assumed that carbonization took place during preparation for storage. Fleshy fruit seeds are perhaps the most reliable indicator of season of deposition, although some of these may have been stored for short periods of time (see Lawson (1967) for descriptions of fruit-drying practices of Piedmont Indians). Thus a number of behavioral factors must be taken into account in assessing the seasonal profile of a given deposit.

Such assessment is often necessary, despits the difficulties involved. For example, the Mitchum site plant remains data set is derived primarily from a number of trash-filled pits, one of which (Feature 6) is notable for containing large numbers of edible grass grains. The species which produce these grains ripen in spring and early summer. In contrast, fruit seeds from burial deposits at both the Wall and Fredricks sites are mainly those of species producing fruit from midsummer or late summer to early fall. If determination of the seasonal nature of these deposits is correct, then the difference in occurrence of grass seeds between Mitchum and the other two sites cannot be confidently attributed to an overall difference in exploitation patterns. While such a difference may exist, further testing would be needed to determine whether cool-season grasses are indeed absent from deposits at the Wall and Fredricks sites. Without consideration of the seasonal nature of deposits, erroneous conclusions might be reached about overall reliance on certain plant foods at the three sites. Therefore, the discussion of results will address this issue.

If determination of season of deposition can be made it is important for what it can indicate about past behavior, as well as for its more negative role in guarding against inappropriate comparisons. On the basis of the data referred to above, inferences can be made about seasonal scheduling of subsistence activities. If a number of seasonally specific deposits were available from a single occupation, a fairly detailed description of a yearly pattern of exploitation might be attempted. Even without such an ideal situation, some conclusions can be drawn about relative investments of energy in various subsistence activities during particular segments of the seasonal cycle. Establishment of seasonal profiles for different types of features can also be helpful in determining their function prior to utilization as trash pits. Dickens (1982) has used quantified plant remains from trash-filled deposits to test hypotheses about the seasonal parameters of their formation. The usefulness of plant remains data as seasonal indicators thus goes beyond determination of subsistence behavior.

The effect of different rates of deposition on the composition of a plant remains assemblage can also be considerable. Trash deposited in a pit would have been relatively closely circumscribed and protected, and usually would have accumulated over a short period of time. A midden, on the other hand, would probably have been deposited over a long period of time, possibly crosscutting seasons, and would not have been protected from post-depositional disturbance. This assumption has been partially substantiated by examination of the relative densities of plant remains in fill from Burial 1-83 and from midden at the Wall site (Johnson 1983). Although the fill from both kinds of deposit is similar in being organically rich, carbonized plant remains are more highly concentrated in the burial fill (the comparison was based upon analysis of light fractions only). One explanation of this difference is that the burial fill was deposited at a faster rate than the midden fill, given the assumption that similar refuse deposits differing in density may have formed at different rates (Schiffer 1983:686). A slower rate of cultural deposition for the midden, and longer intervals between episodes of cultural deposition, would result in a higher ratio of non-cultural to cultural materials. Although midden samples might be expected to contain a more diverse assemblage of plant remains representing all seasons, the relatively low density of plant remains in midden fill results in a smaller sample size. Diversity and information content of midden flotation samples is correspondingly low.

Thus, it is important to consider context in interpreting plant remains data. Midden deposits at the Wall site were created over relatively long periods of time and presumably by many households. The upper fill of burials at the same site represent briefer episodes of cultural deposition that probably were participated in by fewer people. The fill in most burial pits probably came from a single household, since burials at the Wall site were clustered around houses. Although the midden samples were not found to contain different kinds of plant remains than the burial fill, they do contain smaller quantities (relative to volume of fill) of some of the types of plant remains present in burial fill. Results of analyses of midden and burial fill samples are thus presented separately in the tables to be discussed below. Interpretation relies heavily on burial fill samples, which are higher in information content, judging by comparisons of plant remains density for flotation samples. Sampling of waterscreened material from the midden was somewhat more successful in terms of absolute quantities of plant remains recovered. Although these results will be discussed where relevant, most comparisons will be limited to feature and burial data.

For the broad perspective needed to assess change in subsistence practices, the plant remains data set from each site must be considered as a whole. However, it is important to keep in mind the different kinds of contexts from which the remains were extracted (see Table 2 for a summary of sample provenience information). With the exception of midden samples from the Wall site, material from the Wall and Fredricks sites was obtained from similar kinds of deposits, namely the uppermost fill of excavated burial pits (three at Wall and four at Fredricks). Although Feature 1 at the Fredricks site lacked human skeletal remains it was similar enough in form to burials at the site to be classed with them. The burial fill from which plant remains samples were drawn was not in direct association with skeletal remains, and may or may not be associated with the burial event. The Mitchum site samples are drawn from several kinds of features, including stratified and unstratified trash-filled pits, one burial pit, and two cob-filled pits. Analysis of corn from the latter is discussed separately, since the deposit is homogeneous and clearly represents a different kind of activity from that associated with the other features and the burial. The Wall and Fredricks sites are comparable in terms of the contexts from which plant remains were

Table 2. Summary of Plant Remains Sample Types and Sources

Site	Source	Sample Type(s)
Wall	Midden	Flotation (Light fractions)
		Waterscreened
	Upper burial fill (1)[1]	Flotation (Light and heavy fractions)
	Upper burial fill (3)	Waterscreened
Mitchum	Cob-filled pits (2)	Flotation (Light and heavy fractions)
	Trash-filled pits (10)	Flotation (Light and heavy fractions)
		Waterscreened
	Upper burial fill (1)	Flotation (Light and heavy fractions)
		Waterscreened
Fredricks	Upper burial fill (4)[2]	Flotation (Light and heavy fractions)
		Waterscreened

---

[1]Numbers in parentheses refer to number of features.

[2]Includes one burial-type feature without human remains (Feature 1).

derived, upper fill of burials being the source in both cases. Only one burial pit sample was available from the Mitchum site material. The other features included together for purposes of analysis, however, are trash-filled deposits rich in organic material. They share this characteristic with the upper burial fill at the Wall and Fredricks sites.

Recovery Methods

A significant factor affecting the kinds and proportions of plant remains recovered from a site is the type of recovery used in the field. This is one point at which the behavior of the archaeologist plays an important role in shaping the data base derived from an archaeological context. Past behavior initiates a transfer of subsistence remains from systemic to archaeological context; contemporary behavior removes these remains from their archaeological context, records relevant information about them, and tries to establish their significance in terms of past behavior. This process provides a basis for more generalized analyses and explanations of cultural patterns. Therefore, the act of removal of material remains must itself be assessed as to the strengths and limitations of the empirical base upon which interpretation depends.

Two methods of extraction were employed to recover carbonized plant remains from the Wall, Fredricks, and Mitchum sites. Flotation samples were taken from all features at the Mitchum site and the Fredricks site. At the Wall site, where the burial fill usually lacked organic material, only two flotation samples were taken, both from a single burial. Most flotation samples were taken in volumes of 10 l of fill, with a few exceptions; all were measured before processing. In the field, samples were processed using a water separation device similar to the SMAP machine described by Watson (1976). A tub lined with windowscreen recovered the heavy fraction, whereas the light fraction spilled over a spout and into a 0.71 mm brass sieve. The samples were then wrapped in newspaper and dried in the field.

Since being pioneered by Struever (1965, 1968) the water separation method (commonly called flotation) has been used with increasing frequency to recover small-scale archaeological remains. The advantages of flotation over other methods are many. By using sufficiently fine screens for light fraction recovery, even very small seeds can be recovered (see Munson (1981) for a discussion of mesh size requirements), and because the charcoal floats into the fine screen, breakage caused by water pressure is minimized. Some damage is an unfortunate consequence of sequential wetting and drying, but this damage can be minimized if samples are only partly dried before processing. This procedure allows the charcoal to float without removing so much moisture that it breaks apart on contact with water. Finally, samples are taken as measured volumes of fill, which allows for more rigorous comparison than does extraction of unmeasured samples.

Considering the advantages of flotation, use of any other method of recovering plant remains seems superfluous. During the 1983 field season at the three sites under consideration here, however, time and personnel constraints made comprehensive collection and processing of flotation samples impossible. A single pump was used both for flotation and for the sluice set-up used in waterscreening feature and midden fill. Waterscreening of large amounts of fill placed limitations on the amount of time available for field flotation. These restrictions are not peculiar to the project in question, and would certainly be present in any large-scale, open-air site excavation.

Thus it was necessary to turn to waterscreened material for plant remains data, especially for the Wall and Fredricks sites, whose flotation sample amounts were quite small. Subsamples of plant remains were drawn from material recovered in 1/2", 1/4", and 1/16" mesh screens by waterscreening from all sites. If mixed with large amounts of non-plant material such as stone and clay nodules, the 1/16" subsamples were water separated in the lab with the same screen used for recovery of flotation light fractions in the field.

The waterscreening process is more destructive than flotation, and results in loss of very small items. In this case waterscreened material also represents a much larger quantity of fill than a typical flotation sample, and one which is undetermined prior to processing. This quantity can be roughly estimated using recorded information on feature dimensions, but there are problems with this approach. First, the results of such estimation would represent in-ground volume rather than bucket-measured volume of soil. The significance of the difference between measurement methods has been demonstrated by Lopinot (1983:81), who found an uncompacted to compacted soil ratio of 1.79 for his Cahokia site sample. Second, 1/16" mesh plant remains subsamples were in many cases derived from mush larger samples representing the 1/16" size class of an entire burial or feature zone. Such factors render estimation of sample volume for the purposes of this study extremely awkward, if not impossible. An attempt at rough calculation of volume for Burial 2, Zone I at the Fredricks site yielded an estimated volume of 59.5 l after corrections for removal of flotation samples and subsampling. It can safely be said that each analyzed waterscreened subsample (1/16" size class) probably represents at least several times the volume of fill of a 10 l flotation sample of the same provenience, at least for some of the burials at the Fredricks site. The 1/2" and 1/4" analyzed material, which is combined with the 1/16" size class for purposes of analysis, may represent some additional amount of fill. At the Mitchum site, fill volume is quite variable between features, and fill volume of flotation and water-screened samples may be closer to the same value in some cases.

Despite the difficulties of working with waterscreened samples, it was necessary to analyze some of them to obtain sufficient information for a reasonable assessment of subsistence practices at the three sites. Such an apparent disadvantage can be transformed into an opportunity for learning more about what effects two dissimilar recovery methods have upon the composition of plant remains assemblages. To implement this comparison, 1/16" waterscreened samples were analyzed from the Mitchum site (which had a relatively large set of flotation samples with which to work) as well as from the other two sites. Plant remains from 1/2" and 1/4" size classes were sampled from all three sites and included as part of the waterscreened total. Tables 3, 4, and 5 present comparisons between flotation samples (separated into heavy and light fractions) and waterscreened samples, tabulated as percent of total plant food remains. Each feature is presented separately; Mitchum site data are from selected features noted for relatively dense concentrations of plant remains. Table 6 compares flotation and waterscreened results for each site as a whole.

Knowing that flotation is less destructive to fragile plant remains, and that carbonized seeds tend to float, it might be expected that light fractions would recover more seeds than either heavy fractions or waterscreening. The use of very fine mesh for light fraction recovery also supports this assumption. The larger sizes

Table 3. Comparison of Recovery Methods, Fredricks Site (Percent)

Feature/Zone	Sample type[1]	Soil volume in liters (Flotation only)	Total plant food remains (grams)	Hickory nutshell	Acorn shell	Peach pit	Corn	Cucurbit rind	Bean	Seeds
Burial 1/ Zone I	LF	20	0.06	16.7			50.0			33.3
	HF		0.37	97.3			2.7			
	WS		6.77	74.2			20.5	0.3	0.7	4.3
Burial 2/ Zone I	LF	10	0.06				50.0			50.0
	HF		0.01	100.0	x[2]		x			
	WS		1.96	17.3		81.1				1.5
Burial 3/ Zone I	LF	10	0.71	47.9		2.8	43.7	2.8		2.8
	HF		0.63	14.3		77.8	7.9			
	WS		10.60	48.1		39.8	11.4	x		0.7
Feature 1/ Zone I	LF	10	0.21	42.9			57.1	x		x
	HF		0.18	61.1	x		38.9			
	WS		2.01	36.3	2.0		61.7	x		x

[1] LF=light fraction; HF=heavy fraction; WS=waterscreened

[2] x=trace

Table 4. Comparison of Recovery Methods, Mitchum Site, Selected Features (Percent)

Feature/Zone	Sample type	Soil volume in liters (Flotation only)	Total plant food remains (grams)	Hickory nutshell	Acorn shell	Peach pit	Corn	Cucurbit rind	Seeds
Feature 1/ Zone I	LF	10	0.06				66.7		33.3
	HF		0.78	98.7	1.3				
	WS		3.28	84.1	x	10.1	5.5		0.3
Feature 6/ Zone I	LF	20	0.23	8.7					91.3
	HF		0.23	100.0	x		x		
	WS		0.88	93.2			3.4	1.1	2.3
Feature 13/Zone II	LF	10	0.01				100.0		x
	HF		0.40	37.5	37.5	20.0	5.0		
	WS		0.57	42.1	22.9	5.3	19.3		10.5

Table 5. Comparison of Recovery Methods, Wall Site Burials (Percent)

Burial/Zone	Sample type	Soil volume in liters (Flotation only)	Total plant food remains (grams)	Hickory nutshell	Acorn shell	Corn	Seeds
Burial 1/ Z I	LF	15	0.05			80.0	20.0
	HF		0.30	70.0	13.3	13.3	3.3
	WS		6.39	76.2	6.9	16.1	0.8
Burial 2/ Z I	WS		0.46	67.4	2.2	30.4	
Burial 3/ Z I	WS		0.58			100.0	

Table 6. Comparison of Recovery Methods, Site Summaries (Percent)

Site	Sample type	Soil volume in liters (Flotation only)	Total plant food remains (grams)	Hickory nutshell	Acorn shell	Walnut shell	Peach pit	Corn	Cucurbit rind	Bean	Seeds
Fredricks	LF		1.04	42.3			1.9	47.1	1.9		6.7
	HF	50	1.19	47.9	x		41.2	10.9			
	WS		21.34	52.4	0.2		27.2	18.0	0.1	0.2	1.8
Mitchum	LF		0.67	28.4	x			37.3			34.3
	HF	190	4.11	80.8	7.1	1.0	7.5	3.6			
	WS		9.84	72.2	3.5	3.0	11.0	8.0	0.1		2.2
Wall	LF		0.05					80.0			20.0
	HF	15	0.30	70.0	13.3			13.3			3.3
	WS		7.43	69.7	6.1			23.6			0.7

of waterscreened samples might also be expected to disguise this tendency, but this is not the case. When site totals are compared on the basis of percentage by weight, flotation light fractions have a consistently higher percentage of seeds than either heavy fractions or waterscreened samples (in fact, seeds are entirely absent from heavy fractions, with only one exception from a Wall site sample). Comparing results within individual features yields the same kinds of results. It is clear that flotation recovers seeds more effectively than waterscreening, even when the amount of fill processed by flotation is relatively small.

In contrast, heavy and durable materials such as hickory nutshell, walnut shell, and peach pit should occur with low frequency in light fractions. In most cases, hickory nutshell is either absent from light fractions or occurs there only as a relatively low percentage of plant food remains. This pattern is fairly consistent except in Burial 3 and Feature 1 at the Fredricks site. In Burial 3, peach pit is present in large enough quantities to significantly lower the percentage of hickory nutshell. If these two categories are combined, it becomes apparent that these dense items are more concentrated in heavy fractions and waterscreened samples than in light fractions. Results from Feature 1 are somewhat anomalous in this regard; results from Fredricks as a whole show percentage of hickory lowest in light fractions, but values for the three sample types are similar.

Peach pit, present at Fredricks and Mitchum, is clearly more abundant in heavy fractions and waterscreened samples than it is in light fractions. The same is true of walnut shell, which was found only at the Mitchum site, where it was absent from light fractions. Waterscreening thus provides reasonably good recovery of dense nutshell and peach pit. Flotation recovery has the advantage of obtaining comparable relative quantities of these dense items while at the same time maximizing seed recovery in the light fraction.

The pattern of differential recovery is not as clear for more fragile nutshell (such as acorn) and cucurbit rind. Both of these kinds of remains fragment fairly easily, and are therefore infrequently caught in screens with large mesh sizes. Because neither acorn shell nor cucurbit rind is as dense as hickory or walnut shell, they might be expected to float more readily. It is somewhat surprising, therefore, that acorn shell is almost entirely absent from light fractions; only a trace occurs in the Mitchum site samples. Otherwise, acorn shell is present in heavy fractions and waterscreened samples. At the Mitchum site, heavy fractions captured more acorn shell than waterscreened samples within the same feature. Although a similar pattern is evident at the Wall site, only one burial pit was available for comparison of all three sample types. The Fredricks site, from which very little acorn shell was recovered, exhibits no clear pattern except the absence of acorn shell from light fractions. At all three sites, examination of heavy as well as light fractions is essential for determining the presence of acorn shell, as well as that of denser types of nutshell.

Cucurbit rind shows no clear pattern of differential recovery. It occurred in small amounts at both Fredricks and Mitchum in all three sample types. No firm conclusions can be drawn about the likelihood of cucurbit rind being recovered using a particular method. Common bean is another item which was rare at or absent from all the sites, and its occurrence is therefore not helpful in assessing effectiveness of recovery methods.

Corn is a common item at all three sites, occurring in heavy fractions, light fractions, and waterscreened samples. Cupules are more common than kernels in all samples. For each site taken as a whole, corn comprises a greater percentage of plant food remains in light fractions than in any other sample type. At the Fredricks and Mitchum sites, in some features corn is most strongly represented in waterscreened samples. This may be a consequence of the larger soil volumes represented. When contained in a sample processed by flotation, corn seems to float more often than it sinks. Fragments large enough to be contained in 1/16" mesh should be adequately recovered by waterscreening, but would be underrepresented in heavy fractions.

A few conclusions can be drawn from this analysis of recovery methods which have implications for the way in which plant remains data from the three sites in questions are to be interpreted. The most significant disadvantage of waterscreening is that it does not recover seeds small enough to pass through a 1/16" mesh screen, excepting the occasional instance of an item's being retained in the screen by adhering to a larger particle. Waterscreening also may cause mechanical damage to some kinds of plant remains, although the extent of this damage cannot be ascertained. Certain rare items (common bean, for example) occur only in waterscreened samples; this is probably due to the generally larger quantity of soil processed rather than any inherent superiority of waterscreening as a recovery method. Large soil volume is less advantageous than it might be if soil quantities were measured in standard fashion in the field before processing, as they were for flotation samples.

Flotation recovery is superior to waterscreening in several ways.

Light fractions are especially valuable for recovery of seeds, while relatively heavy items like dense nutshell and peach pit are better represented in heavy fractions. Taken together, the two fractions of any given flotation sample should contain the same kinds of plant remains recovered by waterscreening of fill from the same provenience, plus any small seeds lost through 1/16" mesh as well as fragile items which might be destroyed by use of a high-pressure water source. In addition, contents of combined heavy and light fractions represent the charcoal component of a known volume of soil measured in a standardized fashion. The only items lost will be those which do not float and are small enough to pass through 1/16" mesh (the screen size used to recover heavy fractions). Determination of the best methods of treating soil samples to assure maximum light fraction recovery, including drying of excavated soil, will help to minimize loss. Even somewhat unsuitably prepared flotation samples should result in more effective recovery than waterscreening of an equivalent quantity of soil.[1]

Methods of Comparison

This attempt to make certain biases explicit is valuable in itself in provoking awareness of the limitations inherent in describing subsistence behavior on the basis of archaeological evidence. However, information about the relevance of formation processes, food processing behavior, material constitution of plant remains, and systems of recovery used by the archaeologist is directly applicable at the level of comparison. In order to decide what the paleoethnobotanical data mean in terms of subsistence, it is necessary to compare them in

[1]During the 1984 field season, a larger number of flotation samples were taken in an attempt to provide a better plant remains data base.

various ways. Within a site or feature, data must be manipulated so that proportions of various kinds of plant remains can be compared and evaluated as indicators of subsistence importance. Data from the three sites of concern here need to be compared with each other to allow for the interpretation of change in subsistence effort over a period of time. A number of techniques are available for manipulation of data for purposes of comparison and interpretation.

Knowing how samples were recovered is important for deciding what kinds of material should be used for intrasite comparisons. Ideally, flotation samples derived from like quantities of fill should provide the basic data set. As noted above, however, relatively small numbers of flotation samples are available from the Wall and Fredricks sites, so that waterscreened samples were analyzed as well. Because of the differences in results which are likely to occur as a consequence of using these two recovery methods, data derived from each will be presented separately. Essentially, there will be two data sets for each site, and two sets of comparisons between them. It is expected that the strongest inferences will be those supported by both data sets. Divergences between them should be explainable mainly by reference to recovery methods or sample size, and must be approached on an individual basis. Site totals are also presented to provide summary information.

The basic data to be used in comparisons are absolute quantities measured in grams, or by number (for seeds). To facilitate comparison between sites or types of plant remains, these absolute values are converted to relative values expressed as percentage of total plant food remains. There are both advantages and disadvantages to this approach. Using percentages by weight is especially useful for comparing plant remains of the same kind over time or between contexts. When comparing kinds of plant remains belonging to different categories of preservability or density, percentage by weight may be misleading (Yarnell 1982:3). Heavier items will naturally comprise a greater percentage of a given sample than lighter ones, even though the latter may represent a greater amount of food. Peach pit is a good example of a dense kind of material which represents a relatively small amount of food; in some cases, it makes up such a high percentage of plant food remains that its dominance may distort the relative values of other plant remains. For this reason, it is advisable in some analytical contexts to omit peach pit from calculation of percentages.

Comparison of different kinds of nutshell presents similar kinds of difficulties. Hickory and walnut shell are considerably denser than acorn shell, making percentages by weight inadequate for comparative purposes. Acorn has a higher nutmeat to nutshell ratio than hickory; it has been estimated that 1 g of carbonized acorn shell represents anywhere from five to 200 times as much nutmeat as an equivalent quantity of hickory nutshell (Lopinot 1983:94). Yarnell and Black (1983) have recommended multiplying quantities of acorn shell by 50 to arrive at a corrected acorn-to-hickory ratio that provides a more accurate estimate of relative food quantities. The effect of performing this calculation upon assessment of subsistence significance can sometimes be quite striking. Despite the approximate nature of this adjustment, it provides a more realistic basis for comparison of food quantities than does comparison of raw percentages by weight. Ideally, similar correction factors would be available for many kinds of cross-taxon comparisons. Further experimental studies will hopefully yield more of them in the future. In the meantime, appropriate caution must be exercized in comparing relative quantities of plant remains across classes.

An alternative technique is available for such comparisons which does not take account of quantities. Ubiquity measures are designed to provide an indication of the relative frequency of occurrence of the various categories of plant remains. In its simplest form, ubiquity is calculated as the percentage of samples or contexts in which an item occurs. This measure is most appropriately used where samples represent similar amounts of fill, since the significance of a single occurrence will vary with sample size. With samples of different sizes, use of feature or feature zone as the basic unit avoids some of the resultant inaccuracy, especially where cumulative soil volumes from each provenience are more similar than those from individual samples. The latter technique will be used in this study. Ubiquity measures are especially useful for comparison across classes, and provide an alternative measure of subsistence significance for particularly fragile items of low density. When used in conjunction with other measures such as percentage by weight, ubiquity can provide additional insights into the relative importance of a particular kind of plant food.

Seeds, whose individual weights are usually negligible, are counted and their total weight presented for a given context. The amount of food represented by each seed may be difficult to determine, and depends upon the number of seeds present in an individual fruit, seed size, and fruit size. To compare seeds representing different taxa, absolute number can be converted to numbers of seeds per gram of plant food remains. This technique provides a relative measure that takes into account differences between sample sizes. Fruit, grain, and weed seeds are considered separately from corn kernels, bean cotyledons, and peach pits, all of which are present in sufficient quantities or are important enough as classes of food to deserve separate analytic categories. Numbers of whole seeds, corn kernels, and corn cupules are estimated from numbers of fragments when necessary.

Quantified plant remains can be manipulated in a number of other ways that facilitate comparison of different classes both within and between sites. Kinds of plant foods can be categorized differently. For example, some researchers have found calculation of a seed to nutshell ratio useful, especially for assessing the relative importance of seeds and/or fruits as food (Yarnell and Black 1983; Asch, Ford and Asch 1972). Within a fairly broad category of plant food, such as nuts or starchy crops, percentages can be derived that indicate something about the relative subsistence significance of particular taxa that form subcategories of it (e.g. Chapman and Shea 1981). Such operations, like all comparisons based on weight, must take into account density and fragility of materials as well as ratios of carbonized remains to potential food. Until more rigorous methods of comparing quantified plant remains exist, an eclectic approach involving multiple techniques seems best. Hopefully, in this way conclusions that more correctly describe past subsistence behavior can be separated from those that tend to be incorrect because of inadequate assessment of the effects of formation processes, recovery techniques, and differential preservation upon the data. Table 7 summarizes some of the factors relevant to interpretation of plant remains assemblages, giving particular information

Table 7. Factors Relevant to Interpretation of Archaeological Plant Remains from Historic Period Piedmont Sites, By Remains Class

Plant Remains Class	Predepositional and Depositional Factors	Postdepositional Factors	Reliability as indicator of seasonality	Reliability as indicator of use
Fleshy fruit seeds	number of seeds/fruit fruit size use of vegetative plant parts drying for storage edibility and palatability dispersal by humans	loss and destruction in processing	high[1]	depends on quantity
Grain and weed seeds	seed size edibility and palatability incidental deposition parching for storage dispersal by humans	loss and destruction in processing	high[1]	depends on quantity
Corn	role as domesticate roasting use of cob as fuel	loss and destruction in processing, especially of kernels	low	high
Hickory and walnut shell	"meat" (cotyledon) to shell ratio use as fuel durability of shell fragmentation in preparation	concentration in heavy fractions	low	high

Table 7 Continued

Plant Remains Class	Predepositional and Depositional Factors	Postdepositional Factors	Reliability as indicator of season-ality	Reliability as indicator of use
Acorn shell	"meat" (cotyledon) to shell ratio fragmentation in preparation	fragmentation in processing	low	high
Cucurbit rind	rind composition role as domesticate	fragmentation in processing	low	high
Peach pit	drying for storage use as fuel	concentration in heavy fractions	low[2]	high
Common bean	preparation by boiling role as domesticate	destruction in processing	low	high

---

[1]Assumes no storage, or carbonization during preparation for storage.

[2]Assumes storage with pits intact.

on the classes of remains discussed above.

CHAPTER III. COMPARISON OF PLANT REMAINS ASSEMBLAGES

Subsampling and Analysis

In some cases collections of material from waterscreened samples required subsampling. For 1/16" mesh fractions from the Wall and Fredricks sites this was accomplished by analyzing bags of material from each feature of approximately equal weight after processing in the field. For Mitchum site samples the same procedure was followed but involved selecting relatively small subsamples since these were needed primarily for purposes of comparing recovery methods. Samples of ethnobotanical remains from 1/2" and 1/4" mesh size classes were selected on the basis of secure provenience (i.e., omitting collections from feature interface with plowzone or those combining fill from different zones). Feature flotation samples from the Wall and Fredricks sites were analyzed and are included in the tables. For the Mitchum site, at least one flotation sample was available from each feature. Two samples from Zone I of Feature 6 are also included because of this feature's high concentration of small grain seeds. Waterscreened material and heavy fractions sometimes required further processing because they contained large amounts of clay, stone, and other nonorganic material; this step was avoided whenever possible because of potential damage to carbonized plant remains from repeated wetting and drying.

Midden data from the Wall site are presented in separate tables. All flotation light fractions were analyzed; all heavy fractions were examined under the microscope, but were not completely sorted since they contained only very small quantities of carbonized plant remains, and none that were absent from other samples from the site. In addition, two waterscreened samples from the two excavation units with the most organically rich midden fill were analyzed and appear in the tables. Waterscreened samples from the midden contained larger absolute quantities of plant food remains than did flotation samples. However, in order to restrict comparisons to material occurring in similar contexts, midden data were not manipulated like those derived from features.

Methods of analysis are similar to those outlined by Yarnell (1974). Each sample is weighed, then sifted through a series of U.S. Standard brass sieves ranging in mesh size from 6.35 mm to 0.21 mm. Separation of size classes in this way facilitates sorting. Material remaining in screens with mesh size greater than 2.00 mm is sorted completely using a binocular microscope, and each component is weighed. Material passing through the 2.00 mm screen is searched only for seeds and any plant remains not recovered in the larger size category. Total quantities of each component in the 1.41 mm to 0.71 mm size range are calculated on the basis of their representation in the fully sorted material. Material which passes through the 0.71 mm sieve is not included in these calculations, as it usually consists primarily of fine soil particles and dust.

This extrapolation procedure assumes that each component is equally represented in all size classes greater than 0.71 mm. While this assumption is not always justified, the procedure has the advantage of providing the analyst with an estimate of actual quantities which is an upward revision of quantities known for the largest size class. Such estimates can be assumed to be closer to actual quantities

Table 8. Flotation Sample Components, Fredricks Site (Grams)

Feature/ Zone	Soil volume (liters)	Fraction	Weight	Debris	Residue less than .7 mm	Bone and fish scale	Shell	Beads	Wood charcoal	Unknown plant
Bu. 1/ Zone I	20	LF	9.74	4.09	0.59	0.12	0.04		5.27	0.14
		HF	7.72	2.48	0.18	1.90	0.03		2.62	0.14
Bu. 2/ Zone I	10	LF	0.72	0.33	0.05	x[1]			0.26	0.02
		HF	1.88	0.90	0.02	0.32			0.59	0.04
Bu. 3/ Zone I	10	LF	5.48	0.99	0.38	0.34			2.97	0.09
		HF	9.75	1.10	0.06	6.41			1.11	0.44
Fea. 1/ Zone I	10	LF	4.71	0.63	0.27				3.51	0.09
		HF	3.01	0.35	0.08	0.73	0.02	0.01	1.34	0.30
Total	50		43.01	10.87	1.63	9.82	0.09	0.01	17.10	1.26

[1] x=less than 0.005 g

Table 8 Continued

Feature/ Zone	Total plant food remains	Hickory nutshell	Acorn shell	Peach pit	Corn	Cucurbit rind	Seeds
Bu. 1/I	0.06	0.01			0.03		0.02
	0.37	0.36			0.01		
Bu. 2/I	0.06				0.03		0.03
	0.01	0.01	x		x		
Bu. 3/I	0.71	0.34		0.02	0.31	0.02	0.02
	0.63	0.09		0.49	0.05		
1/I	0.21	0.09			0.12		
	0.18	0.11	x		0.07		
Total	2.23	1.01	x	0.51	0.62	0.02	0.07

Table 9. Flotation Sample Components, Mitchum Site (Grams)

Feature/Zone	Soil Volume (liters)	Fraction	Weight	Debris	Residue less than .7 mm	Bone and fish scale
Feature 1/ Zone I	10	LF	1.36	0.09	0.09	
		HF	10.52	7.72	0.22	1.14
Feature 2/ Zone I	10	LF	0.01	x		
		HF	4.86	3.60	0.08	0.31
Feature 3/ Zone I	20	LF	1.50		0.15	
		HF	23.24	15.23	0.01	4.16
Feature 4/ Zone I	10	LF	0.33	0.15	0.03	
		HF	4.94	3.70	0.03	1.02
Feature 5/ Zone I	10	LF	0.82		0.05	
		HF	17.58	15.51	0.09	0.41
Feature 6/ Zone I	20	LF	22.77	1.49	3.80	0.08
		HF	18.45	1.08	1.21	1.09
Feature 6/ Zone Ia	10	LF	3.56	0.38	0.35	0.02
		HF	26.58	16.83	0.52	4.26
Feature 6/ Zone II	10	LF	1.73	0.23	0.36	x
		HF	13.49	9.56	0.19	2.60
Feature 6/ Zone III	10	LF	0.44	0.14	0.13	
		HF	0.55		0.02	0.05
Feature 8/ Zone I	10	LF	0.27	0.09	0.04	
		HF	22.79	0.82	0.27	
Feature 9/ Zone I	10	LF	0.45	0.28	0.04	
		HF	4.04	1.31	0.13	0.23
Feature 10/ Zone I	10	LF	0.90	0.33	0.09	
		HF	24.62	8.09	3.08	0.67
Feature 13/ Zone I	10	LF	0.70	0.21	0.08	
		HF	4.87	0.33	0.52	0.09
Feature 13/ Zone II	10	LF	0.68	0.04	0.05	
		HF	6.96	0.73	0.48	0.42
Feature 13/ Zone III	10	LF	0.20	0.02	0.01	
		HF	26.49	22.13	0.31	1.25
Feature 14/ Zone I	10	LF	0.36	0.18	0.05	
		HF	8.84	7.70	0.23	0.11
Burial 1/ Zone I	10	LF	0.85	0.12	0.04	
		HF	17.51	14.10	0.20	1.41
Total	190		273.26	132.19	12.95	19.32

Table 9 Continued

Feature/ Zone	Shell	Flakes	Metal	Pottery	Beads	Wood charcoal	Unknown plant	Total plant food remains	Hickory nutshell
1/I						1.07	0.05	0.06	
		0.17			0.03	0.46	x	0.78	0.77
2/I						0.01			
		0.47	0.03			0.23		0.14	0.13
3/I						1.30	0.02	0.03	
		0.52		2.61		0.40	0.15	0.16	0.08
4/I						0.13	0.02		
		0.07				0.12	x	x	x
5/I						0.65	0.06	0.06	
		0.18				1.01	0.14	0.24	0.05
6/I	0.02					17.13	0.02	0.23	0.02
	0.04					14.40	0.40	0.23	0.23
6/Ia						2.79	0.02	x	
	0.21	0.24		3.03	0.01	1.15	0.17	0.16	0.16
6/II	x					1.12	0.02	x	
	0.12	0.05				0.84	0.05	0.08	0.08
6/III						0.14	0.03		
						0.38	0.02	0.08	0.02
8/I						0.14			
						21.52	0.14	0.04	0.04
9/I						0.13			
						2.31	0.04	0.02	0.02
10/I						0.33	0.05	0.10	
		0.04				12.01	0.25	0.48	0.48
13/I						0.41		x	
						3.62	0.27	0.04	0.04
13/II						0.49	0.09	0.01	
		0.03				4.65	0.25	0.40	0.15
13/III						0.17	x	x	
	0.04					2.28	0.26	0.22	0.09
14/I						0.11	0.02	x	
		0.02				0.51	0.07	0.20	0.19
Bu. 1/I						0.49	0.02	0.18	0.17
		0.54			0.03	0.21	0.18	0.84	0.79
Total	0.43	2.33	0.03	5.64	0.07	92.71	2.81	4.78	3.51

Table 9 Continued

Feature/ Zone	Walnut shell	Acorn shell	Peach pit	Corn	Seeds
1/I				0.04	0.02
		0.01			
2/I					
		0.01			
3/I				0.03	x
		x	0.04	0.04	
4/I					
		x			
5/I				0.06	
	0.04		0.14	0.01	
6/I					0.21
		x		x	
6/Ia					x
		x			
6/II					x
				x	
6/III					
			0.05	0.01	
8/I					
					x
9/I					
10/I				0.10	x
13/I					x
				x	
13/II				0.01	x
		0.15	0.08	0.02	
13/III		x			
		0.09		0.04	
14/I				x	
				0.01	
Bu. 1/I		x		0.01	
		0.03		0.02	
Total	0.04	0.29	0.31	0.40	0.23

Table 10. Flotation Sample Components, Wall Site (Grams)

Feature/Zone	Soil Volume (Liters)	Fraction	Weight	Debris	Residue less than .7 mm	Bone	Shell	Wood charcoal	Unknown plant
Burial 1/ Zone I	15	LF	2.91	0.12	0.16		0.43	2.12	0.03
		HF	7.82	1.87	0.94	1.37	0.89	2.09	0.36
Total	15		10.73	1.99	1.10	1.37	1.32	4.21	0.39

Feature/Zone	Total plant food remains	Hickory nutshell	Acorn shell	Corn	Seeds
Bu. 1/I	0.05			0.04	0.01
	0.30	0.21	0.04	0.04	0.01
Total	0.35	0.21	0.04	0.08	0.02

Table 11. Midden Flotation Sample Components, Wall Site, Light Fractions (Grams)

Square/Zone/Level	Soil volume (Liters)	Weight	Debris	Residue less than .7 mm	Bone and fish scale	Shell	Wood charcoal	Unknown plant
370R530/ZII/L1	20	2.62	1.84	0.26		0.03	0.42	0.02
370R540/ZII/L2	40	8.11	4.97	0.92	0.30		1.75	0.06
370R540/ZII/L1	40	11.37	7.86	2.35	0.41	0.03	0.62	0.04
370R560/ZII/L2	10	1.59	0.62	0.37	0.19		0.35	
Total	110	23.69	15.29	3.90	0.90	0.06	3.14	0.12

Square/Zone/Level	Total plant food remains	Hickory nutshell	Acorn shell	Corn	Seeds
370R530/ZII/L1	0.05			0.04	0.01
370R540/ZII/L2	0.11		x	0.11	x
370R540/ZII/L1	0.06	x		0.06	x
370R560/ZII/L2	0.06			0.05	0.01
Total	0.28	x	x	0.26	0.02

Table 12. Waterscreened Sample Components, Fredricks Site (Grams)

Feature/Zone	Weight	Debris	Residue less than .7 mm	Bone	Shell	Wood charcoal	Unknown plant	Rhizome	Total plant Food remains
Burial 1/ Z I	84.72	5.03	1.19	1.28	0.82	67.56	1.87	0.20	6.77
Burial 2/ Z I	4.91	0.88	x		0.01	1.89	0.17		1.96
Burial 3/ Z I	81.51	2.42	1.44	2.96	0.04	62.51	1.54		10.60
Feature 1/ Z I	30.47	1.19	0.30	0.04		26.27	0.66		2.01
Total	201.61	9.52	2.93	4.28	0.87	158.23	4.24	0.20	21.34

Feature/Zone	Hickory nutshell	Acorn shell	Peach pit	Corn	Cucurbit rind	Bean	Seeds
Burial 1/Z I	5.02			1.39	0.02	0.05	0.29
Burial 2/Z I	0.34		1.59				0.03
Burial 3/Z I	5.10	x	4.22	1.21	x		0.07
Feature 1/Z I	0.73	0.04		1.24	x		x
Total	11.19	0.04	5.81	3.84	0.02	0.05	0.39

Table 13. Waterscreened Sample Components, Mitchum Site (Grams)

Feature/ Zone	Weight	Debris	Residue less than .7 mm	Bone and fish scale	Shell	Flakes	Beads	Unknown	Unknown plant	Wood charcoal
Fea. 1/ Zone I	14.00	1.55	0.38	0.76					0.62	7.41
Fea. 2/ Zone I	8.31	6.21	0.36	0.66	0.02	0.10			0.02	0.84
Fea. / Zone I	14.50	9.29	2.25	0.86		0.47			0.12	1.32
Fea. 5/ Zone I	18.22	11.65	0.43	1.35		0.34			0.21	2.78
Fea. 6/ Zone I	31.51	1.76	0.32	0.87	0.02				0.53	27.13
Fea. 6/ Zone Ia	11.55	2.07	0.43	1.22	0.04				0.26	7.15
Fea. 6/ Zone II	35.50	24.66	0.45	3.83	0.13	0.66	0.01		0.15	5.20
Fea. 6/ Zone III	9.83	7.28	0.18	0.60		0.29			0.10	1.28
Fea. 8/ Zone I	60.39									60.18
Fea. 9/ Zone I	2.57	0.28	0.01						0.06	2.14
Fea. 10/ Zone I	21.02	5.63	0.29	0.17				0.11	0.46	14.28
Fea. 13/ Zone I	74.82	46.55	5.28	2.09		0.33	0.02		0.52	19.95
Fea. 13/ Zone II	44.30	29.30	0.64	1.82		0.24	0.03		0.52	11.18
Fea. 13/ Zone III	71.90	54.61	2.03	1.55		0.20			0.47	12.53
Fea. 14/ Zone I	72.27	56.86	9.49	0.72		0.07	x		0.29	3.85
Bu. 1/ Zone I	8.46	6.03	0.09							1.82
Total	499.15	263.73	22.63	16.50	0.21	2.70	0.06	0.11	4.33	179.04

Table 13 Continued

Feature/ Zone	Total plant food remains	Hickory nutshell	Walnut shell	Acorn shell	Peach pit	Corn	Cucurbit rind	Seeds	Other
1/I	3.28	2.76		x	0.33	0.18		0.01	
2/I	0.10	0.10							
3/I	0.19				0.15	0.04		x	
5/I	1.46	0.79	0.30	0.09	0.25	0.03			
6/I	0.88	0.82				0.03	0.01	0.02	2 buds (x) tuber fragment (x)
6/Ia	0.38	0.37		x		0.01			
6/II	0.41	0.32		x	0.09			x	
6/III	0.10	0.10							
8/I	0.21				0.21				
9/I	0.08	0.03				0.05			
10/I	0.08			0.02		0.03		0.03	
13/I	0.08							0.08	
13/II	0.57	0.24		0.13	0.03	0.11		0.06	
13/III	0.51	0.35		0.08		0.06		0.02	
14/I	0.99	0.88		0.02	0.02	0.07		x	
Bu. 1/I	0.52	0.34				0.18			
Total	9.84	7.10	0.30	0.34	1.08	0.79	0.01	0.22	

Table 14. Waterscreened Sample Components, Wall Site Features (Grams)

Feature/Zone	Weight	Debris	Residue less than .7 mm	Bone and fish scale	Shell	Wood charcoal	Unknown plant	Total plant food remains
Burial 1/Z I	90.32	3.94	1.37	2.34	0.86	71.49	3.93	6.39
Burial 2/Z I	3.03	0.86	0.02			1.65	0.04	0.46
Burial 3/Z I	1.63	0.24	0.02			0.74	0.05	0.58
Total	94.98	5.04	1.41	2.34	0.86	73.88	4.02	7.43

Feature/Zone	Hickory nutshell	Acorn shell	Corn	Seeds
Burial 1/Z I	4.87	0.44	1.03	0.05
Burial 2/Z I	0.31	0.01	0.14	
Burial 3/Z I			0.58	
Total	5.18	0.45	1.75	0.05

Table 15. Waterscreened Sample Components, Wall Site Midden (Grams)

Square/Zone/Level	Weight	Debris	Residue less than .7 mm	Bone	Root or tuber	Unknown plant	Wood charcoal
370R540/ZII/L2	13.63	3.03	0.09	4.08	0.01	0.32	4.94
370R560/ZII/L2	22.50	2.09	0.37	3.10	0.04	0.96	11.22
Total	36.13	5.12	0.46	7.18	0.05	1.28	16.16

Square/Zone/Level	Total plant food remains	Hickory nutshell	Acorn shell	Corn	Bean	Seeds
370R540/ZII/L2	1.16	0.68	0.03	0.45		
370R560/ZII/L2	4.72	3.14	0.30	1.19	0.05[1]	0.04[2]
Total	5.88	3.82	0.33	1.64	0.05	0.04

---

[1]*Phaseolus* sp., probably *P. vulgaris* (one cotyledon).

[2]One *Galium* sp. and one unknown.

Table 16. Components as Percentage of Total Plant Food Remains (Features)

Site	Recovery method	Total plant food remains (grams)	Hickory nutshell	Walnut shell	Acorn shell	Peach pit	Cucurbit rind	Bean	Corn	Seeds
Fredricks	F[1]	2.23	45.3		x	22.9	0.9		27.8	3.1
	WS	21.34	52.4		0.2	27.2	0.1	0.2	18.0	1.8
	Total	23.57	51.8		0.2	26.8	0.2	0.2	18.9	1.7
Mitchum	F	4.78	73.4	0.8	6.7	6.5			8.4	4.8
	WS	9.84	72.2	3.0	3.5	11.0	0.1		8.0	2.2
	Total	14.62	72.6	2.3	4.3	9.5	0.1		8.1	3.1
Wall	F	0.35	60.0		11.4				22.9	5.7
	WS	7.43	69.7		6.1				23.6	0.7
	Total	7.78	69.3		6.3				23.5	0.9

[1] F=Flotation.

Table 17. Seeds and Corn by Feature, Fredricks Site (Number)

Feature/Zone	*Ambrosia* spp. (ragweed)	*Crataegus* sp. (hawthorn)	*Diospyros virginiana* L. (persimmon)	*Galium* spp. (bedstraw)	*Passiflora incarnata* L. (maypops)	*Phaseolus vulgaris* L. (common bean)	*Rhus* sp. (sumac)	*Rubus* spp. (bramble)	*Vaccinium* spp. (blueberry)	*Vitis* spp. (grape)	Unknown seed	Corn kernels	Corn cupules
Burial 1/ Z I			5	1	1	1[1]		1		10[2]	3	18	63
Burial 2/ Z I		1	1							1	2	4	6
Burial 3/ Z I	3		1	7			1	1	5[3]	2[4]	7	5	111
Feature 1/ Z I				2							4	6	59
Total	3	1	7	10	1	1	1	2	5	13	16	33	239

[1] Two cotyledons.

[2] Plus two pedicels.

[3] Three seeds plus one fruit.

[4] Plus one pedicel.

Table 18. Seeds and Corn by Feature, Mitchum Site (Number)

Feature/ Zone	*Centrosema virginianum* L. (butterflypea)	*Crataegus* sp. (hawthorn)	*Diospyros virginiana* L. (persimmon)	*Galium* sp. (bedstraw)	*Hordeum pusillum* Nuttall (little barley)	*Passiflora incarnata* L. (maypops)	*Phalaris caroliniana* Walter (maygrass)	*Rubus* sp. (bramble)
Fea. 1/ Zone I		1				1		
Fea. 3/ Zone I								
Fea. 4/ Zone I								
Fea. 5/ Zone I							2	
Fea. 6 / Zone I				1	13		425	1
Fea. 6 / Zone Ia						1	6	
Fea. 6 / Zone II							5	
Fea. 9 / Zone I								
Fea. 10/ Zone I								
Fea. 13/ Zone I			2				2	
Fea. 13/ Zone II			1			1		
Fea. 13/ Zone III			1			1		
Fea. 14/ Zone I	1					1		
Bu. 1/ Zone I								
Total	1	1	4	1	13	5	440	1

Table 18 Continued

Feature/ Zone	Solanaceae (Nightshade family)	*Vitis rotundifolia* Michaux (muscadine)	*Vitis* spp. (grape)	*Hordeum/Festuca*	Unidentified grass	Unidentified type A	Corn kernels	Corn cupules	Unknown seed
1/I		1					3[1]	4	2
3/I		1					2	6	1
4/I	1								
5/I								6	5
6/I				14	30	11	1	1	8
6/Ia							2		
6/II									2
9/I							1	2	3
10/I			3				3	1	3
13/I					2			1	
13/II							2	5	
13/III							1	2	
14/I							1	3	
Bu. 1/I								6	
Total	1	2	3	14	32	11	16	37	24

[1] Plus one embryo.

Table 19. Seeds and Corn by Feature, Wall Site (Number)

Feature/Zone	Crataegus sp. (hawthorn)	Diospyros virginiana L. (persimmon)	Iva annua L. var. macrocarpa Jackson (sumpweed)	Passiflora incarnata L. (maypops)	Vitis spp. (grape)	Unknown	Corn kernels	Corn cupules
Burial 1/Z I	1	1	1	1	2	1	8	76
Burial 2/Z I								18
Burial 3/Z I								64
Total	1	1	1	1	2	1	8	158

than those derived from sorting only the largest material. Tables 8-15 present extrapolated component weights for each site by feature and zone, with flotation and waterscreened samples tabulated separately. In Table 16 results are presented as percentage of total plant food remains for each site. Seed counts appear in Tables 17, 18, and 19 by feature and zone. Other tables will be introduced in the text as they are discussed.

Some explanation of categories used in the tables is in order. "Debris" includes all uncarbonized plant material, soil, burned or compacted clay, and stone. Differentiating between fired clay, compacted clay, and soil was often difficult and time-consuming, particularly for heavy fractions and for waterscreened samples which were not subjected to water separation in the lab. The category labeled "wood charcoal" also includes stem charcoal, pine pitch, and bark. Amounts of peach pit and common bean are listed separately from those for other seeds. Corn kernels and cupules are presented as an aggregate weight, and are enumerated in the same tables which include seed counts.

Discussion of Results

Nuts. Nuts have been a staple food in the prehistoric East at least since Early Archaic times, with hickory (*Carya* spp.), acorn (*Quercus* spp.) and black walnut (*Juglans nigra* L.) as the types most commonly represented in archaeological assemblages. Summary information derived from a large number of sites in the Southeast indicates that acorn was probably the most important plant food in the region until Mississippian times. Hickory may have been more important for some locations and times, although it shows more spatial and temporal variation than does acorn. Overall, walnut is less abundantly represented than either hickory or acorn (Yarnell and Black 1983:5).

The plant remains data examined here confirm that acorns and hickory nuts were utilized by inhabitants of all three sites being considered here. This assertion is further supported by travelers' accounts from the Historic period of North Carolina; Lawson (1967) in particular gives a description of the processing of hickory oil, and mentions the use of acorns and acorn oil. The fact that both hickory and acorn were important subsistence items in the Piedmont cannot be questioned. The relative importance of each species during different time periods, however, can be more closely assessed using paleoethnobotanical data.

From site totals (Table 16), quantity of hickory nutshell as percentage of plant food remains declines from the Mitchum site occupation to that of the Fredricks site. Both flotation and water-screened data show the same pattern of a slightly higher percentage of hickory for Mitchum than for Wall, with a drop in percentage evident for the Fredricks site sample. Since both Mitchum and Fredricks samples contain significant quantities of peach pit, values for items like hickory nutshell might be distorted. Therefore, in Table 20 plant food remains are listed by percent, excluding peach pit. When quantities of hickory are examined in this way, values for the Fredricks and Wall sites are very close, whereas Mitchum site values are higher than either. No clear temporal pattern of hickory nut use can be discerned.

There may be no way to decide on an interpretation of change in hickory nut use, given the ambiguities of the data. However, occurrence of acorn shell at the three sites does reveal a temporal

Table 20. Components as Percentage of Total Plant Food Remains, Excluding Peach

Site	Sample type	Total plant food remains (grams)	Hickory nutshell	Walnut shell	Acorn shell	Cucurbit rind	Corn	Beans	Seeds
Fredricks	F	1.72	58.7		x	1.2	36.0		4.1
	WS	15.53	72.1		0.3	0.1	24.7	0.3	2.5
	Total	17.25	70.7		0.2	0.2	25.9	0.3	2.7
Mitchum	F	4.47	78.5	0.9	6.5		8.9		5.1
	WS	8.76	81.1	3.4	3.9	0.1	9.0		2.5
	Total	13.23	80.2	2.6	4.8	0.1	9.0		3.4
Wall	F	0.35	60.0		11.4		22.9		5.7
	WS	7.43	69.7		6.1		23.6		0.7
	Total	7.78	69.3		6.3		23.5		0.9

pattern of some significance. Percentage of acorn shell drops beginning with the Wall site occupation; this is true no matter how the data are arranged, and holds for both flotation and waterscreened samples. Exploitation of acorns was more important for Wall site people than it was for Fredricks site people; the Mitchum site data may represent an intermediate stage of this trend. Changes in acorn utilization may be traceable to shifts in this activity's associated costs. Possible causative factors will be discussed below. The drop in acorn shell percentage from 6.3 at Wall and 4.3 at Mitchum to only 0.2 at Fredricks is striking enough to warrant recognition as a possible temporal trend (see Yarnell and Black 1983).

Compared with hickory nutshell, acorn shell declines as percentage of total nut remains (Table 21). Hickory nutshell values increase to 99.7% of nut remains for the total Fredricks site sample. Data considered separately according to recovery methods display the same pattern. Comparing estimates of relative food value of the two types of nuts, the corrected acorn to hickory ratio (based on a nutmeat to nutshell ratio for acorn which is 50 times that for hickory) is greater than one for Wall (4.55) and Mitchum (2.97). In contrast, the Fredricks site ratio is only 0.16, indicating that the hickory nuthsell recovered represents more food than does the acorn shell from that site. If archaeological representation is a reasonably accurate reflection of utilization, acorn was a less important resource than hickory at the Fredricks site. A comparison of ubiquity values for hickory and acorn at the three sites (Table 22) also supports this interpretation; hickory occurs with greater regularity than acorn at the two later sites. Both nutshell types occur in two out of three Wall site features.

Table 21. Nutshell by Percent

Site	Sample type	Total nutshell (grams)	Hickory	Acorn	Walnut
Fredricks	F	1.01	100.0	x	
	WS	11.23	99.6	0.4	
	Total	12.24	99.7	0.3	
Mitchum	F	3.84	91.4	7.6	1.0
	WS	7.74	91.7	4.4	3.9
	Total	11.58	91.6	5.4	2.9
Wall	F	0.25	84.0	16.0	
	WS	5.63	92.0	8.0	
	Total	5.88	91.7	8.3	

Table 22. Ubiquity Values by Feature

Site	Number of Features	Peach	Hickory	Walnut	Acorn	Cucurbit	Corn	Bean	Persimmon	Grape/ Muscadine
Fredricks	4	.50	1.00		.75	.75	1.00	.25	.75	.75
Mitchum	12[1]	.58	1.00	.08	.58	.08	0.67		.08	.25
Wall	3		.67		.67		1.00		.33	.33

Site	Hawthorn	Blueberry	Maypops	Bramble	Sumac	Maygrass	Little barley	Sumpweed
Fredricks	.25	.25	.25	.50	.25			
Mitchum	.08		.33	.08		.25	.08	
Wall	.33							.25

---

[1]Does not include cob-filled pits.

Reduction in percentage of acorn shell as well as reduction in the acorn to hickory nutmeat ratio through time support the interpretation that exploitation of acorn declined. It is unlikely that local differences in abundance of these resources is responsible for the contrast between Wall and Fredricks site data, since these two sites represent sequential occupation of the same approximate location. Spatial variation may account for the intermediate representation of acorn at Mitchum, which is located in a different river valley. However, general environmental setting for all three sites was similar. Spatial variation is held constant for the earliest and latest sites, so that temporal variation is the best explanation for the drop in the representation of acorn.

Walnut shell is present at the Mitchum site, where it comprises only 2.3% of total plant food remains. Black walnut occurs scattered throughout rich woods in the Piedmont (Radford et. al. 1968:362). Its limited occurrence in only one Mitchum site feature and its absence from the Wall and Fredricks sites may be in part a reflection of its relatively low availability in accessible forest communities. If walnut was exploited by the populations of the Wall and Fredricks sites, it was not an important resource.

In summary, hickory nuts were important at all three sites. Although it is possible that hickory nut use declined in the Middle Historic period (represented by the Fredricks site), there is considerable doubt as to what kinds of changes, if any, actually took place. Acorn shows a decline in subsistence importance relative to hickory throughout the sequence; by the time of the Fredricks site occupation, hickory dominates. Walnut was a minor resource for the Mitchum site population. Nuts in general comprise a smaller percentage of plant food remains at Fredricks than at the two earlier sites. Whereas exploitation of nuts in general may have declined during the Historic period, evidence on this point is inconclusive.

Crops. Corn (*Zea mays* L.) is a significant component of samples from Wall and Fredricks, although at both sites it comprises a smaller percentage of plant food remains by weight than hickory nutshell. This fact should not be taken to indicate that corn had less subsistence importance than hickory, since corn remains are less dense than thick nutshell and therefore less likely to be preserved. Over time, corn percentage drops only slightly between the Wall and Fredricks occupations, although quantity of kernels per gram of plant food remains increases (Table 26). At both sites, corn is present in all features. All midden samples from the Wall site contain corn remains, despite the overall low density of plant remains in midden fill. On the basis of ubiquity, then, corn is the single most common kind of plant food at these two sites, being matched only by hickory at Fredricks. High ubiquity in this case is best explained by high frequency of use as food. Although corn cobs may have been used as fuel, this function of the crop would have been secondary. Such frequent occurrence, along with relatively large quantities, indicates a high degree of subsistence importance for corn both early and late in the temporal sequence. Ethnohistoric sources, among them Lawson (1967) strongly support the statement that corn was a staple crop among Historic Piedmont groups.

The situation at the Mitchum site is somewhat puzzling; corn is much less well represented there than it is at Wall or Fredricks. Since Fredricks and Mitchum are fairly close together both temporally and spatially, such an apparent difference in subsistence is surprising. It may be true that the Mitchum site population relied less on corn agriculture than did the other two; however, considering the importance of corn as a crop in historic accounts of the area, such a sharp contrast seems unlikely. The existence of cob-filled pits at Mitchum is also strong evidence for the importance of corn as a crop there, and may explain why corn is less abundant in other features.

An alternative explanation is that some of the Mitchum site cultural deposits were formed during periods of the year when corn had relatively low availability. A smaller area was excavated at Mitchum than at the other two sites, and the deposits sampled there may represent a more limited seasonal range. The approximate time of year in which certain kinds of seeds were deposited in a feature can be determined, assuming that the food they represent was prepared or eaten fresh, and that they were deposited soon after consumption took place (nuts and corn are easily stored, and are unreliable as seasonal indicators). Average fruiting period can be calculated by finding the time period within which all fruits represented in a given feature zone would have been available. This assures that the time periods derived will be short enough to be contrasted with one another; the actual range of possible fruiting dates is often so broad as to produce similar seasonal profiles for all features.

Table 23 presents average earliest and latest month of fruiting for features for which sufficient data are available, along with percent corn for each. If each month is assigned a value, these values can be averaged for each feature zone (producing a single average fruiting date) and ranked accordingly. Computing Spearman's

Table 23. Feature Seasonality and Corn Content

Site/Feature/Zone	Average Earliest Month of Fruiting	Average Latest Month of Fruiting	Corn as Percentage of Plant Food Remains
Mitchum/Fea. 6/Z Ia	June	July	1.9
Mitchum/Fea. 6/Z I	May	July	2.2
Mitchum/Fea. 1/Z I	May	July	5.3
Fredricks/Bu. 3/Z I	June	August	13.2
Mitchum/Fea. 13/Z III	September	October	14.3
Fredricks/Bu. 1/Z I	July	August	20.3
Mitchum/Fea. 3/Z I	August	October	21.1
Wall/Bu. 1/Z I	September	October	27.2

rank order correlation coefficient, there is a positive correlation (r_s=0.82) between corn percentage and seasonal profile (the result significant at the 0.05 level, two tail). Dickens (1982) found a similar relationship between low corn content and early seasonal profiles in his study of seasonality and feature formation.

This relationship is best illustrated by data from Feature 6, Zone I at the Mitchum site. In these samples, corn comprises 2.2% of total plant food remains while the average period of fruiting based on seeds present is from May to July. In contrast, corn is 27.2% of plant food remains for Burial 1 pit fill at Fredricks, with an average fruiting period of September to October. The three lowest values for corn (averaging 3.1%) are associated with fruits ripening in early to midsummer. The four highest values (which average 20.7%) are associated with late summer to early fall profiles. Although the relationship between scarcity of corn found archaeologically and early-to-midsummer months is not perfect, it does lend some support to the suggestion that the low representation of corn at the Mitchum site is due to the seasonal nature of some of its deposits rather than a minor role for corn.

The presence of cob-filled pits at Mitchum also argues for the importance of corn. Flotation samples from the two pits recovered an aggregate total of 75.93 g of corn cob and kernel fragments. The deposits were quite homogeneous, containing only very small amounts of wood charcoal and non-plant material. The relevant data appear in Tables 24 and 25, along with attributes of measurable cupules and cob segments. Low row number and wide cupules and kernels indicate that the Mitchum corn is an Eastern Complex type (Ford 1973:189). This finding is not unexpected, since Eastern Complex is the race

Table 24. Feature 11 Flotation Sample, Mitchum Site Components with Cob Measurements

Sample Components, Light and Heavy Fractions (Grams)

Corn kernels	less than 0.005 g
Corn cupules and cob fragments	5.55
Kernel fragments	0.05
Wood charcoal	0.01
Fired clay	0.23
Residue less than 2 mm	1.34
Total	7.18

Cob Characteristics

	N	$\bar{X}$	Median	Range
Cupule width	26	8.1	8.2	3.5
Row number	1	8.0	8.0	0.0

Table 25. Feature 7 Flotation Sample, Mitchum Site Components with Cob and Kernel Measurements

Sample Components, Light and Heavy Fractions (Grams)

Corn kernels	0.09 (N=4)
Corn cupules and cob fragments	55.06
Cob segments	8.89 (N=7)
Kernel fragments	0.15
Wood charcoal	0.08
Clay and stone	0.18
Residue less than 2 mm	8.85
Total	73.30

Kernel and Cob Characteristics

	N	$\bar{X}$	Median	Range
Cupule width	61	9.4	9.2	3.8
Row number	7	8.6	8.0	2.0
No. cupules per 10 mm cob length	7	3.1	3.0	0.5
Kernel depth	1	6.5	6.5	0.0
Kernel width	4	8.4	8.3	1.0
Kernel thickness	4	4.9	5.0	0.5

most commonly found archaeologically in the East.

Judging from the data at hand, corn was probably the most important crop at all three sites. There is no evidence of a significant change in degree of reliance on corn from Protohistoric to Middle Historic times. The low proportion of corn remains in the Mitchum site sample is probably not a consequence of corn being only a minor resource. Instead, it may indicate a pattern of seasonal availability and exploitation of certain resources. Certainly the archaeological samples themselves exhibit a seasonal pattern of occurrence.

In the East, common bean (Phaseolus vulgaris L.) is unknown archaeologically before Mississippian times (ca. A.D. 1000), and is uncommon until after A.D. 1200 (Yarnell 1983:5). The Fredricks site samples produced two bean cotyledons, and a single cotyledon was recovered from a Wall site midden waterscreened sample. Although Lawson (1967:82) details a diversity of legume varieties ("pulses") among historic eastern Carolina groups, archaeological evidence from these sites does not lend support to the assessment of beans as a primary resource. The fact that preparation by boiling is less likely to result in carbonization of remains than roasting or parching may account in part for the limited occurrence of bean remains. The archaeological evidence is therefore inconclusive regarding the utilization of beans.

Small amounts of cucurbit rind were recovered from the Mitchum and Fredricks sites. Classification of these rind fragments can be narrowed to two taxa of the Cucurbitaceae, Cucurbita ("squash") and Lagenaria siceraria Standley (bottle gourd). Other members of this family introduced via European contact during the Historic period (such as watermelon) can be discounted because of the unlikelihood of their thin rind becoming preserved through carbonization. The genus Cucurbita has had an association with aboriginal groups of eastern North America that long predated the introduction of Mesoamerican crops. For example, specimens of rind from the Koster and Napoleon Hollow sites in westcentral Illinois, classified as C. pepo, have been dated at ca. 7000 years B.P. (Conard et. al. 1983). Bottle gourd occurs as early as 4300 B.P. in the Midwest (King 1980:5). However, the fleshy cultigen "squash" noted ethnographically in the East may have arrived there no earlier than corn or even beans (Yarnell 1983:9).

Cucurbit rind from the Fredricks site comprises only 0.2% of total plant food remains, but it has a ubiquity value of .75, occurring in the fill of three out of four burial pits. Considering the relative fragility of cucurbit rind, its representation by weight may seriously underestimate the relative importance of cucurbits as resources. Certainly, the relatively high ubiquity value for cucurbit rind indicates that cucurbits and/or gourds were not uncommon as food or utility items during the Fredricks site occupation. At the Mitchum site, cucurbit rind makes up only 0.1% of plant food remains, with a correspondingly low ubiquity of .08. Its only occurrence at the Wall site is a single rind fragment from a water-screened midden sample.

The small quantities of cucurbit rind from all three sites makes interpretation of the subsistence importance of the represented species difficult. All that can be said is that cucurbits of some kind were utilized at all three sites, and that use may have increased somewhat during the latter part of the temporal sequence.

Cultigen sumpweed (Iva annua var. macrocarpa Jackson) appears in westcentral Illinois as early as ca. 2500 to 2000 B.C. (Yarnell and Black 1983:10). The increase in achene size documented for sumpweed during prehistoric times is considered evidence of human-mediated selection resulting in enhanced food value (Yarnell 1978). Utilization of the edible seeds of sumpweed continued in the lower Illinois valley long after maize became a staple (Asch and Asch 1978). However, the large-seeded variety is extinct today and is known only archaeologically. If cultigen sumpweed existed during Historic times, its presence went unnoticed by European chroniclers.

A single carbonized sumpweed seed was recovered from the fill of a Wall site burial. Its dimensions (6.7 mm x 5.3 mm with corrections for carbonization) place it well within the range of the cultigen variety of Mississippian times (Yarnell 1978). This single specimen, although constituting too small a sample to allow for rigorous demonstration of cultigen status on the basis of seed size, is large enough to be well out of the range given for modern populations of Iva annua. Although Iva annua L. is native to the mid and lower Mississippi River drainage and westward to the Plains (Yarnell 1972:335), it occurs locally today in the lower Piedmont and Coastal Plain of the Carolinas (Radford et. al. 1968:1016). The Wall site find represents one of the latest and certainly the easternmost archaeological occurrence of cultigen sumpweed to date.

Although presence of a single specimen is not sufficient for assessment of subsistence significance, the occurrence of large-seeded sumpweed in a secure context at the Wall site is significant for several reasons. It demonstrates that cultigen sumpweed still existed in the East as late as ca. A.D. 1550, and it raises questions about the importance of indigenous North American temperate crop plants for Piedmont populations. To what extent were native grain crops utilized, and how did use of imported crops (especially corn) affect their importance? And what effect, if any, did cultural interaction with European groups play in the extinction of cultigen sumpweed?

Sumpweed was not recovered from the Fredricks site, the Mitchum site, or Upper Saratown on the Dan River, a Siouan site whose period of occupation overlaps with that of Mitchum (J. Wilson 1977). Its presence at the Wall site is surprisingly late, given the known history of cultigen sumpweed in the East. Further analysis of plant remains from both Wall and Fredricks will be needed to establish the significance of its occurrence in the Wall site assemblage.

Cool-Season Grasses. A separate category is reserved for the abundant maygrass, little barley, and other grass seeds recovered from the Mitchum site. Whereas maygrass and little barley have been assessed as crop plants for certain regions and time periods (Asch and Asch 1983; Cowan 1978; Yarnell 1983), their role as domesticates at the Mitchum site is not firmly established. These species share certain morphological and life history characteristics which influence their relationships with human groups and justify their classification together for purposes of discussion.

Maygrass (Phalaris caroliniana Walter) is an annual grass producing edible grains which ripen in May and June (Radford et. al. 1968:122). It is considered a crop plant in the East, at least for certain time periods and localities (Yarnell 1983:6). This assessment is based partly upon the occurrence of maygrass archaeologically outside of its present distributional range at sites in Tennessee, Kentucky, and Illinois (Cowan 1978). It is assumed that this extension of its range prehistorically was due to its cultivation by human groups. Nutritionally, the maygrass grain can be considered a starchy seed because of its high caloric value, bland flavor, ease of cultivation, and high storability (Crites and Terry 1984:116).

A total of 425 maygrass seeds were recovered from Zone I of Feature 6 at the Mitchum site. An additional 11 occurred in two other zones of the same feature. Features 5 and 13 together yielded four additional seeds for a site total of 440. The large quantities present are good evidence for intensive exploitation of maygrass. Although it is within its present distributional range in the Mitchum site locality, the role of maygrass as a prehistoric crop and its abundance at Mitchum argue strongly for its cultivation there. It is important to note that maygrass is most heavily represented in a single feature on the site rather than being commonly found in all deposits.

Little barley (Hordeum pusillum L.) is an annual grass which produces fruit between April and June (Radford et. al. 1968:88). Recent work at the Middle Woodland Smiling Dan site in westcentral Illinois has produced little barley grains in large quantities. Its relative abundance and ubiquity have earned it crop plant status for that region (Asch and Asch 1983:687). Like that of maygrass, the little barley grain can be classified as a starchy seed.

Identification of little barley from the Mitchum site relied heavily on illustrations and detailed description found in Asch and Asch (1983). Little barley from Smiling Dan was initially misidentified as a species of fescue (Festuca). Most of the grains from the Mitchum site tentatively identified as little barley fit neatly the size specifications outlined by Asch and Asch (1983) from their field collection data and carbonization experiments. Some specimens fit the descriptions for carbonized little barley in all respects except size, being considerably smaller than expected. The smaller of the Mitchum specimens have been tentatively labeled "Hordeum/Festuca" in recognition of the similarity of archaeological specimens of the two genera. In fact, the misidentification of little barley as fescue was rectified by a reassessment of size characteristics. It cannot yet be determined whether normal variation within the species could account for the size difference noted for otherwise similar specimens.

A total of 13 little barley seeds was recovered by flotation from Feature 6 at the Mitchum site. An additional 14 seeds were classified as Hordeum/Festuca. The fruiting season of little barley overlaps with that of maygrass, and it is possible that the less numerous little barley seeds were unintentionally or incidentally collected during harvesting of maygrass. Or, relatively smaller quantities of little barley may have been intentionally harvested, resulting in proportionately lower representation in cultural deposits.

The possible seasonal specificity of fill within Feature 6 has been discussed above with reference to the relatively low representation of corn at the Mitchum site. It has been suggested that deposition during spring and early summer months, when corn stores were at a low point, would account for a low percentage of corn as well as the presence of spring-ripening resources such as maygrass and little barley. In the face of dwindling stores of fall-ripening crops, harvesting of such cool-season grasses would constitute an effective method of extracting needed calories in the form of starchy grains. Seasonal utilization of grasses when primary resources are scarce has in fact been documented for certain Southwestern groups (Doebley 1984). During spring and early summer in the Southeast, edible greens are fairly abundant whereas most edible grains and crops in general do not ripen until late summer and early fall.

Harvesting of cool-season grasses by the Mitchum site population, therefore, would have been restricted to the earlier part of the warm season. Such activity is one aspect of year-round scheduling of subsistence activities which reflects cycles of abundance and scarcity of various resources. A similar seasonal pattern may have been typical of the Wall and Fredricks site populations. The absence of maygrass, little barley, and other native grains from these sites may only reflect the fact that the relevant data are drawn from deposits more representative of late summer and fall activities.

In summary, the Wall and Fredricks sites have so far produced no evidence of utilization of native grasses, and a temperate North American crop, sumpweed, is present at Wall but not at Fredricks. Although further sampling will be needed to establish the significance of these differences in assemblages, some possibilities can be suggested. Spring and early summer ripening grasses and grain-producing forbs may have been important resources for many Piedmont groups well into the Historic period, the Fredricks site population being an exception. However, in view of information on subsistence from one other Piedmont site (see below), a general pattern of decreased utilization of native grains during the Historic period can be proposed as a hypothesis subject to future testing.

Fleshy Fruits. Several types of seeds of edible fleshy fruits were recovered from one or more of the three sites. Most of these cannot be classified as crops, but rather as wild or weedy species adapted to early successional habitats, forest edges and disturbed ground. The only fleshy fruit producer which can confidently be described as a crop is peach, a European introduction which is noted for its weediness.

Persimmon (Diospyros virginiana L.), grape (Vitis spp.), hawthorn (Crataegus spp.), and maypops (Passiflora incarnata L.) seeds were recovered from all three sites. Grape (including muscadine, Vitis rotundifolia Michaux) is consistently highest as number of seeds per gram of plant food remains (although at Mitchum grape has the same value as maypops) (Table 26). Persimmon also has relatively high values, especially for the two later sites. Maypops, which has been classified as a weed crop for parts of the East (Yarnell 1983:3), is especially common at Mitchum and scarce at the Wall site. This pattern may reflect the seasonal specificity of some Mitchum site deposits. Sumac (Rhus spp.), blueberry (Vaccinium spp.) and bramble (Rubus spp.) are minor components of the Fredricks site assemblage; Rubus occurs at Mitchum as well. Hawthorn is represented by one seed at each site.

Common fleshy fruits which grow near settlements and in less anthropogenically altered habitats would have been easily collected in season, and could have been harvested incidentally to other activities. There is no evidence that patterns of fruit exploitation changed significantly over time, with the exception of the addition of peach to the diet after its introduction by Europeans. Since fleshy fruits are not staple foods, data on their use is not expected to reveal highly significant changes in subsistence. Preservation and storage of fruits such as that mentioned by Lawson (1967) for Historic period Indians probably did not represent a radical departure from older practices.

Table 26. Seeds and Corn as Number per Gram of Plant Food Remains (Features)

	Wall	Mitchum	Fredricks
Total plant food remains (grams)	7.78	14.62	23.57
Fleshy fruits			
Persimmon	0.13	0.27	0.30
Grape	0.26	0.21	0.55
Muscadine		0.14 =0.34	
Hawthorn	0.13	0.07	0.04
Blueberry			0.21
Maypops	0.13	0.34	0.04
Bramble		0.07	0.08
Sumac			0.04
Grains			
Maygrass		30.10	
Little barley		0.89	
<u>Hordeum/Festuca</u>		0.96	
Sumpweed	0.13		
Common bean			0.04
Corn			
kernels	1.02	1.09	1.40
cupules	20.30	2.67	10.14
Miscellaneous			
Bedstraw		0.07	0.42
Ragweed			0.13
Nightshade family		0.07	
Butterflypea		0.07	
Unknown type A		0.75	
Unknown grass		2.19	

Peach (Prunus persica L.) was first introduced to the Southeast by the Spanish, who planted the trees in mission gardens as early as A.D. 1602 (Sheldon 1978:28). The English carried peach seeds to New England by 1629 (Hedrick 1972:463). The earliest archaeological finds of peach pit are confined to sites in proximity to Spanish missions, and its occurrence is more common during the latter part of the Historic period. Presence of peach pits on a site is generally associated with the occurrence of European-made artifacts and other evidence of cross-cultural contact. By the mid-1600s, references to peach trees in the Southeast are common in the accounts of English travelers (Salley 1911).

The peach tree was brought to North America as a crop plant, and early descriptions make it plain that Indian groups in the East maintained it as such. By what route and in what manner the peach reached interior Indian groups is still uncertain. Sheldon (1978:29) suggests that peaches were first traded up the Chattahoochee River and into the Piedmont. Lawson (1967:115) remarks that Carolina Indians claimed that their use of the peach predated their first direct contacts with the English. However, he also notes that peaches were not found growing far from English settlements. Such statements suggest that the peach tree itself diffused rapidly into areas where it was not directly introduced by Europeans. In the case of the Carolina tribes the tradition of husbandry and use of the peach may have been older than sustained direct contact with Europeans.

There is support for this idea in characteristics of the peach plant itself and in the historical literature. Lawson (1967:115,173) reports that peach seedlings sprout easily without care, and claims that they bear fruit within three years. Modern peach trees generally do begin to bear within three to five years of germination. The ease of germination of the peach plant is attested also by Hedrick (1972:465), who says "The peach is raised with such facility from the stone that its diffusion along routes of communication must necessarily have been very rapid". Today, the peach occurs in the Carolinas as a frequent escape, growing near dwellings, roadsides, and trash heaps (Radford et. al. 1968:566).

Historical accounts from the 1650s onward mention the occurrence of peach trees in the East, both as crops and as spontaneously growing components of less altered habitats. In 1664, Hilton says of Florida that "the country abounds with Grapes, large Figs, and Peaches" (Salley 1911:42). Robert Sandford's Relation mentions a "great number of Peach trees" near Hilton Head Island (Salley 1911:100), and, of Carolina in general Robert Horne says that many kinds of fruit trees occur, including peach (Salley 1911:68). Near Charles Town, according to Thomas Ashe writing in 1682, "The Peach Tree in incredible Numbers grows wild" (Salley 1911:143). By the latter half of the seventeenth century, populations of peaches seem to have been securely established in many parts of the interior Southeast.

At the Fredricks site, where evidence of European contact is abundant, peach is a common component of the plant remains assemblage. It occurs in 50% of features and comprises an overall 26.8% of plant food remains by weight. If burial fill is at all representative of subsistence practices, peach was a commonly used food plant and was certainly managed as a crop. The plants and/or seeds could have been acquired either from the English directly or from neighboring aboriginal groups and ultimately from Spanish sources.

At the Mitchum site, the occurrence of peach is associated with a less intense level of contact, judging from the small quantities of associated trade goods. Despite this fact as well as a slightly earlier temporal placement than Fredricks, peach pit is abundant and fairly ubiquitous at Mitchum. Although it comprises only 9.5% of total plant food remains, its ubiquity value of 58% is comparable to its value for Fredricks. At Mitchum, therefore, abundant peach pit is associated with a degree of contact which was limited to exchange of a few kinds of trade items on the basis of present evidence. The existence of peach in the local area, and possibly its cultivation by Mitchum site inhabitants, thus may not have been dependent on sustained and direct contact with Europeans.

It can be concluded that the peach, at least in some cases, was appropriated as a crop by Piedmont groups somewhat independently of other aspects of European culture. It was attractive to aboriginal groups because of its high yield, short generation time, and ease of cultivation as well as qualities of the fruit that made it a good candidate for drying and storage. Its rapid adoption may also bespeak a familiarity with arboriculture based on native trees such as the persimmon, as suggested by Yarnell (1983). In fact, it would be surprising if the peach had not been incorporated into aboriginal subsistence systems. Change in use of the peach is clearly seen in site data, as peach pit increases to 26.8% of plant food remains at Fredricks from its complete absence at the Wall site. The peach is the only example from the three sites in question of a European introduced crop plant that was readily adopted by aboriginal groups.

Miscellaneous Seeds. Some seeds recovered from the Wall, Mitchum, and Fredricks sites represent species of questionable food value. These are listed as "Miscellaneous" in Table 26. Bedstraw

(<u>Galium</u> spp.) is a frequent component of plant remains assemblages in the East. Although bedstraw seeds can be used to make a beverage, it is more likely that the vegetative part of the plant was used as bedding. Ragweed (<u>Ambrosia</u> spp.) probably occurred as a weed in or near the habitation area or gardens, and the same is probably true of butterflypea (<u>Centrosema virginiana</u> L.). The unidentified grasses from the Mitchum site may have been used for food, or they may have been collected only incidentally to harvesting of specific grasses such as maygrass and little barley. The seed type designated "Unidentified A" is fairly distinctive, although it has not yet been identified using available reference works (Martin and Barkley 1961; Montgomery 1977; USDA 1974). And, a single seed from the Mitchum site could be identified only as belonging in the Nightshade family (Solanaceae).

<u>Summary</u>

From the information presented above, it can be concluded that Piedmont groups maintained a fairly diversified plant food resource base, in spite of the dominance of corn as a staple. Considerable reliance on an agricultural system of food production did not preclude harvesting nuts as an important activity, although its importance may have declined somewhat during the Historic period, particularly in the case of acorns. The only lowering of utilized resource diversity seems to have arisen from reduction or elimination of the harvesting of native grain-producing species. Staple plant foods were stored when possible; al least until the Middle Historic period, these were supplemented seasonally by some populations with starchy grains, fruits, and probably greens. The peach was clearly an addition to the aboriginal diet, but cannot be considered a staple. No other Old World crops were recovered from the Mitchum and Fredricks sites.

Further research will be needed to determine whether the most notable changes for the Historic period were ones of emphasis (as in the case of acorn) or of addition/delection of certain resources.

Additional Data from North Carolina and Tennessee: A Comparison

Although data on Carolina Piedmont subsistence patterns are scarce, some adjacent parts of the Southeast have received considerable attention in the form of paleoethnobotanical studies. The lower Little Tennessee River valley is one area whose archaeological record of plant use has been thoroughly researched. Materials from a number of sites with components dating as far back as the Early Archaic have been analyzed. In Historic times, the Little Tennessee valley was populated by the Cherokee, who are of Iroquoian rather than Siouan linguistic affiliation. Late in the Prehistoric period, sites in the area are affiliated with the Mississippian cultural tradition and with societies more complex than those of most Piedmont groups. Although the Little Tennessee valley is in a different physiographic province than the Piedmont, both regions support temperate deciduous forest. Comparison of plant remains data from the two areas for the late Prehistoric and Historic periods can be helpful both in contrasting local subsistence adaptations and in establishing broader, regional trends.

Chapman and Shea (1981) summarize information from a number of sites in the Little Tennessee River valley dating between A.D. 1300 and A.D. 1819. The Late Mississippian Dallas phase (A.D. 1300 to 1600) is represented by the Toqua site, and seven sites, including Toqua, have components dating to the Historic Cherokee occupation of the area (A.D. 1700 to 1819). The Wall site occupation corresponds temporally roughly to the latter part of the Dallas phase, and that of the Fredricks site to the earlier part of the Cherokee period. Temporally the Mitchum site occupation falls between the two.

Several changes from the Dallas phase to the Historic period concur with the Piedmont Carolina data. Acorn declines as percentage of nut remains from 2.9% to 0.2%, as compared with an ever sharper drop between Wall and Fredricks. Decreasing utilization of acorn after its peak in the Early Woodland has been recognized as a trend in the prehistoric East, based largely upon the lower Little Tennessee data. Acorn may have been the most important plant food in the Southeast until corn replaced it (Yarnell and Black 1983:6). A similar pattern seems to hold for the Piedmont, at least for the latter part of the temporal sequence. Investigations of earlier components would be needed to determine whether this trend is initially associated with the intensification of corn agriculture in the area. Such intensification may have taken place later in the Atlantic Piedmont than in the interior or Southern Piedmont.

For the Tennessee sites, hickory declines in importance while walnut increases. No such pattern can be discerned in the Piedmont, where walnut is so far not abundant archaeologically. If anything, hickory becomes more prominent relative to acorn and walnut. Overall, nuts decrease as percentage of plant food remains from 59.8% for Dallas to an average for sites surveyed of 20.4% for the Historic period. The Piedmont data show a slight drop in nut remains from Prehistoric to Historic. In both areas, nuts certainly remained an important resource, though different types of nut were emphasized at different times. Declining utilization of nut resources is more evident for the Tennessee data than it is for the Carolina Piedmont, but the time period involved is longer for the Tennessee plant remains record.

Corn becomes more abundant during the Cherokee occupations for Tennessee, based on an average of 61.9% for sites of this time period. The Dallas period Toqua site sample is only 36.2% corn. Although the Piedmont data are somewhat ambiguous regarding corn, there is no doubt that it maintained a high level of importance during the Historic period. A very slight drop can be noted for corn between the Wall and Mitchum occupations. However, when peach pit is excluded from calculation of percentages, there is a slight increase. Number of kernels per gram of plant food remains also increases. Data on beans and cucurbits from the Piedmont are limited, and, likewise, present no clear pattern for Tennessee.

Of native grains, maygrass remained important in Tennessee into the Historic period, although it is absent from Dallas phase components. Although domesticated sumpweed disappeared after Dallas, it persists until ca. A.D. 1550 for the Carolina Piedmont, but its significance cannot yet be determined. Use of native grains may have persisted longer in the Little Tennessee valley than it did in the Piedmont, since knotweed (_Polygonum_ spp.), sunflower (_Helianthus annuus_ L.), and chenopod (_Chenopodium_ spp.) occur in some quantity there in Historic period components.

Peach is abundant at Cherokee sites, as it is at Mitchum and Fredricks. Grape remained important in both areas, and persimmon seems to have declined in Tennessee, in contrast to the Carolina Piedmont.

Some of the same trends are readily apparent in both the Tennessee and Carolina Piedmont data, indicating that similar selective factors were at work on subsistence behavior in both areas. Parallel developments took place despite differences in social complexity as well as distinct sets of ecological and culture-historical circumstances. The most significant difference between the two areas is the persistence of native grain crops in Tennessee well into the Historic period.

Within the Piedmont itself, we would expect to find even stronger similarities, particularly between groups assumed to be Siouan-speakers. Upper Saratown (31Sk1a) is a village site in the Dan River drainage of the northwestern North Carolina Piedmont located about 60 miles due west of the Wall and Fredricks sites, and 50 miles west of the Mitchum site. The site was occupied between A.D. 1650 and 1700. Like the Fredricks site, Upper Saratown shows evidence of extensive trade contact with Europeans, though it is dated slightly earlier. Temporally, its occupation may have overlapped with that of the Mitchum site. Analysis of plant remains data from the site was based primarily upon waterscreened samples and secondarily upon flotation material derived from a number of features (J. Wilson 1977).

The Upper Saratown plant remains assemblage closely resembles that from the Fredricks site in a number of ways. Hickory nut seems to have been about equally important at both sites, although walnut and hazelnut are also present at Upper Saratown. Acorn is not abundant at either site; the corrected acorn to hickory ratio for Upper Saratown is slightly less than one (0.94), as compared with 0.16 for Fredricks, indicating that the two kinds of nuts had a similar degree of importance there. This is less of a contrast between the two than with the earlier Wall site, where acorn dominates. Conclusions may be influenced by the larger size of the Upper Saratown sample and the contexts from which it was drawn. In any case, exploitation of nut resources, especially of hickory, remained important in both areas.

Crops, particularly corn, were important subsistence items at Upper Saratown. As at Fredricks, corn was the chief staple crop, supplemented by beans and cucurbits. With the exception of a single sunflower seed, native grain crops are also absent from Upper Saratown. Again, it might be argued that such absence is an artifact of resource and feature seasonality. However, at Upper Saratown a variety of feature types were sampled. Screen size used in recovery may also be a factor influencing seed recovery. The Upper Saratown subsistence pattern, while including a fairly diverse set of plant resources, seems to have been focused on corn cultivation and nut collecting, as at Fredricks.

Relative amounts of fleshy fruits are much the same at Fredricks and Upper Saratown. Grape is the most abundant seed type at Upper Saratown, followed closely by persimmon. Maypops is also well represented. Peach pit makes up 8.5% of plant food remains; although this is far from Fredricks' 26.8%, it indicates a regular utilization of peach.

The Upper Saratown and Fredricks plant remains data are more similar to each other than either is to the Mitchum site assemblage. Mitchum may be contemporaneous with Upper Saratown, yet contrasts in the presence of seasonal grasses and relatively low representation of corn. Fredricks in the eastern Piedmont and Upper Saratown in the western Piedmont show evidence of considerable European contact as well as similar subsistence practices.

CHAPTER IV. DISCUSSION AND CONCLUSIONS

One focus of this study is the relationship between subsistence change, as defined by archaeological data, and cultural interaction of aboriginal and European groups. Having discussed several specific instances of change within the northern North Carolina Piedmont during a period of about 200 years, some suggestions can be made as to why these changes occurred. This can be done with reference to changing time and energy cost-benefit ratios of different food procurement activities. These cost-benefit relationships can in turn be linked causally to European-aboriginal interaction during the Historic period.

It is important first to consider the social context of subsistence change. Boundaries must be established for the cultural unit within which change has taken place. The problems of defining cultural and social units in archaeological studies, particularly for periods of rapid change and culture contact, have already been alluded to. Although these problems remain, it is necessary to at least indicate the subject of study as precisely as current knowledge allows. This can be done by defining the unit that underwent change as a spatially and temporally extended cultural system rather than as a tribe or a set of genetically descendent populations. This system includes the aboriginal cultures of the North Carolina/Virginia Piedmont during the Protohistoric and Historic Periods as well as their interactions with the environment. It is assumed that the populations represented archaeologically can be considered together as part of a larger cultural system distinguishable from those of neighboring groups.

It is also necessary to explain what is meant by subsistence change. In evolutionary terms, change is effected by shifts in the relative frequencies of different behaviors within a human population or group of populations. The immediate cause of this change in frequencies is decision-making by individuals or groups. Ultimately change is effected by environmental factors which tend to select for certain phenotypes which in turn pass on both genes and information to other individuals. Aspects of the environment (cultural as well as natural) influence the energetic costs and benefits of different procurement activities. Subsistence practices vary in their efficiency in terms of time and energy costs, and it is assumed that increased efficiency results in increased fitness (Winterhalder 1981:15). The concept of fitness need not be restricted to that of reproductive success, but can be extended to the realm of cultural inheritance (Rindos 1984).

Cost-benefit approaches to subsistence change have been used by a number of researchers, among them Earle (1980). Similarly, the idea that humans, like other animals, tend to exploit resources in such a way that costs are minimized and benefits maximized is central to optimal foraging approaches to subsistence (Keene 1981; Winterhalder 1981). Although cost-benefit analysis can sometimes present an inaccurate picture of humans as always behaving in economically rational ways, it does have some advantages. Restricting explanation to materialistic considerations is valuable because it recognizes that immediate material needs and ease of procurement guide much of human behavior. Also, recognition of a fitness component guarantees that intentionality and long-term planning need not be invoked to explain changes in subsistence behavior. For the purposes of this study, a non-quantitative cost-benefit approach can assist in the development of preliminary explanations for subsistence change among Piedmont groups during the Historic period.

Exploitation of acorns decreased in the Historic period in the north central Piedmont, as it did in eastern Tennessee. The energetic and time allocation costs of procuring acorns and hickory nuts in a predominantly oak-hickory forest would seem to be very close, depending upon local distribution of mature trees. However, processing costs might differ considerably. While hickory nutmeat can be eaten raw, most acorns possess enough bitter tannins to require considerable processing. Processing costs, if high, would always have been so for acorns, and cannot explain why acorn would decline in importance only in the Historic period after having been a primary resource throughout the East. And despite processing costs, acorns have a much higher meat to shell ratio than thick-shelled hickory. Nevertheless, acorns might have been used less frequently as other higher-ranking resources became more abundant, or as demand for higher-ranking resources was reduced along with population size.

Acorns do differ from hickory nuts in terms of nutritional returns. Unlike most other nuts, acorns are higher in carbohydrates and lower in fat and protein content (Asch, Ford and Asch 1972:13). Acorn complements hickory nut nutritionally, but is more similar in composition to corn and other starchy crops. Without specifying the mechanisms of change, corn cultivation could have become the focus of some of the time and energy originally allocated for acorn collection and processing. Declining acorn use in eastern Tennessee after the Early Woodland period slightly predates the introduction of corn to the area (Yarnell and Black 1983), but thereafter as corn agriculture grows in importance, acorn declines. This evidence indicates that acorns may have been displaced, having been a relatively low-return resource.

For any resource exploited, the cost of procurement can be seen to include the value of activities in which resources could have alternatively been invested (Winterhalder 1983:15; Ferguson 1972:208). The opportunity cost of activity X is thus the value of some other activity foregone in its favor. The concept of opportunity cost can be used to propose possible explanations for declining exploitation of acorns in the North Carolina Piedmont. Because of the high yield of corn agriculture, the opportunity cost of collecting acorns may have risen with increasingly higher ranking of corn as a resource.
Oaks in the Carolina Piedmont produce fruit between September and November (Radford et. al. 1968:372-385), so it is possible that there were scheduling conflicts between acorn collecting and activities associated with the corn harvest. In the face of such conflicts the benefits of acorn collecting would not compensate for the loss of some part of the potential net gain from corn harvesting.

With contact, the opportunity cost of exploiting acorns may have been affected in other ways. The establishment of aboriginal-European trade relationships introduced a new set of potential resources to Indian populations. Although the precise effects of the deerskin trade upon the cost-benefit ratios for other activities have not yet been determined, it is certain that its impact was significant. Initially the benefits of hunting deer and trading deerskins were high because these activities resulted in acquisition of goods (especially non-food items) which otherwise would have been difficult or impossible to obtain. The opportunity cost components of all previous subsistence activities, including acorn collection, were certainly affected by the addition of this set of resources to the environment.

Assuming that only men hunted, the extent to which the opportunity cost of acorn collection was raised by the possiblility of trade in deerskins depends upon the timing of the two activities, the participation of males in acorn collecting and processing, population sex and age structures, and other factors. Although women probably did not hunt, it is very likely that they prepared hides for trade as well as for use by the group. Their activities would have thus paralleled those of males and contributed to increased opportunity cost for acorn exploitation. Faunal remains data are inconclusive regarding any change in the frequency of deer hunting between the Wall and Fredricks site occupations (A. Holm, personal communication 1984).

If Piedmont patterns of subsistence were similar to those postulated for other parts of the Eastern woodlands (Yarnell and Black 1983), decline in exploitation of acorns began before contact. Although the European presence apparently did not initiate this trend in the East as a whole, aboriginal interaction with Eropeans could have intensified it. The Upper Saratown data show that acorn use was not necessarily as low relative to use of hickory during the Historic period as the Fredricks site data indicate. However, there is good reason to believe that where acorn declined in importance, it began to do so before contact.

Assessing reasons for changes in the utilization of indigenous grains is a difficult task. It is not clear whether the lack of these resources in Historic period assemblages is due to change within a local area over time, existence of distinct cultural traditions, spatial variation in resource abundance, seasonal patterning, or a combination of these. However, evidence of indigenous grain resources is lacking from Piedmont Siouan sites showing evidence of sustained and significant European contact. Assuming that the Mitchum site maygrass and little barley represent an exploitation technique which was not retained by later Historic period Piedmont groups, what might explain this change?

When one evaluates the cost-benefit relationship for the exploitation of maygrass and other early-ripening grasses, there appear to be many advantages associated with harvesting such resources. During the spring and early summer, when most plant resources other than greens were not ready for collection, harvesting of available ripe grains would have been energetically expedient. Returns might have been low, but only relative to returns from other resources that were unavailable at the same time. Thus, the opportunity costs associated with exploiting cool-season grasses would have been correspondingly low. With stored staple foods diminishing, the advantages of devoting time and energy collecting such grains are obvious.

Why this kind of behavior became less frequent is not clear. As in the case of acorn, the cost-benefit ratio for harvesting, processing, and perhaps maintaining a habitat for cool-season grasses may have changed so that energy was diverted to different activities. A scheduling conflict with corn planting may have already existed, and would have resulted in reduction of the time devoted to grass harvesting. If in fact corn was increasing in importance, this trend would have been intensified. This shift could have taken place if other activities yielding higher returns became available during the late spring and early summer months. Trade activities may have played this role, and could explain why absence of cool-season grasses archaeologically is correlated with abundant evidence of interaction with Europeans.

Even if deer hunting and trade activities did not conflict with grass harvesting seasonally, changes in population age and sex structure may have affected the costs of the latter. Overall reduction in group size could have called for a reallocation of energy and possibly abandonment of relatively low-return or high-cost activities. Reduction of that segment of the population typically involved in cool-season grass harvesting would have had similar consequences, particularly if the opportunity cost of this activity was raised because of the availability of other resources. Population dynamics certainly played a role in subsistence change, but without adequate demographic data, suggestions about its significance must remain speculative.

Changes in the frequency of cool-season grass harvesting may also have depended upon the local availability of these resources. If maygrass and little barley were crops, planting would have assured at least potential availability at a given location for a particular time. Without planting, the species' natural distributions and timing of seed production would have been somewhat less predictable, resulting perhaps in more spatial and temporal variation in their exploitation. Proximity of cool-season grass populations to a settlement would have resulted in low travel and transport time costs associated with harvesting them. Today, maygrass is described as "locally abundant" and little barley as occurring throughout the Carolinas (Radford et. al. 1968:88, 112). Patchiness of distribution of these species, particularly maygrass, may have been in part responsible for their presence archaeologically at Mitchum but not at other Historic period Carolina Piedmont sites.

Other possible explanations need not be purely materialistic. In light of the host of destabilizing factors acting on aboriginal societies and attributable directly or indirectly to European influence, it is probable that not all changes in aboriginal subsistence should be classed as effective "solutions" to energy-allocation "problems". Not all changes in behavior result in increased adaptation. It is possible that an effective set of behaviors might drop out of the available pool as a result of information loss. In such a case, selection of advantageous behaviors is essentially sidetracked. With respect to European contact, dispersal and reorganization of groups as well as depopulation could have negatively influenced the transfer of certain kinds of information, regardless of its ability to enhance fitness in some way. Further data collection will be needed to resolve this issue, but hopefully some fruitful directions for research have been indicated.

It is easier to answer the question of why peach was incorporated into aboriginal subsistence systems. First, some prehistoric familiarity with arboriculture is a possibility, but certainly not a prerequisite for the adoption of peach. Rather, qualities of the species itself made its adoption advantageous. Leaving aside the question of taste, the peach is both prolific and quick-yielding. Gathering the fruit would have been a simple and low energy-expenditure activity providing relatively high returns. Maintenance of growing trees can be minimal, as peach trees frequently grow well with little or no tending. Processing costs would have been low for consuming the fresh fruit; drying of peaches along with other fruits was a common practice according to Lawson (1967:182, 217). In short, because of the characteristics of the peach, including its ability to extend its range without extensive human aid, it is no surprise that Piedmont groups adopted it rapidly.

Many aspects of Piedmont Siouan subsistence apparently remained stable during the initial period of intensive European contact. Collection of nuts, especially hickory, and production of major crops such as corn remained important. If virtual cultural extinction had not been the outcome of contact it is certain that these relatively stable aspects of subsistence would eventually have undergone change due to altered selection pressures. Removal of native peoples and disappearance of aboriginal cultural traditions occurred before changes in behavior that might be called adaptive could take place.

Some changes in subsistence for Historic period Carolina groups are, nevertheless, evident in the archaeological record. Major systems of exploitation, such as nut-collecting and corn agriculture, remained important despite shifts in emphasis on species within these systems. Although seasonal exploitation of cool-season grasses may have undergone a significant decline, their overall importance prehistorically as well as historically in the Carolina Piedmont cannot yet be assessed. In contrast to mortuary practices and material culture (H. Wilson 1984), subsistence retained most of its original material elements despite rearrangement of the relationships between them.

Evidence of animal exploitation supports this interpretation. Preliminary results of faunal analysis from the Fredricks and Wall sites (A. Holm, personal communication 1984) indicate a possible increase in utilization of small anumals, with representation of turkey and box turtle rising relative to that of deer. One bone of a domestic pig and a single horse tooth, both from Fredricks, are the only evidence of European-introduced animal species. Overall, continuity is more evident than qualitative change. Thus, major systems of plant and animal exploitation continued to function, despite changes in emphasis within them.

There is evidence for such changes in emphasis in the general correlation between intensity of contact and certain characteristics of plant food subsistence. For the sites studied, a high degree of contact as measured by frequency of occurrence of trade artifacts is associated with abundant peach pit, relatively low representation of acorn, and no evidence of utilization of indigenous grains. Where evidence of contact is lacking, peach is absent, acorn abundant relative to hickory, and native grains present. Only peach displays an unambiguous pattern in its correlation with extent of contact.

An assumption that European contact produced universally rapid changes in all aspects of aboriginal culture is, therefore, not justified. Subsistence behavior of the groups in question was adjusted to environmental change (in the form of an alien culture) and consequent internal shifts in activity cost-benefit relationships. Changes which were indeed prodound, such as population decline and the introduction of relationships and material goods associated with trade, inevitably affected those cost-benefit ratios. The main process, however, seems to have been one of adjustment rather than rapid selection for many new or atypical behaviors.

Collection and interpretation of much more data will be needed before these interpretations can be properly assessed. Although continued assessments of technique and method are also needed, it is clear that properly collected flotation samples provide a better data base than waterscreened samples. Issues surrounding subsistence change--

both its evolutionary aspects and its relation to cultural interaction--are complex. The Piedmont Siouan cultures provide a valuable test case for examining these larger issues archaeologically.

REFERENCES CITED

Asch, D. and N. Asch

1983 Archaeobotany. In Excavations at the Smiling Dan Site: Delineation of Site Structure and Function During the Middle Woodland Period, edited by Barbara D. Stafford and Mark B. Sant, pp. 635-725. Center for American Archaeology, Contract Archaeology Program, Reports of Investigations No. 137.

Asch, Nancy B. and David L. Asch

1978 The Economic Potential of Iva annua and its Prehistoric Importance in the Lower Illinois Valley. In The Nature and Status of Ethnobotany, edited by Richard I. Ford, pp. 301-341. Museum of Anthropology, University of Michigan, Anthropological Papers No. 67, Ann Arbor.

Asch, Nancy B., R. I. Ford, and David L. Asch

1972 Paleoethnobotany of the Koster Site: The Archaic Horizons. Illinois State Museum, Reports of Investigations 24.

Chapman, Jefferson and Andrea B. Shea

1981 The Archaeobotanical Record: Early Archaic Period to Contact in the Lower Little Tennessee River Valley. Tennessee Anthropologist 6:61-84.

Coe, Joffre L.

1952 The Cultural Sequence of the Carolina Piedmont. In Archaeology of Eastern United States, edited by James B. Griffin, pp. 301-311. University of Chicago Press, Chicago.

1964 The Formative Cultures of the Carolina Piedmont. Transactions of the American Philosophical Society 54, Philadelphia.

Conard, Nicholas, David L. Asch, Nancy B. Asch, David Elmore, Harry Gove, Meyer Rubin, James A. Brown, Michael D. Wiant, Kenneth B.

Farnsworth, and Thomas G. cook

1983 Prehistoric Horticulture in Illinois: Accelerator Radiocarbon Dating of the Evidence. Center for American Archaeology, Archaeobotanical Laboratory Report No. 54.

Cowan, C. Wesley

1978 The Prehistoric Use and Distribution of Maygrass in Eastern North America: Cultural and Phytogeographical Implications. In The Nature and Status of Ethnobotany, edited by Richard I. Ford, pp. 263-288. Museum of Anthropology, University of Michigan, Anthropological Papers No. 67, Ann Arbor.

Crafton, W. M. and B. W. Wells

1934 The Old Field Prisere: An Ecological Study. Journal of the Elisha Mitchell Society 50:225-246.

Crites, Gary D. and R. Dale Terry

1984 Nutritive Value of Maygrass, Phalaris caroliniana. Economic Botany 38:114-120.

Davis, R. P. Stephen Jr.

1983 Aboriginal Ceramics from the Eno and Haw River Valleys and their Bearing upon the Identification of John Lawson's Occaneechi Town. Paper presented at the 17th Annual Meeting of the Society for Historical Archaeology, Williamsburg.

Dennell, R. W.

1976 The Economic Importance of Plant Resources Represented on Archaeological Sites. Journal of Archaeological Science 3:229-247.

Dickens, Roy S. Jr.

1982 The Form, Function, and Formation of Garbage-Filled Pits on Southeastern Aboriginal Sites: An Archaeobotanical Analysis. Ms. in possession of author.

1984 In Search of Occaneechi: Archaeology and History of the Aboriginal North Carolina Piedmont. Paper presented at the 17th Annual Meeting of the Society for Historical Archaeology, Williamsburg.

Dimbleby, Geoffrey

1978 Plants and Archaeology. Humanities Press, Atlantic Highlands, New Jersey.

Dobyns, Henry F.

1983 Their Numbers Become Thinned: Native American Population Dynamics in Eastern North America. University of Tennessee Press, Knoxville.

Doebley, John F.

1984 "Seeds" of Wild Grasses: A Major Food of Southwestern Indians. Economic Botany 38:52-64.

Earle, Timothy K.

1980 A Model of Subsistence Change. In Modeling Changes in Prehistoric Subsistence Economies, edited by Timothy K. Earle and Andrew L. Christenson, pp. 1-30. Academic Press, New York.

Ferguson, C. E.

1972 Microeconomic Theory. Third Edition. Richard D. Irwin, Homewood, Illinois.

Ford, Richard I.

1973 The Moccasin Bluff Corn Holes. Appendix 15 in The Moccasin Bluff Site and the Woodland Cultures of Southwestern Michigan, by Robert Louis Bettarel and Hale G. Smith, pp. 188-197. Museum of Anthropology, University of Michigan, Anthropological Papers No. 49, Ann Arbor.

Gleason, Henry A. and Arthur Cronquist

1964 The Natural Geography of Plants. Columbia University Press, New York.

Hedrick, U. P., ed.

1972 Sturtevant's Edible Plants of the World. Dover Publications, New York.

Hudson, Charles

1976 The Southeastern Indians. University of Tennessee Press, Knoxville.

Johnson, Kristen J.

1983 Formation of Archaeological Refuse Deposits at the Wall Site. Ms. in possession of author.

Keene, Arthur S.

1981 Optimal Foraging in a Nonmarginal Environment: A Model of Prehistoric Subsistence Strategies in Michigan. In Hunter-Gatherer Foraging Strategies, edited by Bruce Winterhalder and Eric Alden Smith, pp. 171-193. University of Chicago Press, Chicago.

King, Frances B.

1980 Early Cultivated Cucurbits in Eastern North America. Ms. in possession of author.

Lawson, John

1967 A New Voyage to Carolina. Edited by Hugh Lefler. University of North Carolina Press, Chapel Hill.

Lopinot, Neal H.

1983 Analysis of Flotation Sample Materials from the Late Archaic Horizon. Chapter VII in The 1982 Excavations at the Cahokia Interpretive Center Tract, St. Clair County, Illinois by Michael

S. Nassaney, Neal H. Lopinot, Brian M. Butler, and Richard W. Jefferies, pp. 77-108. Center for Archaeological Investigations, Southern Illinois University at Carbondale, Research Paper No. 37.

Margalef, Ramon

1968 Evolution in the Frame of Ecosystem Organization. In <u>Perspectives in Ecological Theory</u> by Ramon Margalef, pp. 80-102. University of Chicago Press, Chicago.

Martin, Alexander C. and William D. Barkley

1961 <u>Seed Identification Manual</u>. University of California Press, Berkeley.

Montgomery, F. H.

1977 <u>Seeds and Fruits of Plants of Eastern Canada and Northeastern United States</u>. University of Toronto Press, Toronto.

Moore, Julie Hackney

1973 <u>Preimpoundment Studies, Falls Project, A Survey of the Vascular Plants</u>. Department of Environmental Sciences and Engineering, School of Public Health, University of North Carolina at Chapel Hill.

Moore, Julie H. and Emily W. Wood

1976 <u>B. Everett Jordan Dam and Lake, Assessment of the Vegetation</u>. Department of Environmental Sciences and Engineering, School of Public Health, University of North Carolina at Chapel Hill.

Munson, Patrick J.

1981 Note on the Use and Misuse of Water-Separation ("Flotation") for the Recovery of Small-Scale Botanical Remains. <u>Mid-Continental Journal of Archaeology</u> 6:123-126.

Navey, Liane

1982 <u>An Introduction to the Mortuary Practices of the Historic Sara</u>.

Unpublished Master's thesis, Department of Anthropology, University of North Carolina at Chapel Hill.

Radford, Albert E., Harry E. Ahles, and C. Ritchie Bell

1968 A Manual of the Vascular Flora of the Carolinas. University of North Carolina Press, Chapel Hill.

Rindos, David

1984 The Origins of Agriculture: An Evolutionary Perspective. Academic Press, New York.

Salley, Alexander S., ed.

1911 Narratives of Early Carolina, 1650-1708. Charles Scribner's Sons, New York.

Schiffer, Michael B.

1976 Behavioral Archaeology. Academic Press, New York.

1977 Toward a Unified Science of the Cultural Past. In Research Strategies in Historical Archaeology, edited by Stanley South, pp. 13-50. Academic Press, New York.

1983 Toward the Identification of Formation Processes. American Antiquity 48:675-706.

Sheldon, Elisabeth Shepard

1978 Childersburg: Evidence of European Contact Demonstrated by Archaeological Plant Remains. Southeastern Archaeological Conference Special Publication No. 5, pp. 28-29.

Struever, Stuart

1965 The "Flotation" Process for Recovery of Plant Remains. Southeastern Archaeological Conference Bulletin 3:32-35.

1968 Flotation Techniques for the Recovery of Small-Scale Archaeological Remains. American Antiquity 33:353-362.

U. S. Department of Agriculture

1974 Seeds of Woody Plants in the United States. Agriculture Handbook No. 450. Forest Service, Washington D. C.

Ward, H. Trawick

1980 The Spatial Analysis of the Plow Zone Artifact Distributions from Two Village Sites in North Carolina. Unpublished Ph.D. dissertation, Department of Anthropology, University of North Carolina, Chapel Hill.

1983 A Review of Archaeology in the North Carolina Piedmont: A Study of Change. In The Prehistory of North Carolina, edited by Mark A. Mathis and Jeffrey J. Crow, pp. 53-82. North Carolina Division of Archives and History, Department of Cultural Resources, Raleigh.

Watson, P. J.

1976 In Pursuit of Prehistoric Subsistence: A Comparative Account of Some Contemporary Flotation Techniques. Mid-Continental Journal of Archaeology 1:77-100.

Wilson, Homes Hogue

1984 European Trade Goods from the Fredricks Site (31Or231). Paper presented at the 17th Annual Meeting of the Society for Historical Archaeology, Williamsburg.

Wilson, Jack H.

1977 Feature Fill, Plant Utilization and Disposal Among the Historic Sara Indians. Unpublished Master's thesis, Department of Anthropology, University of North Carolina, Chapel Hill.

1983 A Study of the Late Prehistoric, Protohistoric, and Historic Indians of the Carolina and Virginia Piedmont: Structure, Process, and Ecology. Ph.D. dissertation, University of North Carolina.

University Microfilms, Ann Arbor.

Winterhalder, Bruce

1981 Optimal Foraging Strategies and Hunter-Gatherer Research in Anthropology: Theory and Models. In Hunter-Gatherer Foraging Strategies, edited by Bruce Winterhalder and Eric Alden Smith, pp. 13-35. University of Chicago Press, Chicago.

1983 The Analysis of Hunter-Gatherer Diet: Stalking an Optimal Foraging Model. Paper prepared in advance for Wenner-Gren Symposium No. 94, Cedar Cove, Florida.

Wolf, Eric R.

1984 Culture: Panacea or Problem? American Antiquity 49:393-400.

Yarnell, Richard A.

1972 Iva annua var. macrocarpa: Extinct American Cultigen? American Anthropologist 74:335-341.

1974 Plant Food and Cultivation of the Salts Cavers. In Archaeology of the Mammoth Cave Area, edited by Patty Jo Watson, pp. 113-122. Academic Press, New York.

1978 Domestication of Sunflower and Sumpweed in Eastern North America. In The Nature and Status of Ethnobotany, edited by Richard I. Ford, pp. 289-299. Museum of Anthropology, University of Michigan, Anthropological Papers No. 67, Ann Arbor.

1982 Problems of Interpretation of Archaeological Plant Remains of the Eastern Woodlands. Southeastern Archaeology 1:1-7.

1983 Prehistoric Plant Foods and Husbandry in Eastern North America. Paper presented at the 48th Annual Meeting of the Society for American Archaeology, Pittsburgh.

Yarnell, Richard A. and M. Jean Black

1983 Temporal Trends Indicated by a Survey of Prehistoric Plant

Food Remains from Southeastern North America. Revised version of a paper presented at the 40th Annual Meeting of the Southeastern Archaeological Conference, Columbia, South Carolina.