

Late Prehistoric and Historic Period Paleoethnobotany  
of the North Carolina Piedmont

by

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A Dissertation submitted to the faculty of The  
University of North Carolina at Chapel Hill in partial  
fulfillment of the requirements for the degree of  
Doctor of Philosophy in the Department of Anthropology.

Chapel Hill

1989

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## ABSTRACT

KRISTEN JOHNSON GREMILLION. Late Prehistoric and Historic Period Paleoethnobotany of the North Carolina Piedmont (under the direction of Richard A. Yarnell).

Change and continuity in plant use by aboriginal populations of the northeastern North Carolina Piedmont between ca. AD 1000 and AD 1740 are examined with particular reference to the impact of European contact. Hypotheses about plant and land use are formulated by combining general assumptions about human ecology and subsistence with specific ethnohistoric and archaeological information. The resulting hypotheses center around responses to temporal variability and spatial heterogeneity and their consequences for diet composition. Evaluation of these hypotheses using paleoethnobotanical data reveals considerable continuity despite potentially disruptive European activity in the region. Scheduling of subsistence activities and storage of plant foods had similar features before and after contact. Emphasis on use of anthropogenically disturbed plant communities continued. Spatial distance between European and aboriginal settlements limited the impact of White land use practices on the vegetational mosaic. Plant resource diversity remained high, which facilitated modification of diet breadth according to changing environmental

circumstances. The relatively high productivity of maize ensured its continued importance. Certain small grains of the Eastern Agricultural Tradition were important seasonally when other plant foods were scarce in the environment. Two Old World domesticates were adopted by aboriginal groups, peach and watermelon. Both species were inexpensive to produce, productive, and easily incorporated into existing plant management systems. Other changes in the use of plant foods appear to represent the continuation of trends initiated prior to contact. Initially, effects of contact on plant use were minimal and frequently allowed for incorporation of new elements into existing subsistence systems. In the northeastern Piedmont ethnic extinction seems to have preceded adaptation through extensive acculturation.

## ACKNOWLEDGEMENTS

This work owes a debt to a number of individuals. The comments and suggestions of the author's dissertation committee (Donald Brockington, George Holcomb, Vin Steponaitis, Trawick Ward, Bruce Winterhalder, and Richard A. Yarnell) improved it in a number of ways. Dick Yarnell's support, teaching, and friendship contributed greatly to my development as a scholar, as did our many conversations about ecology, evolution, and ethnobotany. The late Dr. Roy Dickens' efforts guided much of the Siouan Project research out of which this dissertation grew. The excellent direction of that project (carried on by Trawick Ward and Steve Davis) and the efforts of its field crews resulted in collection of the plant remains that made my own research possible. Conversations and arguments with many colleagues and friends (including Jean Black, Gayle Fritz, Paul Gardner, Julie Hammett, Homes Hogue, Annie Holm, David Moore, and Greg Waselkov, to name a few) over the years have been instructive as well as entertaining. Special thanks are also due to Paul Gardner for friendship, encouragement, much shared laughter, and a nearly constant exchange of ideas both momentous and trivial.

I would also like to acknowledge the financial assistance of the Graduate School at the University of North Carolina, Chapel Hill, from which I received an On-Campus Dissertation Grant. My parents, John and Bettina Quinn, also provided financial support throughout my graduate career. I would like to thank them especially for being so generous and patient.

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of archaeological data on Late Prehistoric and Historic period Piedmont groups. Results of this research are to be found in a number of publications, including Davis and Ward (1988); Dickens et al. (1987); McManus and Long (1986); Simpkins (1985); Simpkins and Petherick (1986); and Ward and Davis eds. (1988), as well as various Master's theses and dissertations (Gremillion 1984; Holm 1985; Hogue 1988) in addition to the current work. Other relevant research includes the work of Wilson (1977, 1983), which built upon archaeological investigations of Piedmont sites before the most recent phase of the Siouan project was instigated. Much of the ensuing overview of history and current archaeological knowledge relies upon information summarized in Davis and Ward (1988), Dickens et al. (1986), and Simpkins (1985) in addition to unpublished field records.

Various aspects of Siouan Project research contributed to the model of and hypotheses about plant use developed here. Its initial findings indicated that maintenance of traditional patterns, with selective incorporation of European-introduced elements, characterized the postcontact history of Piedmont groups (Dickens et al. 1986). Accommodation of novel material goods was accompanied by participation in newly established exchange networks. However, Piedmont populations remained largely committed to traditional subsistence and social patterns until ethnic extinction occurred. The sociocultural systems of the Piedmont thus vanished before any extensive reorganization

CHAPTER I  
INTRODUCTION

This research effort seeks to define and explain both change and continuity in plant and land use by Native Americans in the context of interethnic contact during the period of Europe's exploration, colonization and conquest of the New World. The setting chosen for examination of aboriginal subsistence patterns in this turbulent era is the Piedmont of North Carolina, a region once inhabited by small, tribally organized societies of which little is known historically. These groups rapidly lost their sociocultural identities under the influence of warfare and depopulation stimulated by the European presence. They ultimately gave way to White settlement, dispersing to join other Native American groups or remaining behind to become assimilated into local Black and White communities.

Research questions involving continuity and change in plant use were initially developed within a larger project designed to explore culture change among these small Piedmont groups, most of which spoke some dialect of the Siouan language. The Siouan Project of the Research Laboratories of Anthropology at the University of North Carolina, Chapel Hill, has resulted in a still-growing body

of those systems in response to environmental disruption took place. The model of selective incorporation of a limited number of new elements within a traditional framework stimulated the formulation of several hypotheses about change and continuity in subsistence. These hypotheses propose that continuity should be more evident than change in the Historic period paleoethnobotanical record. Responses to temporal variability, responses to spatial heterogeneity, and aspects of diet composition inferred from paleoethnobotanical data should therefore reflect considerable continuity with preceding patterns.

#### HISTORICAL BACKGROUND

Much ink has been spilled over the linguistic and ethnic affiliations of Piedmont groups because historical sources tell so little of them. Mooney (1894) set the pattern for much subsequent anthropological research on these populations by classifying them as probable speakers of dialects of eastern Siouan. He included in his tally of probable Siouan speakers the Tutelo, Saponi, Occaneechi, Eno, Shakori, Sissipahaw, Sara, and Keyauwee, all of whom settled in the northern Piedmont at some time (Swanton 1924; Simpkins 1985). Swanton (1924) emphasized the division between a Northern or Virginia group (including the Tutelo, Saponi, and Occaneechi) and a Southern group (including the Catawba and Sara). Linguistic affiliations of some of these

groups have been debated (Binford 1959; Swanton 1924). Assessment of their ethnic affiliation is further complicated by frequent population movements during the Historic period as well as lack of adequate linguistic evidence. Linguistic affiliations of the Eno, Shakori, and Adshusheer have never been determined (Simpkins 1985). Despite some degree of cultural diversity among these Piedmont groups, "Siouan" has proved to be a useful label for them and will be so used here.

Two particularly important clarifications of the position of these Piedmont Siouans have emerged from recent anthropological and historical research. One of these is the probability that some of the groups initially classified as Siouan (particularly the Virginia group) had strong ethnic affiliations with the Northeast culture area. The Occaneechi, for example, appear to be closely allied to the Susquehannock (Simpkins 1985:5). They moved into the Piedmont from southern Virginia. Hogue (1988) concludes that the Occaneechi were non-Siouan and had affinities with the Iroquoians of the inner Coastal Plain. The Sara, on the other hand, had greater connections with groups to the south such as the Catawba, whom they joined in the 1730s (Hogue 1988:322).

A second relevant fact about these Piedmont groups is that except for the Saxapahaw, none were indigenous to the Eno, Haw and Dan River drainages (Simpkins 1985:48). Because of frequent population movements, the problems

involved in disentangling relationships between Late Prehistoric archaeological manifestations and historically known aboriginal settlements are considerable. For the purposes of studying subsistence, emphasis has been placed upon comparison of spatial and temporal variation in plant remains assemblages among locations without any attempt to demonstrate change or continuity between earlier and later populations of a particular ethnic group.

The ethnohistory of individual Siouan groups has been thoroughly summarized elsewhere (Wilson 1983; Simpkins 1985). The paleoethnobotany of the project area pertains to several named groups of the Historic period. The Dan drainage was primarily occupied by the Tutelo and Saponi as well as the Sara; the Eno by the Eno and Shakori, as well as the Occaneechi after 1680; and the Haw by the Saxapahaw and perhaps other groups as well (Dickens et al. 1986:2). The ethnic position of the Late Prehistoric populations studied archaeologically are not clear.

Piedmont Indian societies were largely extinct by 1722, remnant populations having moved out of the region to join the more populous Catawba and Iroquois (Dickens et al. 1986; Simpkins 1985). This represents the conclusion of the brief history of contact between relatively autonomous interior aboriginal groups and European invaders that began as early as the 1520s with exploration of the Carolina coast. Piedmont groups experienced a relatively long period of largely indirect contact with Europeans that was

accomplished through middleman trade. Such trade was initiated perhaps as early as the 1620s as Virginia explorers and traders began making inroads into the interior (Merrell 1987:20). After about 1670, White traders began to establish more direct trade connections with interior groups with the establishment of Charles Town, although initially the Carolina traders ignored the Piedmont (Merrell 1982:69). The removal of the Occaneechis from their position on the Roanoke River opened a major trading path up to the Virginia traders after 1676. Early in the eighteenth century, following a brief period in which trade in deerskins flourished, the combined disruptive effects of conflicts between settlers and Indians and raids from the north by hostile native groups resulted in the near-abandonment of the northern Piedmont by its aboriginal inhabitants (Merrell 1987:20).

#### ARCHAEOLOGICAL BACKGROUND

Archaeological research in the Piedmont Siouan area focused in the 1930s on village sites thought to be associated with named groups of the Historic period. Work in the 1940s on the Roanoke River failed to locate evidence of the ca. 1670 Occaneechi Island village visited by John Lederer, although earlier prehistoric occupations were found and studied. Excavations at the Upper Saratown site (31Sk1a) on the Dan River were begun by the Research

Laboratories in 1972. This work revealed a village of the late 1600s that was probably occupied by Sara Indians. The Siouan Project has resulted in excavation of a number of Late Prehistoric and Historic period sites in the Eno/Flat, Haw, and Dan River drainages, including the Fredricks site (31Or231), which has been identified as Lawson's 1701 Occaneechi Town (Dickens et al. 1986). In addition, survey of the three drainages was carried out and resulted in identification of additional sites (Simpkins 1985). Figures 1 and 2 show locations of sites in the Eno/Flat, Haw, and Dan drainages that produced plant remains considered in the present work.

Prior to the instigation of the most recent phase of the Siouan Project in 1983, paleoethnobotanical research in the Piedmont was limited to analysis of material collected during wet screening of feature fill, rather than by special techniques geared to maximize recovery of plant remains. Wilson (1977) analyzed a considerable quantity of waterscreened material from Upper Saratown. Despite the limitations on the data imposed by lack of flotation recovery, this research resulted in the first carefully quantified body of plant remains data for the North Carolina Piedmont. From 1983 on, flotation recovery of paleoethnobotanical samples was routinely carried out at all Siouan Project sites. This dataset provides the empirical basis for the present work, and includes plant remains from

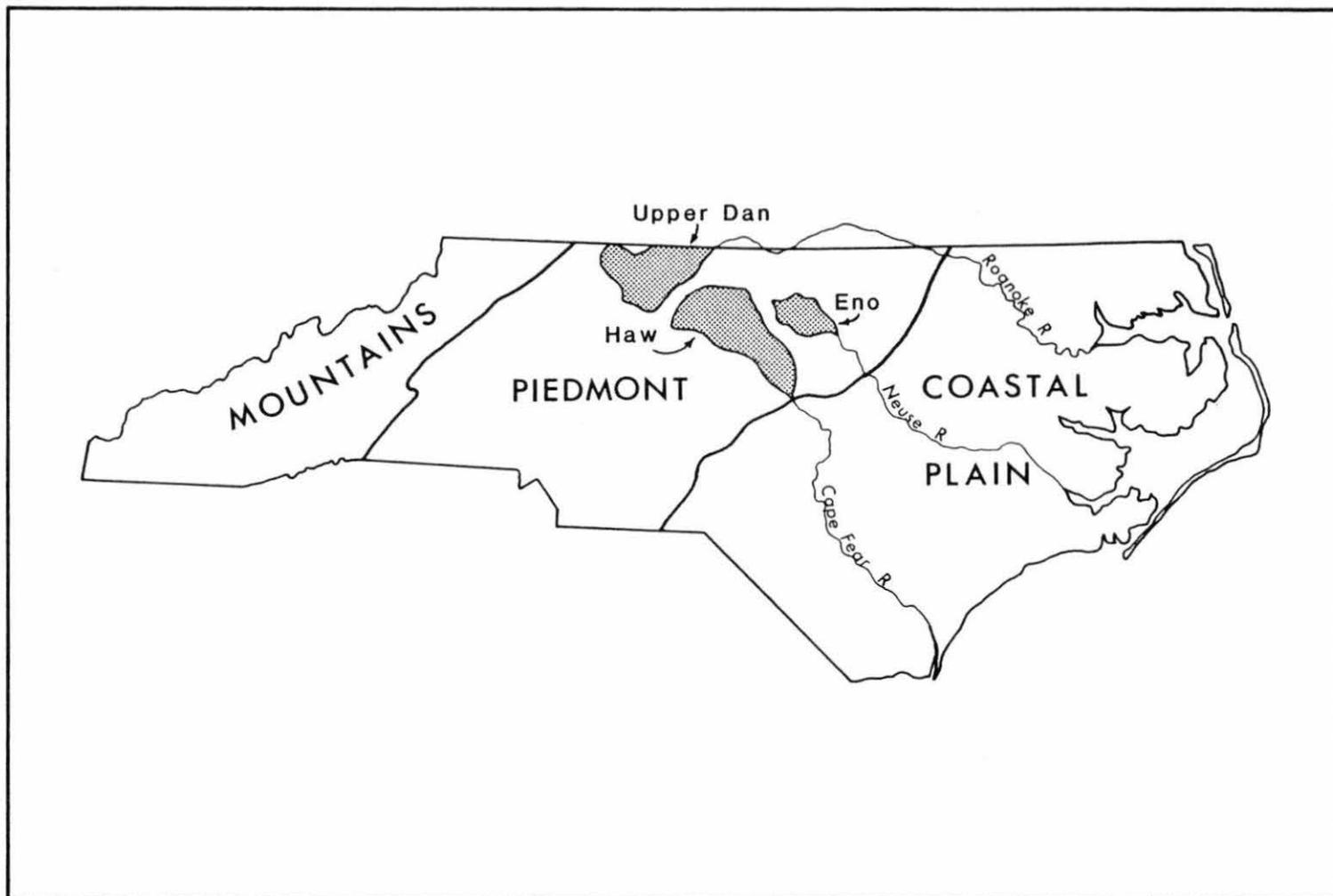


Figure 1. Locations of Siouan Project Drainages

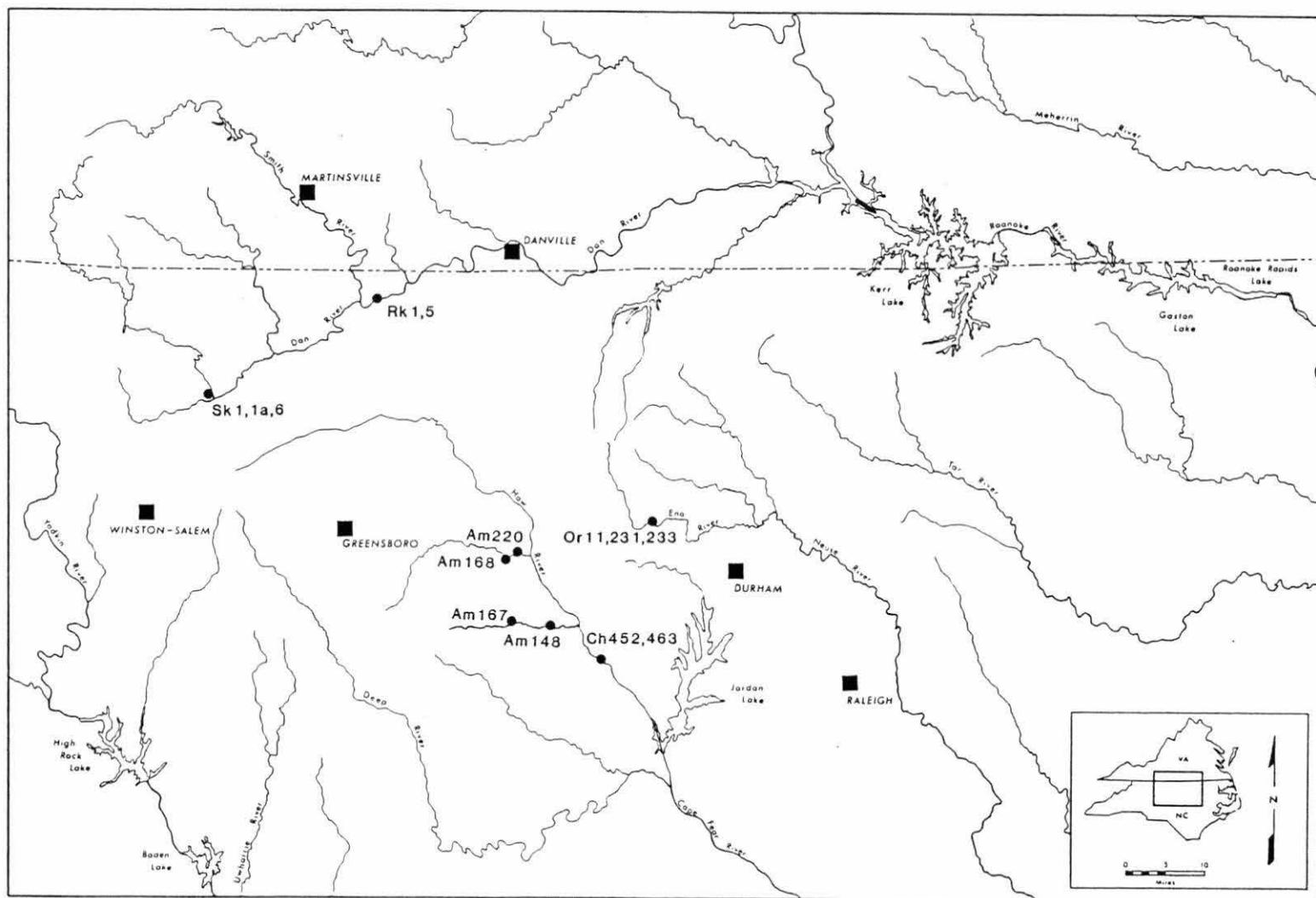


Figure 2. Locations of Sites Providing Paleoethnobotanical Data

sites in all three of the drainages included in the Siouan Project study area.

Little paleoethnobotanical research has been carried out elsewhere in the Piedmont. The Donnaha site (31Yd9) on the Yadkin River produced a limited sample of plant remains analyzed by Mikell (1987). Poor chronological control of this material limits its usefulness. More recently a sample of plant remains recovered by flotation from the Upper Catawba drainage in the western Piedmont has been studied (Gremillion 1989). The two sites excavated, Berry (31Bk22) and McDowell (31Mc41), date to the Late Prehistoric and Protohistoric (David Moore, personal communication) and thus provide useful comparative data for the present study.

#### CHRONOLOGY

Paleoethnobotanical datasets discussed in the ensuing chapters have been grouped according to archaeological phases recently defined for project area drainages and summarized in Davis and Ward (1988). I have chosen to superimpose upon these chronological divisions larger periods that can be applied to the study area as a whole. These divisions are set forth in Table 1. The Late Prehistoric period, from AD 1000 to 1500, corresponds to the Haw River and Dan River phases (although the Dan River phase actually extends to 1550). The Protohistoric period covers the period approximately from earliest Spanish exploration

Table 1. Site Information

Drainage	Period	Phase	Site Name	Site Number	Dates
Eno/Flat	L. Prehistoric	Haw River (1000-1500)		31Or233?	AD 920 ± 60
	Protohistoric	Hillsboro (1500-1620)	Wall	31Or11	AD 1545 ± 80
	Historic	Fredricks (1670-1710)	Fredricks	31Or231	AD 1680-1710
Haw	L. Prehistoric	Haw River (1000-1500)	Holt Webster Guthrie	31Am168 31Ch463 31Am148	AD 1470 ± 50 AD 1440 ± 70 AD 1330 ± 70
	Protohistoric	Hillsboro (1500-1620)	G. Rogers E. Rogers	31Am220 31Am167	AD 1600 ± 50 AD 1600 ± 50
	Historic	Mitchum (1620-1670)	Mitchum	31Ch452	AD 1650?
Dan	L. Prehistoric	Dan River (1000-1550)	Lower Saratown Klutz Powerplant	31Rk1 31Sk6 31Rk5	AD 1400-1500? AD 1200-1500? AD 1000-1300
	Protohistoric	Early Saratown (1550-1620)	E. Upper Sara- town Powerplant	31Sk1 31Rk5	AD 1550-1650?
	Historic	Middle Saratown (1620-1660)	Lower Saratown	31Rk1	
		Late Saratown (1660-1710)	Klutz Upper Saratown	31Sk6 31Sk1a	AD 1680-1700? AD 1660-1680

of the interior Southeast to the initiation of English explorations of the Piedmont in about 1620. This corresponds to the Early Saratown phase for the Dan drainage and the Hillsboro phase for the Eno/Flat and Haw drainages. Although the latter commences about 40 years before the DeSoto expedition, it largely postdates the earliest Spanish explorations of continental North America (Sturtevant 1962). Aboriginal/European interaction in the Piedmont during this period was indirect. The Historic period corresponds to the Mitchum, Fredricks, and Middle and Late Saratown phases. During this period, trade intensified and trade goods became more common in archaeological assemblages, although middleman trade prevailed until relatively late in the period.

Archaeological phases were defined for the three project area drainages based upon certain environmental and cultural features that distinguish the Dan drainage from the Eno/Flat and Haw drainages. Large floodplains with extensive bottomlands are found in the Dan drainage, whereas those of the Eno/Flat and Haw are more restricted. Partly as a consequence of these environmental features, the upper Dan drainage supported a greater population density and earlier development of nucleated settlement (Davis and Ward 1988:11). Paleoethnobotanical assemblages have been similarly grouped for purposes of analysis to facilitate comparison of combined Eno/Flat and Haw datasets with that assembled for the upper Dan. Combining the Eno/Flat and Haw

sites is also useful in balancing the paleoethnobotanical sample sizes, which are relatively large for the Dan and Haw drainages, but small for the Eno drainage with the exception of the Fredricks site.

#### SITE DESCRIPTIONS

##### Eno Drainage

Fredricks (31Or231). This palisaded settlement on the Eno River near present-day Hillsborough represents the Occaneechi village visited by the English traveller John Lawson in 1701. Excavations conducted in 1983-1986 revealed several structures, a cemetery, a sweat lodge with an interior fire pit, and numerous pit features. Population of this settlement, which was occupied only briefly, is estimated at 50 to 75 individuals. Trade goods and historical information support an occupation date of 1680 to 1710 (Dickens et al. 1987; Ward and Davis eds. 1988). Contrasting burial types in the settlement and ceramic diversity indicate that the population may have been comprised of different ethnic groups. Four seasons of excavation at this site produced a large and varied sample of plant remains.

Feature 30 at the Fredricks site produced a radiocarbon date of AD 920  $\pm$  60. This Haw River phase feature represents part of an earlier occupation of this bend in the Eno River, possibly associated with the nearby site 31Or233.

For convenience, this site number is used in the tables that follow. Only one flotation sample was recovered from this feature.

Wall (31Or11). Located in the same bend of the Eno River as Fredricks, the Wall site was originally excavated by UNC in 1938-41 and was at that time thought to be the remains of Lawson's Occaneechi Town. Excavations that were undertaken there in 1983, in conjunction with reexamination of earlier data, cast doubt on this attribution. The conclusion that the Wall site was too old to be the historic village was further strengthened by radiocarbon determinations that yielded an average corrected date of AD 1545  $\pm$  80 (Dickens et al. 1987:6). The site is comprised of a set of circular houses surrounded by multiple palisade lines. Maximum population has been estimated at 150 persons or 15 to 20 households. The Wall site exemplifies the compact, nucleated village settlement type of the Hillsboro phase (Davis and Ward 1988:5). The relationships between the Wall site population and later Historic occupations in the Eno drainage have not been determined, but ceramic evidence indicates a discontinuity between the Hillsboro phase and the Late Prehistoric Haw River phase.

#### Haw Drainage

Mitchum (31Ch452). The site which originally defined the Mitchum phase is located on the Haw River and may represent a Saxapahaw village. This palisaded settlement

contained oval and circular houses and nearby storage pits (Davis and Ward 1988:6). Assessment of trade goods from the site (mostly glass trade beads from six features and one burial) indicates a mid-seventeenth century date (Carnes 1987). Flotation samples were recovered from a large number of features.

George Rogers (31Am220). The George Rogers site is located on the first terrace on the north side of Great Alamance Creek. Like the contemporaneous E. Rogers site (see below), it exemplifies the small hamlet settlement type characteristic of the later Hillsboro phase. The site contained a number of trash-filled pits and part of a circular house (Davis and Ward 1988:6). Uncorrected radiocarbon dates of AD 1720  $\pm$  60 and AD 1600  $\pm$  50 were obtained from two features. The sample of plant remains from this site, though small, proved to be quite informative.

Edgar Rogers (31Am167). This site is situated along Cane Creek. Excavation exposed 11 pit features and a human burial. No houses were identified. The site produced a single uncorrected radiocarbon date of AD 1600  $\pm$  50.

Holt (31Am168). The Holt site is located on an upland knoll near Alamance Creek. It represents a small settlement with several trash-filled storage pits (Davis and Ward 1988:4). Two radiocarbon determinations produced divergent uncorrected dates of AD 1050  $\pm$  50 and AD 1470  $\pm$  50. Ceramic evidence indicates a fourteenth or fifteenth century date.

Although only a small number of features was excavated, the plant remains were of considerable interest. The sample contained a relatively heterogeneous seed assemblage, including small grains as well as Mesoamerican cultigens.

Webster (31Ch463). Located directly across from the Mitchum site on the Haw River, the Webster site was suspected to have a Historic occupation based on reports of local collectors. However, excavation revealed only one isolated pit with Dan River pottery. The feature produced an uncorrected radiocarbon date of AD 1440  $\pm$  70. The site produced only a small sample of plant remains.

Guthrie (31Am148). This Haw River phase site is located on Cane Creek. It produced several features but few artifacts. A single uncorrected radiocarbon date of AD 1330  $\pm$  70 was obtained from a burial pit, but the pottery assemblage supports a mid- to late fifteenth century date. Guthrie reflects the low artifact density and apparent brief occupation characteristic of most Haw River phase sites (Davis and Ward 1988:4). Plant remains from the site proved to be limited in quantity.

#### Dan Drainage

William Klutz (31Sk6). This site is located on the Dan River and produced plant remains both from the Late Saratown and Dan River phases. The Late Saratown component produced a large number of burials as well as numerous pit features.

As at Fredricks, there is some indication of ethnic diversity in the site's ceramic assemblage.

Upper Saratown (31Sk1a). This Late Saratown phase site on the Dan River was extensively excavated by the RLA in the 1970s, exposing 13 circular houses as well as numerous pit features and burials. This palisaded village is thought to have contained a maximum of 200-250 persons (about 20-25 households). Although no flotation samples were recovered from the site, Wilson (1977) analyzed a large sample of plant remains from the site. Results of this analysis are reported in subsequent tables.

Lower Saratown (31Rk1). Located on the Dan River just below the mouth of Smith River, this site appears to be a compact palisaded village of the Middle Saratown phase. Plant remains were also recovered from a Dan River occupation at the site. The sample of plant remains from the Middle Saratown component was quite large.

Early Upper Saratown (31Sk1). Located on the Dan River upstream from both the William Klutz and Upper Saratown sites, test excavations were conducted at this site by the RLA in 1981. A small sample of waterscreened plant remains from a single feature was analyzed by the author. The site appears to date to the late sixteenth or early seventeenth century.

Powerplant (31Rk5). Also located on the Dan River, this site has produced evidence primarily of a small Dan River phase settlement. Some features appear to be associated

with an Early Saratow phase occupation. Plant remains were recovered from both components.

#### SUMMARY OF RESEARCH QUESTIONS, METHODS, AND GOALS

Siouan Project investigations of culture change in the northeastern Piedmont indicate that aboriginal sociocultural systems retained many of their precontact features in the Historic period. Although Europeans introduced material goods, exchange networks, and pathogens, archaeological evidence of extensive systemic changes in response to these influences is minimal. Although northeastern Piedmont groups were not isolated from the effects of the European presence, their interactions with Whites were indirect for much of the contact period. Thus, a model of plant use emphasizing relative continuity from the Late Prehistoric to Historic periods seems appropriate.

A number of sites from three drainages in the northeastern North Carolina Piedmont with occupations dating to these periods have been excavated with the goal of investigating culture change. Paleoethnobotanical data from these sites will be used to evaluate specific hypotheses about continuity and change in plant exploitation in the Piedmont. The hypotheses that are most amenable to assessment using paleoethnobotanical evidence focus on the expected responses of aboriginal groups to their environment. In conjunction with a set of general

assumptions about human/environment relationships, a model emphasizing continuity in plant use will be used to construct three sets of related hypotheses. These hypotheses specify the nature of and changes in responses to temporal variability, responses to spatial heterogeneity, and diet composition during the Late Prehistoric and Historic periods.

As an initial step in analysis, paleoethnobotanical methods are discussed. This discussion includes consideration of the relationship between subsistence behavior and the archaeological record and of appropriate methods for manipulation of paleoethnobotanical data. Next the general assumptions about ecology and subsistence used to formulate the specific model and hypotheses about Piedmont plant use are introduced. After briefly stating these hypotheses, succeeding chapters examine each set in detail. Specific archaeological implications of each hypothesis are proposed and relevant paleoethnobotanical evidence evaluated. A concluding statement summarizes the results thus obtained. A functional explanation of these results links continuity and change in plant use to potentially relevant causal factors, including aspects of European contact.

The conclusions of this study will be of interest to paleoethnobotanists in general for its contribution of new data as well as its conclusions about change and continuity in plant use. Although considerable attention has been

devoted in recent years to the contact period archaeology of eastern North America (see Ramenovsky 1987, M. Smith 1987), relatively few such studies have dealt specifically with subsistence. The present work is intended to supplement current knowledge of the impact of European contact on the subsistence patterns and ecological relations of aboriginal North American populations. Its findings should therefore be of interest both to archaeologists and historians involved with this period.

## CHAPTER II

### PALEOETHNOBOTANICAL METHODS AND TECHNIQUES

#### INTERPRETING THE PALEOETHNOBOTANICAL RECORD

Paleoethnobotanists are confronted by many of the same problems of interpretation that plague archaeological research in general (Yarnell 1982). A number of factors intervene between human activities in the past and their material traces as they are observed in the present. In the case of plant remains, the frequent decomposition of unmodified organic materials makes preservation highly variable. Consequently, in seeking to analyze past subsistence patterns it is necessary to examine the various behavioral and environmental factors that result in a particular paleoethnobotanical assemblage. Ultimately such studies will allow us to reconstruct diet and nutritional status of past human populations, but given present limitations archaeological evidence seems best suited for examining subsistence (i.e., patterns of resource procurement) (Dennell 1979). Factors that shape paleoethnobotanical assemblages and are relevant to interpreting them as records of subsistence can be divided into predepositional and postdepositional factors (Gremillion 1984).

### Predepositional Factors

Past human behavior is the most important of factors creating the material record of plant use. It is this behavior itself that comprises the primary goal of most paleoethnobotanical research, particularly subsistence and dietary practices. Behaviors relevant to this research include plant collection, gardening activities, plant processing and storage, and food consumption. Unfortunately, the archaeological record is uninformative about past agricultural practices in most cases (other than the crops used), and these and other activities must frequently be reconstructed by analogy with ethnographic and ethnohistoric evidence. Even basic information such as the kinds of plants collected and their relative quantities, although accessible to the paleoethnobotanist, is often acquired only with great effort and attention to detail. Unfortunately, there is no simple correspondence between this behavior and the types and proportions of preserved plant remains usually collected by the archaeologist. Past human behavior, in addition to being the goal of our search, seems to conspire to confound it by modifying material evidence. In this way an advantage of archaeology over history (the informants' lack of intent to record their own actions) becomes, in some ways, a frustration.

For example, food processing and consumption practices influence the probability that a particular plant part will become carbonized. Carbonization occurs under certain

conditions of combustion in a reducing atmosphere and is necessary to retard organic decomposition on most open sites (Dimbleby 1978; Yarnell 1982). Food preparation by drying over fires or parching for storage is likely to result in loss of at least a few of the items thus processed, which fall into the fire beneath. Fruits not processed in this way are less likely to be preserved. Consumption of only part of the plant (e.g., hickory nuts, peaches) results in the discard of inedible parts such as shells, husks, and large seeds. These may have been expectorated into the fire inside a domestic structure, or in the case of hickory nutshell, maize cobs and other large, combustible items, may have been intentionally used as fuel. As Dennell (1976) has remarked, much archaeological evidence for subsistence consists of what was not eaten. But caution must be exercised to ensure that not all carbonized plant remains (e.g., weed seeds) are automatically assumed to represent food processing or consumption activities. Presence does not always indicate use just as absence cannot be assumed to indicate non-use. Utilized grain and non-utilized weed seeds, for example, may occur in the same deposit (Dennell 1979), and are sometimes accompanied by seeds of utilized "weeds" whose presence further complicates interpretation. Many eastern North American cultigens also occur in the environment as weeds, and may become carbonized and deposited in a refuse-filled pit by natural means.

Patterns of refuse disposal also influence the archaeological record of plant use, and vary from community to community and over time. Hearth and floor sweepings were probably regularly disposed of in some designated location. In the Eastern Woodlands, abandoned storage pits were frequently used for this purpose as well as clay borrow pits and other depressions in the ground originally excavated for some purpose other than refuse disposal. Such deposits may form at varying rates, depending upon the diameter and depth of the feature and whether the disposal site was used for routine household dumping or in the context of a specific event (e.g. the accidental burning of a structure). Such variables affect the heterogeneity of the resulting plant remains and the density of carbonized plant remains found therein. There is some indication that denser concentrations of plant remains result from more rapid deposition in restricted contexts such as pit features, whereas less dense concentrations are characteristic of less closely circumscribed contexts deposited over longer periods of time such as middens (Johnson 1983).

Middens may have been more frequently formed as refuse dumps in communities using aboveground crop storage facilities (Ward 1980). Although they form in specific locations, middens accumulate on the ground surface and thus are subject to more severe postdepositional disturbances than is feature fill. Carbonized plant remains from middens often show more signs of postdepositional deterioration and

are less likely than features to produce homogeneous clusters of plant food remains such as a single seed type or a cluster of acorn meats. Circumscribed subterranean deposition provides opportunities for exceptional preservation of charred (and sometimes even uncharred) plant remains, especially burial pits containing copper objects, proximity to which retards microbacterial decomposition.

Burial deposits offer special problems of interpretation for the paleoethnobotanist. At Late Prehistoric and Historic period Piedmont aboriginal sites, burial fill is generally more or less sterile around the body and in the lower levels of the pit. Some carbonized plant remains occur in these levels, but studies of the resulting data show a strong similarity between these plant remains and those occurring in the more charcoal-rich upper zones of burials, which suggests that downward movement of charcoal, or mixing of midden and relatively sterile soils prior to refilling, is responsible (Gremillion 1987). The top fill zones are frequently rich in food remains. In some cases slump from surrounding midden is indicated, but in others intentional deposition (perhaps of food offerings) has been suggested as a more likely explanation (Ward 1987). In such cases an examination of plant remains from these contexts separately from other plant remains from the site might be important at some stage of the analysis. Remains of a "burial meal" or other ceremonial offering can be expected to vary somewhat from everyday food consumption

patterns if intended to symbolically distinguish the living from the dead. On the other hand, a burial accompaniment, as a symbolic "last meal", might be typical of everyday consumption. Because there is no adequate evidence indicating which pattern to expect, interpretation of the origins of these deposits using plant remains is problematic.

Interpretation of plant remains data is further complicated by the period of time during which the deposit was formed. Time of year is particularly important in this regard. Ultimately what is sought by the analyst is a broad reconstruction of an average or typical pattern of plant use. Within this broad characterization can be found regular temporal variations (as between seasons of the year, e.g. crop-harvesting time versus planting time or acorn-collecting time) that themselves will vary irregularly from year to year depending upon stochastic environmental variables. These seasonal patterns may also vary over time in a certain direction, producing a subsistence trend that has various relationships to environmental, economic, social and biological factors.

It is important to be able to describe plant use at these various levels, or at least to strive toward this goal. Too normative a view ignores important variability (Winterhalder 1980), whereas attempts to chart yearly subsistence patterns using only archaeological evidence generally fail due to lack of adequate temporal control.

One solution for the paleoethnobotanist is to acquire a large sample from a site, one that includes material from many contexts, thereby crosscutting any seasonally specific deposits. In this way one can obtain a reasonably representative sample of remains indicative of the range of plant processing and consumption activities during the period of site occupation. "Homogenizing" the evidence in this way tends to obscure seasonal and year-to-year variation, but given a large enough sample it should produce a picture of average conditions. If the sample thus used is limited to only a few features or is exceptionally small in size, however, there is a danger of taking the particular characteristics of what may be a distinctive assemblage to be indicative of overall conditions in the community.

Another strategy to maximize the information to be obtained from such a skewed record is to examine paleoethnobotanical data on a feature-by-feature basis. In this way it is sometimes possible to identify features containing evidence of linked or temporally associated subsistence activities. For example, Feature 6 at the Mitchum site produced a seed assemblage that reflects deposition primarily in spring and early summer. Such determinations are most useful in cases in which deposits are formed over a brief period of time (thus containing charred seeds that correspond in their period of production). If limited-period deposition of seeds thus found together is assumed, the time of year of deposit

formation can be discerned by finding the narrowest time period during which all taxa would have produced seeds. However, this assumption is often not a reasonable one, particularly when studying deep pits. In addition, seeds of crop plants and nutshell must be eliminated from such studies because these food plants were often stored and thus available beyond their fruit-production periods. The same is true of some fleshy fruits (e.g., grape and peach), which can be dried for storage. Despite these difficulties, plant remains assemblages can in some cases provide valuable insights about seasonally patterned activities (see for example Dickens [1985]).

Year-to-year variability is even harder to detect archaeologically than is seasonally-specific subsistence activity. The "averaging" approach advocated above has the disadvantage of obscuring year-to-year variation in activities such as acorn or hickory collection or crop mixing strategies, producing instead a single interpretation that might not reflect conditions in any of the years of site occupation. For instance, a site assemblage as a whole might produce evidence of similar quantities of acorns and hickory nuts deposited in refuse pits. The analyst might then report that acorns and hickory nuts seem to have been of equal importance. This is a reasonable conclusion given the limitations of the evidence, but the same sitewide quantities could result from a series of years in which acorn and hickory were of similar importance or from an

alternative series in which the two taxa alternated in importance. Such difficulties may be insoluble at present, but the disadvantages of the averaging approach can be counteracted somewhat by noting within-site variability in the occurrence of plant food remains.

Although past human behavior (including food preparation and consumption, refuse disposal, and temporal variation in these activities) conditions the paleoethnobotanical record, the physical characteristics of plant parts are important as well. Inadequate attention to the varying effects of charring and other sorts of human manipulation of plant parts can lead to erroneous interpretations of the relative importance of food plants. Of course these physical traits of the plants themselves interact with postdepositional disturbance as well as with human behavior occurring before deposition in producing assemblage characteristics. However, plant part preservability plays its most important role predepositionally by eliminating from the archaeological record leaves, flowers, many fruits (and some seeds), stem foods, and many underground plant parts that are made unrecognizable when charred. Plant remains that are preserved through carbonization vary in their tendency to fragment and most importantly in the relative quantities of edible matter represented by different types of non-consumable waste products. Thus direct comparisons of weights of different types of nutshell (e.g., acorn and

hickory) can be misleading as indicators of the relative amounts of food in cultural deposits that they represent. In this particular case, experimental studies (Lopinot 1983) have produced a range of estimates of food:nutshell ratios for two taxa that can be used in interpreting results. However, such quantitative solutions to the problem of variable representation of plant parts due to their physical makeup are still rare.

Similar difficulties exist for comparing seeds of different taxa by number, since these vary in number of seeds per fruit and quantity of calories and nutrients as well as in overall preservability. Appropriate methods of determining the relative importance of plant foods whose remains are dissimilar in preservability and food:nonfood ratio must be decided upon in the interpretation phase of paleoethnobotanical research. Calculation of taxon ubiquity is the most useful method of this sort. Ubiquity measures the frequency of occurrence of items in samples or deposits on a simple presence/absence basis. When quantities are compared, correction factors can sometimes be applied to compensate for great disparities in food:nonfood ratios. An adjusted acorn:hickory ratio will be used to compare these different nutshell types.

#### Postdepositional Factors

After they become part of the archaeological record through human agency, the transformation of plant remains

continues through both cultural and natural processes (Schiffer 1976, 1983). Pedoturbation by earthworms and rodents moves charcoal fragments through the soil, displacing and abrading them (Stein 1983). It is primarily during this phase of the formation of the paleoethnobotanical record that action by microorganisms breaks down the constituents of plant material not converted to charcoal. Physical processes including freezing and thawing, precipitation and erosion all contribute to continued degradation of plant materials not destroyed initially by organic decay. These factors frequently remove the materials from their original place of deposition. The effects of these processes upon paleoethnobotanical assemblages in open sites vary according to the context of deposition, for example a sheet midden as compared to a deep bell-shaped pit. Differential exposure to weathering agents probably accounts to a great extent for the higher density of plant food remains in pit features as opposed to midden deposits and shallow features at Siouan Project sites. Soil texture and acidity influences the activity level of biological agents as well as the action of weathering agents.

A final stage of alteration of plant remains occurs when archaeologists recover the materials from the soil matrix. Initial handling in the field can further influence assemblage composition by eliminating certain elements. In recent years, particularly since the publication of

Struever's (1968) article on recovery of small plant and animal remains using water separation, archaeologists have learned how to minimize damage to paleoethnobotanical remains during collection and processing. However, paleoethnobotanical assemblages still suffer from bias introduced by damage to the remains as well as their complete loss from the archaeological data set. In the early days of scientific archaeological research, the neglect of techniques needed to recover minute and often fragmentary botanical remains sometimes resulted in severely erroneous conclusions about subsistence. For instance, prior to the use of fine-screen water separation, seeds were thought to be scarce at Ali Kosh; over 40,000 seeds were later recovered from the site using this technique (Wagner 1988:22).

Although such major errors seem to be a thing of the past, methods of recovering plant remains vary enough to produce considerable differences in recovery potential. High-pressure waterscreening was at one time a distinct improvement over spot collection or dry screening through large mesh. However, it tends to abrade carbonized plant remains considerably more than does flotation and results in the complete loss of very small seeds. When they are used, water separation techniques (usually called "flotation" in the archaeological literature) vary in how well they recover small items, a trait that is governed largely by mesh size (Wagner 1988, Munson 1981). When recovery of the contents

of archaeological soils is in some way deficient, care must be taken to consider this factor when interpreting the resulting data, particularly when attributing subsistence importance to the absence of certain plant foods.

Higher-level archaeological activities influence the paleoethnobotanical data base as well as other archaeological data. Problems of sampling, whether at the regional, site, or context level, are familiar to the archaeologist and concern the paleoethnobotanical specialist as well. Time and energy for recovery and processing of plant remains as well as other archaeological activities are limited. Thus decisions must be made about which contexts to sample and how much material to draw from each. Inevitably such choices shape the paleoethnobotanical data base, as do decisions about how to subsample plant remains once they have been removed from the site (Schaaf 1981). The most straightforward way to ensure a representative sample is to maximize its size although, as Yarnell (1982) points out, a small representative sample is as useful as a large one.

#### Data Manipulation and Interpretation of Results

The factors that affect the composition of the paleoethnobotanical record are thus sometimes revealing about past subsistence practices, but just as often tend to obscure them. Awareness of predepositional and postdepositional processes affecting the record is an important aspect of the interpretation phase of

paleoethnobotanical research. Such knowledge can be applied to paleoethnobotanical data in choosing quantitative methods for assessing and comparing data. In some cases, difficulties encountered in assessing the relative importance of different plant foods can be remedied by appropriate manipulation of data.

Due to sampling and differential attrition of plant remains, paleoethnobotanical data sets are always incomplete. But even materials that do arrive in the laboratory for analysis often need to be subsampled according to size. Most samples contain fragments of charcoal and other materials that are too small to be effectively sorted by the analyst. Even if considerable constraints of time and accuracy did not exist, it is likely that sorting of all materials would produce unnecessary redundancy in the resulting data. For this reason, it is standard procedure for paleoethnobotanists to sort samples completely only within a designated size category. The remaining material can simply be reported as an aggregate weight.

An alternative is to estimate quantities of the various sample components based upon the fully sorted category. The validity of this estimation procedure (hereafter referred to as "extrapolation") rests on the assumption that proportions in the larger and smaller size categories are alike. This assumption does not always hold for paleoethnobotanical samples, and never holds for the very smallest (less than

0.71 mm) size class. Thus the advisability of this kind of extrapolation varies from sample to sample and must be often reassessed. Paleoethnobotanical data from Siouan Project sites were found to be appropriate for such a procedure. Specifically, quantities of various items in the fully sorted size class (greater than 2.0 mm) were multiplied by the ratio of material greater than 0.7 mm:material greater than 2.0 mm for each sample. The resulting extrapolated values are estimates of quantities in the entire greater than 0.7 mm size category. Quantities of seeds and cultigen remains are usually not extrapolated because they are extracted from all size classes.

Despite the extra calculations involved, when properly applied extrapolation provides an estimate of quantities of plant remains in a sample that is closer to actuality than weights of only fully sorted material. At the same time, this procedure maintains relationships between quantities of different types of remains. Extrapolation is particularly appropriate when calculating ratios of different types of remains that are based upon absolute quantities of materials completely sorted only up to a certain size limit (such as nutshell) and those removed from all size categories (such as seeds). Some paleoethnobotanists (e.g. Wagner 1988) believe strongly that only actual weights should be reported. However, the necessity of reporting only raw data seems questionable since comparisons are based upon relative representation. Whether or not extrapolated values are

used, it is important to specify this aspect of data manipulation and to take it into account when making comparisons. Ideally, extrapolated datasets should be compared with others of the same type, but this is usually only feasible when the same analyst has worked with all of them. The potential for confusion resulting from variability in procedure at this stage of quantification is lessened by the fact that relative representation is the basis of most comparisons. Extrapolation does not alter interpretation based on percentages, although it will affect ratios such as seed:nutshell and densities.

Once a set of absolute counts and/or weights of plant food remains is obtained, the data must be manipulated so that comparisons can be made between samples and assemblages. The goal of these comparisons is to discern similarities and differences between the plant use practices of different communities separated by time and/or space. Several kinds of data manipulation are used first to characterize these practices individually and then to compare them. Within an assemblage, the kinds of plant foods represented and their relative representation must be established. From the latter, attempts can be made to infer subsistence activities and diet. Methods usually employed to compare types of plant foods include proportions and ratios that compare quantities to a standard such as fill volume or total weight of plant food remains (Table 2).

Table 2. Comparison of Quantification Methods

Measure	Compares	Best For	Disadvantages
Percentage (Weight)	Item to all items of its class Comparison of items similar in preservation potential, food:waste ratio	Comparison of same item over time	Underestimation of importance of less massive items If waste products weighed underestimation of items with high food:waste ratio
Percentage (Count)	Item to all items of its class	Seeds of similar size and type (e.g., small grains)	Underestimates relative importance of taxa with fewer seeds per fruit
Ubiquity (% of features or samples)	Item to trait of site, sample	Most useful for comparing dissimilar types	Does not take quantity into account (except as present or absent)
Ubiquity (% of identifications)	Item to all items of its class	Most useful for comparing dissimilar types	Does not take quantity into account (except as present or absent)
Density (quantity per unit volume)	Item to trait of site, deposit	Interassemblage comparison, intra-site distribution	Measures concentration in soil
Comparison ratios	Mutually exclusive items	Interassemblage comparison	Compares only two items at a time

Percentages by weight have the advantage of directly comparing relative representation of plant foods but have the disadvantage of comparing remains that are dissimilar in preservability or food:nonfood ratios, resulting in inaccurate assessment of importance. Percentages by count (e.g., of seeds) are less subject to gross biases of this kind, but food:nonfood ratios must also be taken into account. For example, small many-seeded fruits and large single-seeded fruits that produce similar numbers of archaeological seeds represent quite different edible portions. Relative seed size is also relevant to assessment of subsistence importance based on seed counts. Percentages by count or weight can most effectively be used within assemblages to compare similar types of remains, such as small grain seeds, to each other. It is customary to present tables reporting the percentage composition of plant food remains in samples. Although this serves as a ready assessment of assemblage composition, comparison of (for example) grams of hickory shell to grams of grain seeds can tell us little about the relative importance of these two foods.

An alternative method of comparing plant remains involves calculating ubiquity, the percentage of features or samples a taxon was found in. This method measures regularity of occurrence and only incorporates quantity as one of two possible states, present or absent. Therefore ubiquity is somewhat less subject to biases introduced by

incidental factors and food:nonfood ratios than are percentages based on weight. Dissimilar types of plant remains that are usually quantified in different ways (for example, seeds and nutshell) can be compared using ubiquity. This advantage of ubiquity is somewhat offset by the fact that it does not distinguish between a taxon producing 1,000 seeds from one that produces a single seed provided that both taxa occur in the same number of features. In some instances ubiquity compares frequency of occurrence between samples of different sizes.

Ubiquity as percentage of features or samples in which an item occurs provides a basis for ranking all the plant foods represented in an assemblage. Each such occurrence of a taxon in a feature or sample is termed an identification. Representation can also be calculated as proportion of these identifications in all features or samples that are accounted for by a given taxon. These percentages of identifications can be scaled so that they sum to one, which is needed in data used to calculate diversity. The latter type of measure compares taxa directly to each other, so that a change in one value results in changes in the rest. The former (ubiquity as percentage of features or samples) compares the occurrence of each to a property of the assemblage as a whole, so that values are independent of each other.

Another type of ratio is density, usually determined as quantity of material per volume of soil. Densities compare

different plant remains types to a common standard rather than to each other as proportions of some total. Density is particularly useful for assessing rates of deposition and spatial variation in plant food processing and consumption. The fact that densities compare quantities to soil volume makes this quantification method useful for interassemblage comparisons as well.

Another way of comparing plant remains is to calculate comparison ratios in which numerator and denominator denote mutually exclusive items (Miller 1988). An example is the seed:nutshell ratio often used in paleoethnobotanical studies with considerable time depth (e.g. Asch, Ford and Asch 1970). Comparison ratios can also be calculated as a way of adjusting for different relative quantities of food to waste product found archaeologically. This problem has been most extensively studied for nutshell. Experimental studies have shown that a gram of acorn shell represents anywhere from 5 to 200 times as much food as an equivalent quantity of hickory shell (Lopinot et al. 1983). A factor of 50 has been suggested by Yarnell and Black (1985) as a reasonable one by which to multiply acorn shell to produce an acorn:hickory ratio ( $\text{g acorn shell} \times 50/\text{g hickory shell}$ ) that better represents relative quantities of food in an assemblage. Further studies (Lopinot 1988) have resulted in mass conversion factors that correct for carbonization and meat:shell ratios for several nut types. These can be used to estimate quantities of nutmeat represented so that

interpretations of their subsistence importance need not be based merely upon quantity of waste products.

#### MATERIALS AND METHODS

The paleoethnobotanical samples given primary consideration here were collected from a number of sites using the same field and laboratory procedures. All were analyzed by the author. Other data sets used for comparison were in some cases handled differently and will be discussed where appropriate.

##### Recovery

Flotation samples comprise the majority of plant remains discussed. A few waterscreened samples (mesh 1/16 in, approximately 1.6 mm) were analyzed and reported upon, but only flotation samples were included in feature and site totals and subjected to further quantification. Waterscreened samples provided a useful supplement when flotation samples from certain contexts were unavailable or inadequate in some way. Earlier studies (Gremillion 1984) showed that flotation samples were superior to waterscreened samples in recovery of seeds and in representing known quantities of fill. The two types of samples produced similar relative quantities of nutshell and maize. Although much greater quantities of fill were processed by waterscreening than by flotation from the sites in question,

flotation produced better quality samples. The greater quantities of material produced by waterscreening were too large to be studied without extensive subsampling and presumably would have produced largely redundant results.

As a rule flotation samples were drawn from all excavated features and from midden or old humus zones when they occurred on a site. Most fill samples for flotation were taken in 10-liter increments. At least one such sample was drawn from each zone. Soil samples were measured by filling a calibrated bucket. Additional 10-liter samples were taken from particularly large or charcoal-rich zones. Samples of various volumes were also drawn from special contexts or from small zones or pockets of fill.

Each sample was dried for about a day before processing in order to replace some of the moisture from the charcoal with air, which improves capture of charcoal in the light fractions. Each sample was poured gradually into the inner (heavy fraction) bucket of the flotation device, which resembled the one described in Watson (1976). Clumps of soil were gently broken apart by hand. Processing ceased when most of the soil in the sample was removed and when visible charcoal had either sunk to the bottom of the heavy fraction container or had floated over the light fraction spout. After the valve supplying water to the central spigot inside the tank was turned off, additional charcoal that floated to the surface was scooped out.

A 0.71 mm brass U.S. Standard geological screen was used to capture light fractions. Although the smaller mesh sizes necessary to capture minute seeds are therefore preferable (Munson 1981), this was not practical for the Siouan Project samples, which typically had a moderate to high clay content. After processing, light fractions were packaged in swatches of tight-weave polyester with mesh finer than the 0.71 mm used for recovery and were air-dried away from sunlight. Heavy fractions were dried in the sun.

### Analysis

Analysis procedures approximated those outlined by Yarnell (1974). Each sample was weighed and then passed through a series of U.S. Standard geological screens ranging in size from 6.25 mm to 0.21 mm. Material remaining above the 2.00 mm screen was sorted into components, each of which was weighed. For heavy fractions and waterscreened samples, only carbonized plant remains were sorted into components. Material in the 1.41 mm and smaller size categories was searched for seeds, cultigen remains, and plant remains not identified in the larger size category. Quantities of components in the greater than 0.71 mm size screens were extrapolated based upon their representation in the 2.00 mm and larger size category. Materials passing through the 0.71 mm screen were not considered in extrapolating because they consist primarily of fine carbon and soil particles and do not resemble the largest size category in composition.

One sample was too large to allow for complete sorting of the greater than 2.00 mm size class, and extrapolations were based upon quantities in the 2.38 mm and larger screens (Fredricks site, Feature 36). Maize cupules were usually removed from all size categories, but when they were extremely numerous their weights were extrapolated along with other plant food remains.

All light fractions considered here were analyzed in their entirety. All carbonized plant remains from most heavy fractions were analyzed completely as well. However, in some cases heavy fractions contained large quantities of charcoal in addition to bone, stone, pottery, and soil. Two methods were employed to subsample these heavy fractions. One option was to use a riffle-type sample splitter to halve the samples into reasonably representative subsamples. This procedure was used on only three heavy fractions from the Fredricks site (one from Feature 53 and two from Feature 56). The overall effect of this subsampling upon plant remains densities and ratios for the site as a whole is probably only slight, since the site sample is quite large. The other option was to immerse heavy fractions in water and then pour off the charcoal repeatedly until little or none remained. The charcoal thus recovered was then analyzed. This procedure had the advantage of yielding quantities of plant remains that were essentially the same as those that would have been obtained had the entire sample been analyzed. However, it too was only used in a few cases,

because repeated wetting and drying of charcoal causes additional fragmentation. Unless heavy fractions were exceptionally large, they were analyzed in their entirety.

### Quantification

Percentages and ratios were calculated based upon extrapolated weights. Certain items, such as seeds and fruits, were weighed as aggregates for each sample and itemized by number. Counts also provided the basis for calculations of percentages or ratios. Vernacular names are used in the tables, but their Latin binomial equivalents are listed in Table 3.

Discussion of results centers around site and component totals, although absolute quantities are presented by feature and feature type for each site. Although consideration of summary totals eliminates some detail, it allows for tentative generalizations about plant use patterns for different sites and time periods. The loss of detail can be remedied, however, by continual reference to more detailed results in order to guard against biases created by differences in depositional context and preservation.

### SUMMARY

Factors affecting the composition of the paleo-ethnobotanical record can be divided according to when they

Table 3. Latin Binomials for Plant Taxa Recovered  
Archaeologically<sup>1</sup>

Vernacular Name	Latin Binomial and Authority
Acorn (Oak)	<u>Quercus</u> sp.
Amaranth	<u>Amaranthus</u> sp.
Bearsfoot	<u>Polymnia uvedalia</u> L.
Bedstraw	<u>Galium</u> sp.
Blackgum	<u>Nyssa sylvatica</u>
Marshall	
Blueberry/Cranberry	<u>Vaccinium</u> sp.
Bramble	<u>Rubus</u> sp.
Bulrush	<u>Scirpus</u> sp.
Cane (Giant cane)	<u>Arundinaria gigantea</u> L.
Chenopod	<u>Chenopodium</u> sp.
Chestnut (American chestnut)	<u>Castanea dentata</u> (Marshall) Borkh.
Common bean	<u>Phaseolus vulgaris</u> L.
Copperleaf	<u>Acalypha</u> sp.
Dogwood	<u>Cornus florida</u> L.
Elderberry	<u>Sambucus canadensis</u> L.
Giant cane (Walter)	<u>Arundinaria gigantea</u> Muhl.
Grape	<u>Vitis</u> sp.
Grass family	Poaceae
Groundcherry	<u>Physalis</u> sp.
Hawthorn	<u>Crataegus</u> sp.
Hazelnut	<u>Corylus</u> sp.
Hickory	<u>Carya</u> sp.
Horse gentian	<u>Triosteum</u> sp.
Huckleberry	<u>Gaylussacia</u> sp.
Knotweed	<u>Polygonum</u> sp.
Legume family	Fabaceae
Little barley	<u>Hordeum pusillum</u> L.
Maize	<u>Zea mays</u> L. ssp. <u>mays</u>
Maygrass	<u>Phalaris caroliniana</u> Walter
Maypops	<u>Passiflora incarnata</u> L.
Morning glory	<u>Ipomoea</u> sp.
Nightshade	<u>Solanum</u> sp.
Nightshade family	Solanaceae
Pepo ("squash")	<u>Cucurbita pepo</u> L.
Persimmon	<u>Diospyros virginiana</u> L.
Pink family	Caryophyllaceae
Plum	<u>Prunus</u> sp.
Poke	<u>Phytolacca americana</u> L.

Table 3 continued

Vernacular Name	Latin Binomial and Authority
Ragweed	<u>Ambrosia</u> sp.
Rose family	Rosaceae
Spurge	<u>Euphorbia</u> sp.
Strawberry	<u>Fragaria virginiana</u>
Duchesne	
Sumac	<u>Rhus</u> sp.
Sumpweed	<u>Iva annua</u> L.
Sunflower	<u>Helianthus annuus</u> L.
Viburnum	<u>Viburnum</u> sp.
Walnut (Black walnut)	<u>Juqlans nigra</u> L.
Watermelon	<u>Citrullus vulgaris</u> Schrader ex Ecklon & Zeyher

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<sup>1</sup>According to Radford et al. (1968).

The data discussed herein were derived from flotation recovery of known quantities of soil from Siouan Project sites. All analysis was conducted by the author. Several of the quantification methods discussed will be used to organize and interpret data. Resulting inferences about plant use by Piedmont populations will be used to evaluate hypotheses about use of plant communities, responses to temporal variability, and diet composition.

occur relative to deposition of the plant remains that make up the record. Predepositional factors include the human behaviors involved in collecting, consuming, preparing, storing, and discarding plant products. These processes and the period during which they occur influence the composition of paleoethnobotanical assemblages. After deposition, the physical characteristics of plant tissues and the weathering that occurs in archaeological soils also have important consequences for the resulting assemblages. Post-depositional behavioral factors include the activities of the archaeologists and paleoethnobotanists who sample, recover, and analyze ethnobotanical materials.

Analysis and interpretation of paleoethnobotanical data involve various kinds of quantification and manipulation. Analysis of quantities provides the primary basis for inferring past subsistence behavior. Quantities of a given remains type can be compared either directly to quantities of some other type (e.g., seed:nutshell ratios), to totals for its category (as in percentages of food remains), or to some property of the site or deposit (as in densities). Ubiquity compares regularity of occurrence and is especially useful for comparing types of plant remains that are dissimilar in food:waste ratio and/or preservation potential. Interpretation using these methods of quantification must proceed with attention to the effects of pre- and postdepositional factors upon the archaeological evidence of plant use.

### CHAPTER III

#### GOALS, ASSUMPTIONS, AND HYPOTHESES

The goals of this study are to describe plant use by Late Prehistoric and Historic period Piedmont Indians, to determine what changes (if any) took place in these subsistence patterns based upon ethnohistoric and archaeological evidence, and to offer tentative explanations of these changes (and continuities) with special reference to their relationship to European contact. Explanations to be offered will primarily be of the "human behavior noncausal" type described by B. Smith (1982:80-81). That is, their primary goal is to identify relevant factors or variables as a prelude to defining causal relationships. In addition, potential causal relationships themselves will be discussed. Both functional and more explicitly causal explanations of human behavior must rely in turn upon the lower-level types of explanation involving documentation of patterns in the archaeological record (artifact-based noncausal) and linking of this patterning with behavior (human behavior-material culture causal) (B. Smith 1982:79).

A functional explanation of behavior of this kind does not require any one specific form of logical argument and is not required to supply the ability to predict the event being explained, as is deductive-nomological explanation.

In its more formal guise, the statistical relevance (S-R) model of explanation (M. Salmon 1982:107; W. Salmon 1982:53) seeks instead to identify factors that are statistically relevant to the event to be explained. However, informal assessment of statistically relevant factors constitutes a type of functional explanation often used implicitly in archaeology and particularly well-suited to archaeological problems (Smith 1982, M. Salmon 1982).

The relationships between subsistence change and trade relationships, disease and depopulation, population aggregation, loss of traditional knowledge, and biotic environmental factors are obviously complex. This complexity is quite daunting to any prehistorian with both aspirations to tackle large questions and a sense of responsibility to scientific methods. However, careful study of what happened in the past based largely upon archaeological evidence and organized using ecological concepts can help to identify which of these factors are most relevant. Doing so sets the stage for an exploration of causal relationships. One way of isolating relevant factors is to compare data from the northeastern Piedmont with other regions of the Southeast that have produced evidence of plant use during the contact period. Through such comparisons, correlations between change and continuity in plant use and various factors associated with European contact can be discerned. Correlation, although it does not itself constitute

causality, does help to identify plausible causal relationships.

#### HYPOTHESES, EVIDENCE, AND EXPLANATION

A set of general assumptions about subsistence will be used in conjunction with historical and anthropological sources in the following pages to construct a model of precontact and postcontact plant use. Hypotheses about native plant use patterns and their transformations after initiation of European contact in the study area will be formulated using this specific model as a guide. Paleoethnobotanical evidence relevant to evaluating these hypotheses will be examined.

Once evidence is presented and an interpretation of change and stability in plant and land use formulated, various specific assertions can be combined into a tentative functional explanation. This explanation consists of identifying the factors most relevant to specific changes in subsistence. Relevant factors are likely to include aspects of contact, such as deerskin trade-related activities and plant introductions. Although these are the environmental elements of particular interest in this study, exclusive attention to contact-related phenomena presents the danger of creating a plausible (but not necessarily probable) "just-so story" explaining change, a frequent feature of functional or "scenario" explanations (Renfrew 1982). For

this reason a particular effort will be made to examine stability as well as change and to assess the relevance of factors not specifically related to the European presence.

What methods can be used to assess the relevance of various factors to change and continuity in plant use? One is to directly assess statistical relevance using quantitative methods, the procedure included in formal applications of the S-R method of explanation. Such assessment allows assignment of a probability value for the event being explained (M. Salmon 1982:109). Non-quantitative assessment of relevance is more appropriate for the present study. On the simplest level, phenomena (e.g., presence of European food plants) can be compared with their temporal placement and other factors reflecting the degree of contact in order to assess the relevance of contact to their occurrence. Frequently this is a simple matter of comparing nominal data (e.g. presence/absence of a species) with a single nominal variable (e.g. presence/absence of contact with Europeans). Paleoethnobotanical data from outside the study area can also be manipulated to compare plant use patterns with type and degree of European-aboriginal interaction.

#### ASSUMPTIONS ABOUT ENVIRONMENT AND SUBSISTENCE

Construction of a specific model of Piedmont plant use and its transformations after European contact will rely in

part on a series of ecological concepts. These concepts, drawn from evolutionary ecology, domestication theory, disturbance theory, and ecological anthropology in general will be used to organize data, hypotheses, and explanations, providing a framework for analysis. In many cases, these concepts constitute models of various phenomena. Modeling is a process that simplifies complex systems, rendering them more accessible for study (Winterhalder 1981:18). Such models are used to generate testable hypotheses (Levins 1966:430). In this study, models of ecological relationships will be used to organize discussions of, and to help formulate hypotheses about, change and stability in plant use by Piedmont Indians. Together, these models make up a set of assumptions about human-environment interaction upon which the ensuing discussion is based. A more specific model of stability and change in Piedmont plant use arises from viewing available archaeological and ethnohistoric evidence in the context of the general model. Resulting hypotheses will be tested using archaeological evidence of plant use from the study area.

#### Temporal Variability

Subsistence behavior can be in part understood in terms of human responses to both regular and unpredictable temporal variation in the environment (Winterhalder 1980). Predictable variability in the form of seasonality typically produces a pattern of group movement and seasonally specific

subsistence activities among aboriginal Southeastern groups. Details of these seasonal patterns varied regionally. Although specific historical data for the northeastern Piedmont are limited, fairly specific accounts of nearby groups such as the Tuscarora and coastal Algonquian are more common (see Wright 1947; Major 1849; Lefler 1967). The paleoethnobotanical record can also indicate which plant foods were used seasonally, although seasonally specific activity areas on sites usually remain obscure. Storage strategies and behavioral responses such as adaptation to extreme consumption and deprivation patterns (Colson 1979) can in some cases be documented using historical and/or archaeological evidence.

#### Spatial Heterogeneity

Human groups organize subsistence activities in ways that recognize spatial heterogeneity in various aspects of the environment. Natural and anthropogenic disturbances create a spatial mosaic of plant communities (Pickett and White 1985), each of which contains a different set of resources and requires a different set of behaviors for exploitation and management. Spatial variability and human responses to it cannot be properly studied without attention to temporal dynamics and non-normative situations (Winterhalder 1980; Pickett and White 1985), since this environmental mosaic is continually changing. These changes and human responses to them can be explored with reference

to ecological studies of secondary succession, both substantive (Keever 1950; Crafton and Wells 1934; Schafale and Christensen 1986) and theoretical (Horn 1974; Drury and Nisbet 1973).

Human use of different plant communities, many of which constitute distinct habitat patches (Wiens 1976), including gardens and fields, can be inferred using paleo-ethnobotanical and historical evidence. Unfortunately, the vegetational mosaic at the time(s) of site occupation is impossible to reconstruct, but modern vegetational studies of nearby areas (Moore 1973; Moore and Wood 1976; McCurdy 1975; Bornkamm 1975) and studies of community types likely to have occurred regionally are useful for approximating past conditions.

#### Diet Composition

Spatial and temporal variability elicit responses from human communities in the form of choice of resources, scheduling of activities, storage, and use of different habitat types. These responses result in allocation of time and energy to certain subsistence activities at the expense of others and ultimately in diet composition for the group as a whole at a particular time. Diet can only be inferred archaeologically, and then usually without precision, knowledge of it having been derived largely from disturbed refuse deposits rather than from direct observation. Nevertheless, conclusions about allocation of effort to

different activities (i.e., subsistence) have dietary implications that can be used to organize interpretations of paleoethnobotanical data.

One approach to identifying and understanding variables relevant to such subsistence choices has been devised within evolutionary ecology. Optimal foraging theory is a set of hypotheses and models derived largely from microeconomic theory. Its proponents have identified several components of foraging behavior that can be used to develop predictions about diet breadth and other decision categories (Winterhalder 1981; E. Smith 1979, 1983). The models generated using these concepts operate on the assumption that maximization of energetic efficiency acts to maximize fitness and thus places the individual at a selective advantage (E. Smith 1979). Predictions have been generated about how diet breadth should change with alterations in environmental parameters given this assumption. Behavioral components of food acquisition relevant to predicting the optimal diet include time and energy costs of locating, pursuing, capturing and processing the resource. Opportunity cost (Winterhalder 1983), that is the potential cost of activities forgone, has also been considered.

The general model adopted here does not include the assumption that maximization of energetic efficiency always overrides other goals (Smith 1979) nor does it formulate the precise link between subsistence behavior and fitness. It does, however, borrow from optimal foraging theory the

assumption that human populations make subsistence decisions based to a large extent upon considerations of relative time and energy costs of alternative activities.

Recognizing the components of subsistence activities identified by optimization theorists can help in explaining patterns of plant use in terms of relative costs of locating, obtaining, and processing different resources (Earle 1980). Cost concepts drawn from optimization theory can be applied as explanations of the narrowing or expansion of diet breadth. The specific predictions of the diet choice model (Winterhalder 1981) and other models can also play an explanatory role. Cost concepts and foraging models can be applied to such issues as the introduction of Eurasian plants, particularly domesticates, to Piedmont groups. By comparing regional variations in patterns of adoption (or neglect) of European-introduced plants it may be possible to identify potential causes of such subsistence changes.

The general model of human-environment interaction plays the dual role of providing concepts relevant to the more specific model, and of introducing relationships that can be used to link relevant factors. As part of its initial role, the general ecological model is used in conjunction with more specific historical and archaeological information to generate a specific model of plant use during the contact period. This specific model of change and continuity in plant use and expectations derived from it are used to generate hypotheses. The hypotheses are grouped to

reflect the three aspects of the general model (temporal variability, spatial heterogeneity, and diet composition) discussed above.

Hypotheses are then evaluated using paleoethnobotanical data and resulting inferences are used to reconstruct plant use patterns and their modifications over time. Comparing these findings for various assemblages allows correlation of plant use with other aspects of behavior, which will be identified as relevant factors. At this stage, an initial functional explanation will have been constructed. However, reassessment of inferences in the light of the general model allows for some propositions about causality based upon relevant factors. This additional step brings general ecological concepts and theories, such as diet breadth, succession, and optimization into play.

#### A SPECIFIC MODEL AND SOME HYPOTHESES

Given a general model of human-environment interaction centered on responses to temporal and spatial variability and their consequences for diet composition, a more specific model of pre- and post-contact plant use in the northeast Piedmont can be proposed. Primary and secondary historical sources as well as archaeological studies add information about culture change in the East that suggest directions for investigation of subsistence stability and change in the Piedmont. The consequences of the slave, deerskin, and fur

trade networks for aboriginal Eastern populations have been well-documented and widely discussed, emphasizing both historical (Bailey 1969; Bishop 1974, 1981; Crosby 1976; Krech 1981) and archaeological (M. Smith 1987; Bradley 1987; Dickens et al. 1987) sources of evidence. The devastating effects of Old World pathogens upon Native American populations and the effects of epidemic disease upon social organization, subsistence patterns, and transmission of traditional knowledge have also been widely studied from both historical and anthropological perspectives (Dobyns 1983; Fitzhugh 1985; Milanich and Proctor 1978; Ramenovsky 1987; M. Smith 1987). Later in the Contact period, with European settlement nearby, competition for natural resources often occurred as well (Merrell 1982).

The establishment of trade networks, particularly those demanding a supply of furs and deerskins, had well-documented effects upon aboriginal cultural dynamics in the East. The effects of the skin and fur trade included modification of scheduling to extend the hunting season (Wright 1981) and overhunting leading to local depletion of game populations (White 1983:9, 317). Some groups acted as middlemen in the trade, indirectly modifying the behavior of groups actually procuring the resources (Waselkov 1986b). Thus European-introduced trade networks stimulated changes in responses to temporal variability such as scheduling of hunting. These changes might be expected to have consequences for other traditional activities if trade-

related tasks (including those of women, such as dressing skins) appropriated increasing amounts of a community's time and energy. Non-predictable temporal variation in environmental parameters such as drought and consequent crop loss seems to have provided a stimulus for dependency upon European food sources with simultaneous abandonment of secondary strategies (White 1983:97).

Trade relations and the European presence in general might be expected to have even more direct effects upon aboriginal subsistence in the form of introduced plants and animals. In fact, such introductions have been documented both historically (Blake 1981; Crosby 1972, 1986; Hendry 1934;) and archaeologically (Sheldon 1982; Gremillion 1987; Gremillion 1989c). The timing and extent of the adoption of European domesticates varied regionally, in some cases transforming into an acculturative pattern mimicking Anglo-American husbandry (as seems to have been the case with larger groups such as Creeks and Choctaws). In other instances the plants were adopted with little sign of modification of agricultural practices or adoption of animal husbandry (which seems to have been the case for the northeastern Piedmont). Plant introductions have implications for changes in diet breadth and composition, and adoption or rejection of foreign agricultural techniques is relevant to the nature and extent of alterations in land use. Responses to spatial variability therefore are also

expected to be potentially sensitive to changes brought about by new trade relationships.

The effects of introduced pathogens and consequent depopulation are also quite complex. A number of these effects have potential consequences for subsistence. Aggregation of depleted populations and incorporation of decimated groups by more populous ones has been documented historically (Merrell 1982; Wright 1986) and investigated archaeologically (M. Smith 1987; Ward and Davis 1988). Aggregation and formation of larger communities sometimes caused local game depletion (Van Doren 1928:181) and competition for access to land for hunting and agriculture (Cronon 1983:101). In other contexts, population losses resulted in disruption of agricultural activities (Merrell 1982:359), and when severe, in loss of traditional information as older people died in large numbers (M. Smith 1987:59). With resettlement in new locations, information about the resources of a formerly occupied area became superfluous so that food procurement and processing techniques once useful to a group were lost (Merrell 1982:114). In later periods, as Europeans began to inhabit the local landscape, changes in the disturbance regime and thus the distribution and structure of various habitats occurred (Cronon 1983:91).

Extensive modification of availability of natural resources and human resources for exploiting them might be expected to cause massive disruption of traditional patterns

of plant use. Some studies have shown instead a tendency for groups to change some other aspect of their cultural existence in order to maintain traditional subsistence patterns. The Choctaw, for instance, moved from bottomlands to uplands to avoid slave raids and epidemics and continued to grow traditional crops there. Later in their history, the Choctaw moved westward across the Mississippi River, into an unfamiliar environment, in order to maintain their agricultural/hunting way of life (White 1983). Bishop (1981:50), in similar fashion, explains the behavior of northeastern Indians early in the fur trade period as an attempt to "maximize traditional values" using trade goods. This tendency to alter cultural elements just enough to maintain the system within accustomed boundaries has been formulated as "Romer's Rule." Romer's Rule simply states that "the initial survival value of a favorable innovation is conservative, in that it renders possible the maintenance of a traditional way of life in the face of changed circumstances" (Hockett and Ascher 1964:137). The Romer's Rule concept might provide a useful framework for explaining unexpected continuity in the context of potentially disruptive external influences.

There is evidence of both considerable continuity as well as change in aboriginal subsistence in the East after European contact. Acculturation is probably an inappropriate concept for approaching the devastating changes wrought by epidemic disease in the early contact

period in the interior Southeast (M. Smith 1987). For the northeastern North Carolina Piedmont, acculturative change seems to have been relatively unimportant (Dickens et al. 1986). The native peoples of the North Carolina Piedmont had little opportunity to adapt to spatial proximity to European settlers. Instead, any subsistence changes noted are more likely to be related to the effects of trade activities and disease-related depopulation.

In general, a selective/incorporative model of plant use in the Late Prehistoric and Historic periods seems more appropriate for the Piedmont than one emphasizing change through acculturation. In its most general formulation, acculturation refers to change occurring as a direct result of contact between different sociocultural systems (not just between different populations). Indirect results of contact, such as those stimulated by epidemic disease, are therefore not acculturative. Piedmont groups underwent some degree of acculturation in the process of adjusting to direct contact with Europeans and their artifacts. However, there does not seem to have been extensive reorganization of aboriginal economic patterns, at least not initially. New material goods and types of exchange were incorporated into existing systems without replacing them. Acculturation therefore seems not to have been characteristic of initial European-aboriginal contact in the northeastern Piedmont.

Later, of course, as Piedmont groups dispersed and gave way to White settlement, cultural continuity was broken and

assimilation into other Native American groups or into White society occurred. However, adoption of some European domesticates and land-use practices did not take place among Piedmont groups to the extent that it did among larger populations that retained an ethnic identity, such as the Cherokee, Creek and Choctaw. Neither extensive acculturation nor a "Romer's Rule" adaptive pattern for Piedmont groups is evident. Instead, relatively small-scale incorporative change was followed by rapid ethnic extinction.

This specific model for the Piedmont emphasizes maintenance of considerable continuity in subsistence. The history of contact in the northeastern Piedmont suggests that contact-related perturbations may have been relatively minor initially. Later, the disappearance of aboriginal villages from the area was virtually coincident with Euroamerican settlement and the arrival of new disruptive factors that might otherwise have stimulated subsistence change. Accordingly the model projects the termination of traditional patterns rather than their transformation.

The overall pattern of adaptation (or non-adaptation) may be difficult to discern on the basis of archaeological evidence, given the fact that certain kinds of change may act to preserve traditional material correlates of behavior. Thus attention must be given to mechanisms maintaining stability (e.g., persistence of certain aspects of

technology as inferred from material remains) in the face of changed circumstances (Winterhalder 1980:139).

Hypotheses to be examined can be grouped as follows according to the aspects of subsistence chosen to frame the general model:

1. Temporal variability: Scheduling of agricultural and other harvesting activities remained largely the same as it was prehistorically. Extension of the hunting season, if it occurred, did not have considerable impact upon plant procurement activities. Storage acted to extend availability of plant foods. Piedmont groups did not abandon traditional agricultural activities (an expected result of crop failures and epidemic disease).

2. Spatial heterogeneity: A pattern emphasizing use of habitats subjected to different degrees of anthropogenic disturbance and/or management was maintained after contact. Euroamerican settlement did not substantially alter the environmental mosaic near Piedmont villages because of the spatial separation of Indian and White settlements in the region. Introduction of European tools increased effectiveness of traditional agricultural methods rather than promoting Euroamerican-style land-use techniques.

3. Diet composition: A fairly diverse set of plant resources, including domesticates and non-domesticates, continued to be utilized in postcontact times. The European-introduced domesticates that were adopted were ones that were easily incorporated into the traditional husbandry

system and did not necessitate replacement of traditional items in the diet.

#### SOURCES OF EVIDENCE

Hypotheses will be tested using paleoethnobotanical evidence from sites in the northeastern Piedmont (see Chapter II). However, ethnohistorical sources are often quite informative about postcontact subsistence patterns in the East and their relationship to European activity. With very few exceptions (Lefler 1967; Lederer 1966), however, travellers' accounts do not provide information about the study area in particular during the relevant period (that is, approximately AD 1000 to 1730). Those that do provide such information represent the observations of individuals passing through the region as explorers enroute elsewhere, not of residents.

A summary of historical sources used in this study appear in Table 4. Robert Beverley (Wright 1947), Thomas Harriot (1972), and William Strachey (Major 1849) discuss plant use in some detail, but they refer to coastal Algonquians. Peter Kalm's substantial and botanically sophisticated account of the Northeast (Benson 1987) is even farther afield geographically, but is referred to here because of the accuracy and detail of the observations of this contemporary of Linnaeus. William Bartram (Van Doren 1928), and James Adair (Williams 1930) provide valuable

information about landscapes and subsistence activities of interior groups, but they wrote later in the eighteenth century and visited groups such as the Creek and Cherokee that had experienced a considerable degree of acculturation. Even John Lawson, in his A New Voyage to Carolina (Lefler 1967), a source treasured for its perceptive accounts of eastern North Carolina, seems to have reserved his more extensive discussion of Native American lifeways for the Tuscarora of the inner coastal plain rather than the less well known groups of the Piedmont. William Byrd II's travels along the boundary line between Virginia and North Carolina are particularly informative about regional vegetation patterns (Boyd 1967).

In addition to the frequent lack of specific information on the time, location, and ethnic groups of particular interest, ethnohistory of the North Carolina Piedmont shares a difficulty common to historiography in general, observer bias (Brettell 1986). Many early observations of North Carolina Indians are recognized as largely accurate despite certain biases on the part of the authors, for example the work of Lederer, Beverley, and William Byrd (Randolph 1973). John Lawson, like many other travel writers of the European expansionist period, wrote as a propagandist for settlement as well as to enlighten and to entertain (Adams 1980; Lindgren 1972). Nevertheless, such resources are valuable for suggesting avenues of

Table 4. Historical Sources

Observer	Location	Linguistic/ethnic affiliation	Approximate date	Reference
Robert Beverley	coastal Virginia	Southern Algonquian	1705	Wright 1947
James Adair	interior Southeast	various ("Civilized Tribes")	1730s, 1740s	Williams 1930
John Smith	coastal Virginia	Southern Algonquian	1607	Hawke 1970
Lincecum ms. (oral tradition)	Mississippi	Choctaw	collected 1823-25	Campbell 1959
William Bartram	coastal, interior Southeast	Seminole, Cherokee, Creek	1773-1776	Van Doren 1928
Peter Kalm	PA, NY, Quebec	Iroquoian, Algonquian?	1744	Benson 1987
William Strachey	coastal Virginia	Southern Algonquian	1607	Major 1849
William Byrd II	n. NC, s. VA Piedmont, Coastal Plain	Southern Algonquian, E. Siouan	1728	Boyd 1967

Table 4 continued

Observer	Location	Linguistic/ethnic affiliation	Approximate date	Reference date
John Lawson	NC Pied- mont, Coastal Plain	Tuscarora (coastal Algonquian, e. Siouan?)	1701	Lefler 1967
William Hilton	Cape Fear region	?	1664	Salley 1911d
Thomas Ashe	SC near Charles Town	?	1682	Salley 1911b
Robert Horne	coastal Carolinas	?	1666	Salley 1911a
Robert Sandford	near Hilton Head	?	1666	Salley 1911e
John Lederer	VA and NC, Piedmont, foothills	E. Siouan ?	1670	Lederer 1966
Edward Bland	VA and NC border region	Nottoway, Tuscarora, Occaneechi	1651	Bland 1966
Thomas Harriot	coastal NC	S. Algonquian	1585	Harriot 1590
Mark Catesby	SC and FL	various	1722	Catesby 1771

investigation and plausible hypotheses for archaeological testing.

The difficulties of interpreting archaeological data are surely no less intimidating than those involved in historical research. However, the problem of evaluating the reliability of individual historical sources will be avoided here by using them for constructing hypotheses rather than as specific evidence for the Piedmont groups being studied. Most information derived from historical sources forms part of the specific model of plant use constructed to develop hypotheses. Thus this information need not be subjected to the same rigorous standards as to factual correctness that would be applied to potential evidence. Similarly, the criterion of applicability to specific groups and time periods, an important feature of evidence used to test hypotheses, is less important when used to formulate them.

In some cases such sources, in addition to secondary works, can inform about subsistence patterns and their relationship to contact in other regions or in the East as a whole, providing material for hypothesis formulation. Some propositions are not testable using presently available archaeological evidence, but historical sources can provide tentative interpretations based upon regionally recognized patterns.

## SUMMARY

One goal of this study is to describe plant use by aboriginal populations of the northeastern North Carolina Piedmont. A related goal is to offer a functional explanation of continuity and change with special reference to the effects of European contact. These goals are to be achieved in a series of steps. Ecological concepts and theories relevant to human responses to spatial and temporal variability in the environment and their consequences for diet composition will be introduced. These assumptions will be combined with historical and archaeological data about the study area in the construction of hypotheses about plant use. Hypotheses will be evaluated using paleoethnobotanical evidence. Conclusions about how plant use changed, or did not, during the Historic period will be drawn. Factors relevant to these differences will be identified and causal relationships proposed as subjects of further study.

Subsistence behavior responds to both regular temporal variability (seasonality) and unpredictable fluctuations in environmental features such as resource availability. Group movement and storage are common responses to seasonality. Succession and disturbance within existing plant communities create spatial heterogeneity. As a result human populations exploit different plant communities in specific ways. Both types of response have consequences for diet composition. One assumption about diet composition is that subsistence

options are exercised largely according to material considerations. Thus, assessment of time and energy costs of various plant procurement activities is useful in explaining the types and proportions of plant resources used by a group. These three aspects of subsistence (responses to temporal variability, responses to spatial heterogeneity, and diet composition) are reflected to some degree in the archaeological record.

Specific hypotheses about continuity and change address each of these aspects of plant use. Trade, introduced disease, and competition are aspects of contact that are likely to have had consequences for aboriginal subsistence, judging by historical and archaeological data from throughout the eastern United States. Research in the northeastern Piedmont, however, has produced evidence of considerable continuity in subsistence, technology, and settlement. The notion that innovation may function to maintain tradition ("Romer's Rule") was introduced. This concept may have some utility for explaining continuity in the face of changed environmental circumstances. However, the specific model and its related hypotheses reflect the belief that even tradition-maintaining change was cut short by ethnic extinction in the northeastern Piedmont.

Both archaeology and history will provide data used to formulate and test hypotheses. Most evaluation of hypotheses will utilize archaeological (primarily paleoethnobotanical) data. Ethnohistorical information will

be used chiefly to suggest problems of interest and direct the construction of hypotheses. This approach avoids many of the methodological pitfalls of historical research while allowing for discussion of the extensive body of written material on aboriginal North American plant use and land management.

CHAPTER IV  
RESPONSES TO TEMPORAL VARIABILITY

SEASONALITY

Seasonal variation in the availability of food plants is probably the most important type of regular temporal variability affecting subsistence patterns in the Piedmont. In temperate regions such as this one, seasonality is due largely to changes in day length (photoperiodism) and temperature. In eastern North America, spring begins with vegetative growth (and in some cases flowering) of plants. A first peak of growth in understory species occurs before the canopy closes, shading the forest floor (R. Smith 1983:107). The so-called "cool-season" grasses also bloom and fruit early in the year, utilizing last year's stored energy for a growth spurt (Doebley 1984). A second growth peak occurs in mid- to late summer, when plants of open areas (including forest openings, fields, and roadsides) bloom. A few species bloom later, when the forest canopy thins in the fall.

The majority of plant taxa found archaeologically on sites in the study area fall into the second category, that is of late summer to fall ripening species. Table 5 demonstrates this pattern by listing ripening periods of

Table 5. Phenology of Non-Cultigen Taxa Represented Archaeologically by Fruits or Seeds

Taxon	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
<u>Fragaria virginiana</u>		X	X	X	X							
<u>Galium aparine</u>			X	X								
<u>Hordeum pusillum</u>			X	X	X							
<u>Phalaris caroliniana</u>				X	X							
<u>Prunus angustifolia</u>				X	X	X						
<u>Rubus flagellaris</u>				X	X	X	X	X				
<u>Scirpus sp.</u>				X	X	X	X	X				
<u>Phytolacca americana</u>				X	X	X	X	X		X		
<u>Euphorbia maculata</u>				X	X	X	X	X	X			
<u>Polygonum aviculare</u>				X	X	X	X	X	X	X	X	
<u>Vaccinium vacillans</u>						X	X					
<u>Rubus argutus</u>						X	X					
<u>Rhus glabra</u>						X	X	X	X	X		
<u>Solanum americanum</u>						X	X	X	X	X		
<u>Chenopodium album</u>						X	X	X	X	X		
<u>Amaranthus hybridus</u>						X	X	X	X	X		
<u>Gaylussacia dumosa</u>						X	X	X	X	X		
<u>Prunus serotina</u>							X	X				
<u>Sambucus canadensis</u>							X	X				
<u>Ipomoea purpurea</u>							X	X	X			
<u>Passiflora incarnata</u>							X	X	X	X		
<u>Polymnia uvedalia</u>							X	X	X	X		
<u>Polygonum punctatum</u>							X	X	X	X		
<u>Quercus rubra</u> var. <u>rubra</u>									X			
<u>Prunus americana</u>								X	X			
<u>Corylus americana</u>								X	X			
<u>Triosteum perfoliatum</u>								X	X	X		
<u>Nyssa sylvatica</u>								X	X	X		

Table 5 continued

Taxon	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
<u>Viburnum acerifolium</u>								X	X	X		
<u>Crataegus uniflora</u>								X	X	X		
<u>Vaccinium stamineum</u>								X	X	X		
<u>Ambrosia artemisiaefolia</u>								X	X	X		
<u>Rhus copallina</u>								X	X	X		
<u>Rhus radicans</u>								X	X	X		
<u>Viburnum nudum</u>								X	X	X		
<u>Vitis rotundifolia</u>								X	X	X		
<u>Crataegus crus-galli</u>									X	X		
<u>Cornus florida</u>									X	X		
<u>Castanea dentata</u>									X	X		
<u>Vitis labrusca</u>									X	X		
<u>Diospyros virginiana</u>									X	X		
<u>Quercus prinus</u>									X	X	X	
<u>Quercus alba</u>									X	X	X	
<u>Carya tomentosa</u>										X		
<u>Carya pallida</u>										X		
<u>Juglans nigra</u>										X		
<u>Carya cordiformis</u>										X		

Source: Radford et al. (1968).

Table 6. Common Name Equivalents of Plant Species Chosen to Represent Archaeological Taxa

Latin Binomial and Authority	Vernacular Name
<u>Amaranthus hybridus</u> L.	pigweed
<u>Ambrosia artemesiifolia</u> L.	ragweed
<u>Arundinaria gigantea</u> (Walter) Muhl.	giant cane
<u>Carya cordiformis</u> (Wang.) K. Koch	bitternut hickory
<u>Carya pallida</u> (Ashe) Engler & Graebner	pale hickory
<u>Carya tomentosa</u> (Poiret) Nuttall	mockernut hickory
<u>Castanea dentata</u> (Marshall) Borkh.	American chestnut
<u>Chenopodium album</u> L.	lamb's quarters
<u>Citrullus vulgaris</u> Schrader ex Ecklon & Zeyher	watermelon
<u>Cornus florida</u> L.	flowering dogwood
<u>Crataegus crus-galli</u> L.	hawthorn
<u>Crataegus uniflora</u> Muenchh.	hawthorn
<u>Corylus americana</u> Walter	hazelnut
<u>Cucurbita pepo</u> L.	spurge
<u>Diospyros virginiana</u> L.	persimmon
<u>Euphorbia maculata</u> L.	spurge
<u>Fragaria virginiana</u> Duchesne	wild strawberry
<u>Galium aparine</u> L.	bedstraw
<u>Gaylussacia dumosa</u> (Andrz.) T. & G.	dwarf huckleberry
<u>Hordeum pusillum</u> Nuttall.	little barley
<u>Helianthus annuus</u> L.	sunflower
<u>Ipomoea purpurea</u> (L.) Roth	common morning glory
<u>Iva annua</u> L.	sumpweed
<u>Juglans nigra</u> L.	black walnut
<u>Nyssa sylvatica</u> Marshall	black gum
<u>Passiflora incarnata</u> L.	maypops
<u>Phalaris caroliniana</u> Walt.	maygrass
<u>Phaseolus vulgaris</u> L.	common bean
<u>Phytolacca americana</u> L.	poke
<u>Polygonum aviculare</u> L.	knotweed
<u>Polygonum punctatum</u> Ell.	knotweed
<u>Prunus americana</u> Marshall	wild plum
<u>Polymnia uvedalia</u> L.	bearsfoot
<u>Prunus angustifolia</u> Marshall	chickasaw plum
<u>Prunus serotina</u> Ehrhart var. serotina	black cherry
<u>Rhus copallina</u> L.	winged sumac
<u>Rhus radicans</u> L.	poison ivy
<u>Quercus alba</u> L.	white oak
<u>Quercus rubra</u> L. var. rubra	red oak
<u>Quercus prinus</u> L.	chestnut oak
<u>Rhus glabra</u> L.	smooth sumac
<u>Rubus argutus</u> Link.	blackberry
<u>Rubus flagellaris</u> Willd.	dewberry

Table 6 continued

Latin Binomial and Authority	Vernacular Name
<u>Sambucus canadensis</u> L.	elderberry
<u>Scirpus</u> sp.	bulrush
<u>Solanum americanum</u> Miller	nightshade
<u>Triosteum perfoliatum</u> L.	horse gentian
<u>Vaccinium stamineum</u> L.	squaw-huckleberry
<u>Vaccinium vacillans</u> Torrey	
<u>Viburnum acerifolium</u> L.	maple-leaved v.
<u>Viburnum nudum</u> L.	viburnum
<u>Vitis labrusca</u> L.	fox-grape
<u>Vitis rotundifolia</u> Michaux	muscadine
<u>Zea mays</u> L. <u>ssp.</u> mays	maize, corn

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Source: Radford et al. (1968)

Agricultural groups have the advantage of knowing the timing of ripening and the precise location of crop resources, although non-predictable variability such as droughts that cause crop failures can have devastating effects (Rindos 1984). For agricultural groups, scheduling is complicated by activities such as clearing, planting, and cultivating, all of which generally take place prior to the peak of non-crop plant food availability in the late summer and fall. For Piedmont groups, hunting was important as well as agriculture and harvesting of non-crop plant resources. This mixed economy, which probably acted as a buffer against the risks entailed by a highly specialized subsistence pattern, necessitated a finely-tuned but flexible scheduling of activities.

Ethnohistory. Although the precise sequence and timing of seasonally-specific activities varied between local groups and environmental zones, the Southeast seems to have shared at least the broad outlines of a scheduling pattern. This general pattern included particular times of the year focused upon large game hunting; planting; harvesting; collecting of mast resources and fruits; and, in some areas, exploitation of aquatic resources. Often seasonally specific activities necessitated annual movements of entire communities or of their male members (in the case of hunting forays).

Evidence of scheduling is fairly abundant in historical sources, particularly in accounts of travelers and traders.

Because such eyewitness accounts by Europeans necessarily occurred after contact, they may reflect to some extent the impact of trade relationships and depopulation upon preexisting patterns. However, these reports are not likely to contain the biases (such as exaggeration of crop yields) that characterize many accounts, since the seasonal cycle of native activities lacked propagandistic potential. Primary sources that are most informative about scheduling of subsistence activities in the East include the Lincecum Manuscript, an oral history of the Choctaw collected in the nineteenth century (Campbell 1959); the writings of Captain John Smith (Hawke 1970) and William Strachey (Major 1849) concerning the coastal Algonquians in the early seventeenth century; and John Lawson's account of North Carolina Indians (probably the Tuscarora of the inner coastal plain) of the early eighteenth century (Lefler 1967). The Lincecum manuscript takes the form of "narrative folklore", but most of the information it presents has been confirmed independently (Campbell 1959). Portions of Strachey's account were apparently plagiarized verbatim from Smith. Despite Smith's tendency to self-glorification and exaggeration (Hawke 1970), there seems no reason to doubt his accuracy about Indian customs. Lawson is a favorite source on North Carolina, despite the book's propagandistic elements. Although they have shortcomings as evidential documents, these sources contain information about seasonal scheduling of subsistence activities in the Southeast that

can be compared with archaeological evidence from the North Carolina Piedmont.

One common feature of scheduling in the three accounts, despite differences in timing, is the allocation of time for agricultural activities. These included planting, cultivating, harvesting and associated tasks such as processing food for storage. Planting took place in the spring (presumably in mid-April or later in the northeastern Piedmont, as it does today). Adair (Williams 1930:436), writing of the Southeastern Indians in general in the mid- to late eighteenth century, remarks that planting was done in May, when "the wild fruit is so ripe, as to draw off the birds from picking up the grain." In coastal Virginia, some portion of the population might disperse for shellfishing and plant gathering, though important foods in May and June reported by Strachey (Major 1849:73) include acorns, chestnuts, walnuts (all of which must have been stored the previous year), fish, and chechinquarnins (probably a grain). Fishing was an important springtime activity, indicated also by Lawson's mention of use of anadromous fish (Lefler 1967:162). Few plant foods were available in spring, with the exception of greens, some fruits and many herbs used for seasoning (Major 1849:120).

Another feature that these accounts have in common is the winter hunt. Both Strachey (Major 1849:75) and Lawson (Lefler 1967:215) note that entire communities moved (inland, in the case of the coastal Algonquian) away from

villages in order to hunt, after crops had been harvested and food processed for storage. Fire-hunting was often practiced during these winter hunts, and deerskins obtained for trading (Lefler 1967:216). The Choctaw males were absent from villages during the winter hunt, but women and children gathered nuts, presumably remaining behind at the village (Campbell 1959:14). Late fall and early winter were best for hunting deer because the dry leaves provided excellent fuel for fire drives, tracking was easier in snow or leafless woods, and bucks were less wary during the rut (Hudson 1976).

Archaeology of Scheduling. This aspect of scheduling can be investigated archaeologically. Among North Carolina coastal plain groups, whole populations moved to winter camps (Lefler 1967:215). Among some groups only males went (Campbell 1959:11), with resulting vulnerability to the women, children and elderly remaining in the village. It has been suggested (DeBoer 1988, Ward 1985) that below-ground storage occurs primarily as a strategy for concealment of foodstuffs or other items of value during absences from settlements. If this relationship between subterranean storage and seasonal absence is assumed, then periodic site abandonment should be reflected in the presence of features interpreted as refilled storage pits. All sites from the three drainages have produced at least some storage pits except for Edgar Rogers, indicating that below-ground storage was practiced in Prehistoric as well as

Historic times. Storage pits are the dominant feature type at the Fredricks site (Petherick 1987, Ward 1988), where about 39% of features (excluding burials and disturbances) are classified as storage pits or possible storage pits. The Middle Saratow component at Lower Saratow produced a somewhat lower proportion of storage pits at about 25% of features (38% if the three classified as pits are considered as storage facilities). It is apparent that seasonal site abandonment, probably by the entire community, was an important aspect of subsistence in the northeastern Piedmont in Historic times. It is most likely that such abandonment occurred during the winter and early spring for the primary deer hunting season.

Is there evidence that this winter hunt pattern was less important, or not scheduled at all, in the Late Prehistoric and Protohistoric? A total of 45% of features from the Dan River component at the Powerplant site were classified as storage pits (equalling the number of basins). This is similar to the pattern of dominance of basins and storage pits at Lower Saratow during the Middle Saratow phase, except for its higher proportion of storage pits. On the other hand, Hillsboro phases sites show a contrasting low proportion of storage pits (13%, none, and 21%, for George Rogers, Edgar Rogers, and Wall, respectively) (Petherick 1987; Ward and Davis 1988). The Haw River phase sample is small and produces contradictory

results. Guthrie lacks storage pits, but at Holt they make up four out of six features.

The resulting picture of changes in scheduling as measured by frequency of subterranean storage is complex. For the Dan drainage, subterranean storage was utilized extensively in the Late Prehistoric as well as after contact. In the Eno/Flat and Haw drainages, below-ground storage is much less evident in the Protohistoric than in the Historic period, implying above-ground storage and year-round occupation. The argument for a strong unidirectional trend toward increased seasonal movement is weakened somewhat by evidence from the Holt site, unless Guthrie provides a better indication of below-ground storage patterns. At any rate, there is evidence in the study area for continuity in both scheduling of subsistence activities and use of storage facilities. There is some indication of a shift to greater seasonal mobility (which may represent a return to an earlier prehistoric pattern).

### Storage

Phenological patterns dictate that abundance of plant foods in the environment would have been highest in the late summer and fall and lowest in the winter and early spring. Information on the timing of fruit production for various plant taxa represented archaeologically on North Carolina Piedmont sites (Table 5) certainly indicates this pattern of availability. Storage would have offset this pattern

somewhat, but stored resources have limited lifespans. Thus stored crops, such as maize, and mast products, such as acorn and hickory nuts, might be depleted before next year's harvest.

Storage thus constitutes another response to seasonality that is often practiced along with scheduling. In agricultural societies, storage of surplus becomes a necessary strategy for avoiding the disasters to which a large population is subject as a result of crop failure or insufficient production over a period of years (Colson 1979). Food storage has also been recognized as an important strategy among some hunter-gatherers who are not also agriculturalists (Testart 1982). Storage of plant foods effectively extends the limits of their availability beyond the period when the fruits become ripe but before they are eaten by other animals or decompose.

Ethnohistory. Historical evidence of plant food storage is quite common for the East. Sources particularly useful for assessing the importance of storage among Piedmont groups include Lawson (Lefler 1967); Lederer's account of the Virginia and North Carolina Piedmont in 1670 (Lederer 1966); and William Bartram's report on interior Southeastern groups including Creek and Cherokee in the late eighteenth century. Other briefer mentions of plant food processing and storage are summarized in Table 7.

Maize was "their chief produce, and main dependance" (Williams 1930:437), and considerable effort was devoted to

Table 7. Observations of Food Storage and Processing Practices in the Eastern U.S.

Plant food	Observation	Location or group	Reference
[STORAGE]			
Acorns, chestnut, hickory nuts	smoke-dried, enclosed in mud shells	Choctaw	Campbell 1959:15
"seeds"	stored for winter use		
fruits	dried	interior SE	Williams 1930:439
peaches	dried	coastal Algonquian	Wright 1947:181
maize	stored in bark-lined pits	northeastern U.S.	Benson 1987:268
"pumpkins"	dried in strips	northeastern U.S.	Benson 1987:517
maize	aboveground granaries	Hitchiti (Seminole)	Van Doren 1928:168
grapes	dried in "great quantities"	interior SE	Van Doren 1928:321
maize	stored in cribs	Santee (SC)	Lefler 1967:23

Table 7 continued

Plant food	Observation	Location or group	Reference
maize	preserved for winter use	NC and SC	Lefler 1967:182
hickory nuts	stored	NC and SC	Lefler 1967:105
"wild Fruits"	sun-dried	NC and SC	Lefler 1967:217
"Pulse"	stored for winter use	NC and SC	Lefler 1967:216
"Hurts"	dried for "Plum-Bread"	NC and SC	Lefler 1967:110
chinkapin, hickory nuts	dried for winter use	Congaree (SC)	Lefler 1967:34
maize	storage of year's provision	Occaneechi (s. VA)	Lederer 1672:13
maize and mast	above-ground storage	Eno (NC Piedmont)	Lederer 1672:15
maize	stored for winter use	coastal Algonquian (VA)	Major 1849:74

Table 7 continued

Plant food	Observation	Location or group	Reference
walnut, hickory, acorn, chinkapin	stored to supplement maize	SC, FL	Catesby 1771:x
[PROCESSING]			
hickory nuts	extracting "milk"	interior SE	Williams 1930:439
hickory nuts	extracting "milk"	coastal Algonquian	Wright 1947:181
hickory nuts	extracting "milk"	northeastern U.S.	Benson 1987:268
acorns	acorn oil extracted	coastal Algonquian	Harriot 1590:19
chinkapin, chestnuts	boiled to make "broth" and bread	coastal Algonquian (VA)	Major 1849:118
acorns	oil extracted	coastal Algonquian (VA)	Major 1849:128
hickory nuts	extracting "milk"	coastal Algonquian (VA)	Major 1849:129

processing surplus for storage. Lawson and Bartram both describe above-ground storage structures for maize (Lefler 1967:25; Van Doren 1928:168). So does Lederer, who traveled through the northern North Carolina Piedmont (Lederer 1966:15). Mast resources also were stored as a supplement to maize, since the Indians "seldom plant corn enough to last them the year round, yet in some measure they supply that want by their autumn-collection of black walnuts, hiccory nuts, chinkapins and acorns, which they lay up for winter store." Catesby (1771:x).

Reports of drying of fruit for storage and processing of hickory "milk" and acorn oil are also common (Table 7). Hickory oil is reported by Thomas Ashe (Salley 1911b:142) to become rancid after six months. Whole acorns and hickory nuts would probably have lasted somewhat longer, particularly if first dried, as Harriot describes (Harriot 1590:19). In some areas, mast resources were stored in considerable quantities, as was maize (Lefler 1967:34, 105).

Archaeology of Storage. Archaeological evidence of plant food storage is available for the northeastern Piedmont but is sometimes difficult to interpret. The presence of deep subterranean pits at many sites is the most immediately visible archaeological indication that plant foods were stored. However, these pits were generally refilled with refuse. Thus it is a heterogeneous assemblage of refuse, and not the original stored contents, that later excavation usually reveals. Although direct evidence of

stored foods is therefore not available, carbonized plant remains from refilled pits of various kinds sometimes provides evidence of seasonally-specific activity and thus (indirectly) of storage practices.

One way of determining how and when stored resources were utilized involves creating profiles of sites or features based upon types and quantities of fruit and grain seeds found in them. From this information the time of year best represented by the deposit(s) can be defined. For example, it is assumed that a feature filled with refuse in May and June will produce a profile emphasizing taxa that produce seeds and fruits during these months. Plant foods most likely to be stored in quantity and thus available year-round, such as cultigens and nuts, are excluded from consideration. Many fruit species are likely to have been dried and stored also, but their seeds are assumed to have been deposited when the fruits were ripe. This assumption is necessary to provide adequate information for assessing seasonality.

Seeds can be quantified in various ways to produce seasonal "profiles". Quantities of seeds can sometimes produce misleading results because of the representation of unusual deposits (such as the 225 blackgum seeds from a single feature at the George Rogers site) and variation between taxa in number of seeds per fruit. Another problem encountered in archaeological studies of seasonality is that many species have very long periods of availability,

resulting in nearly identical seasonal profiles for many features, if it is assumed that deposition could have taken place at any time during the full span of availability of all species in a deposit. Instead, the profile can be narrowed to reflect only the time during which all taxa would have been available. However, in this case a frequently unjustified assumption must be made that a deposit was created over a very brief period of time. In large features, taxa identified may not even overlap in their period of availability (see for example Gremillion 1989b).

A method was used here for creating seasonal profiles for sites and features that takes account both of the full timespan potentially represented and any emphasis on a more restricted period. First, fruiting times (in months) were determined using Radford et al. (1968). For a taxon identified archaeologically only to genus, two or more species relatively common in the study area were selected to represent it (Table 5). For a site or feature containing at least four usable taxa (that is, non-cultigen weed, grain or fruit genera or species), the availability periods of all taxa were determined. Each instance of an item from a deposit being available during a given month is termed an identification. For each site or deposit, the percentage of the total of such identifications accounted for by each month was calculated. The histograms presented in Figures 3-19 are based on these percentages. Results are presented

by site in Figures 3-12. Seasonality histograms of selected refilled storage pits and food processing features are presented in Figures 13-16. For comparison, Figures 17-19 are provided. They display histograms for all taxa found at Siouan Project sites, March through June taxa only, and July through October taxa only, respectively.

These histograms confirm expectations about the greatest intensity of plant food collecting and processing occurring in the late summer and early fall. Most of the samples examined (with the important exception of Feature 6 at the Mitchum site, discussed below) display a gradual increase in the percentage of identifications represented, beginning usually with April and terminating in October. The taxon assigned the longest availability period is knotweed (Table 5), probably a weed on these sites. Its presence frequently extends the profile into November, although food plants other than some oaks would not have been harvested then. Bedstraw is responsible for April being represented in seasonality histograms. This taxon was probably used for bedding or some other non-food use. Therefore, its seeds may have been deposited outside of its actual period of ripening (although if used as greens, it would have been collected before seed production). Thus it is appropriate to narrow the time of most extensive plant food exploitation activity to roughly May to October based on seed profiles. Harvesting of crops and mast would of course have taken place during this period as well.

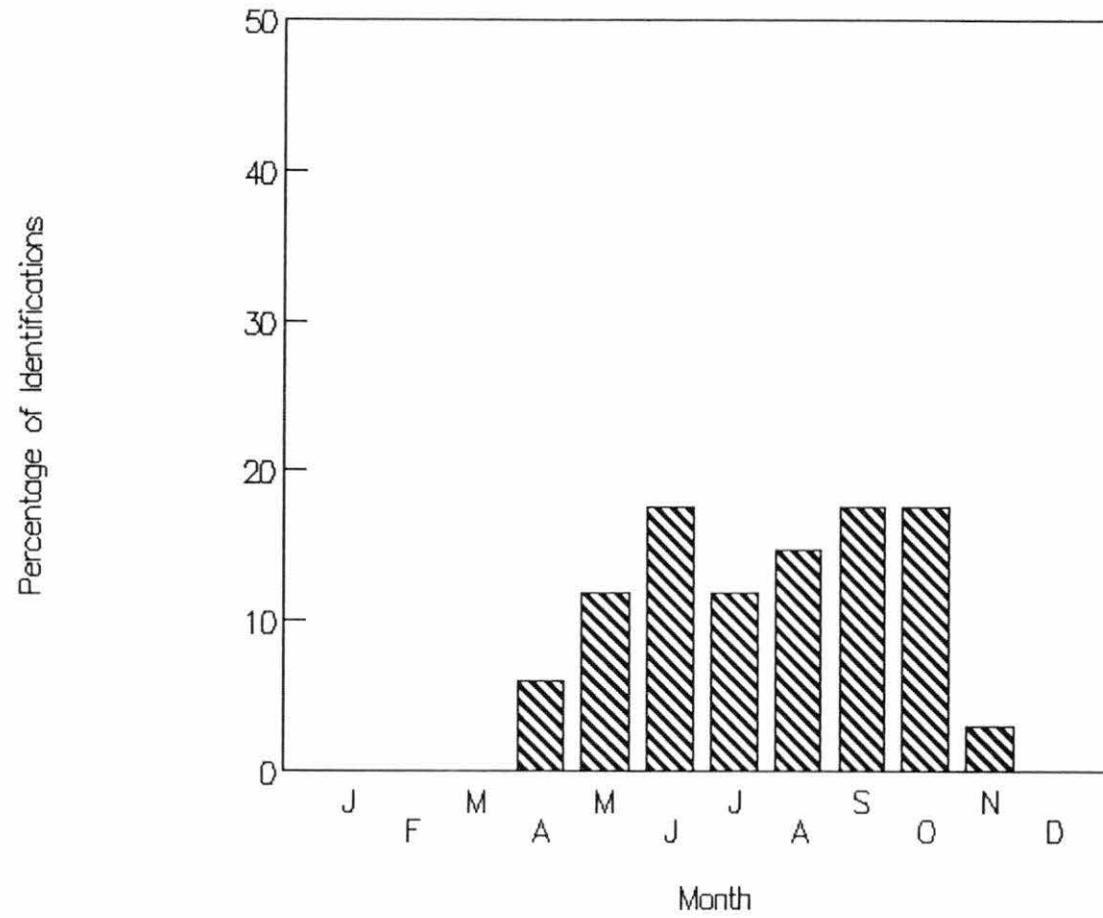


Figure 3. Holt Site, Seasonality Histogram

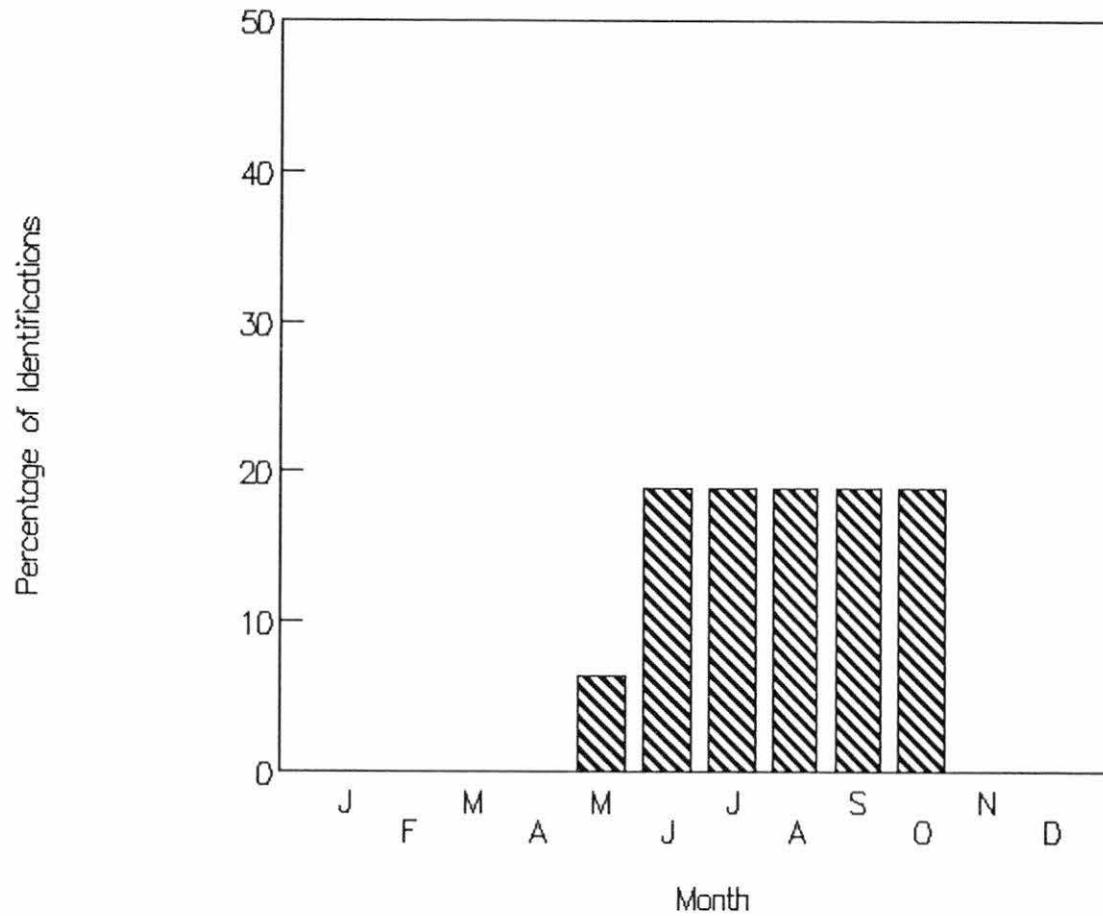


Figure 4. Powerplant Site (Dan River Features), Seasonality Histogram

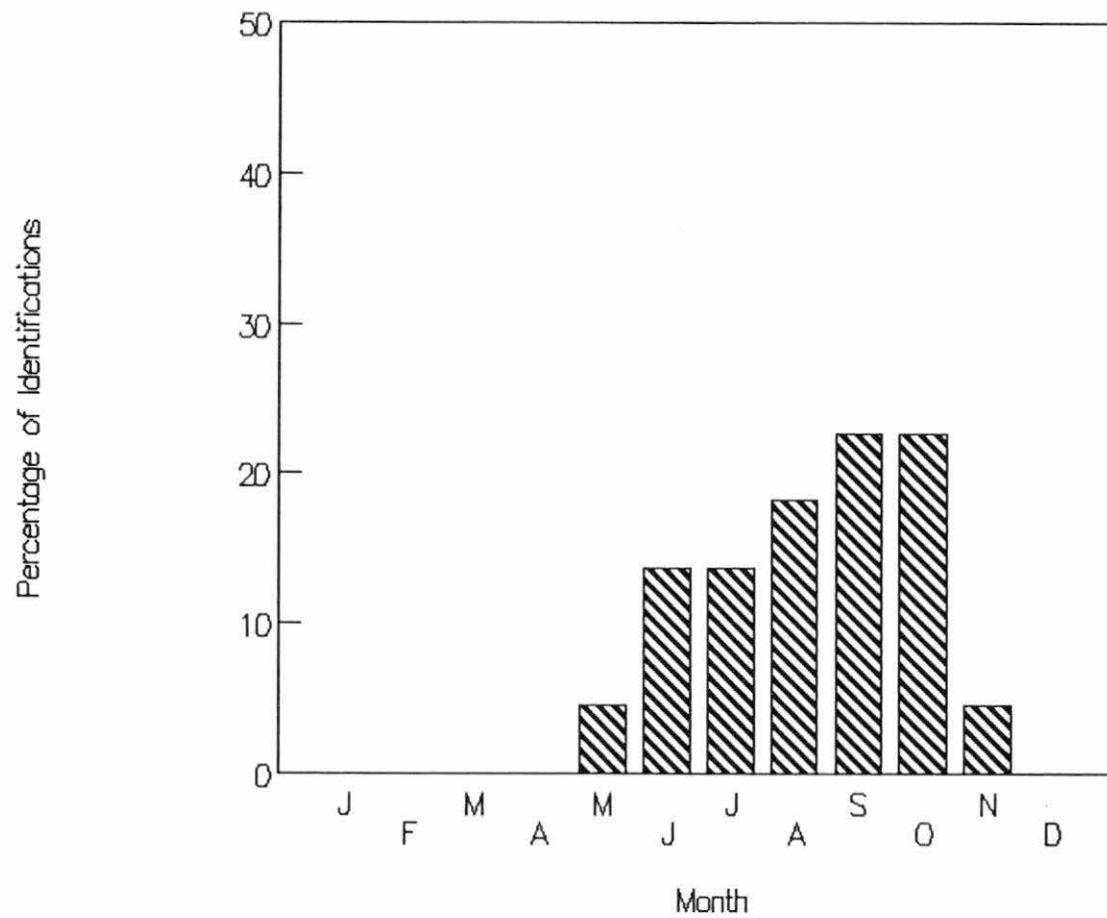


Figure 5. Klutz Site (Dan River Features), Seasonality Histogram

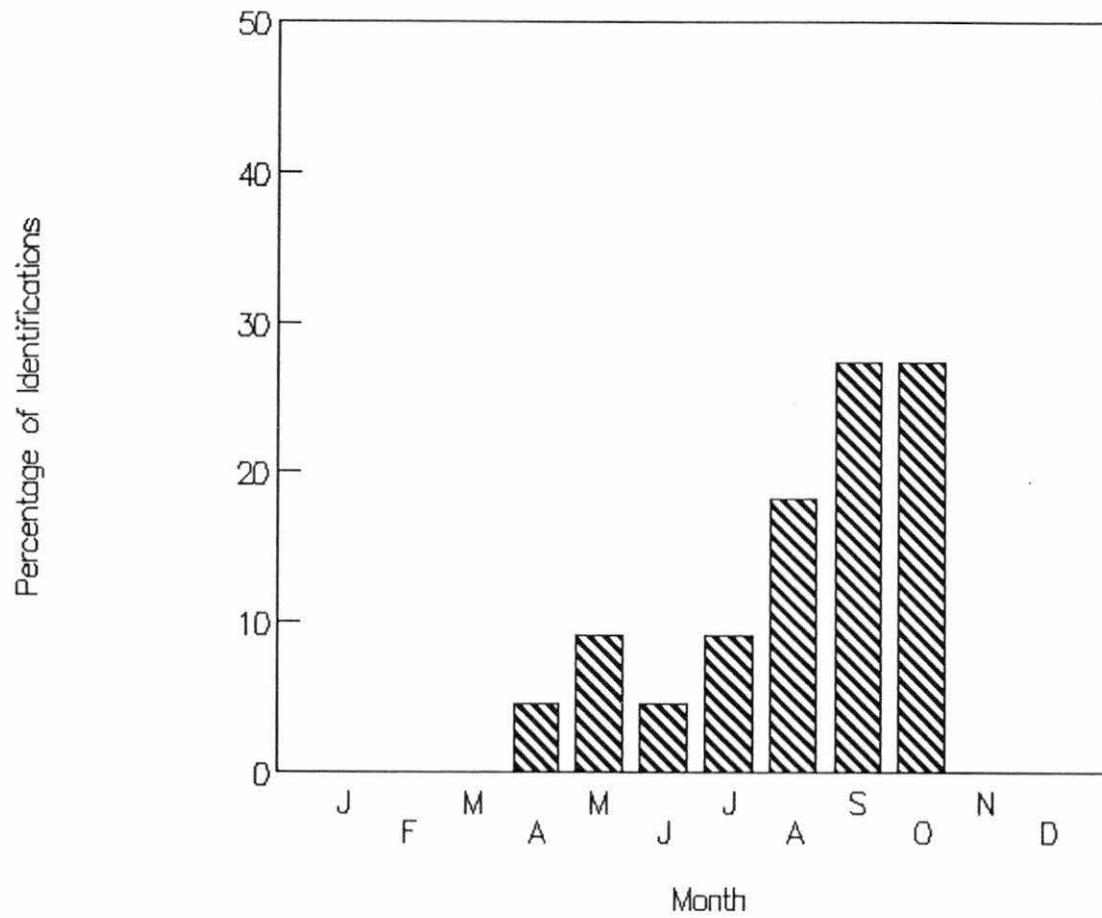


Figure 6. Wall Site, Seasonality Histogram

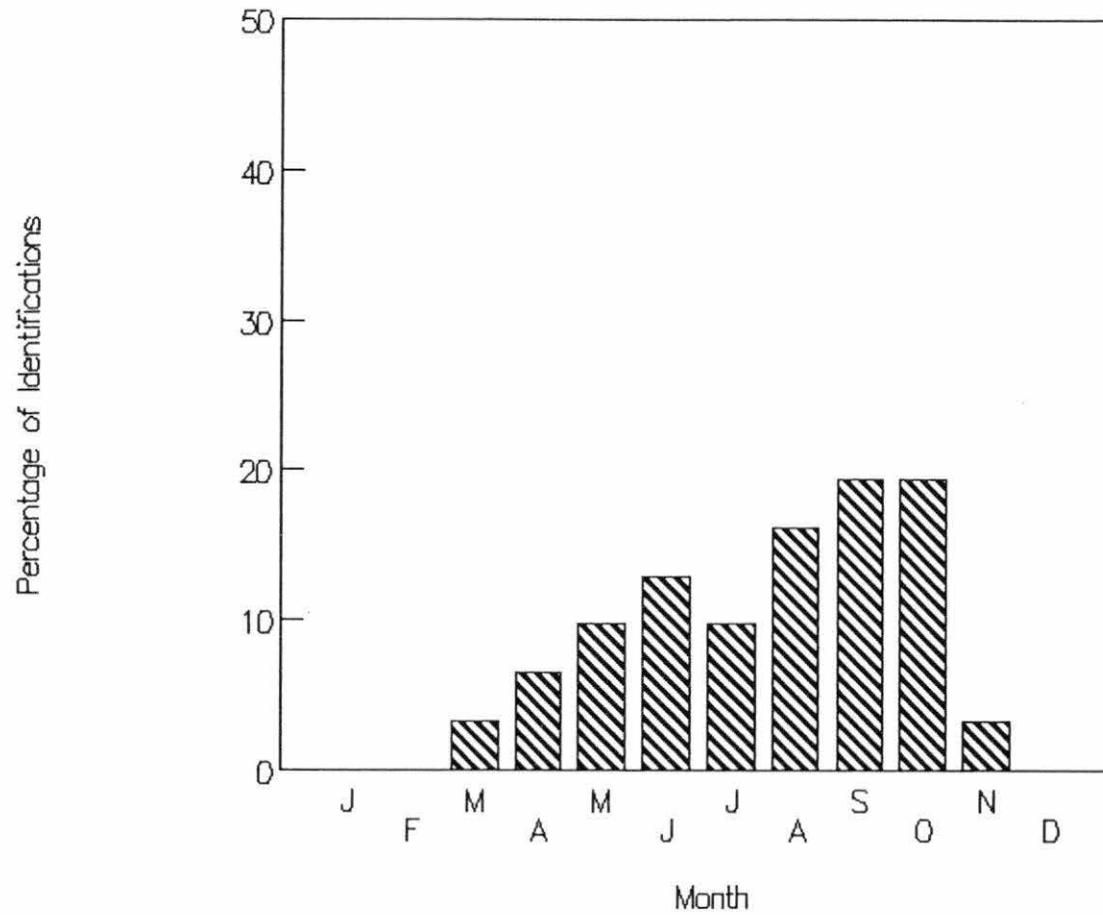


Figure 7. George Rogers Site, Seasonality Histogram

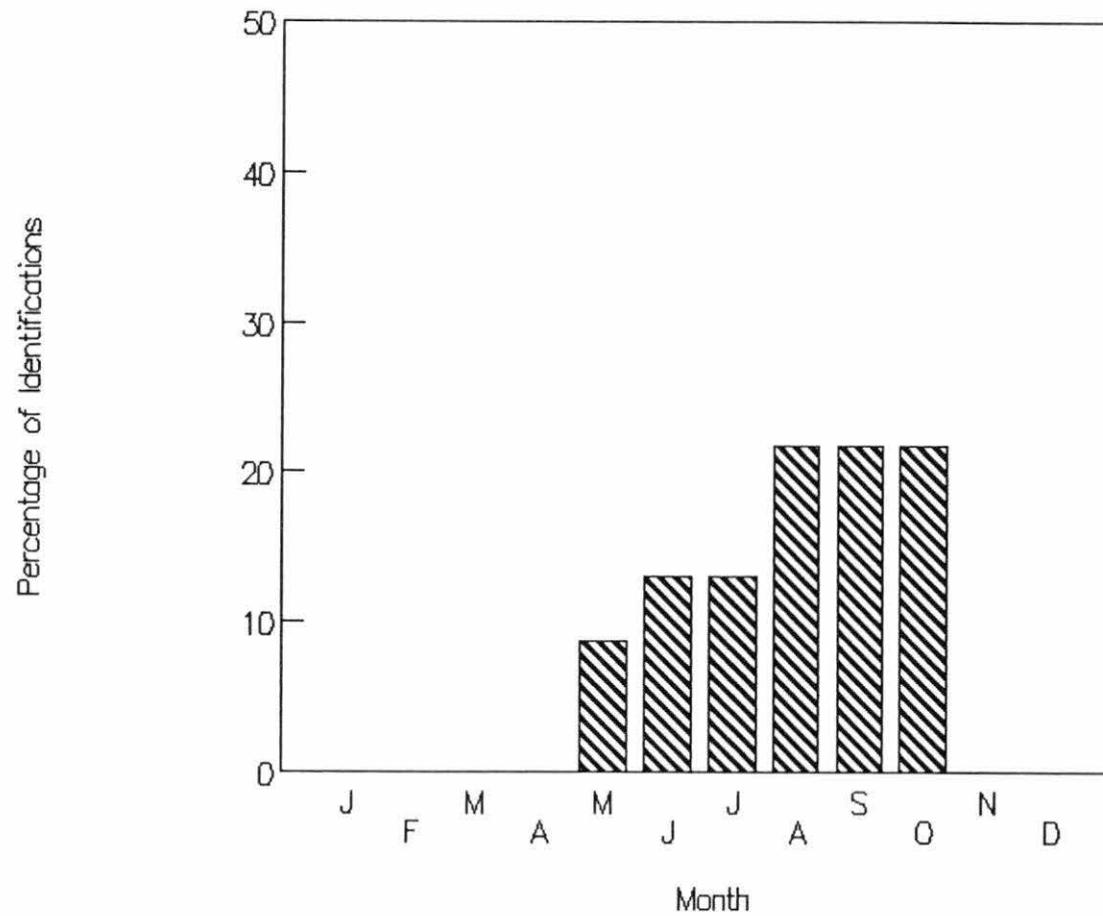


Figure 8. Edgar Rogers Site, Seasonality Histogram

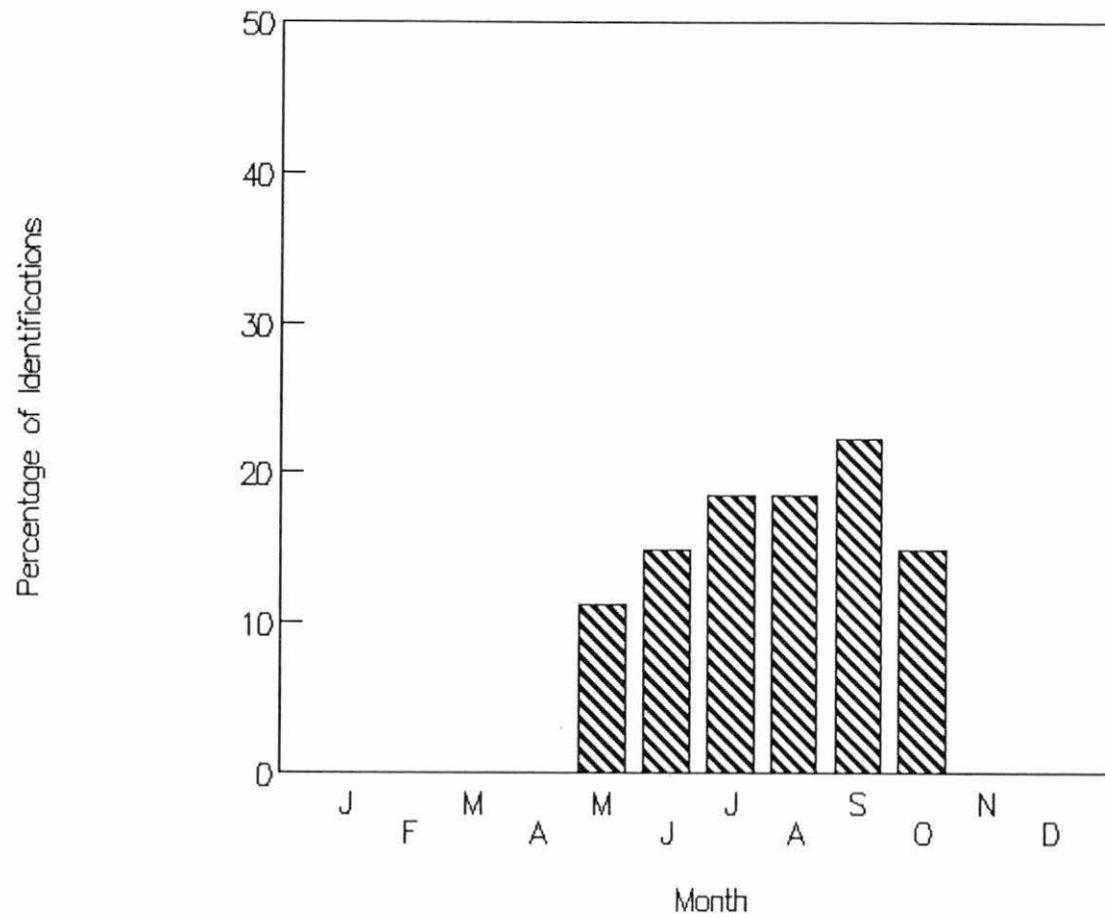


Figure 9. Klutz Site (Historic Features), Seasonality Histogram

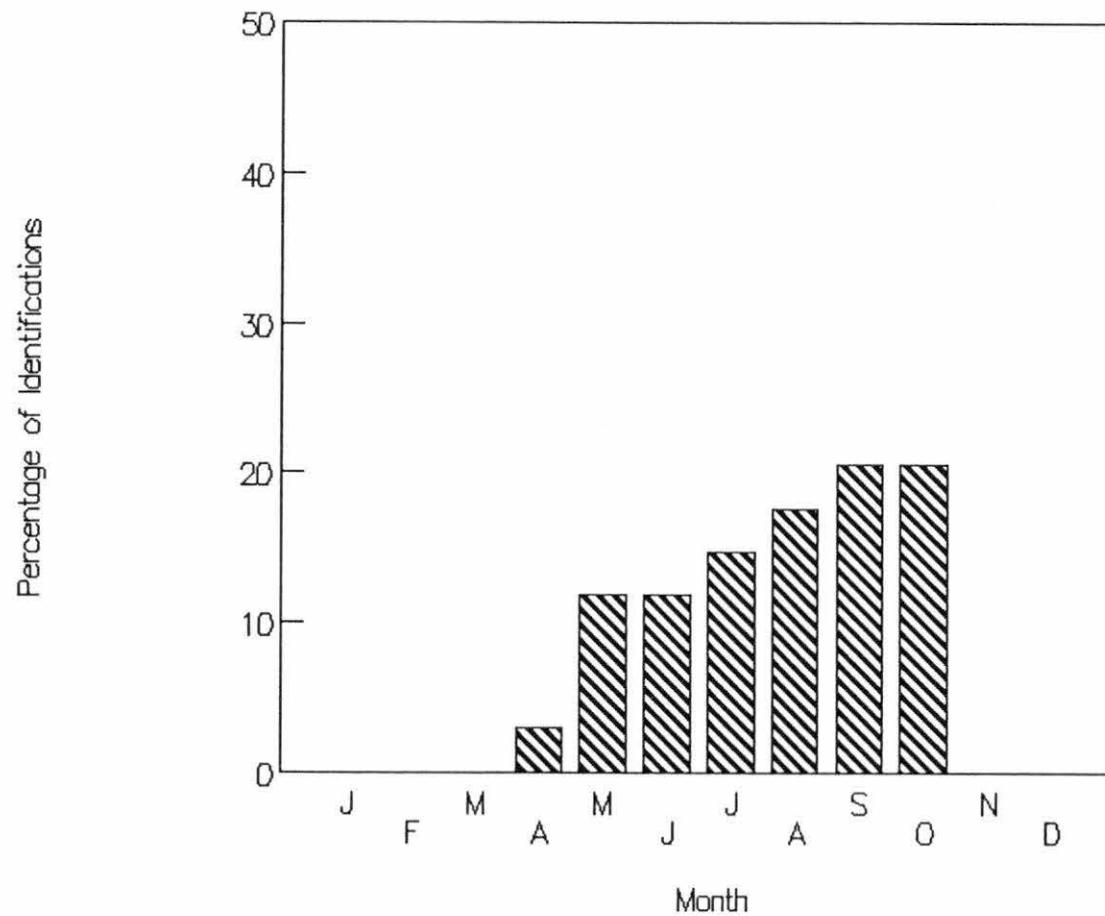


Figure 10. Lower Saratov Site (Historic Features), Seasonality Histogram

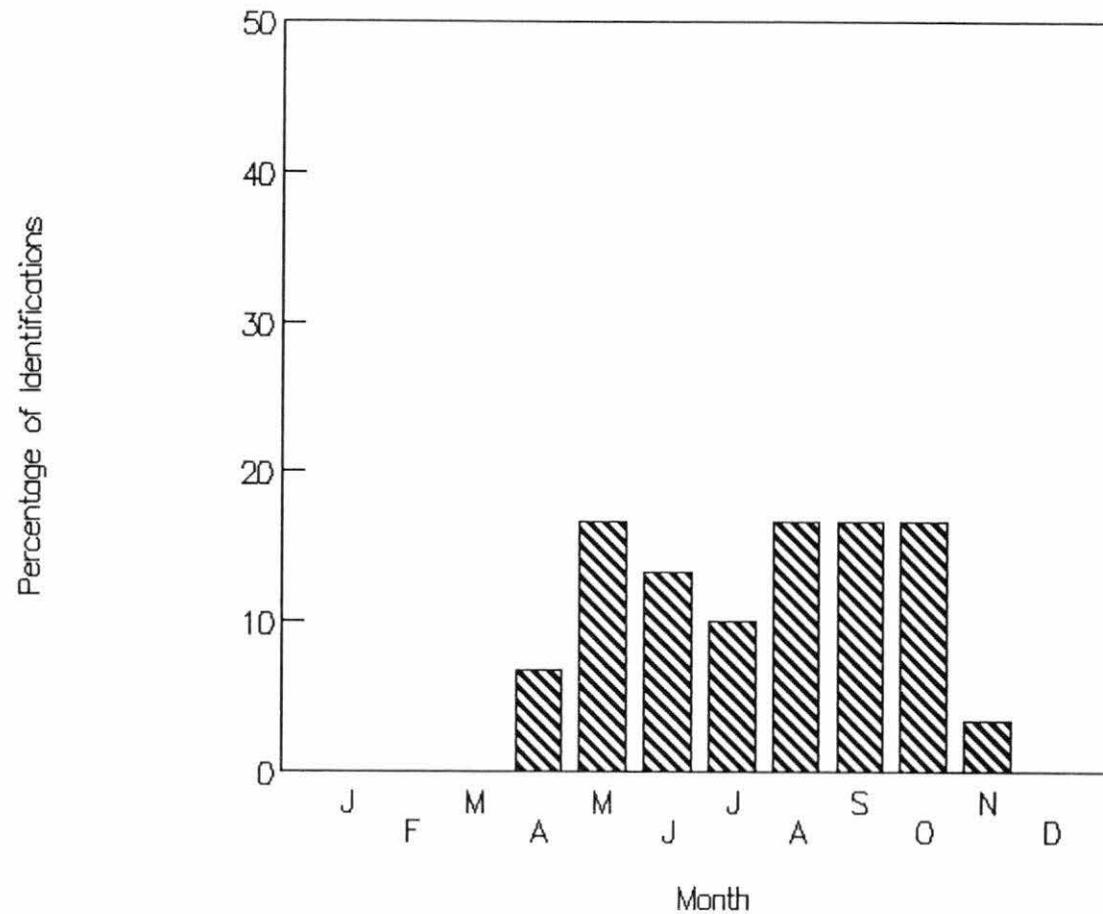


Figure 11. Mitchum Site, Seasonality Histogram

Figure 10. Lower Saratown Site (Historic Features), Seasonality Histogram

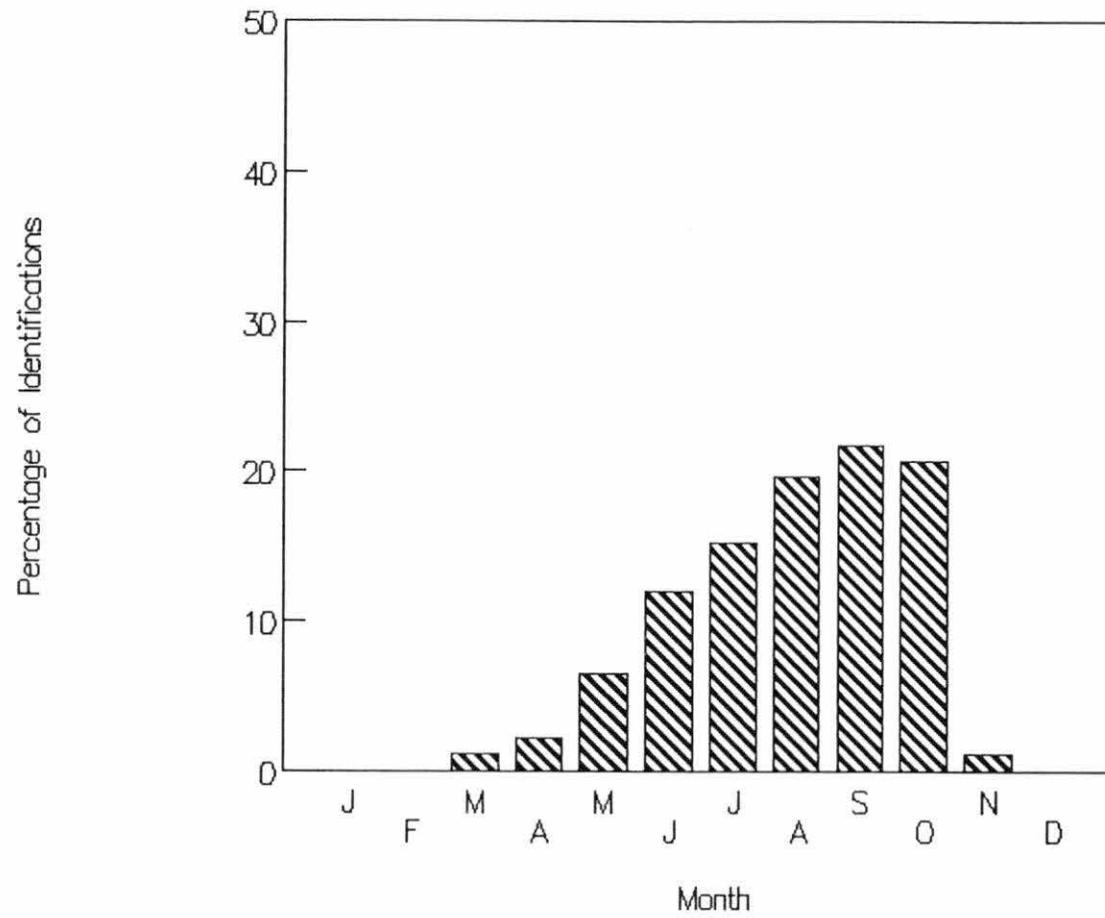


Figure 12. Fredricks Site, Seasonality Histogram

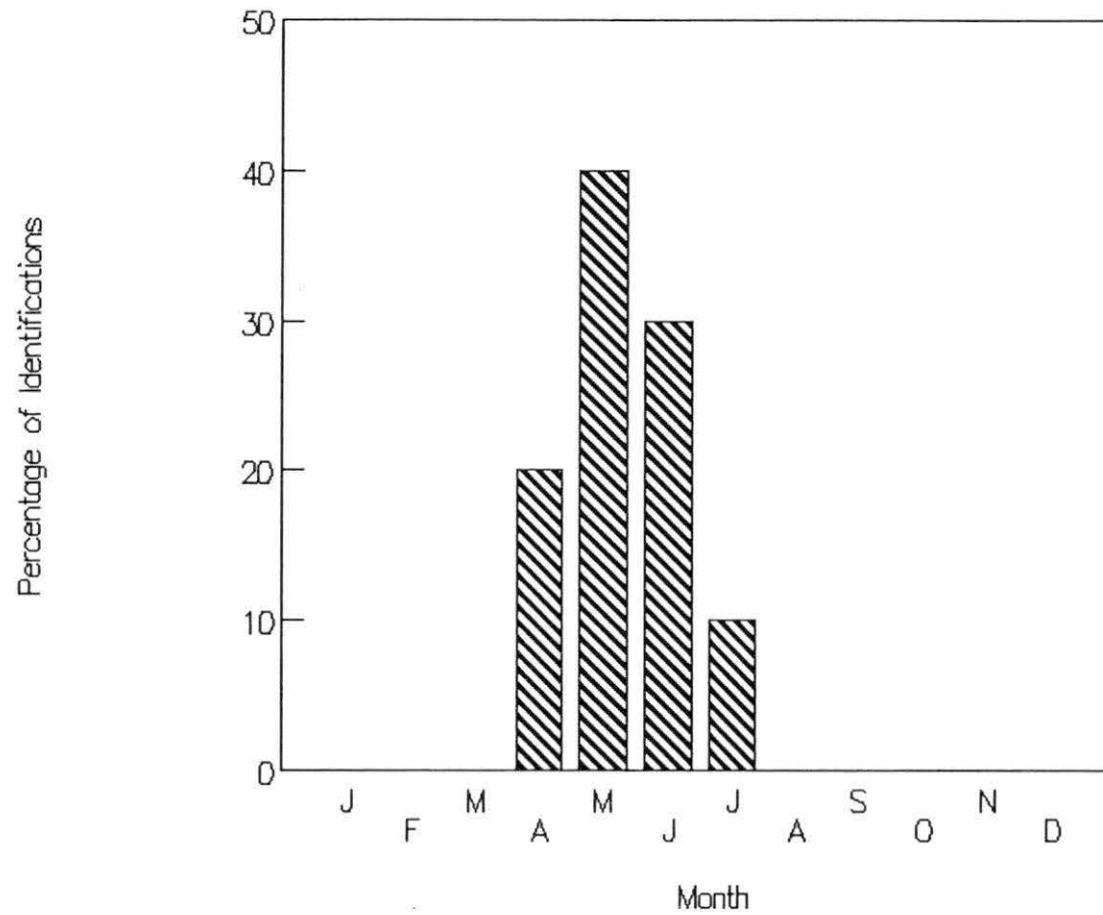


Figure 13. Mitchum Site (Feature 6), Seasonality Histogram

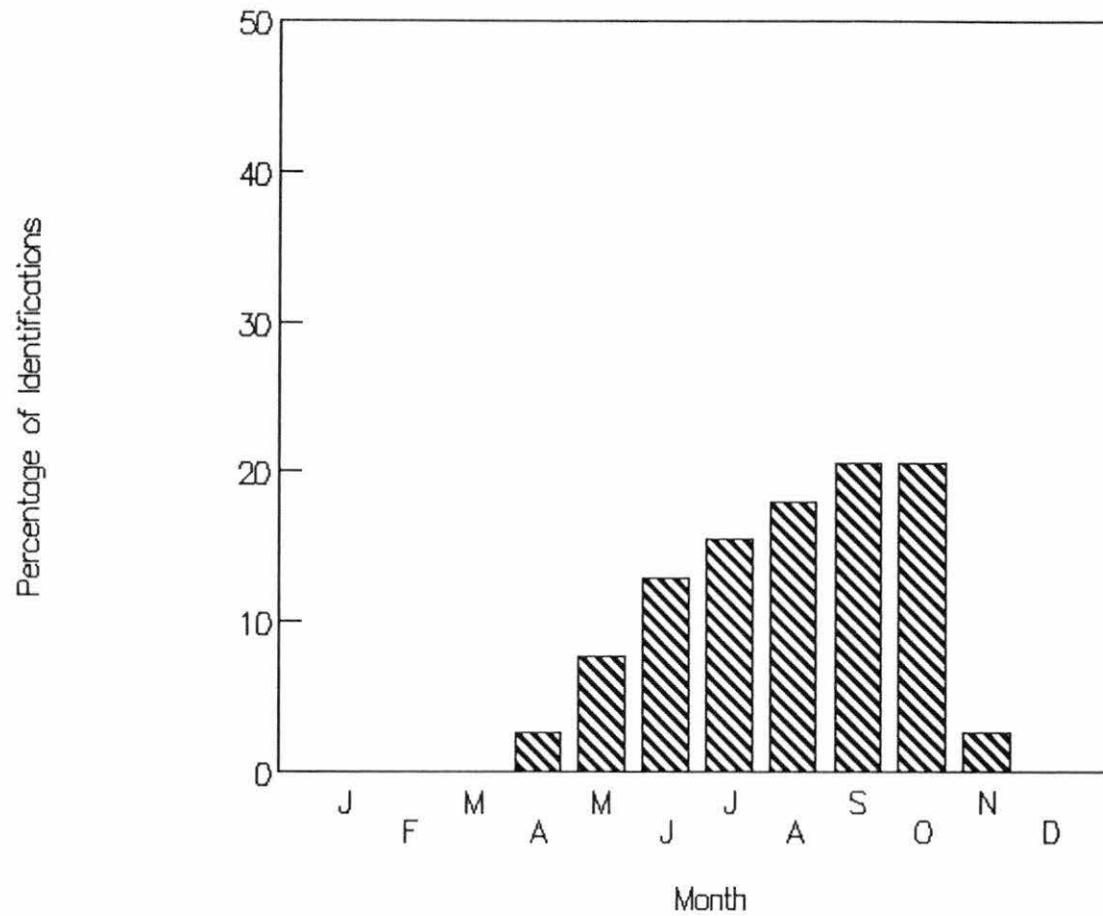


Figure 14. Fredricks Site (Feature 28), Seasonality Histogram

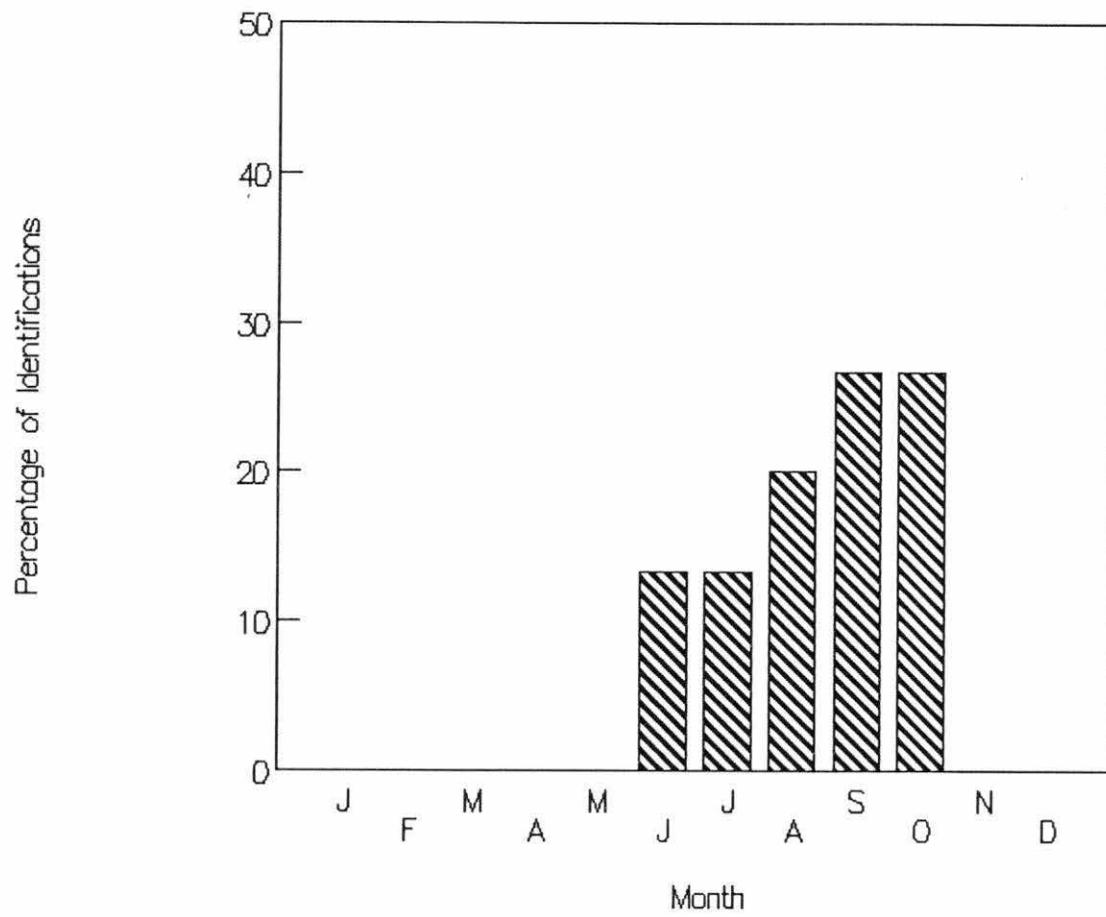


Figure 15. George Rogers Site (Feature 1), Seasonality Histogram

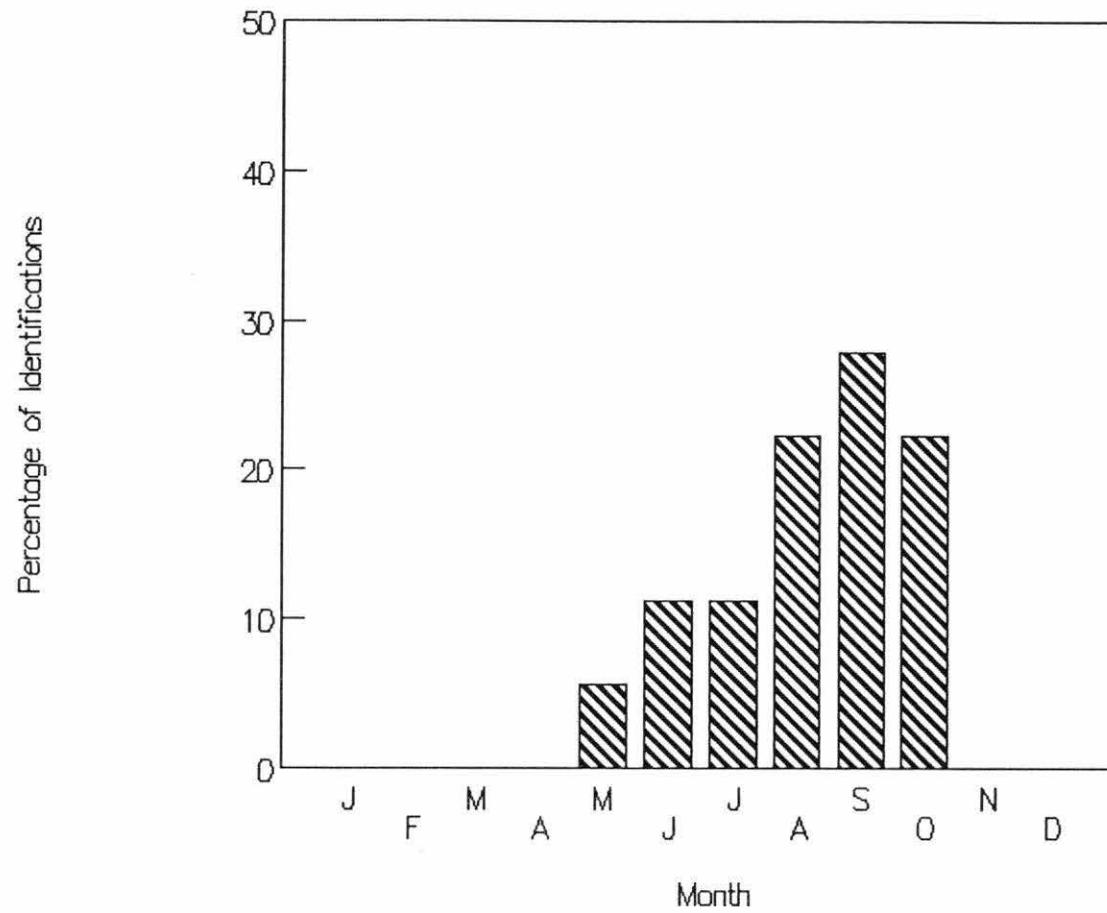


Figure 16. Edgar Rogers Site (Feature 1), Seasonality Histogram

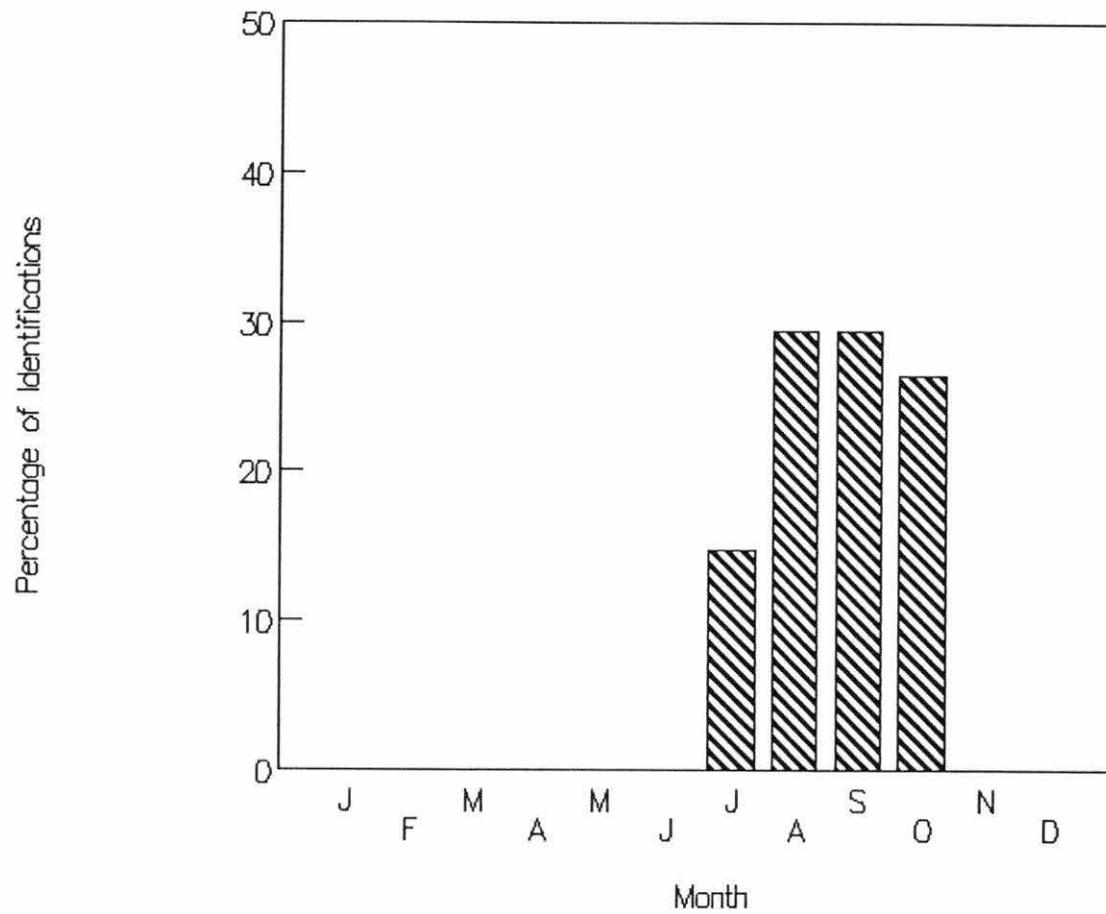


Figure 17. Summer/Fall Taxa, Seasonality Histogram

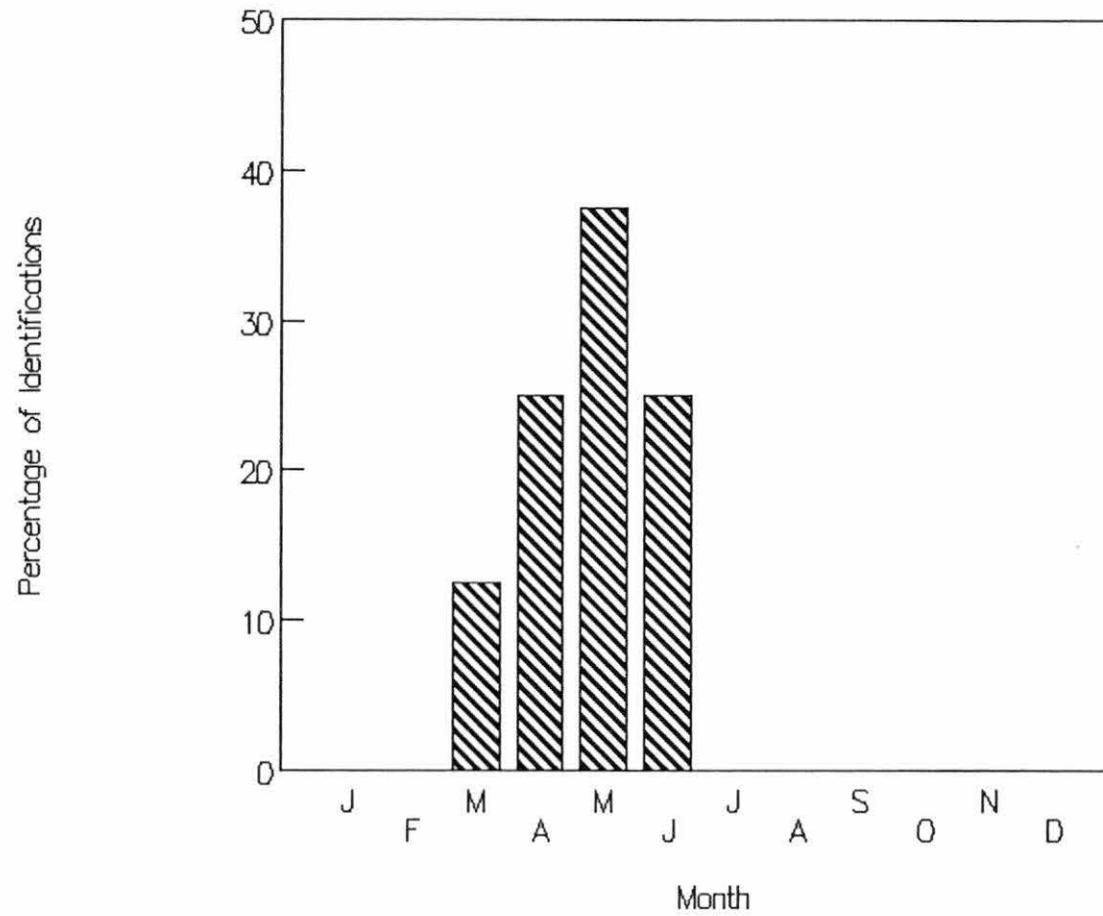


Figure 18. Spring/Summer Taxa, Seasonality Histogram

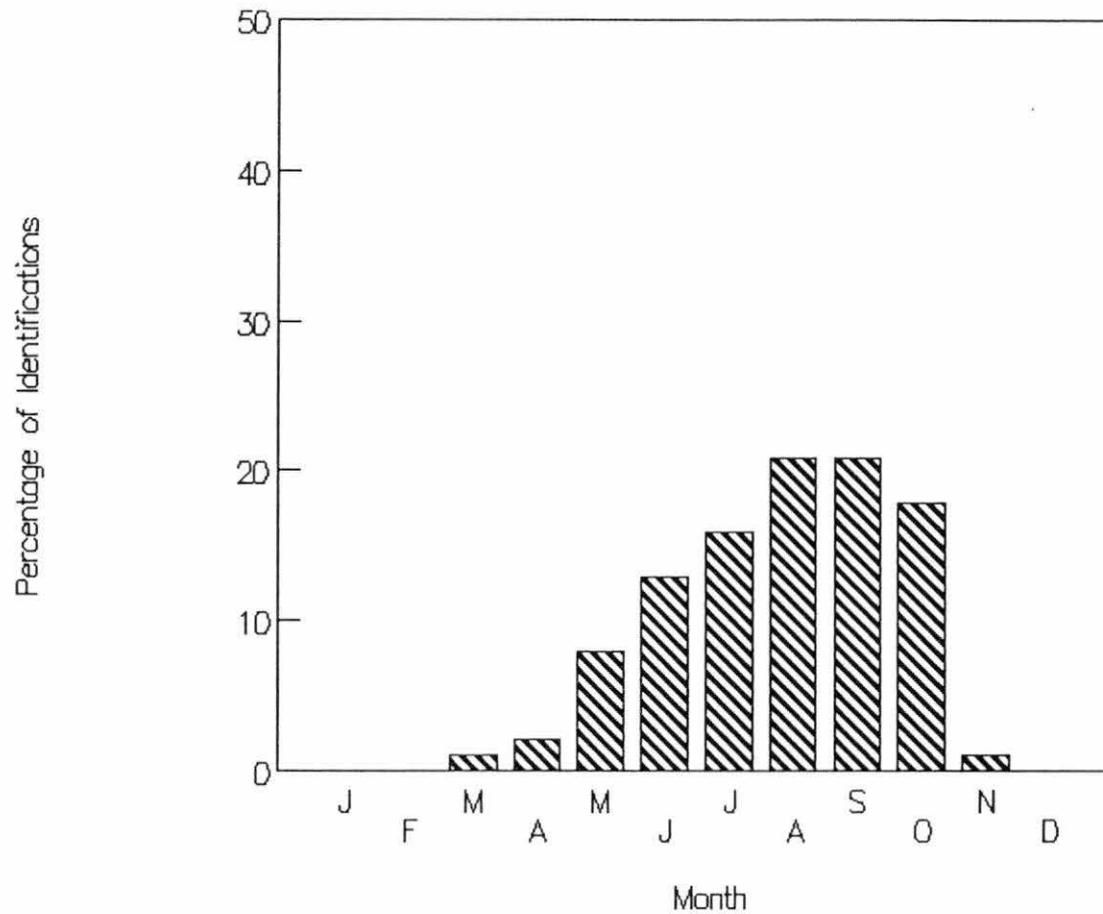


Figure 19. All Taxa, Seasonality Histogram

One notable exception to this expected emphasis on summer- and fall-ripening plant taxa was provided by the Historic period Mitchum site, especially Feature 6 (Figures 11 and 13). In Feature 6, emphasis is heavily upon spring- and summer-ripening species, including maygrass and little barley, two "cool-season" grasses recognized as crop plants in some parts of the East (Yarnell 1987). Large quantities of maygrass caryopses were found in this feature (see Table 49 for seed counts). In fact, maygrass grains from this feature exceed the numbers of maize kernels found in any other single feature from any of the project sites. This fact is a good indication of harvesting and probably husbandry as well.

At the Mitchum site there was intense plant harvesting activity in spring. Such activities also occurred in summer and fall, as Figure 11 indicates. This seems to be an unusual pattern compared to ethnohistoric and archaeological evidence of scheduling. It also diverges considerably from seasonality histograms based both upon all taxa and upon summer and fall taxa (Figures 17 and 19). One possible explanation is that human manipulation of the plant's natural life cycle (Cowan 1985) brought its ripening time into line with that of other crops, so that reference to natural phenological data is misleading. However, it is more likely that such a resource would be more valuable during the period of springtime scarcity of plant foods.

Maygrass was important as a crop in both central and eastern Kentucky prehistorically (Cowan 1978; Gardner 1987; Gremillion and Ison 1989; Yarnell 1974), and little barley was particularly important in Illinois (Asch and Asch 1985). Since implementation of modern flotation procedures, maygrass and little barley have been found in North Carolina at sites ranging geographically from the mountains (Gremillion 1989b) to the coast (Paul Gardner, personal communication 1989), as well as in the Piedmont. Sometimes the two species are found in association. These findings support the potential of little barley and maygrass as seasonally important crops.

Although apparently not an important resource at most of these sites given the small quantities of grains, it is likely that "cool-season" grasses were utilized when other plant foods were scarce in the environment. Springtime plant food scarcity was common in aboriginal New England, although it may not have been a yearly occurrence. There, native populations relied chiefly on aquatic resources and stored plant foods during this time of year (Bennett 1955:378). A similar pattern of plant food scarcity and development of specific behavioral responses to it probably existed in the Southeast as well.

At Mitchum harvesting of maygrass and little barley in April, May and June, (when most crops were just being planted) may illustrate such a response. It is assumed that maygrass and little barley grains ripened there during the

same period when they would have been available in the wild. If maize and/or mast harvests had been poor the previous year, stored surplus would have been depleted by this time or nearly so. So, although there is no evidence from the northeastern Piedmont that these grasses were as economically important in either the Late Prehistoric or Historic periods as they were in the Early Woodland in Kentucky, they may well have been seasonally important. Perhaps the chechinquarnins of Strachey was a spring-ripening grain crop that filled a comparable gap in the seasonal availability of plant foods.

Archaeologically, if spring and early summer were times of relative plant food scarcity and if stored resources were depleted before the next harvest, we would expect to find evidence that staples such as hickory, acorn, and maize were consumed at a greater rate in the late summer and fall, when they were harvested. We already know, of course, that relatively few plant foods actually ripen early in the year; but paleoethnobotanical data can assess the extent to which the stored resources of the time of maximum plant food availability were depleted by spring.

Assuming that discard of associated refuse is roughly proportional to the extent of use of particular plant foods, relative quantities of staple foods such as nuts and maize can be compared with seasonal profiles to determine whether or not consumption of these foods varies with season. One way of examining whether a relationship exists between

season and use of nuts and maize is to calculate correlation coefficients. Spearman's rank-order correlation coefficient was used initially in this case because the expectation is merely that features with lowest relative quantities of nutshell and maize will also have earliest seasonal profiles, not that the two characteristics will track each other precisely. Fifteen features provided data for this comparison; all were refilled storage pits, earth ovens, and food processing features. The coefficient was also calculated on the basis of sitewide data. Only sites in the Haw and Eno/Flat drainages provided data for calculation by feature, since only they produced these types of features with seed assemblages varied enough to produce seasonal profiles.

For each feature or site, percentages of maize and nutshell relative to total plant food remains were calculated. The resulting percentages were then compared to lateness in the year as measured by percentage of seed identifications in months before July (see above for a definition of "identification"). In determining rank order, the highest value for maize or nutshell percentage was assigned the rank of 1, as was the highest proportion of pre-July identifications. Thus a strong relationship between relatively low quantities of nutshell or maize (indicating utilization of relatively small quantities of these foods) and relatively high percentage of pre-July identifications (indicating springtime activity) will result

in a high negative correlation coefficient ( $r$ ). A significantly high negative value of this coefficient is expected if, in fact, stored staples were less available early in the year than later.

A moderate negative rank correlation significant at the .05 level resulted between percentage of maize and percentage of pre-July identifications by feature ( $r = .46$ ,  $n = 15$ ), and by site ( $r = .57$ ,  $n = 10$ ) (Figures 20 and 21). These results provide some support for the hypothesis that maize harvested and stored in summer was consumed to a lesser extent in the spring. For nutshell, results were surprising, indicating no significant correlation between its representation and pre-July identifications. By feature, the correlation coefficient is positive but near 0 ( $r = .02$ ,  $n = 15$ ), indicating no relationship between abundance of nutshell and seasonal profile. Data by site produced a weak positive correlation ( $r = .37$ ,  $n = 10$ ) between the two variables. Neither of these values of  $r$  was significant at the .05 level.

So for nutshell, deposition of waste products does not appear to vary seasonally, whereas for maize there is some support for the hypothesis of decreased consumption of maize in the spring. Assuming that methods of assessing seasonality and food consumption are reasonably accurate,

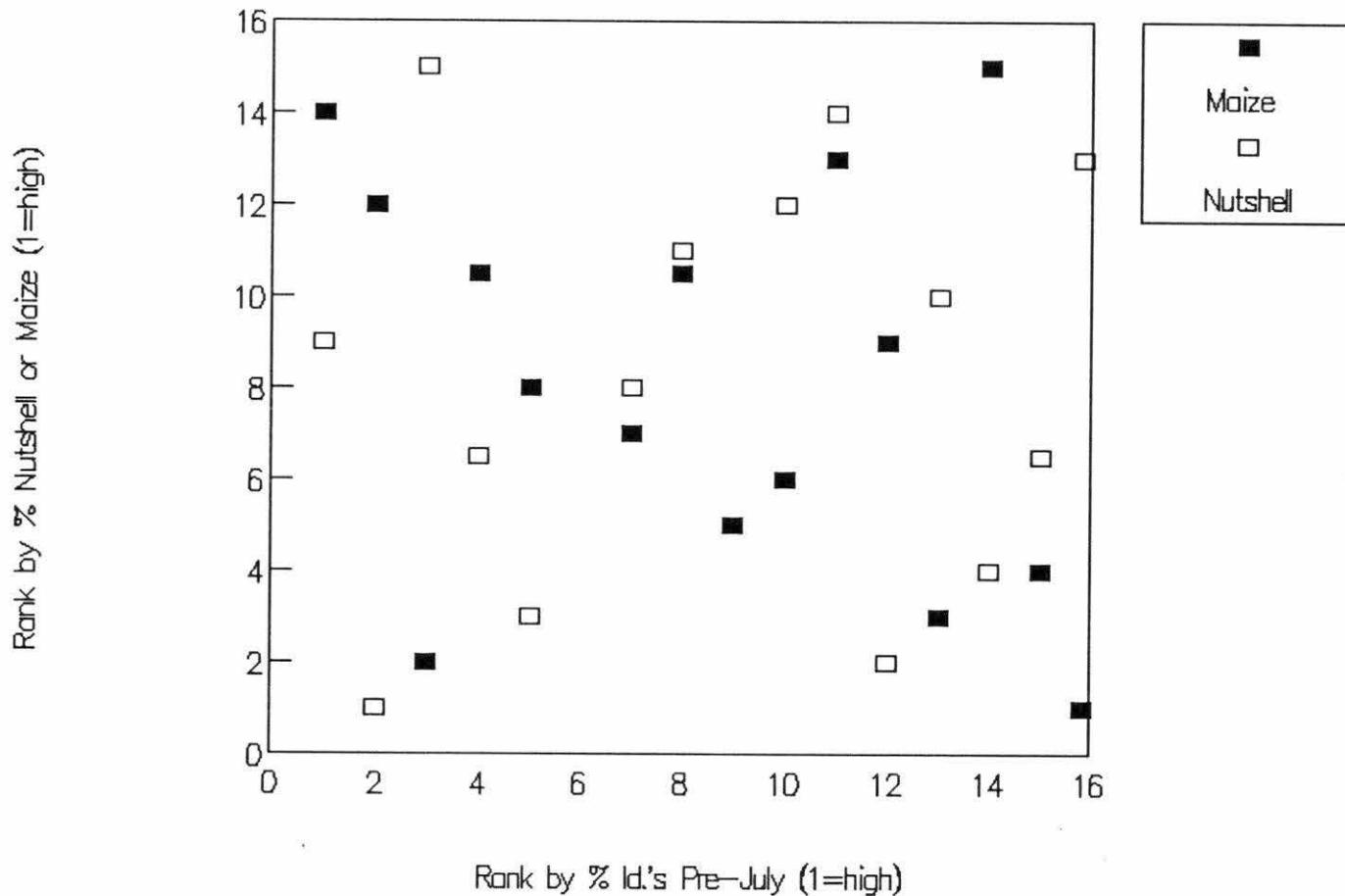


Figure 20. Scatterplot Comparing Feature Seasonality with Percentage Rank of Nutshell and Maize

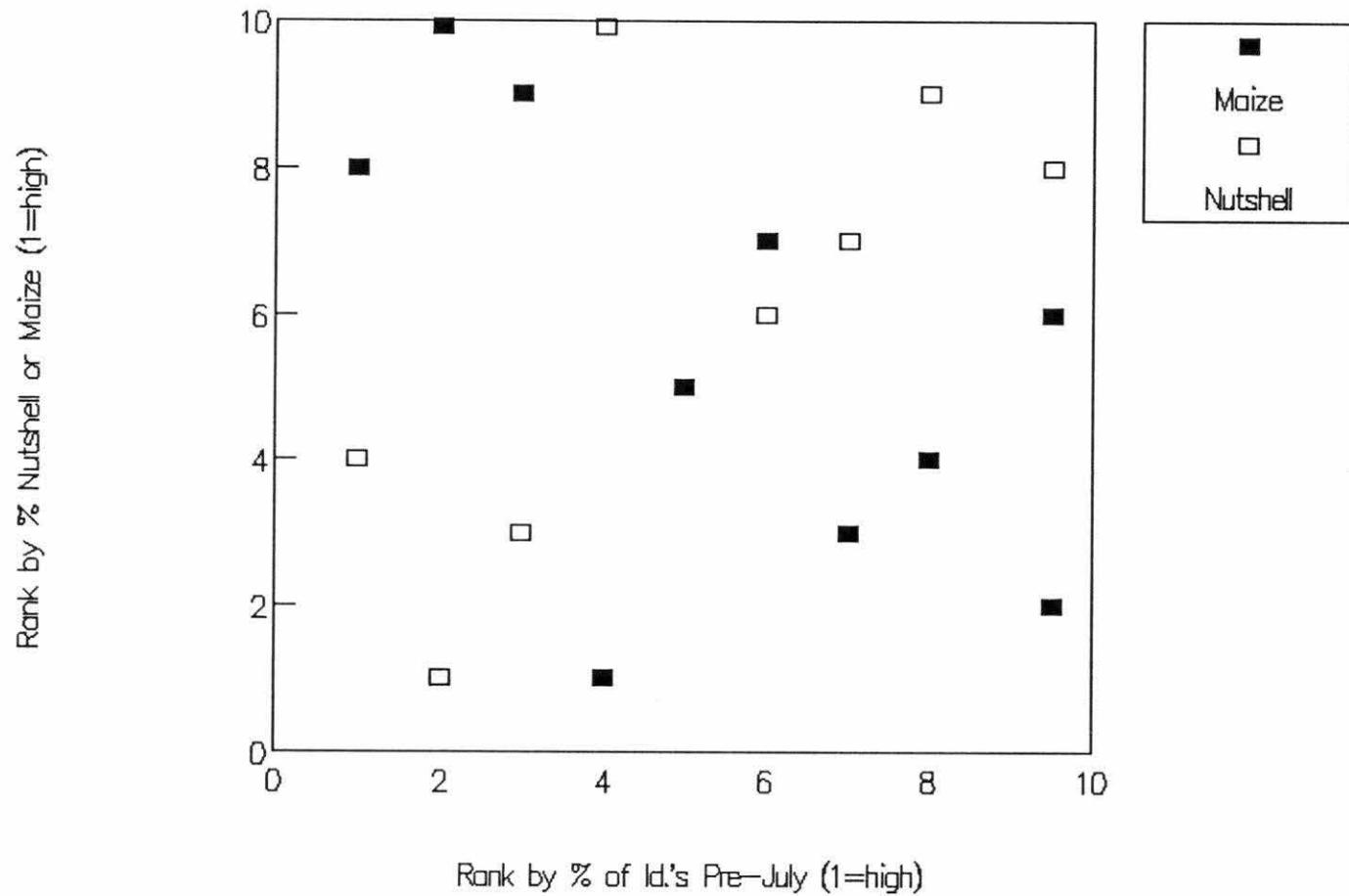


Figure 21. Scatterplot Comparing Site Seasonality with Percentage Rank of Nutshell and Maize

several alternative explanations of this pattern can be offered. One is that stored resources lasted until the following harvest except under unusual circumstances, such as a particularly poor harvest of maize and/or mast. This situation might produce a pattern such as that found at Mitchum, combining low proportions of maize and nutshell with occurrence of grain resources available in early summer. Another hypothesis is that food refuse reflects activity later in the year and should not be expected to reflect spring and early summer consumption patterns, even if some deposition of seeds took place then.

Springtime scarcity of plant foods as determined by phenological patterns probably did not change after contact, but responses to it might have. If reliance on resources stored the previous year helped to counteract springtime plant food scarcity, seasonality histograms should reveal a similar pattern of late summer and fall-fruiting species being dominant. For the Dan drainage, Dan River and Middle and Late Saratown phase profiles exhibit considerable continuity, with late summer and fall-ripening taxa predominating and the number of identifications gradually rising through the year. The Lower Saratown site does show a second peak in May (Figure 10). The pattern for the Eno/Flat and Haw drainages is quite similar, although both the Holt (Haw River phase) and Mitchum (Historic) sites show evidence of a late spring and early summer peak as well as one for late summer and fall. There may have been more

activity in the villages during the spring and early summer during these times periods, but the pattern occurs both early and late in the temporal sequence. One-directional change in intensity of site occupation in spring or in use of cool-season grasses can therefore be ruled out.

### Discussion

Site abandonment during winter is difficult to assess paleoethnobotanically, since plant foods are largely unavailable then, except for stored resources. However, relative abundance of features interpreted as storage pits indicates that below-ground storage facilities were fairly common in the Piedmont. If the purpose of pits was concealment in addition to storage, it follows that settlements were probably temporarily abandoned. Movement into hunting camps is the best interpretation of such temporary absence and is documented for nearby regions ethnohistorically.

Scheduling of subsistence activities to take advantage of yearly variation in availability of plant resources is suggested ethnohistorically and confirmed by paleoethnobotanical and archaeological evidence from the northeastern Piedmont. Late summer and early fall were times of maximum availability of mast resources such as acorn and hickory nuts as well as staple crops such as maize. Harvesting, processing, and storing these resources were the dominant activities during this season.

In spring, plant foods were relatively scarce in the environment. Depending upon the previous year's harvest, the length of absence, and how much food was transported to winter camps, stored plant foods would have dwindled before harvest time. Archaeological data do not however seem to indicate that these foods gradually diminished in importance as stores were expended. Maize supplies may have been somewhat depleted in spring and summer, but use of alternative resources (such as fish) would have kept some of the stored maize available longer. Stored hickory nuts and acorns probably lasted longer in storage pits and cribs than maize did, if archaeological abundance indicates availability. Some populations made use of spring and early summer-ripening grain crops, perhaps as secondary resources reserved for times of scarcity.

Archaeological evidence does not, for the most part, disconfirm the hypothesis of continuity in responses to seasonality. Evidence for maintenance of the winter hunt/site abandonment pattern is inconclusive. For the Dan drainage, stability is more apparent than change. For the Haw and Eno/Flat sites, evidence of seasonal mobility in the Historic period is preceded by a decided lack of such evidence in the Protohistoric. Evidence for the Haw River phase is ambiguous. The sites with best evidence of spring and early summer activity (Mitchum and Holt) are also ones with strong evidence of periodic site abandonment in the form of abundant storage facilities. Maize and other

cultigens, and mast crops, continued to be harvested in late summer and fall. Except for the Mitchum site, plant foods were little exploited in the spring and early summer (except for greens and tubers, utilization of which cannot be assessed archaeologically).

#### NON-PREDICTABLE ENVIRONMENTAL VARIABILITY

Human groups have a variety of ways of coping with times of food scarcity, including diversification of subsistence activities, storage of food, storage and transmission of information on secondary resources (so-called "famine foods"), transformation of food surplus into tradable commodities, and maintenance of social relationships (Colson 1979:21). Of these, a diverse subsistence base and information on secondary resources are often important for coping with non-predictable variation in food availability, and can be examined using archaeological evidence.

Piedmont groups utilized a fairly heterogeneous set of plant resources. Although maize was certainly the chief staple crop, mast products remained important in the Historic period, as paleoethnobotanical evidence indicates. There is no evidence that the number of resources utilized decreased after contact; in fact, at least two resources, peach and watermelon, were added, at least in the Haw and Eno/Flat drainages (see Appendix). Diversity of plant

remains assemblages will be discussed in some detail in Chapter VI, but an appropriate summary statement is that utilization of a diverse set of resources by Piedmont groups continued after contact. Avoidance of too exclusive a reliance on a limited set of resources would have acted to buffer the devastating effects of drought or depopulation upon crop production. This advantage of a mixed economy has also been noted by White (1983:29) for the contact period Choctaw.

A second strategy for coping with irregular variability in resource availability noted for the Choctaw was maintenance of a "secondary food cycle", a set of behaviors and resources that involved dispersal into the borderlands, exploitation of seldom-used wild plant foods, and extension of the deer hunting season (White 1983:30). Based purely upon archaeological evidence, it is impossible to distinguish between preferred and secondary plant foods. However, judging by the usual scarcity or absence of little barley and maygrass on Piedmont sites, their abundance at Mitchum indicates that they may have been used there as a response to an unusual situation, such as food shortage.

The use of these species seems to have been part of a longstanding tradition in the Haw River drainage, where they are present in small numbers at Holt and Edgar Rogers (maygrass only) as well as at Mitchum. Perhaps they remained in the subsistence system of local groups (long after being superseded by maize) as secondary resources used to cope

with seasonal or irregular food shortages. In optimal foraging terms, diet breadth is expected to expand as highly ranked resources become relatively less abundant (Winterhalder 1980). According to this prediction, the less productive cool-season small grains would enter the diet only in times of maize scarcity. Evidence from earlier time periods will of course be needed to assess their economic importance prior to the Late Prehistoric. Neither of these species has been found at any of the Eno River sites so far, and only one little barley grain came from a Dan River site (Powerplant, Early Saratown component).

White (1983:97) notes that the French began to provision the Choctaw late in the eighteenth century to prevent them from taking up their traditional secondary food cycle in times of crop failure, which would have made them unavailable for military service. There is no direct archaeological evidence of provisioning in the form of European grain crops at Historic period sites. However, such behavior might be difficult or impossible to detect archaeologically, particularly if native foods, such as maize, were used. At least at the Mitchum site, a secondary food cycle seems to have been in place. Traditional strategies of coping with food shortage were at least not entirely displaced after contact.

An additional strategy for coping with food shortage is not easily detected archaeologically but deserves mention here because it was so frequently commented upon by European

observers. This was the behavioral adjustment of simply tolerating hunger when necessary and consuming copiously when food was abundant. John Smith found it strange "to see how their bodies alter with their diet; even as the deer and wild beasts, they seem fat and lean, strong and weak" (Hawke 1970:8). Beverly notes in addition to tolerance of hunger (made less painful by "girding up their Bellies, just as the wild Arabs are said to do"), a tendency to consume large quantities of food when it was abundant (Major 1849:181). But the fullest description of this feast-or-famine behavior, and one that bears upon Indians of the northeastern Piedmont, is found in the writings of William Byrd II:

They can Subsist Several days upon a little Rockahominy, . . . With this Slender Subsistence they are able to travel very long Journeys; but then, to make themselves Amends, when they do meet with better Chear, they eat without ceasing. [Boyd 1967:203-204].

Given his general reliability and basis of his writing in first hand observation (Randolph 1973:65), this report can stand in lieu of archaeological data as evidence of alternation of feasting and fasting as a strategy for coping with periodic food shortage in the Piedmont.

#### SUMMARY

Seasonality affects the availability of plant resources by staggering their availability during the yearly cycle. One common response to this variability is scheduling of

subsistence activities. Agricultural activities such as planting and harvesting follow the ripening schedules of crop plants. Archaeological and phenological data confirm that most plant harvesting activities of Piedmont populations took place in late summer and early fall.

The winter movements to hunting grounds documented historically for many Southeastern groups probably reflect a more effective allocation of time and energy than year-round residency at a single location. Such movement potentially increased the rate of encounter with deer, the chief prey species, thereby lowering search and handling costs associated with hunting. Archaeological evidence of seasonal village abandonment is inconclusive. There is some evidence of increased use of subterranean storage in postcontact times, which might indicate periodic absence of all or part of the population. However, there does not appear to be any directional trend in scheduling of population movements.

Another common response to seasonal variability in availability of plant resources is storage. Storing plant foods extends their availability. Use of lower-ranked resources also offsets scarcity of higher-ranked resources during certain seasons (such as spring and early summer in the Piedmont). In fact, the diet breadth model predicts such an expansion as search time increases for highly ranked resources. Archaeological data from the Piedmont indicate that although most plant harvesting took place in late

summer and early fall, collection of spring-ripening grains sometimes took place. These resources were recovered from deposits that indicate limited utilization of maize. Comparison of several features from Siouan Project sites indicates that use of spring and early summer plant taxa occurred along with consumption of (presumably stored) hickory nuts. Maize may have been less heavily utilized during these times than it was at harvest. There is no evidence that these patterns changed after contact.

Non-predictable variability in availability of plant resources elicits responses that emphasize flexibility. Use of a large number of different resources is evident archaeologically. Maintaining knowledge of many plant resources offsets risk of famine by allowing for a shift to lower-ranked resources when unpredictable events limit availability of higher-ranked ones. Actual diet during specific seasons can then expand and contract. Individuals cope with food shortages by tolerating hunger, a pattern documented ethnohistorically for some Southeastern groups, but not archaeologically for the Piedmont.

The hypothesis that scheduling of agricultural and other plant exploitation activities had largely similar features both before and after contact is largely substantiated by archaeological evidence. If scheduling of the winter hunt or of plant exploitation activities changed as European-aboriginal interaction intensified, there is little archaeological evidence of it. Storage of plant

foods continued to be used to counteract potential shortages during seasons of environmental plant food scarcity.

Relatively low-ranked resources such as spring-ripening small grains came into play during these periods in addition to stored foods. A relatively broad plant resource base allowed for expansion of diet in response to non-cyclical environmental variability as well. These various responses to temporal variability, as inferred archaeologically, were in place prior to European contact and remained important thereafter.

CHAPTER V  
RESPONSES TO SPATIAL HETEROGENEITY

The aspect of spatial heterogeneity that will be of primary concern for this study is environmental patchiness, a quality reflecting the fact that resources (and other environmental factors) are discontinuously distributed (Winterhalder 1980:151). Spatial variation in such environmental factors as soil, slope, drainage, elevation, and rainfall regime is also relevant to subsistence patterns although it does not always result in patches that are discrete from the perspective of a human population. Vegetational patchiness at a single point in time is due in large part to temporal processes such as secondary succession. Natural or anthropogenic disturbances create an environmental mosaic composed of patches at various successional stages. This mix of habitats can be exploited by human groups in various ways and can also be manipulated through controlled forms of anthropogenic disturbance. The main hypothesis to be tested here is that both Late Prehistoric and Historic period Piedmont groups made use of a variety of plant communities, most of which were disturbed patches in an otherwise forested matrix. Emphasis was upon anthropogenically disturbed communities such as gardens;

fields and old fields; and grassland or parkland maintained at an immature successional stage by burning.

The patchiness of aboriginal landscapes has been emphasized and discussed by Cronon (1983) for colonial New England and Hammett (1986) for the Southeast, and can be contrasted with the once-popular conception of the precontact "virgin wilderness". For the most part, the relative proportion of disturbed to relatively undisturbed plant communities on the Piedmont landscape is hypothesized to have remained largely as it was before contact, at least until White settlement brought plow agriculture and timbering to the area. Thus the same kinds of patches were utilized both before and after contact, and managed and other anthropogenic communities were utilized most heavily.

#### THE VEGETATIONAL MOSAIC

In order to assess land use, some reconstruction of the past vegetational mosaic must be attempted. Some studies (e.g., Chapman et al. 1982) have used both macrobotanical and pollen data to reconstruct changing patterns of environmental disturbance and land management. Where adequate data are available, land survey records have been used to assess past forest composition (Delcourt 1975). Pollen records have also been used to document changes in vegetation brought about by human activity (Delcourt 1987).

The sites used in this study were found early in the project not to contain adequate quantities of pollen for vegetation analysis, as is often the case for open sites (Dimbleby 1978). Wood charcoal studies are particularly susceptible to biases created by human selection of firewood as well as sampling difficulties. Although wood charcoal data can be used profitably to address questions about environmental disturbance, particularly if based upon material sampled with particular research questions in mind, time constraints dictated a focus upon plant food remains in the present project. Unlike the later Government Land Office surveys, many early North Carolina surveys (such as William Byrd's of 1728) were apparently not planned using a grid-based township and range system (Boyd 1967). This characteristic eliminates the random quality of tree sampling that makes the GLO survey data valuable for environmental reconstruction (Delcourt 1975).

As an alternative to palynology, wood charcoal analysis, and land survey records, modern vegetational studies from the northern Piedmont will provide the primary database for reconstructing past plant communities. Contemporary vegetation and historical information will be used to create a schematic reconstruction of the vegetational mosaic likely to have been found around Siouan Project sites. How vegetation was modified and exploited for plant resources can be further assessed archaeologically. Even if the unavailable data sets had

been utilized, it would be impossible to reconstruct precisely the vegetational mosaic around each site, due to shifts in its composition with succession and new disturbances. The proposed schematic reconstruction is adequate for assessing the kinds of plant communities used and to what extent each provided plant resources for human groups.

Modern vegetational studies provide the primary database for this reconstruction. Vegetational surveys of several Piedmont drainages have resulted from impoundment projects (Moore 1973; Moore and Wood 1976). These reports tend to have rather thorough descriptions of plant community types over a fairly large area, and also include lists of plants collected. Several county-wide floristic surveys have been conducted as well, mostly as Master's theses (e.g., Sawyer 1968; McCurdy 1975). These sources vary as to their coverage of community types and disturbance. In addition, interest in processes of secondary succession has stimulated a number of studies of early successional communities in the Piedmont (Keever 1950; Crafton and Wells 1934; Schafale and Christensen 1976) and of succession in Piedmont forests (Christensen 1977).

Of these, Moore and Wood (1976) was selected to provide a baseline for vegetational reconstruction because of its proximity to the study area, its treatment of community types according to features of the landscape (such as relative elevation), and its attention to disturbed habitats

and successional processes. Using this source, terrestrial plant community types available to Piedmont Indians would have included both bottomland and upland forests, swamp forest, fields and pastures, and scrub communities. Table 8 lists Moore and Wood's habitat types along with the number of taxa from each that have been identified archaeologically at northeastern Piedmont sites.

This basic reconstruction must be modified, however, to account for processes that would have not been operating when the sites were occupied, and for others that are less important today than they were aboriginally. For example, large-scale timbering produces distinctive types of scrub community, such as mixed scrub (Moore and Wood 1976:36). Clearcutting was limited aboriginally, given technological constraints. Agricultural clearing may have been extensive in some cases, but was probably at least partly accomplished using fire. Selective timbering would have been a more likely procedure for obtaining wood for construction and results in different species composition and community structure than does clearcutting. Succession after selective timbering of hardwood stands results in various types of scrub communities, depending upon the original composition of the forest stand. Scrub communities were probably more restricted in the Piedmont before Euroamerican settlement than they are at present.

William Byrd's observations do indicate, however, that scrub communities were present on the aboriginal Piedmont

Table 8. Vegetation Types of Jordan Lake Before Inundation

Community Type	Location	Characteristic Vegetation	No. Archaeological Taxa
Fields, Pastures, Cleared Areas (< 50% Pine)	Various	Natural vegetation partly or completely removed	9
Scrub	Various	Forested but no canopy layer	19
Pine scrub		85%+ of trees pine; herbs freq. absent	3
Hardwood scrub	Mesic/ bottomland	85%+ of trees hardwoods; rare	2
Mixed scrub	Various	Pine/hardwood mix; often from timbering	8
Bottomland forest	Bottomland	Occurs most lowlands; closed canopy, open understory	9
Alluvial forest	Well-drained	Well-drained sand-silt banks, terraces	3
Swamp forest	Poorly-drained	Depressions behind alluvial terraces	5
Mesic forest	Moist, well-drained slopes	Not extensive; large, well-spaced trees	9
Mesic hardwood forest		85%+ hardwoods	see above
Mixed mesic forest		15%+ pines	see above

Table 8 continued

Community Type	Location	Characteristic Vegetation	No. Archaeological Taxa
Upland forest	Higher, well-drained sites	Large, well-spaced trees, closed canopy, well-developed understory	10
Upland hardwood forest		85%+ hardwoods	see above
Mixed upland forest		15%+ pine	see above
Pine forest	Various	Successional, pines dominant	9
Ponds	Farms	Aquatics	0
Sumps	Depressions w/ blocked drainage	Variable	1

Note: Adapted from Moore and Wood (1976).

landscape. As a surveyor, Byrd took particular note of vegetation, especially thick shrubby vegetation that hindered his crew's progress. The existence of scrub communities in the northeastern Piedmont is indicated by his complaint that "We were forct to scuffle through a Thicket about two Miles in breadth, planted with Locusts and hiccory Sapplings, as close as they cou'd stand together" (Boyd 1967:230). After a stretch of relatively open woods, Byrd and his crew spent the rest of a day's journey "pester'd with Bushes and Grape vines" (Boyd 1967:230). References of this sort, to shrubby thickets and tangles of saplings, abound throughout Byrd's account (Boyd 1967:178, 188, 228, 214, 222, 232, 234).

Another qualification of this borrowed vegetational reconstruction involves the use of fire as a land management and hunting tool by Piedmont Indians. Fire hunting was apparently quite common and served to maintain periodically burned areas at a successional stage that produced abundant deer browse as well as favoring plant species used by humans (Hammett 1986; Hudson 1976). The importance of this kind of disturbance for the vegetational reconstruction is that it resulted in a distinctive type of vegetational patch or association of patches, an open area perhaps with scattered trees but dominated by herbs. It has been speculated that the "savannas" noted by Lawson (Lefler 1967:23, 34, 59, 56) and other travellers in otherwise forested regions were

habitats altered by periodic fires, some of which were anthropogenic (Day 1953).

Fire seems to have been an important factor affecting vegetation in the North Carolina Piedmont, judging by Byrd's report that many wooded areas were burned on a yearly basis by local Indian groups (Boyd 1967:228). Fire drives, such as the one Byrd's Indian companions used to provide game for the survey crew (Boyd 1967:284), are likely to have been responsible for some of the disturbance creating early successional habitats, including scrub vegetation. Plant resources available in fire-maintained parkland or scrub would have included those listed for other open, early successional habitats such as old fields and pastures. In addition, surviving trees would have had well-developed canopies. The yield of mast producers, such as hickory, would have been considerably greater than in a closed-canopy habitat such as alluvial or upland forest (Munson 1986).

The assumption is made here that relatively open patches of vegetation were also produced through agricultural clearing. Gardens and fields of course contained crops as well as some useful weeds. Field abandonment following soil depletion or village relocation produced the old fields that were scattered across the landscape. A number of European travellers in the East mention these old fields and describe their vegetation. Bartram, for example, makes frequent mention of abandoned Indian fields (Van Doren 1928:57, 174, 272, 280, 326). Byrd

remarks on the legendary fertility of Haw old fields between the Eno and Saxapahaw (Haw) Rivers (Boyd 167:298). Bland notes in his travels along the North Carolina/Virginia border region that the "high land of the old fields" lay beyond the trees along the riverbank, an arrangement that indicates cultivation of natural levees and terraces (Bland 1966:7). Reports of these old fields and the absence of fertilization of the soil provides evidence that Southeastern Indians practiced some sort of fallow-field agriculture in stream bottomlands (Hudson 1976:291). The tendency of large Mississippian period sites to be located on rich bottomland soils supports this assumption (Ward 1965). Accordingly, it is assumed that Piedmont Indians would have had access to old fields at various stages of succession.

Many herbaceous taxa found archaeologically on Piedmont sites grow in fields and other cleared areas today (Table 8). On the other hand, dominant species of modern old fields in the Piedmont are usually Eurasian weeds well-adapted to colonizing such open habitats. An example of such a non-native, aggressive species is crabgrass [*Digitaria sanguinaria* (L.) Scopoli], which is often dominant the first year after abandonment (Crafton and Wells 1934:226; Keever 1950:249). Other dominants of later successional stages (e.g., species of *Andropogon*, *Aster*, and *Solidago*) are native to the Piedmont. Although considerable variation in old field community species composition has

been noted for upland sites (Schafale and Christensen 1986), a sequence of stages reflecting dominant life forms and life cycle strategies does occur, beginning with a pioneer herb stage followed by a tall weed stage, and eventually introduction of pine seedlings, shrubs, and development of a canopy (Crafton and Wells 1934; Keever 1950).

In addition to the community types themselves, another important aspect of environmental patchiness is the nature and extent of edge habitats. Much has been made in ecology of the "edge effect", that is the tendency of boundaries between two ecological zones to contain more species than either of the two zones individually. Edges can be created through disturbance or through natural discontinuities in aspects of the environment (R. Smith 1980:586). Since any patch has by definition boundaries with its surroundings (or matrix), patchiness and edge area are closely linked. In fact, it has been noted that small, scattered disturbances have an especially high ratio of edge to internal area (Runkle 1985:23). Although there is no way to actually measure the extent of edge or patch area for the present study, it is important to keep in mind that a patchy landscape will have considerable edge area, resulting in high-diversity zones mixing the plant resources of adjacent vegetational communities.

An important caution accompanying this vegetation reconstruction is that it should be viewed as a temporally dynamic and spatially variable system. Succession is

continually operating to alter the species composition and ecological functioning of these various community types. Human disturbance is necessary to create and maintain several of these community types, so that modifications in human activities such as agricultural clearing, cropping, fallowing, or burning will affect the size and number of patches and related edge area. There is also reason to believe that, although the broad outlines of the vegetation reconstruction hold for the study area in general, there are important differences between the drainages in the extent of the different community types, overall patchiness, and species abundance. It has been noted, for example, that the Dan drainage contains broader floodplains than either the Haw or the Eno/Flat (Davis and Ward 1988). Frequency and/or intensity of human disturbance may consequently have been higher there. These questions will be considered below as part of the discussion of human responses to environmental patchiness.

A general reconstruction of plant community types in the northeastern Piedmont for the Late Prehistoric and Historic periods is presented in Figure 22. To the extent that the more disturbed communities such as scrub, fields and gardens, old fields, and parklands existed as discrete areas within a largely forested landscape, the reconstruction reflects patchiness. Although direct archaeological confirmation of this reconstruction is not possible, Table 8 shows that plant taxa found in each of the

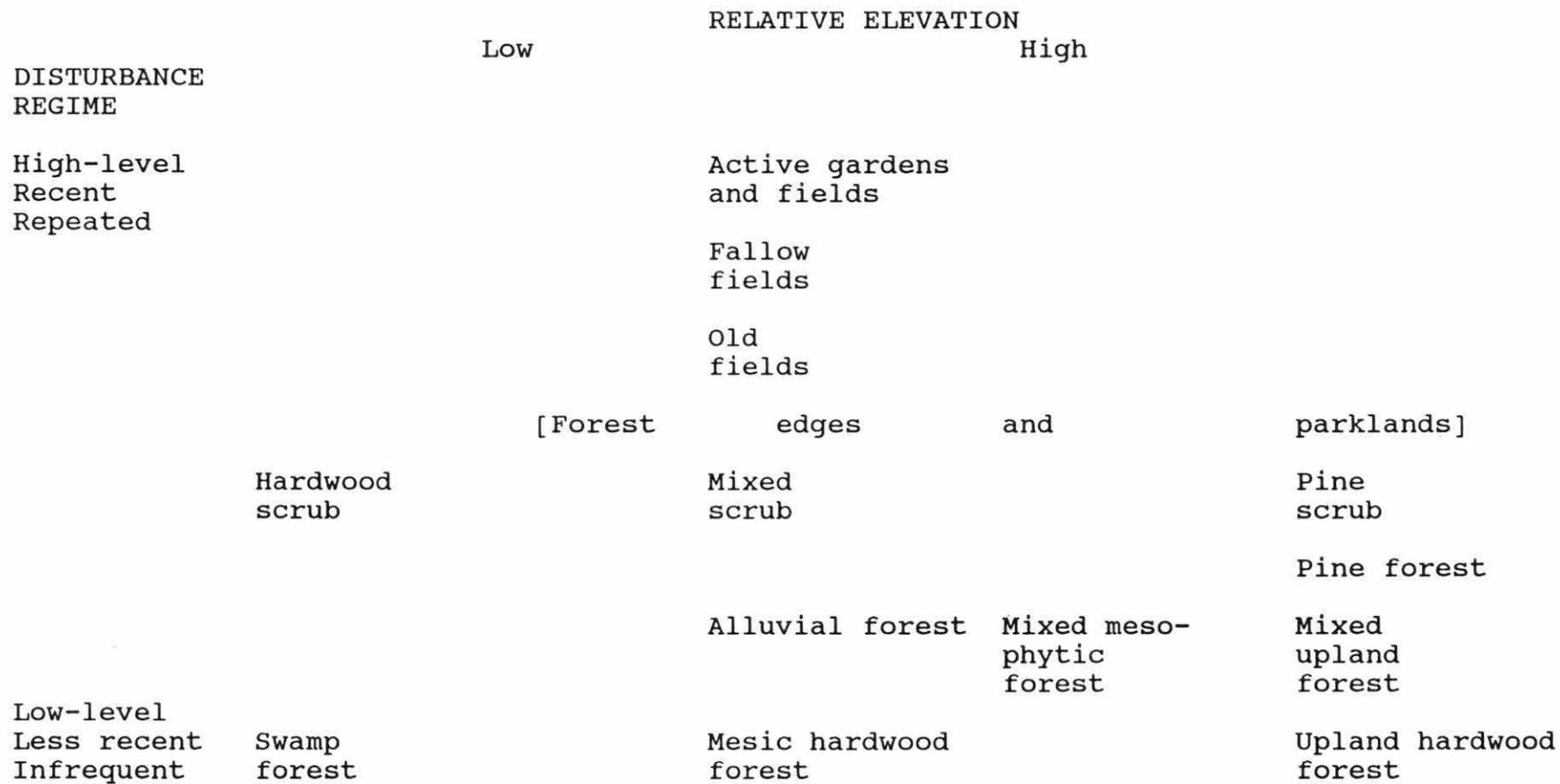


Figure 22. Schematic Reconstruction of Piedmont Vegetation Before Euroamerican Settlement

terrestrial community types have been identified archaeologically. The presence of forested, open/disturbed, and agricultural plant communities in the site vicinity is strongly indicated by paleoethnobotanical evidence.

#### EXPLOITATION AND MANAGEMENT OF PLANT COMMUNITIES

Human groups are expected to choose among communities as sources of plant foods while simultaneously modifying some of them. Selection of resources and spatial locations targeted for exploitation, as well as management in the form of burning, clearing, and planting constitute a set of responses to this kind of spatial heterogeneity. Because disturbances (especially human-caused) are so important in creating environmental patchiness, use and maintenance of successional habitats will be a focal point of the ensuing discussion. The hypothesis that Piedmont subsistence emphasized use of disturbed and managed habitats, and that this pattern persisted after contact, will be explored using ecological, ethnographic and ethnohistoric data and evaluated using paleoethnobotanical data from the Piedmont.

#### Disturbance, Succession, and Subsistence

There are a number of reasons to expect human groups, particularly agricultural ones, to emphasize use of disturbed habitats based upon disturbance and succession theory. One of these is the relatively high diversity of

early-successional plant communities. Although the relationship between community maturity and species diversity has been a subject of debate (Drury and Nisbet 1973), it is apparent that a disturbance that does not eliminate existing species in a climax community will add species to the system (Horn 1974:30). Small disturbances thus create patchiness, increasing the amount of edge and number of species within an area (and with these, often the number of plant resources utilizable by human groups). Early successional habitats also encourage the growth and spread of pioneer species that reproduce abundant offspring at a rapid rate (Horn 1974:28). Many of these species produce edible seeds and/or fruits. Even species whose mature individuals are typically found in closed-canopy situations produce much greater numbers of fruits in open habitats (Yarnell 1982).

### Ethnography

Two studies of contemporary Mexican communities illustrate the potential importance of plants found in anthropogenically disturbed habitats for largely agricultural communities. Wilken (1970) notes the range of habitats exploited for useful plants by a village in southwestern Tlaxcala, including fallow fields and stream borders as well as wooded mountain slopes. Alcorn's (19849) study is an ethnobotanical ethnography of a Yucatecan Indian community. She finds that most of the vegetation zones

utilized by the community are anthropogenic and that various forms of management (ranging from destruction to sparing to encouragement and planting) are utilized even on forested slopes far from dwellings and cultivated fields.

Anthropogenic zones include dooryard gardens; agricultural fields in various stages of succession or preparation for planting or harvest; cornfields converted to mixed gardens that produce a variety of tolerated, encouraged, and planted species; and casually managed "orchards" in forested areas (Alcorn 1979:331 ff).

### Ethnohistory

The ethnohistoric sources that were used to modify the vegetation reconstruction for the Piedmont also indicate the use of anthropogenically modified plant communities in the East. The creation, location and use of agricultural fields and gardens was of considerable interest to European travellers. Both Adair (Williams 1930:435) and Bartram (Van Doren 1928:169) describe an infield/outfield agricultural system, that is, one in which mixed dooryard gardens provided medicinals and some food plants and large fields of maize and other staple crops were planted well away from habitations. Bartram also observed this system at the Alachua town of Cuscowilla (Van Doren 1928:169). A similar pattern of fields spatially separated from habitations is indicated by Byrd's observation that certain abandoned Sara fields lay seven or eight miles away from their former

village (Boyd 1967:208). Somewhat different accounts come from coastal Virginia, where Smith (Hawke 1970:7) describes houses surrounded by their cornfields, although Strachey (Major 1849:72) describes dooryard gardens as well.

Similar, Lawson's (Lefler 1967:56) account places the houses at Keyauwee town in the Piedmont within substantial agricultural fields. Bartram alludes to an arrangement of outlying fields surrounding towns and fruit tree groves for Seminole country and for the Cherokee (Van Doren 1928:251, 284). Even with large fields close by, a house garden with herbs for cooking and medicinals would be an asset. Kitchen or house gardens are a worldwide phenomenon (Ninez 1984).

Reports also vary as to whether weeding was practiced in the aboriginal Southeast. Most European observers remarked on the disorder of gardens and fields, generally attributing the abundance and variety of non-crop vegetation to laziness (e.g., Adair in Williams 1930:438; Hilton in Salley 1911c:42). Strachey, in contrast, reports of coastal Virginia that "Their women and children do continually keepe the ground with weeding" (Major 1849:117). Since the Algonquian communities observed by Strachey appear to have had the equivalent of dooryard gardens (small plots around houses planted with tobacco, cucurbits, maypops [Major 1849:72]), weeding of cornfields would not have interfered with the availability of weedy species that might have been used for food, seasoning, and medicine. The utility of many volunteer plants may have accounted for the disorder found

so displeasing to the European eye. The category of "useful weeds" contributed, along with the crops themselves, to the usefulness of gardens and fields as locations for plant exploitation.

The existence of old fields and their vegetation has been amply documented for the Southeast ethnohistorically. Grasses are frequently mentioned as components of old field vegetation, for example by Byrd (Boyd 1967:208), Lawson (Lefler 1967:38), and Bartram (Van Doren 1928:65). Useful fleshy fruits were present as well; no less than four sources (Williams 1930:49; Lefler 1967:38; Van Doren 1928:288; Wright 1947:141) specify the abundance of strawberries on old fields. Adair comments that those he saw were "larger strawberries than I have seen in any part of the world; insomuch, that in the proper season, one may gather a hat-full, in the space of two or three yards square". Woody vegetation growing on old fields is also described by Bartram, incorporating plants such as waxmyrtle, magnolia, laurels, cherry, and plum (Van Doren 1928:65).

Additional observations by Bartram of abandoned Indian villages or old fields are of particular interest for examining the question of arboriculture. On one mound near a riverbank of a branch of the Savanna River he observed persimmon, honeylocust, chickasaw plum, red mulberry, shellbark hickory, and black walnut. "Though these are natives of the forest", he remarks "yet they thrive better,

and are more fruitful, in cultivated plantations, and the fruit is in great estimation with the present generation of Indians" (Van Doren 1928:57). He also notes "orchards" of peach and plum on abandoned sites, as well as fig in warmer climates (Van Doren 1928:280, 326). Peach and fig were both historic introductions to southeastern Indians, but prehistoric arboriculture is hinted at as early as 1540, when De Soto's troops encountered "garden-like lands" with widely spaced trees, many fruit-bearing, near Talomeco (Varner and Varner 1951:314). Closer to the study area, Byrd observed an old-field covered with grass but also trees that grew "Surprisingly large in this low-Ground", including shellbark hickory (Boyd 1967:208).

Thus there is some evidence that fruit- and nut-bearing trees were managed in the Southeast, perhaps simply by removing competing vegetation, allowing greater canopy development and higher yields. The situation may have been analogous to that of the informal forest orchards of Alcorn's study involving varying amounts of attention, sometimes limited to protection of valuable trees and selective removal of competitors (1984:373-4). Munson (1986) makes an argument for hickory silviculture in the East by showing how low the productivity of hickories is in closed-canopy situations. Apparent population aggregation in the Middle Archaic, he claims, was supported by effective exploitation of hickory nuts, which also increase in the archaeological record during this time. Competition with

squirrels and extremely low productivity of hickories in closed-canopy forests favors the hypothesis of management by selective removal of competitors to increase productivity. The prominence of hickory shell at Siouan Project sites and at many aboriginal sites in the Eastern Woodlands lends some support to this generalization.

Like old fields, Lawson's "savannas" were characterized primarily by grasses and scattered trees. Such parklands may have been maintained by prescribed burning to clear land for agriculture or encourage deer browse (Day 1953). Periodic natural wildfires would have had similar effects. Lawson noted the presence of parklands both in the Piedmont near Keyauwee Town (Lefler 1967:56) and again near Sapona Town, the approach to which crossed some 25 miles of "pleasant Savanna Ground, high, and dry, having very few Trees upon it, and those standing at a great distance" (Lefler 1967:57). The town was surrounded by "a clear Field, about a Mile square" (Lefler 1967:52). A similar type of vegetation is indicated by Lederer, who says that, near Oenock-Town, "The Country here, by the industry of these Indians, is very open, and clear of wood" (Lederer 1966:15). Accounts of such clearings around settlements may indicate gradual depletion of firewood, but more extensive parkland suggests widespread human-mediated disturbance.

There is evidence, then, that anthropogenically disturbed habitats including gardens, fields, old fields, (and perhaps groves of fruit and/or nut trees) were

extensively utilized by Southeastern Indians. Scrub communities, relatively early successional habitats, produced plant foods as well and were generated by human disturbance. Fire-maintained "savannas" were particularly valuable in providing forage for game animals, and vegetation on them seems to have been similar to that of old fields. Closed canopy forests, which typically have a poorly-developed understory of shrubs and herbs, was probably the least productive plant community from the perspective of human populations. Even mast-bearing species, which were important resources both before and after contact, were relatively unproductive within relatively undisturbed upland, bottomland, and mesic forest communities.

### Archaeology

How well is the hypothesis of emphasis on human-disturbed and managed plant communities confirmed by archaeological evidence from the northeastern Piedmont? Plant remains data are not adequate for rigorously testing the hypothesized vegetation reconstruction proposed in Figure 22. However, it is possible to determine habitat preferences for taxa represented archaeologically and to assess use of different vegetational communities in this way. Habitat information was obtained from Radford et al. (1968) but was supplemented by more regionally specific sources (Sawyer 1968; Moore 1973; Moore and Wood 1976).

When taxa were identified archaeologically only to genus, two or three species were selected from Radford et al. (1968) that are fairly common in the Piedmont. Latin binomials and authorities for these species appear in Table 6. Habitat descriptions in Table 9 are grouped into four categories. These categories are: crops from gardens and fields; non-crops from fields, disturbed habitats, and forest openings ["weeds"]; plants found either in woods edges, woods, and/or open areas ["edge taxa"]; and plants characteristic of wooded areas ["forest taxa"]. This classification is not as fine as that proposed in the vegetational reconstruction, but correspondences can be drawn as follows: weeds come from active gardens, fallow fields, old fields, forest edges, savannaa, and scrub; edge taxa are found sometimes in open habitats but also in forests; forest taxa grow chiefly in upland and mesic forests; and crops grow in gardens and fields.

An important point to remember is the general rule that fruit production is higher in open habitats than in closed-canopy habitats. Given this fact and Munson's (1986) assertions about hickory husbandry, the assignment of hickories, oaks, walnut, chestnut and hazelnut to the forest category may be somewhat inaccurate in this case. It is particularly noteworthy that oak, hickory, and walnut all occur as components of scrub communities, which result from selective timbering (Moore and Wood 1976). However, these taxa were categorized according to the plant communities in

Table 9. Habitat Preferences of Plant Taxa from Piedmont Sites

Taxon	Habitat (s)
Fields and pastures ("Weeds")	
<u>Chenopodium berlandieri</u>	Rich soils, cult. fields, barnyards
<u>Ambrosia artemisiifolia</u>	Fields, pastures, roadsides, waste places
<u>Passiflora incarnata</u>	Fields, roadsides, fencerows, thickets
<u>Solanum americanum</u>	Woodland margins, fields, roadsides, wastelaces
<u>Ipomoea purpurea</u>	Fields, roadsides, thickets, waste places
<u>Euphorbia maculata</u>	Cult. areas, waste ground
<u>Amaranthus hybridus</u>	Cult. fields, waste ground, barnyards
<u>Hordeum pusillum</u>	Roadsides, fields, waste places
<u>Phytolacca americana</u>	Waste ground, pastures; usually disturbed
<u>Rubus flagellaris</u>	Old fields, pastures, clearings, railroads
<u>Rubus argutus</u>	Meadows, woodland borders, fence rows, old fields
<u>Fragaria virginiana</u>	Old fields, woodland borders
<u>Prunus persica</u>	Escaped about dwellings, roadsides, trash heaps
Open and/or wooded areas ("Edge")	
<u>Viburnum acerifolium</u>	Mixed deciduous forests
<u>Viburnum nudum</u>	Bogs, savannahs, low woods
<u>Viburnum prunifolium</u>	Alluvial woods, powerlines
<u>Crataegus uniflora</u>	Thickets, woodlands; pine woods
<u>Crataegus crus-galli</u>	Pastures, stream banks
<u>Galium aparine</u>	Meadows, woodlands, roadsides, waste places
<u>Sambucus canadensis</u>	Swamp forests, alluvial woods & pastures (usually open)
<u>Diospyros virginiana</u>	Dry deciduous forests, pinelands, old fields
<u>Prunus serotina</u> var. <u>serotina</u>	Woodlands, fence rows, pastures
<u>Prunus angustifolia</u>	Woodland borders, pastures, fence rows
<u>Polymnia uvedalia</u>	Pastures, woodlands, meadows; low ground
<u>Rhus copallina</u>	Woodlands, thickets, fence rows, old fields
<u>Rhus glabra</u>	Meadows, thickets, woodland borders, waste ground
<u>Rhus radicans</u>	Woodlands, meadows, roadsides, waste places

Table 9 continued

Taxon	Habitat (s)
<u>Polygonum aviculare</u>	Dry, open habitats
<u>Polygonum punctatum</u>	Usually alluvial woods, swamp forests, marshes
<u>Vitis labrusca</u>	Low woods, rich woods, stream banks
<u>Vitis rotundifolia</u>	Low woods, rich woods; disturbed areas
<u>Gaylussacia frondosa</u>	Open disturbed areas; pine & upland forest
Wooded areas ("Forest")	
<u>Juglans nigra</u>	Rich woods, scattered
<u>Carya cordiformis</u>	Rich or low woods
<u>Carya pallida</u>	Dry rocky or sandy woods
<u>Carya tomentosa</u>	Dry woods
<u>Quercus alba</u>	Woods
<u>Quercus prinus</u>	Rocky ridges, bluffs
<u>Quercus rubra</u> var. <u>rubra</u>	Rich hardwood forests
<u>Cornus florida</u>	Woodlands
<u>Castanea dentata</u>	Rich woods, occasional in piedmont
<u>Corylus americana</u>	Rich woods
<u>Vaccinium stamineum</u>	Rocky or sandy, us. xeric woodlands
<u>Vaccinium arboreum</u>	Sandy or rocky, us. xeric woodlands
<u>Nyssa sylvatica</u>	Upland and low woods
<u>Triosteum perfoliatum</u>	Dediduous or mixed woods or openings
Fields and gardens ("Crops")	
<u>Zea mays</u> ssp. <u>mays</u>	
<u>Phaseolus vulgaris</u>	
<u>Cucurbita pepo</u>	Cultivated fields and gardens
<u>Helianthus annuus</u>	
<u>Iva annua</u>	
<u>Citrullus vulgaris</u>	

Source: Radford et al. (1968).

which they are most numerous today, namely hardwood and mixed forests.

How well exploitation of different plant communities is reflected in plant remains data depends in large part upon whether or not the taxa represented archaeologically were utilized. Taxa specifically adapted to disturbed habitats such as weeds are more indicative of environmental conditions than of plant use, particularly when found in small numbers. Another interpretive difficulty arises from the fact that durable plant parts, such as nutshell, will probably be more frequently and abundantly preserved than small grain seeds or certain types of cultigen remains. However, comparing entire assemblages has the advantage of allowing assessment of habitat use based upon more evidence and avoids the often difficult task of determining which plants were not utilized.

Representation of plant community types was first calculated by finding the percentage of identifications accounted for by each category at each site (an identification is an instance of a taxon being identified in a feature, and is easily culled from the ubiquity tables). The results appear in Figures 23-25. For all time periods, forest species (accounted for primarily by hickory and acorn nutshell) comprise the greatest proportion of identifications. Given the likelihood that the bulk of the food obtained from these species came from individual trees in open or edge situations rather than within closed-canopy

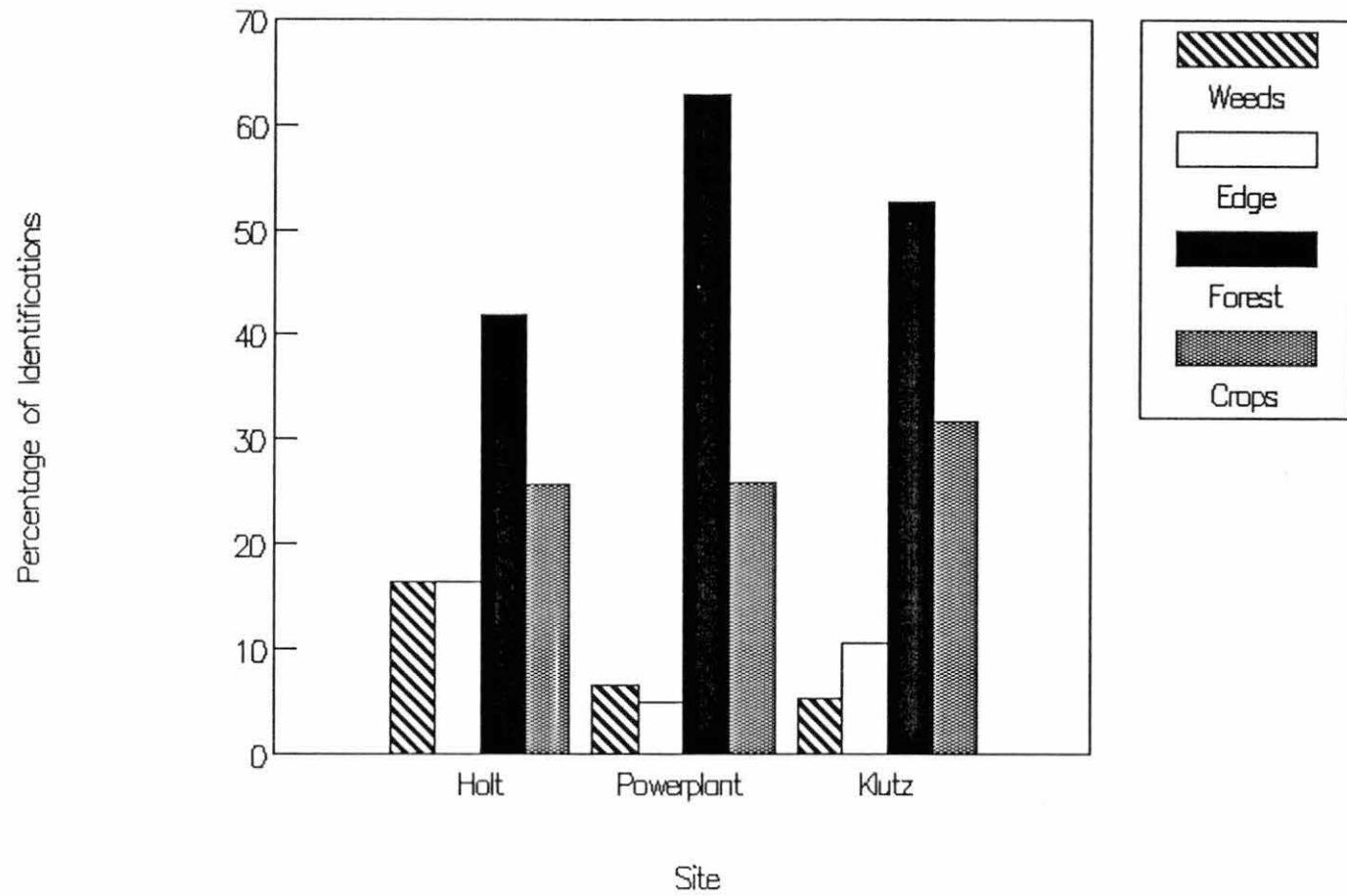


Figure 23. Identifications by Habitat, Prehistoric Sites

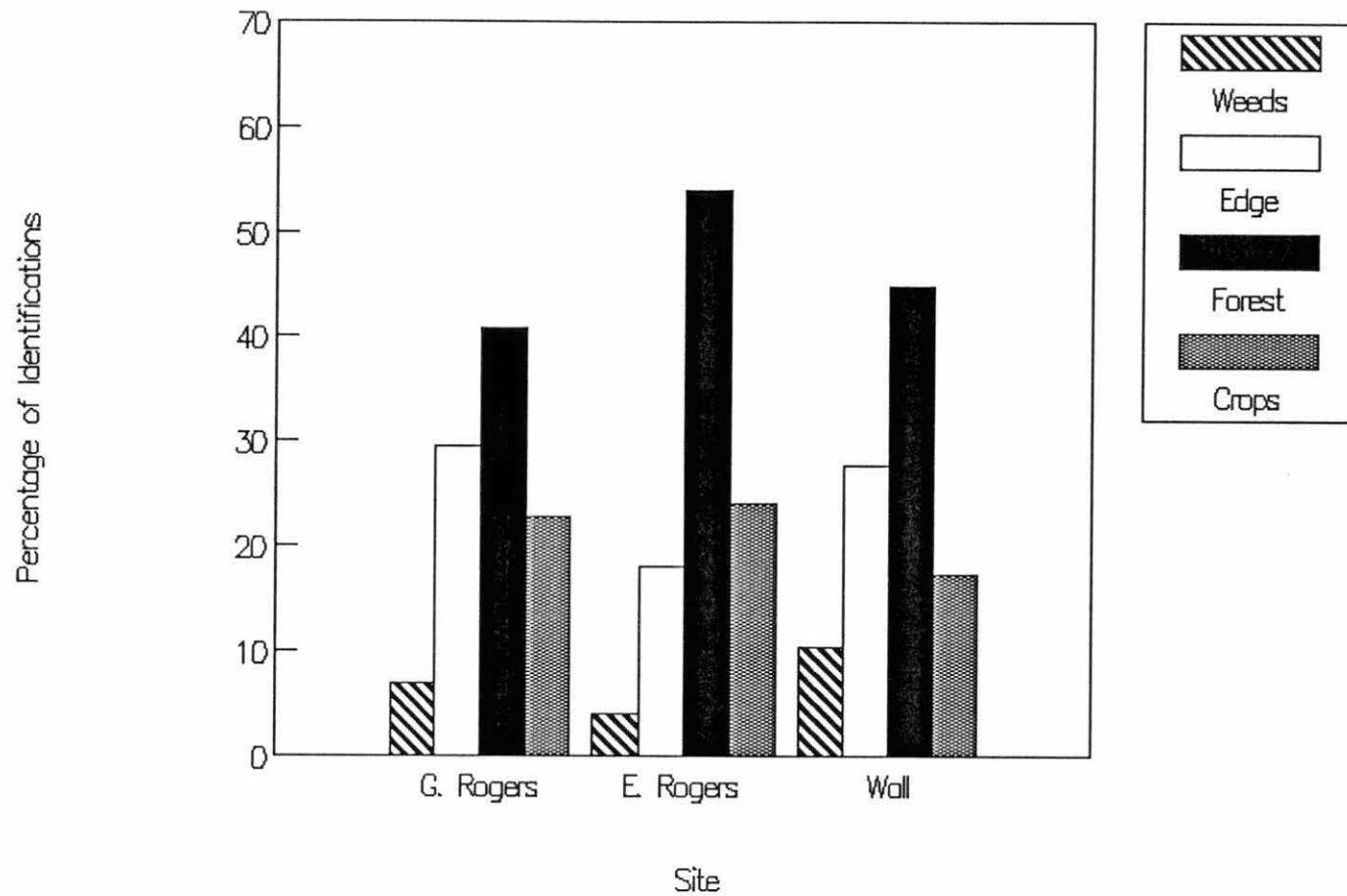


Figure 24. Identifications by Habitat, Protohistoric Sites

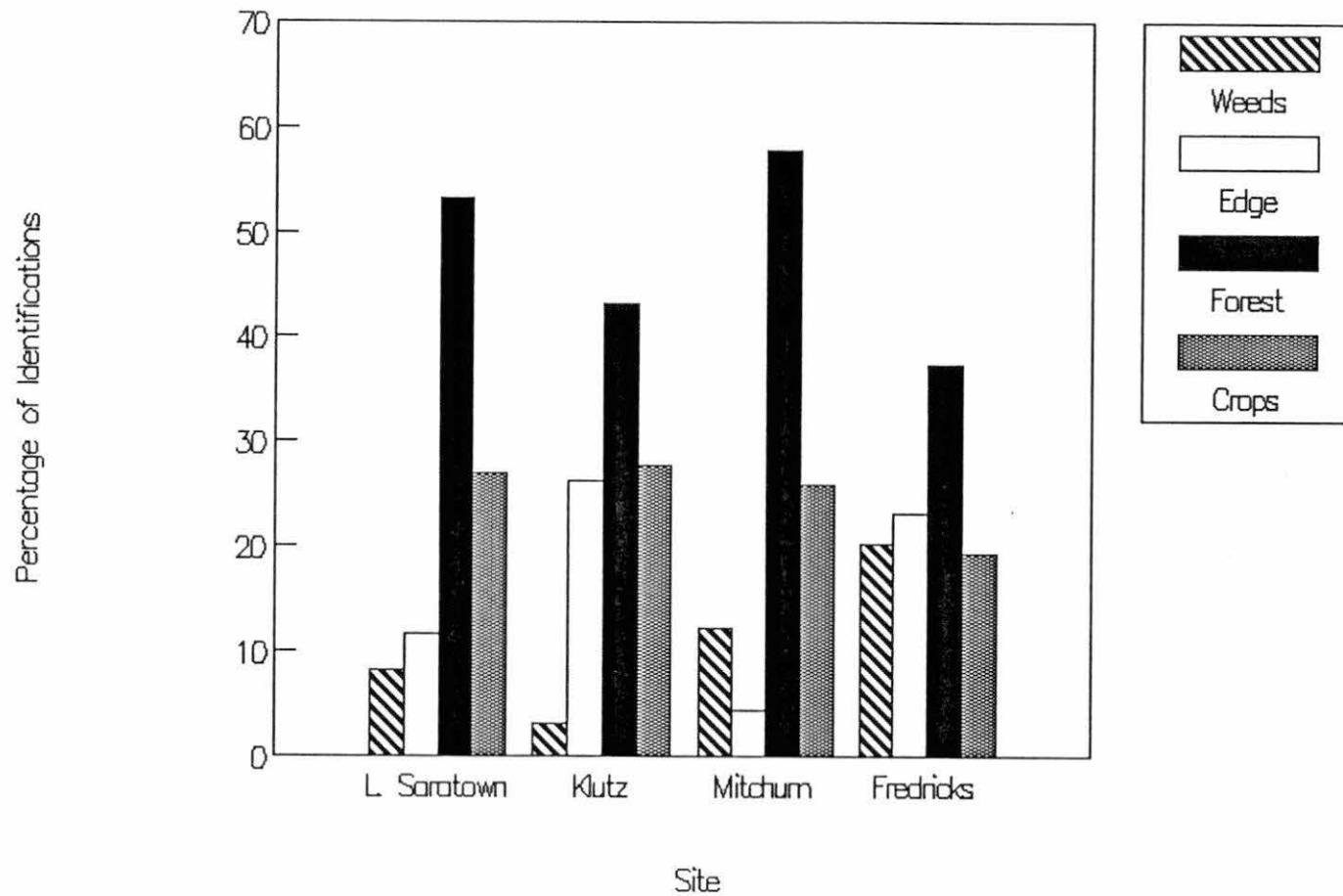


Figure 25. Identifications by Habitat, Historic Sites

forest, this proportion is probably not an accurate reflection of habitat use. It does, however, point out the importance of mast producers as resources.

Croplands are reflected to a similar degree in all three time periods. However, at the prehistoric sites examined, croplands are better represented than are fields and woodlands. This relationship is more variable at protohistoric and historic sites, and is in general difficult to interpret because the ratios used (that is, percentages) assess values relative to the other categories, so that a change in one inevitably results in a change in at least one of the others. One clear interpretation does emerge from this examination, namely that combined identifications of crop, weed, and edge taxa equal or exceed forest taxa identifications at most of the sites. Some weed taxa (e.g., chenopod, amaranth) probably were not utilized (except as greens), but others (maypops, bramble) were. Thus even if mast resources were drawn from forests and not from forest edges or groves, anthropogenically disturbed plant communities are better represented in the paleoethnobotanical record using this method of quantification. This finding provides some support for the hypothesis of aboriginal emphasis on such communities as sources of plant foods.

The problem of comparing plant remains types with widely divergent durability and recoverability can be avoided by eliminating nutshell from consideration and

quantifying only seeds. Instead of calculating seed percentages, counts can be standardized against fill volume to provide densities of seeds originating in different plant communities. This method of quantification results in most cases in complete elimination of the forest category, since only a few seeds of exclusively forest taxa typically occur (the fruits, or nuts, of most taxa are usually fragmentary and so are not counted). Peach pits are not counted for the same reason, but elimination of peach from consideration affects the "weed" category.

Results of this seed density study appear in Figures 26-28. Forest taxa are not represented by any seeds at most sites, and when they are the densities are quite low. The exception to this tendency is found at the Edgar Rogers site, where the unusually high density of forest seeds is largely accounted for by 225 seeds of black gum from a single feature. This observation is not made to dismiss the importance of forest resources at the site; black gum seeds are seldom found in such concentrations, and their presence makes a strong case for utilization of the species. On the other hand, the unusually high density produced should not be taken to indicate that exploitation of forests overshadowed attention to other habitats near the site.

Crop seeds indicate utilization of gardens and fields at a similar, and relatively high, level at all the sites. An exception is Mitchum, where crop seeds are particularly dense. Most of these seeds are of maygrass and little

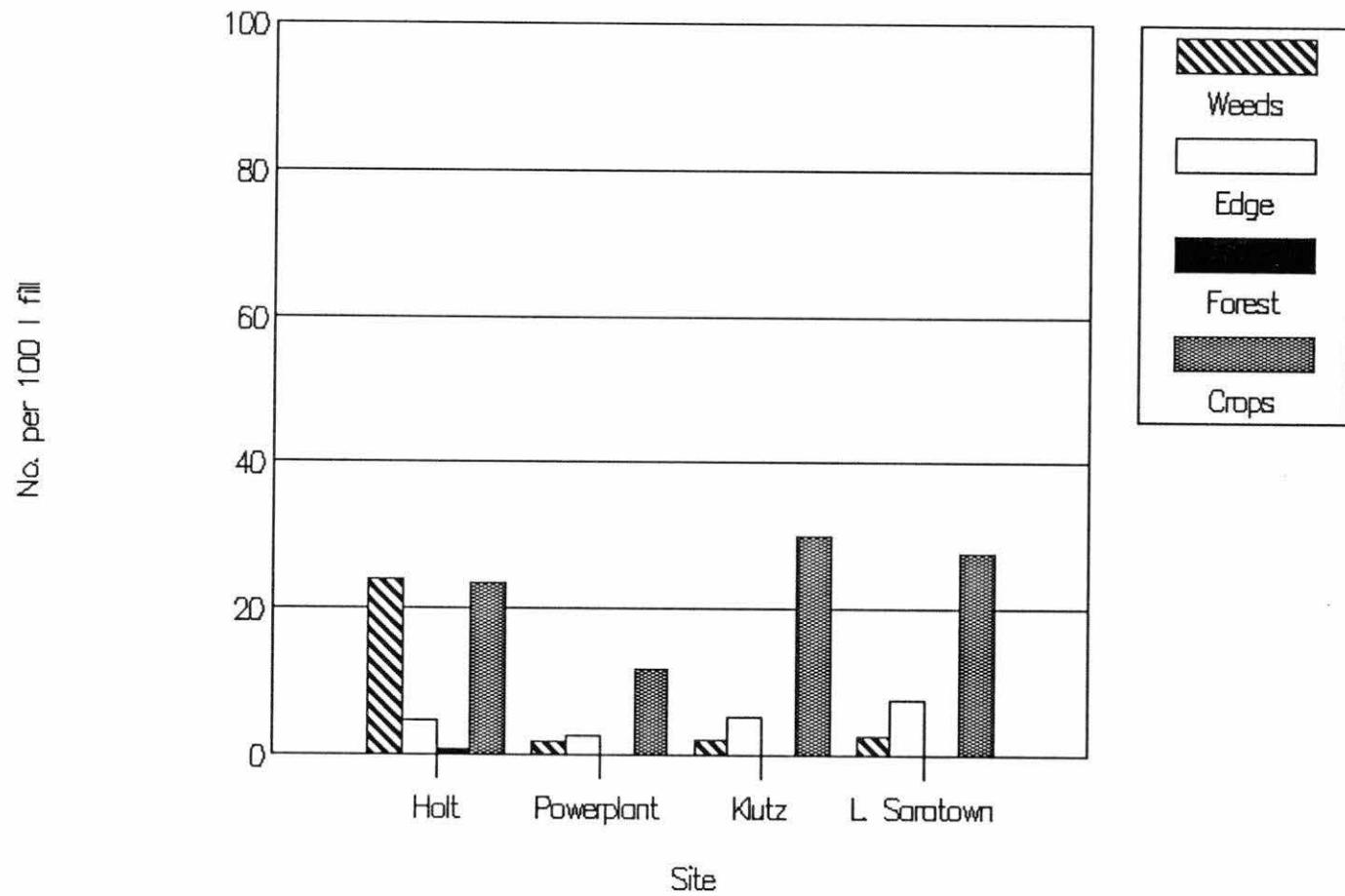


Figure 26. Seed Density by Habitat, Prehistoric Sites

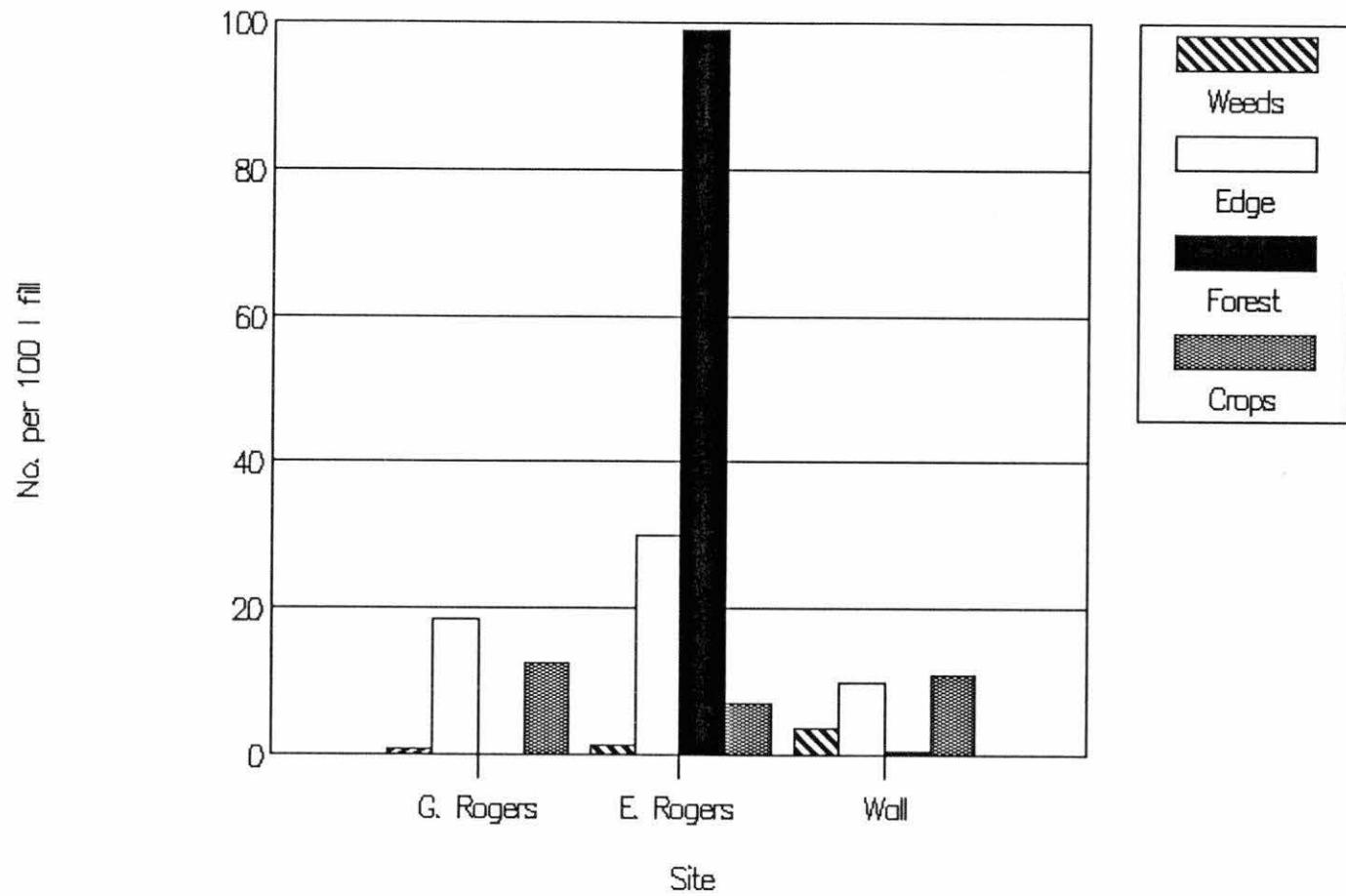


Figure 27. Seed Density by Habitat, Protohistoric Sites

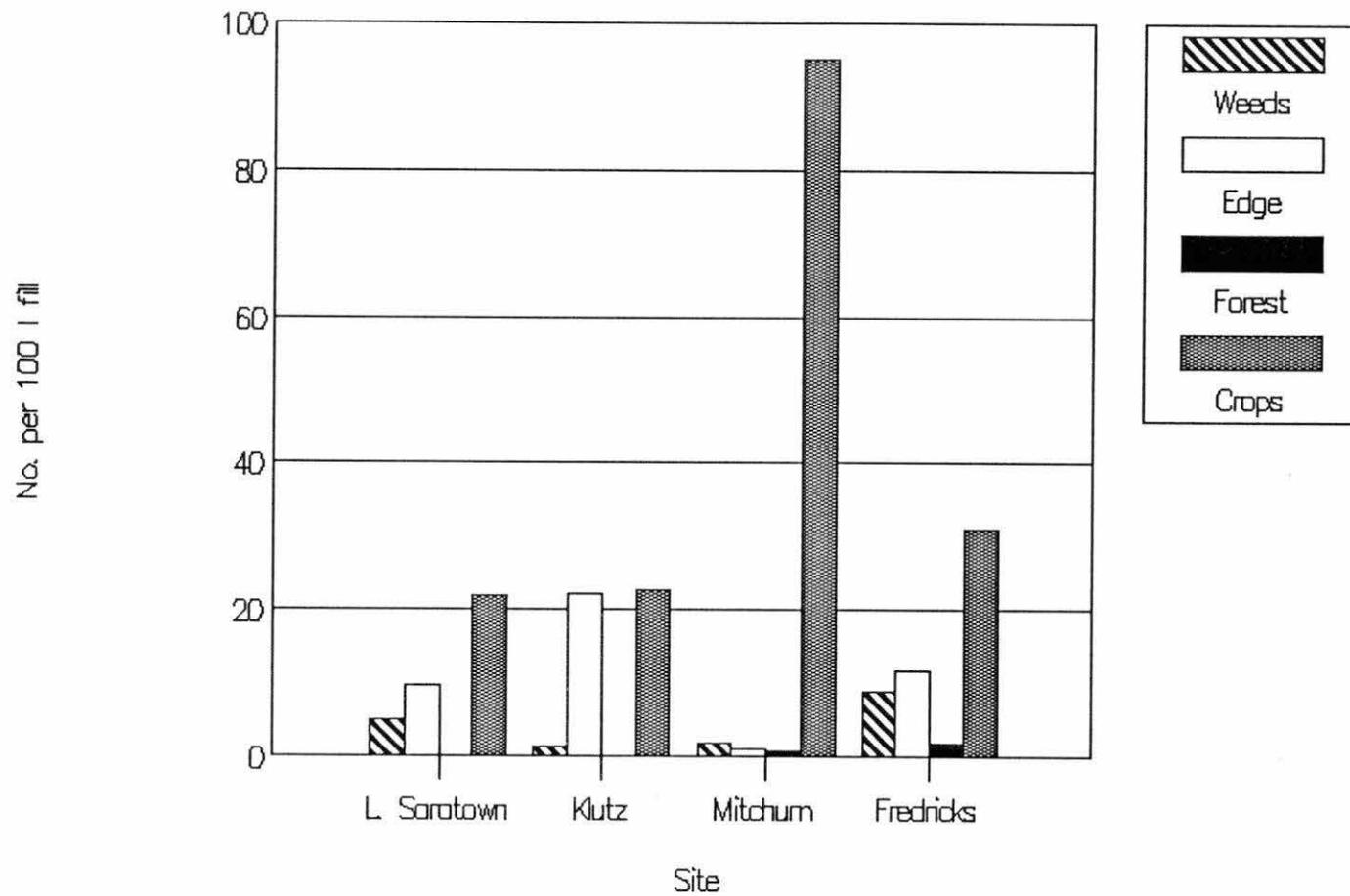


Figure 28. Seed Density by Habitat, Historic Sites

barley, which established the occurrence of spring and early summer plant harvesting there. For this site only, maygrass and little barley were considered crops because of their large quantity and apparent role as crops at other sites in the East. As with black gum at Edgar Rogers, a single feature provided most of the seeds that resulted in Mitchum's high crop density. Even if they were not in fact crops at Mitchum, but collected from a location at which they occurred naturally, they still reflect utilization of an early successional plant community. Without these species, the density of crop seeds from the site would have been 3.1 seeds/liter rather than 95.1 seeds/liter, whereas weed taxa would have risen to 93.7 seeds/liter.

Croplands seem to be less well represented at Protohistoric than at Late Prehistoric or Historic sites. Only at the Edgar Rogers and George Rogers do densities of weed and edge seeds exceed crop seed densities. At Wall the edge and crop densities are quite close. This could indicate a deemphasis on croplands during the Protohistoric, at least for those drainages. Such an interpretation, if borne out by additional evidence, would not support the hypothesis of continuation of traditional land use patterns throughout the contact period. However, it would also not support a hypothesis postulating a unilinear trend of increasing or decreasing emphasis on croplands.

The weed and edge categories produced moderately high densities for most of the sites. At the Late Prehistoric

Dan River sites, these categories produce densities considerably lower than the crop category, whereas at the Holt site in the Haw drainage, values for weed taxa are somewhat higher than for crop taxa. At Protohistoric sites, edge taxa overshadow the other three categories at two of the three sites. At Historic sites except for Mitchum, weed and edge densities are higher than they are at most of the earlier sites, although they are usually exceeded by crop seed densities.

These observations can assist in evaluating the hypothesis that human disturbance of local plant communities was of similar intensity and scope before and after European contact in the northeastern Piedmont. The seed density data are inconclusive regarding this hypothesis. Densities of weed and crop taxa, the ones diagnostic for anthropogenic habitats, do not contrast by time period in any easily interpretable way. Two of the Historic sites, Fredricks and Lower Saratown, do have relatively high densities of both crop and weed seeds. However, values for these categories are also quite high at the Late Prehistoric Holt site. In general, variability in habitat representation is high within sites of the same period as well as between sites of different periods.

Focusing attention on particular species rather than categories of taxa can shed some light on the question of anthropogenic disturbance. Maypops, a species particularly well-suited to open areas, particularly agricultural fields,

is a good indicator of disturbance. Apparently it grew so readily in cornfields that planting was unnecessary, according to Robert Beverley (Wright 1947:142). Whether or not it was planted, its abundance near sites, and presumably human use of the fruits and deposition of the seeds in fires, would have increased along with extension of its preferred habitat. In fact, Gremillion (1989a) has documented that increased representation of maypops archaeologically in the East coincides with seed and wood charcoal evidence of increased environmental disturbance through clearing and gardening.

Assuming this correlation can be applied to interpreting smaller data sets, the occurrence of maypops in all three drainages supports the notion of increased human disturbance. Maypops is not present at all at Haw River phase sites. In the Eno drainage, maypops appears in the Protohistoric, and remains fairly ubiquitous in the Historic period. At the Dan River sites, maypops appears only in the Middle and Late Saratown phases (see Appendix). Small sample size may account for its absence from the Early Saratown phase; however, reasonably large samples are available from Powerplant, Holt, George Rogers, and Edgar Rogers. The best explanation of this pattern is that more suitable habitat for maypops (e.g., gardens, fields, and other human-maintained habitats) was created late in the Protohistoric and Historic periods in the Dan and Eno drainages than was available earlier.

Other evidence of increased disturbance through agricultural activities can be sought in the archaeological record of lithics and trade goods. Chipped stone hoes and axes were not recovered from Wall, Mitchum, Fredricks, Early Upper Saratown or Upper Saratown (Tippitt and Daniel 1987), although digging implements were (Daniel 1988). Several iron axe heads and hoe blades were recovered from the Fredricks site (Carnes 1987), so European tools were apparently being used for clearing land and preparing for planting. Hoes were not recovered from Upper Saratown, although one iron axe head was (Carnes 1987). The mere presence of these tools does not imply any large-scale alteration of traditional farming practices. In fact, sites with hoes and axes (such as Fredricks) have similar disturbance regimes to roughly contemporaneous sites (such as Mitchum) that lack these items. Disturbance as measured by presence of maypops is correlated with position in the temporal sequence. However, it is not correlated with presence of European farming tools, at least as recovered archaeologically.

#### SUMMARY

Two hypotheses regarding responses to spatial heterogeneity by Piedmont populations have been assessed using paleoethnobotanical evidence. One of these is that disturbed vegetational communities were emphasized

throughout the temporal sequence. The other, related hypothesis is that local environmental disturbance regimes, including agricultural techniques, did not greatly change after contact.

Reconstruction of a generalized vegetational mosaic for the Siouan Project area has been proposed as a framework for inferring how plant communities were utilized. This reconstruction is based primarily upon modern vegetation studies but is supplemented by ethnohistoric information. In general, the model of vegetation thus obtained reveals the presence of a number of different types of anthropogenic plant communities on the landscape, including agricultural gardens and fields, old fields, post-fire successional communities, and parklands.

Testing of the two hypotheses was preceded by a discussion of the ecological principles and ethnohistoric data initially used to formulate them. Emphasis upon disturbed habitats is hypothesized in light of the relatively high biomass productivity of spatially open, early successional habitats. Many species that typically inhabit closed-canopy forest (such as nut trees) are more productive in cleared areas. The utilization of disturbed habitats by modern non-industrialized agricultural communities lends plausibility to this hypothesis. Accounts of European observers also report the creation and utilization of anthropogenic habitats.

The second hypothesis, which proposes relative continuity in level and type of environmental disturbance (including agriculture) was based on the spatial distance between aboriginal and European settlements in the northeastern Piedmont. In some parts of the East, fire drive hunting became more common in the context of trade. Old fields and other disturbed habitats sometimes actually decreased in frequency as a result of aboriginal depopulation (Cronon 1983). Adoption of more destructive European agricultural practices such as plowing, if it had occurred, would have created a more disturbed landscape. A hypothesis of continuation of a similar disturbance regime has been proposed instead for the northeastern Piedmont because of the relatively late settlement of the region by Euroamericans. The impact of European agricultural practices on the vegetational mosaic was therefore probably not felt there until after aboriginal abandonment of the area.

Analysis of the representation of different plant communities archaeologically supports the hypothesis of emphasis on disturbed communities. Crop plants appear to be less well represented at Protohistoric than at either Prehistoric or Historic sites. However, there is no indication of a directional trend in archaeological representation of crop plants. Support for the second hypothesis is less firm. Disturbed habitats apparently were utilized extensively throughout the temporal sequence.

However, the presence of maypops only late in that sequence indicates that gardens may have become increasingly more important loci of activity. If they did, use of European tools apparently played little role in changing agricultural practices, judging by the archaeological distribution of metal axes and hoes.

In general, the landscape on which Piedmont peoples lived and from which they drew plant resources was a mosaic of plant communities at different stages of succession. Aboriginal populations took advantage of the high productivity of edible plants in disturbed habitats and manipulated that productivity by maintaining early stages of succession through burning or other types of clearing. Such open habitats could be exploited for nut and fruit trees, and managed through planting, tending, or simply selective cutting of competing plants. The most extreme form of land management involved clearing, cultivating, planting and tending gardens and fields. These highly artificial ecosystems were primary loci for the intense form of human-plant mutualism labelled domestication (Rindos 1984).

CHAPTER VI  
DIET COMPOSITION

Scheduling, storage, and exploitation of specific plant communities result in circumscription of a set of plant resources that characterizes a given population during a period of time. Decisions about which plant resources to use also rely upon other aspects of the environment (such as resource availability) and of the population in question (such as group size). Subsistence behaviors can be examined by assessing features such as diet composition (which items are included in the diet) and diet breadth (the number of items and the evenness of their representation). Although diet is difficult to reconstruct adequately using archaeological data, it can be inferred to some extent from subsistence information. In the present case, inferred characteristics of diet are acknowledged to be restricted to plant foods and consequently incomplete. The most reliable inferences about diet to be obtained paleoethnobotanically are the simplest, that is those that deal with the number, types, and diversity of resources used rather than the dietary contribution of each kind of plant food. However, questions about subsistence importance are relevant to each of these simpler parameters and need to be explored as well.

## OVERVIEW OF PLANT FOOD RESOURCES

Ethnohistory

European travellers were probably poor judges of Indian diet, since for the most part they did not reside long enough in native communities to observe seasonal (or longer-term) subsistence patterning. Often they were guests for only a brief period of time and had little opportunity to observe everyday dietary patterns of Indian communities. Some observers, such as James Adair, lived in these communities long enough to offer detailed and reliable accounts both of subsistence activities and diet.

Despite a certain amount of regional diversity and variation in the reliability of sources, early European observers in the Southeast concur on the major components of native diet. All accounts indicate the primacy of maize as chief crop and staple food (see for example Williams 1930:437; Lefler 1967:182; Wright 1947:143). Other crops mentioned with some regularity include various legumes and cucurbits. A few accounts note grain crops known today only by Indian names and descriptions, for example, Harriot's melden, now thought to be a chenopod (Harriot 1590:14). The Natchez grain choupichoul was probably a chenopod as well (Yarnell 1987). Other "mystery grains" are Strachey's chequinarnins (Major 1849:72) and nattourne, a small-fruited grass (Major 1849:118), and the cereal described by Peter Martyr (Sauer 1971:228).

Nuts (usually acorn and/or hickory) are inevitably mentioned as well, although the types of nuts noted by European observers varied regionally (and perhaps temporally, given typically brief periods of observation and scheduling of nut harvests to coincide with periods of optimal availability). Lawson, for example, noted only acorns in his description of "the Indians food" (Lefler 1967:182), although elsewhere in A New Voyage he describes processing and storage of hickory and chinkapin (Lefler 1967:105, 34).

A variety of fleshy fruits is usually mentioned. Grape, plum and persimmon appear in travellers' accounts with some regularity. Grapes received particular attention because of their relative abundance and diversity in North America as compared to Europe. Some selection for desirable traits seems to have occurred in plums as well as in grapes (Sauer 1971:290), which indicates some degree of mutualism between humans and these plants. Persimmon, unknown in Europe, is often mentioned as well (Lefler 1967:109; Major 1849:118; Wright 1947:130).

Relying on ethnohistoric sources for the Southeast in general produces the impression that Indian plant food diet might be classified using three major components, cultigens (including lesser grain crops); nuts (chiefly acorn and hickory); and fleshy fruits (with grape, plum, and persimmon among the most important). Some species, such as watermelon, fall into more than one category. Other plant

products were undoubtedly used, for example cooked greens. However, "raw Sallads" were never eaten, according to Lawson (Lefler 1967:231). This lack of interest in uncooked greens is also noted by Beverley (Wright 1947:181) and Adair, who remarks of "raw sallads" that the Indians "reckon such food is only fit for brutes" (Williams 1930:442). Archaeological evidence of use of underground plant parts, as of leaves, is unlikely to be found, so that their occurrence and importance at particular sites cannot be assessed. However, roots and tubers seem to have been used extensively by coastal groups, judging by descriptions in Harriot (1590), Strachey (Major 1849), and William Hilton (Salley 1911d:117). Farther inland, Lawson mentions "ground-nut" (Lefler 1967:182), but underground storage organs seem not to have been as important or as heterogeneous a resource as they were on the coast.

### Archaeology

Although some plant foods are not represented because of the vagaries of preservation, there seems to be a high correspondence between the archaeological record and ethnohistoric accounts. Lawson (Lefler 1967), although his observations pertain largely to Coastal Plain groups, provides botanical details about eastern North Carolina and describes aboriginal utilization of many plants. A list was compiled of 23 food plants described by Lawson in A New Voyage as having been used by Indians, excluding ones likely

to have been prepared in such a way as to leave no traces archaeologically. Watermelon, muskmelon, and groundnut were included despite low perservability. Pawpaw and chinkapin were also listed, although they are rarely recovered archaeologically (Yarnell 1982). Even with inclusion of these taxa, 16 of the 23 taxa have actually been recovered from Piedmont sites (Table 10). Of the remaining 7, 5 have low likelihood of recovery. Only gourd and honeylocust are expected but not recovered. Thus depending on how expected taxa are determined based upon Lawson's account, at least 70% and as many as 89% of plants expected to occur have in fact been recovered archaeologically. A similar study based upon comparison of waterscreened material from the Upper Saratown site with Lawson's account reported occurrence of 17 out of 21 expected taxa (Yarnell 1982).

Further assurance of strong correspondence between plant use and paleoethnobotanical remains is provided by the fact that plants regularly represented archaeologically comprise only a small subset of plant species in the local environment. Siouan Project sites produced evidence of at least 39 plant species. If each genus-level identification is assumed to represent two species (and most probably actually represent only one, a few more than two), an estimated total number of species represented is 57. Even considering the absence of many food plants from the archaeological record, this is only a small fraction of the 3,250 angiosperm species counted for North and South

Table 10. Comparison of Archaeological Plant Remains with Food Plants  
Mentioned by John Lawson

Taxon	Page	Archaeological Evidence	Comments
oak	100	X	
black gum	102	X	
hickory	105	X	
walnut	105	X	
chinkapin	105-6		seldom recovered archaeologically
chestnut	107	X	
honeylocust	55, 105		
beans, "pulses"	82, 182	X	
watermelon	83	X	low likelihood of preservation
muskmelon	83, 182		low likelihood of preservation
squash	83, 182	X	
gourd	83, 182		probably used as containers
grape	108	X	
persimmon	180, 109	X	
huckleberry	110	X	
pawpaw	111		seldom recovered archaeologically
plum	109, 111, 116, 267	X	
hawthorn	112	X	
peach	117	X	
maize	182	X	
groundnut	182		low likelihood of preservation
blackberry	110	X	
cucumber	182, 83		low likelihood of preservation
TOTAL 23		TOTAL 16	

Note: Page numbers refer to Lefler (1967).

Carolina in Radford et al. (1968). Of course, three physiographic regions account for the total number of species, but many occur in all three. What this assessment points out, besides the selectivity involved in choice of plant foods, is that there is a strong association between a restricted set of plant taxa and archaeological deposits in the Eastern Woodlands. This fact, along with the comparison of ethnohistoric and ethnobotanical evidence, affirms the assumption connecting the paleoethnobotanical record with past subsistence behavior, at least in terms of the set of plant foods used.

This set of plant foods as it is revealed archaeologically can be summarized according to the three categories of major foods, that is nuts, crops, and fleshy fruits. These categories are devised to group plant foods according to overall inferred dietary importance, methods of procurement and preparation, and general nutritional characteristics. Also commonly found archaeologically are grain and weed seeds. Most of these probably represent commensal plants common on anthropogenically disturbed sites. Some of these probably were food plants, at least in times of food scarcity. However, without evidence that they were used or grown, such ambiguous taxa are included in the grain and weed category. The need for this category emphasizes the flexibility of the boundary between weed and domesticate. A miscellaneous category was also created to

incorporate taxa of doubtful utility and those whose use could not be securely determined.

To assess the relative importance of plant foods found archaeologically, plant remains data have been organized and quantified according to geographical and temporal placement. Tables 11 and 12 summarize proportions of different nutshell types and compare representation of nutshell and maize by weight. Tables 13 and 14 give densities in feature fill of various types of plant remains. Tables 15 and 16 compare quantities of different classes of plant remains (total plant remains, wood charcoal, maize, nutshell, and seeds) directly to each other. In Tables 17 and 18 ubiquity of selected plant foods calculated as percentage of features producing each taxon is presented. Tables 19 and 20 record the proportional representation of different seed taxa.

Nuts. All sites studied had some acorn and hickory shell (Tables 11 and 12). In addition, walnut was found in all but two components, both of which were very small samples (Fredricks [Haw River component] and Webster). Chestnut and hazelnut were found in small quantities but only at Dan River sites. In general, acorn and hickory seem to have been the most important of these resources. Walnut is more abundant in the Dan drainage than in the Eno/Flat and Haw drainages, although considering the different meat:shell ratios involved it appears not to have been utilized as extensively as acorn. Chinkapin [the term used today to refer to Castanea pumila (L.) Miller] was described

Table 11. Haw and Eno/Flat Drainages, Percentage of Plant Foods and Nutshell Ratios

Phase/Period	Site	Plant food remains (g)	% Maize	% Nut- shell	Identified nutshell (g)	% Acorn	% Hick- ory	% Wal- nut	Acorn: hickory <sup>1</sup>
Haw River	Webster	17.36	0.1	99.9	17.34	0.7	99.3		0.35
	Holt	41.30	3.2	92.1	38.04	21.0	67.4	11.6	15.56
	Guthrie	2.18		97.2	2.12	0.9	98.1	0.9	0.48
	Or233	4.69	tr	95.1	4.46	9.2	90.8		5.06
L. Prehistoric total		65.53	2.1	94.6	61.96	13.8	79.1	7.1	8.70
Hillsboro	G. Rog- ers	53.22	3.5	84.1	44.75	5.0	86.1	8.9	2.91
	E. Rog- ers	106.19	23.4	64.7	68.73	31.0	68.2	0.8	22.77
	Wall	32.34	10.0	86.9	28.10	10.6	85.5	3.9	6.20
Hillsboro total		191.75	15.6	73.8	141.58	18.8	77.3	4.0	12.14
Mitchum	Mitchum	14.02	7.9	83.1	11.65	5.1	89.3	5.7	2.84
Fredricks	Fred- ricks	266.07	23.2	61.3	163.09	3.2	95.2	1.6	1.67
Historic total		280.09	22.5	62.4	174.74	3.3	94.8	1.9	1.74

<sup>1</sup>Grams acorn shell x 50/grams hickory shell.

Table 12. Dan Drainage, Percentage of Plant Foods and Nutshell Ratios

Phase/Period	Site	Plant Food Re- mains (g)	% Maize	% Nut- shell	Total Identi- fied Nut- shell (g)	% Acorn	% Hick- ory	% Wal- nut	% Chest- nut	% Hazel- nut	Acorn: hickory
Dan River	Power- plant	7.46	8.0	81.0	6.04	21.7	68.2	10.1			15.90
	Klutz	2.84	27.8	63.0	1.79	3.4	72.1	24.6	tr		2.33
	L. Sara- town	2.49	16.1	82.3	2.05	4.9	93.2	1.5		0.5	2.62
Late Prehistoric total		12.79	14.0	77.2	9.88	14.9	74.1	10.9	0.1		10.04
Early Saratown	Power- plant	2.18	9.2	90.8	1.98	tr	82.3	17.7			0.08
Protohistoric total		2.18	9.2	90.8	1.98	tr	82.3	17.7			0.08
Middle Saratown	L. Sara- town	170.30	44.0	55.4	94.28	0.7	85.5	13.4	0.3	0.1	0.41
Late Saratown	Klutz	15.51	12.6	81.8	12.69	1.2	95.6	3.2			0.62
Historic total		185.81	41.4	57.6	106.97	0.8	86.6	12.2	0.3	0.1	0.45

Table 13. Haw and Eno/Flat Drainages, Density of Plant Foods

Phase/Period	Site	Nutshell (g/100 l)	Maize (g/100 l)	No. Seeds/g Plant Food Remains	Plant Food Remains (g/100 l)	Fill Vol- ume (l)
Haw River	Webster	38.53	0.04	0.17	38.58	45.0
	Holt	25.36	0.89	2.81	27.53	150.0
	Guthrie	1.30		3.67	1.35	162.0
	Or233	44.60	0.03	26.65	4.70	10.0
L. Prehistoric total		16.88	0.37	2.09	16.71	367.0
Hillsboro	G. Rogers	171.40	0.70	2.71	20.39	261.0
	E. Rogers	30.14	10.89	3.63	46.57	228.0
	Wall	9.83	1.13	3.22	11.31	286.0
Hillsboro total		18.27	3.86	3.32	24.74	775.0
Mitchum	Mitchum	2.29	0.22	40.09	2.75	509.0
Fredricks	Fredricks	8.99	3.40	3.69	14.64	1817.5
Historic total		6.22	2.23	1.09	9.95	2815.5

Table 14. Dan Drainage, Density of Plant Foods

Phase/Period	Site	Nutshell (g/100 l)	Maize (g/100 l)	No. Seeds/g Plant Food Remains	Plant Food Remains (g/100 l)	Fill Vol- ume (l)
Dan River	Powerplant	2.63	0.26	5.76	3.24	230.0
	Klutz	1.79	0.79	15.85	2.84	100.0
	L. Saratown	5.13	1.00	6.83	6.23	40.0
Late Prehistoric total		2.67	0.48	8.21	3.46	370.0
Early Saratown	Powerplant	3.96	0.40	3.21	4.36	50.0
Protohistoric total		3.96	0.40	3.21	4.36	50.0
Middle Saratown	L. Saratown	22.64	18.06	1.07	41.04	415.0
Late Saratown	Klutz	7.05	1.09	6.71	8.62	180.0
Historic total		17.93	12.92	1.54	31.23	595.0

Table 15. Haw and Eno/Flat Drainages, Comparison Ratios

Period/Site	Seed: Nut- shell	Seed: Plant Remains	Seed: Wood	Nut- shell: Plant Remains	Nut- shell: Wood	Wood: Plant Remains	Maize: Nut- shell	Maize: Wood
<u>Haw River</u>								
Webster	0.17	0.12	0.38	0.67	2.18	0.31	x	x
Holt	3.05	0.53	0.69	0.17	0.22	0.77	0.04	0.01
Guthrie	3.77	0.86	1.16	0.23	0.31	0.74		
Or233	28.03	16.94	43.86	0.60	1.56	0.39		
Late Prehis- toric total	4.07	0.96	1.35	0.24	0.33	0.71	0.02	0.01
<u>Hillsboro</u>								
G. Rogers	3.22	0.71	1.02	0.22	0.32	0.70	0.04	0.01
E. Rogers	5.60	1.28	2.09	0.23	0.37	0.61	0.36	0.13
Wall	3.70	0.80	1.17	0.22	0.32	0.68	0.12	0.04
Hillsboro total	4.47	1.00	1.53	0.22	0.34	0.65	0.21	0.07
<u>Historic</u>								
Mitchum	48.24	3.05	3.44	0.06	0.07	0.89	0.10	0.01
Fredricks	6.90	0.98	1.34	0.14	0.19	0.73	0.38	0.07
Historic total	9.66	1.26	1.68	0.13	0.17	0.75	0.36	0.06

Note: x=less than 0.05 g. Ratios reflect numbers of seeds, grams of all other items.

Table 16. Dan Drainage, Comparison Ratios

Period/Site	Seed: Nut- shell	Seed: Plant Remains	Seed: Wood	Nut- shell: Plant Remains	Nut- shell: Wood	Wood: Plant Remains	Maize: Nut- shell	Maize: Wood
<u>Dan River</u>								
Powerplant	7.12	0.62	0.71	0.09	0.10	0.87	0.10	0.01
Klutz	25.14	0.90	1.00	0.04	0.04	0.90	0.44	0.02
L. Saratown	8.29	0.87	1.03	0.10	0.12	0.84	0.20	0.02
Late Prehis- toric total	10.63	0.75	0.86	0.07	0.08	0.87	0.18	0.01
<u>E. Saratown</u>								
Powerplant	3.54	0.43	0.51	0.12	0.14	0.85	0.10	0.01
Protohistoric total	3.54	0.43	0.51	0.12	0.14	0.85	0.10	0.01
<u>Historic</u>								
L. Saratown	1.94	0.43	0.91	0.22	0.47	0.48	0.79	0.37
Klutz	8.20	0.69	0.78	0.08	0.10	0.88	0.15	0.01
Historic total	2.68	0.50	0.86	0.19	0.32	0.58	0.72	0.23

Table 17. Haw and Eno/Flat Drainages, Ubiquity of Selected Plant Foods

Phase/Period	Site	Features	Acorn	Hickory	Wal-nut	Maize	Bean	Peach	Pepo
Haw River	Webster	2	100.0	100.0		100.0			
	Holt	6	100.0	100.0	83.3	100.0	50.0		16.7
	Guthrie	5	80.0	100.0	20.0				
	Or233	1	100.0	100.0		100.0	100.0		
L. Prehistoric total		14	92.9	100.0	42.9	71.4	28.6		7.1
Hillsboro	G. Rogers	8	75.0	75.0	62.5	75.0	12.5		
	E. Rogers	10	80.0	100.0	40.0	80.0	30.0		10.0
	Wall	7	71.4	85.7	14.3	57.1	14.3		
Hillsboro total		25	76.0	88.0	40.0	72.0	35.7		4.0
Mitchum	Mitchum	33	63.6	93.9	33.3	60.6	12.1	21.2	
Fredricks	Fredricks	52	76.9	92.3	34.6	84.6	19.2	48.1	13.5
Historic total		85	71.8	92.9	34.1	74.1	16.5	37.6	8.2

Note: Ubiquity is calculated as percentage of features in which an item occurs.

Table 17 continued

Phase/Period	Site	Sun- flower	May- grass	Cheno- pod	Little barley	Grape	May- pops	Persim- mon	Black- gum
Haw River	Webster								
	Holt	16.7	16.7	50.0	16.7			33.3	16.7
	Guthrie								20.0
	Or233								
L. Prehistoric total		7.1	7.1	21.4	7.1			14.3	14.3
Hillsboro	G. Rogers	37.5		12.5		50.0		62.5	
	E. Rogers		10.0	10.0		30.0		40.0	40.0
	Wall					28.6	28.6	14.3	
Hillsboro total		12.0	4.0	8.0		36.0	8.0	40.0	16.0
Mitchum	Mitchum	3.0	12.1		3.0	6.1	18.2		12.1
Fredricks	Fredricks			3.8		30.8	21.2	26.9	7.7
Historic total		1.2	4.7	2.4	1.2	21.2	20.0	16.5	9.4

Table 18. Dan Drainage, Ubiquity of Selected Plant Foods

Phase/Period	Site	Features	Acorn	Hickory	Walnut	Maize	Bean	Pepo	Sunflower
Dan River	Power-plant	17	45.5	94.1	50.0	59.1	9.1		4.5
	Kluttz	8	62.5	87.5	62.5	100.0	12.5		
	L. Saratown	4	100.0	100.0	50.0	100.0			
L. Prehistoric total		29	65.5	93.1	62.1	86.2	3.4		3.4
Early Saratown	Power-plant	5	40.0	100.0	60.0	80.0			
Protohistoric total		5	40.0	100.0	60.0	80.0			
Middle Saratown	L. Saratown	26	76.9	96.2	53.8	96.2	23.1	3.8	
Late Saratown	Klutz	4	25.0	100.0	75.0	75.0	25.0		
Historic total		30	70.0	96.7	56.7	93.3	23.3	3.3	

Table 18 continued

Phase/Period	Site	Sump- weed	Cheno- pod	Little barley	Grape	May- pops	Persim- mon
Dan River	Power- plant		9.1		9.1		
	Kluttz	12.5	12.5		12.5		25.0
	L. Sara- town				25.0		
L. Prehistoric	total	3.4			10.3		6.9
Early Saratown	Power- plant			20.0			
Protohistoric	total			20.0			
Middle Saratown	L. Sara- town		3.8		34.6	19.2	19.2
Late Saratown	Kluttz				50.0	25.0	25.0
Historic	total				36.7	20.0	20.0

Table 19 continued

Hillsboro Phase

Category	Taxon	G. Rog- ers	E. Rog- ers	Wall	Total No.	Total %
Culti- gens	Maize	34.1	2.6	38.6	63	13.5
	Bean	1.2	2.2	5.7	12	2.6
	Sunflower	3.7			3	0.6
	Pepo		0.3		1	0.2
	Watermelon					
Total		39.0	5.1	44.3	79	17.0
Grains	Amaranth					
	Chenopod	1.2	0.6		3	0.6
	Knotweed	1.2			1	0.2
	L. barley					
	Maygrass		0.3		1	0.2
Total		2.4	1.0		5	1.1
Weeds	Poke			1.4	1	0.2
	Spurge					
	Morning glory					
Total			1.4	1	0.2	
Fleshy fruits	Grape	6.1	9.9	31.4	58	12.5
	Maypops			12.9	9	1.9
	Persimmon	46.3	11.2	1.4	74	15.9
	Bramble					
	Huckleberry					
	Elderberry					
	Strawberry	1.2			1	0.2
	Blueberry					
	Hawthorn	2.4		2.9	4	0.9
	Nightshade					
	Sumac	1.2			1	0.2
	Plum		0.3		1	0.2
	Viburnum					
Black gum		71.9		225	48.4	
Total		57.3	93.3	48.6	373	80.2
Misc.	Bedstraw	1.2		1.4	2	0.4
	Bearsfoot		0.3	2.9	3	0.6
	Unid. A					
	Horse gentian		0.3		1	0.2
	Dogwood			1.4	1	0.2
Total		1.2	0.6	5.7	7	1.5
Site total		82	313	70	465	100.0

Table 19. Haw and Eno/Flat Drainages, Percentage of Identified Seeds

<u>Haw River Phase</u>							
Cate- gory	Taxon	Web- ster	Holt	Guth- rie	Or233	Total No.	Total %
Culti- gens	Maize	100.0	34.2			29	14.0
	Bean		7.6		0.8	7	3.4
	Sunflower		2.5			2	1.0
	Pepo Watermelon						
Total		100.0	44.3		0.8	38	18.4
Grains	Amaranth						
	Chenopod		40.5			32	15.5
	Knotweed		1.3			1	0.5
	L. barley		1.3			1	0.5
	Maygrass		1.3			1	0.5
Total			44.3			35	16.9
Weeds	Poke						
	Spurge						
	Morning glory						
Total							
Fleshy fruits	Grape						
	Maypops						
	Persimmon			3.8		3	1.4
	Bramble			2.5		2	1.0
	Huckleberry						
	Elderberry						
	Strawberry						
	Blueberry						
	Hawthorn			1.3		1	0.5
	Nightshade						
	Sumac			1.3		1	0.5
	Plum						
Viburnum							
Blackgum			1.3	100.0	3	1.4	
Total			10.1	100.0	10	4.8	
Misc.	Bedstraw			1.3	75.8	95	45.9
	Bearsfoot				4.8	6	2.9
	Unid. A				18.5	23	11.1
	Horse gentian						
	Dogwood						
Total			1.3	100.0	99.2	124	59.9
Site total		2	79	2	124	207	100.0

Table 19 continued

Hillsboro Phase

Category	Taxon	G. Rog- ers	E. Rog- ers	Wall	Total No.	Total %
Culti- gens	Maize	34.1	2.6	38.6	63	13.5
	Bean	1.2	2.2	5.7	12	2.6
	Sunflower	3.7			3	0.6
	Pepo		0.3		1	0.2
	Watermelon					
Total		39.0	5.1	44.3	79	17.0
Grains	Amaranth					
	Chenopod	1.2	0.6		3	0.6
	Knotweed	1.2			1	0.2
	L. barley					
	Maygrass		0.3		1	0.2
Total		2.4	1.0		5	1.1
Weeds	Poke			1.4	1	0.2
	Spurge					
	Morning glory					
Total			1.4	1	0.2	
Fleshy fruits	Grape	6.1	9.9	31.4	58	12.5
	Maypops			12.9	9	1.9
	Persimmon	46.3	11.2	1.4	74	15.9
	Bramble					
	Huckleberry					
	Elderberry					
	Strawberry	1.2			1	0.2
	Blueberry					
	Hawthorn	2.4		2.9	4	0.9
	Nightshade					
	Sumac	1.2			1	0.2
	Plum		0.3		1	0.2
	Viburnum					
Black gum		71.9		225	48.4	
Total		57.3	93.3	48.6	373	80.2
Misc.	Bedstraw	1.2		1.4	2	0.4
	Bearsfoot		0.3	2.9	3	0.6
	Unid. A					
	Horse gentian		0.3		1	0.2
	Dogwood			1.4	1	0.2
Total		1.2	0.6	5.7	7	1.5
Site total		82	313	70	465	100.0

Table 19 continued

Historic

Category	Taxon	Mitch- um	Fred- ricks	Total No.	Total %
Culti- gens	Maize	2.3	56.5	553	37.6
	Bean	0.6	1.7	19	1.3
	Sunflower	0.2		1	0.1
	Pepo		0.4	4	0.3
	Watermelon		0.1	1	0.1
Total		3.1	58.7	578	39.3
Grains	Amaranth		0.1	1	0.1
	Chenopod		2.0	19	1.3
	Knotweed	0.2	0.8	9	0.6
	L. barley	5.3		27	1.8
	Maygrass	86.1		441	30.0
Total		91.6	2.9	497	33.8
Weeds	Poke		0.8	8	0.5
	Spurge		0.1	1	0.1
	Morning glory		0.2	2	0.1
Total			1.1	11	0.7
Fleshy fruits	Grape	0.4	7.6	75	5.1
	Maypops	1.6	6.6	71	4.8
	Persimmon		3.2	31	2.1
	Bramble	0.2	1.7	17	1.2
	Huckleberry		1.4	13	0.9
	Elderberry		0.4	4	0.3
	Strawberry		0.3	3	0.2
	Blueberry		1.0	10	0.7
	Hawthorn	0.2	0.4	5	0.3
	Nightshade		4.7	45	3.1
	Sumac		1.6	15	1.0
	Plum				
	Viburnum		0.2	2	0.1
Black gum	0.6	1.5	17	1.2	
Total		2.9	30.6	308	21.0
Misc.	Bedstraw	0.2	5.8	57	3.9
	Bearsfoot		0.5	5	0.3
	Unid. A	2.1	0.1	12	0.8
	Horse gen- tian		0.2	2	0.1
	Dogwood				
Total		2.3	6.7	76	5.2
Site total		512	958	1,470	100.0

Table 20. Dan Drainage, Percentage of Identified Seeds

Dan River Phase

Category	Taxon	Power-plant	Klutz	L. Sara-town	Total No.	Total %
Culti-gens	Maize	64.9	51.4	73.3	54	60.7
	Bean	5.4	16.2		8	9.0
	Sun-flower	2.7			1	1.1
	Sump-weed		13.5		5	5.6
Total		73.0	81.1	73.3	68	76.4
Grains	Ragweed					
	Chenopod	8.1	2.7		4	4.5
	Knotweed		2.7		1	1.1
	Little barley					
Total		8.1	5.4		5	5.6
Weeds	Poke					
	Spurge					
Total						
Fleshy fruits	Grape	5.4	5.4	13.3	6	6.7
	Maypops					
	Persimmon		5.4		2	2.2
	Bramble	2.7			1	1.1
	Nightshade		2.7	6.7	2	2.2
	Sumac	10.8			4	4.5
Total	Plum	18.9	13.5	20.0	15	16.9
Misc.	Bedstraw			6.7	1	1.1
	Bulrush					
Total				6.7	1	1.1
Site total		37	37	15	89	100.0

Table 20 continued

Protohistoric

Category	Taxon	Power-plant No.	Power-plant %
Culti-gens	Maize	6	85.7
	Bean		
	Sunflower		
	Sumpweed		
Total		6	85.7
Grains	Ragweed	1	14.3
	Chenopod		
	Knotweed		
	L. barley		
Total		1	14.3
Weeds	Poke		
	Spurge		
Total			
Fleshy fruits	Grape		
	Maypops		
	Persimmon		
	Bramble		
	Nightshade		
	Sumac		
	Plum		
Total			
Misc.	Bedstraw		
	Bulrush		
Total			
Site total		7	100.0

Table 20 continued

Historic

Category	Taxon	Klutzn	L. Sara- town	Total No.	Total %
Culti- gens	Maize	43.7	57.0	124	52.1
	Bean	5.7	3.3	10	4.2
	Sunflower				
	Sumpweed				
Total		49.4	60.3	134	56.3
Grains	Ragweed	1.3		2	0.8
	Chenopod	0.7		1	0.4
	Knotweed	31.0		27	11.3
	L. barley				
Total		31.0	2.0	30	12.6
Weeds	Poke	0.7	1	0.4	
	Spurge	2.0	3	1.3	
Total		2.6	4	1.7	
Fleshy fruits	Grape	4.6	11.9	22	9.2
	Maypops	1.1	3.3	6	2.5
	Persimmon	10.3	9.3	23	9.7
	Bramble	1.1	5.3	9	3.8
	Nightshade				
	Sumac				
	Plum	1.1		1	0.4
Total		18.4	29.8	61	25.6
Misc.	Bedstraw	5.3		8	3.4
	Bulrush	1.1		1	0.4
Total		1.1	5.3	9	3.8
Site total		87151	238	100.0	

by Lawson as having been collected and stored in quantity (Table 7). Its close relative, American chestnut, was identified at the Lower Saratown site. Lawson may in fact have had both of these representatives of the genus Castanea in mind when he referred to chinkapin. Both species have thinner shells than acorn and are exceptionally vulnerable to fragmentation and probably destruction upon burning, so it is difficult to assess their dietary importance archaeologically.

Cultigens. Cultigens represented include those of Mesoamerican origin (maize, common bean); of Eastern North American origin (sunflower, sumpweed); and unspecified New World origin (pepo). The maize and common bean recovered from Feature 30 at the Fredricks site (which may be part of 310r233) is associated with charcoal dating to AD 920. These finds represent the earliest adequately dated occurrences of these species in North Carolina. The cultigen status of sumpweed and sunflower from Siouan Project sites is supported by the dimensions of the carbonized achenes, which exceed the size ranges reported for modern wild populations (Asch and Asch 1985). Reconstructed achene dimensions of these specimens are presented in Table 21. These values incorporate corrections for carbonization and represent estimation of achene size based upon the dimensions of carbonized seeds (Asch and Asch 1985:163; Yarnell 1978:296). Pepo (Cucurbita pepo L.) includes C. pepo ssp. ovifera, which incorporates squash

Table 21. Sunflower and Sumpweed Achene Dimensions

Sumpweed

Site	Provenience	L	W	L X W
Wall	Burial 1, Zone I	6.7	5.3	35.5
Kluttz	Feature 15, Z. 2	7.7	5.7	43.9
		5.3	4.0	21.4

Sunflower

Site	Provenience	L	W	L X W
Holt	Feature 2, Z. 1	9.9	7.5	74.3
		6.0	5.5	33.0
G. Rogers	Feature 1, Zone I	13.0	7.0	91.0
	Feature 4, Zone II	7.9	4.6	36.3
Mitchum	Feature 26, Zone I	12.9	6.0	77.4
Powerplant	Feature 6, Zone I	6.9	4.1	28.0

Note: All dimensions in mm. Values are estimated on the basis of actual dimensions of carbonized seeds.

cultivars of Eastern North American origin, and a Mesoamerican pumpkin ( *C. pepo* ssp. *pepo*) (Decker 1988). Another cucurbit, watermelon, is indigenous to Africa and was introduced to North America by Europeans. One watermelon seed was recovered from the Fredricks site.

Of these crops, maize is the most ubiquitous and was found at all sites except Guthrie. Remains of pepo are not common, but this is not surprising given the relative fragility of the rind. Watermelon rind is very unlikely to survive burning. Thus it is difficult to assess the importance of these foods. Remains of common bean occur somewhat more regularly and were found on most of the sites studied. Preparation by boiling rather than roasting may result in underrepresentation of common bean relative to the extent of its use.

Fleshy Fruits. As a category, fleshy fruits are distinguished on the basis of moisture content from dry fruits (such as grass grains). Fleshy fruits are often rich in complex carbohydrates and vitamins and thus are important nutritionally, although they do not constitute staple resources, as do many dry fruits. Grape seeds are quite common at Siouan Project sites. Persimmon, bramble, nightshade, and hawthorn also occur fairly regularly; maypops seeds occur in later components. Black gum, whose fruits were eaten according to Lawson (Lefler 1967:102), is especially abundant at Edgar Rogers. Most of the woody taxa (such as plum, hawthorn, and persimmon) are frequently found

at forest edges and open areas. The herbaceous taxa (maypops, strawberry, nightshade) are all plants of open habitats. Peach is a European domesticate that naturalizes readily, although it was probably managed in some way by Indians. Ethnohistoric sources provide strong indications of husbandry of indigenous fleshy fruit trees, including plum and mulberry.

Grains and Weeds. These two categories contain both field weeds associated with agriculture and other sorts of anthropogenic disturbance, but of doubtful utility, and other weedy taxa likely to have been food plants. Species of amaranth, chenopod, and knotweed have been noted as cultigens for various regions and time periods in the East but generally occur on Piedmont sites in small numbers easily attributable to deposition independently of human utilization. Maygrass and little barley are better candidates for crop plant status, at least at the Mitchum site, where they were important at least seasonally. The phenology of these plants made their continued role as at least occasional resources appropriate even in the context of a highly productive maize-based agricultural system. Poke, a vigorous colonizer of disturbed habitats, is a source of greens.

Miscellaneous. Of these taxa of unknown utility, bedstraw is the one most consistently found on archaeological sites in the East. Its seeds can be used to make a beverage, but its vegetative parts also can be used

as bedding (Uphof 1968) or eaten as greens. The frequency of occurrence of bedstraw seeds certainly indicates that the plant was used, but currently the nature of its use is uncertain.

Of the remaining taxa in the category, bearsfoot (a composite) also occurred fairly regularly on project sites. Unidentified Type A is a distinctive, small seed with a rounded-triangular cross section and a somewhat concave ventral surface. The remaining taxa included in this category are bulrush (often found in marshes), horse gentian (a forest herb found on basic or circumneutral soils) (Radford et al. 1968) and dogwood.

For all sites, the following numbers of taxa have been found archaeologically for each category (each genus-level identification implying at least one species): nuts, 5 (3 genus-level); crops, 6 (including watermelon); fleshy fruits, 14 (9 genus-level); grains and weeds, 8 (5 genus-level, 2 probably crops at one or more sites); and miscellaneous, 7 (5 genus-level). Numbers of representatives of each category vary little between sites and time periods, and differences that have been noted seem to be correlated with sample size. Computation of Spearman's rank order correlation coefficient comparing number of plant taxa and sample size (measured as soil volume) for 15 sites in fact demonstrates a positive correlation between these two variables ( $r = .76$ , significant at the .01 level). The relatively large numbers

of taxa from large samples such as Lower Saratow (17 taxa) and Fredricks (30 taxa) are predictable given this correlation. Thus small samples of plant remains are expected to have few taxa, and large ones to have many, regardless of the temporal placement of the source site.

Although numbers of taxa remain fairly consistent temporally and spatially within the study area, types of plant food remains are more variable. There is a strong tendency for the same taxa to appear repeatedly in assemblages, most notably maize, hickory and acorn. The most interesting exceptions to this general tendency concern certain starchy and oily grains, and European introductions. The grains in question (sunflower, sumpweed, little barley and maygrass) belong to a group of plants that were cultigens in eastern North America before the introduction of maize. For convenience, they are referred to here as "Eastern Agricultural Tradition" plants. The term "tradition" acknowledges that the pre-maize annual crops of the East were used in various combinations in different regions and thus did not properly speaking constitute a complex. The existence of such a pre-maize gardening tradition, once hotly debated, has been securely established by recent research on a domesticated chenopod (B. Smith 1985a, b) as well as Late and Terminal Archaic cultigen sumpweed (Asch and Asch 1985) and sunflower (Yarnell and Black 1985). A recent revision of Cucurbita pepo L. has described one subspecies (ssp. ovifera) many of whose

cultivars are of eastern North American origin (Decker 1988). Whether or not any of these species were of Mesoamerican origin (a possibility for Chenopodium berlandieri and C. pepo, but with no evidential basis), a gardening tradition was present in eastern North America as early as the Late Archaic, and included some unquestionably native Eastern domesticates, sunflower and sumpweed. B. Smith (1987b) summarizes the case for pre-maize gardening systems in the East based upon the archaeological record.

Both regional and temporal variation in the distribution of starchy and oily indigenous grains have been noted between northeastern Piedmont sites. In the Dan River drainage, sunflower and sumpweed appear only in Dan River phase contexts from sites producing flotation data, although one sunflower seed was reported from the Late Saratow phase Upper Saratow site (Wilson 1985). Maygrass is absent from Dan River drainage sites, and only one little barley caryopsis was identified (from the Early Saratow component at Powerplant). In the Haw and Eno/Flat drainages, evidence of Eastern Tradition plants is stronger, particularly at sites on the Haw River and its tributaries. These plants are absent from the Fredricks site but the nearby Wall site produced a sumpweed seed that is the latest recovered from a North Carolina site. Cultivation of sunflower appears to have continued throughout the Late Prehistoric and Historic, at least in the Haw drainage. Little barley appears both early and late in this sequence, although in small numbers.

The Mitchum site is exceptional in providing a clear indication of the survival of elements of the pre-maize gardening tradition well past the adoption and intensification of maize agriculture and into the contact period.

Another notable contrast in utilization of plant resources is found in occurrence of the European-introduced domesticates peach and watermelon. Their diffusion and role in subsistence will be further discussed in the section to follow. Besides the obvious and expected observation that these cultigens are found only at Historic period sites, there are less predictable variations in their occurrence. Peach is fairly ubiquitous both at Fredricks and at Mitchum (Table 17). In the Dan drainage, peach was abundant at the Upper Saratowan site but absent from the slightly earlier Middle Saratowan occupation at Lower Saratowan, which is roughly contemporaneous with the Mitchum site (Table 18). Thus there was variation between sites and/or drainages either in access to the plants or fruits or adoption of the peach as a food plant. Although the spread of peach through the Southeast proceeded at least somewhat independently of direct contact, indirect relations with Whites through Indian middlemen facilitated its spread. Thus variation in the archaeological occurrence of this species in conjunction with other evidence can be informative about the nature and extent of European contact.

## RELATIVE IMPORTANCE OF PLANT FOODS

It has been noted that determination of relative importance of plant foods based upon archaeological evidence is subject to a number of potential pitfalls. However, an attempt will be made to compare apparent importance between and within the major plant resource categories. These comparisons can also aid in assessing changes in diet composition over time.

Maize and Other Crop Plants

At most of the Siouan Project sites, maize overshadows all other plant foods, except acorn and hickory nut, in quantity and ubiquity. Despite preservational biases, the consistently high ubiquity and relative quantity of maize remains indicate its primary importance among plant foods. Variability in the representation of maize by site can be assessed in a number of ways. Ubiquity calculations show high values (above 80%) for most of the sites. Small sample size skews results in the direction of misleadingly high ubiquity values for some sites, such as Webster, Lower Saratown (Dan River component) and Klutz (Late Saratown component) (Tables 17 and 18). Even within sites, however, maize typically ranks highest. Sometimes maize is tied with, or just exceeded by, one of the nut taxa (usually hickory).

Percentages and ratios of maize to nutshell allow for more direct comparisons of these two most visible types of plant food remains. The durability of hickory shell is probably superior to that of maize cob and cupule fragments, but not greatly. The two types of remains both represent refuse and seem to have roughly similar food:nonfood ratios, though this assumption has not been tested experimentally. Nutshell makes up a higher percentage of plant food remains than maize, and ratios of maize to nutshell are less than one at all sites (Tables 15 and 16). Because of ethnohistoric accounts emphasizing the dietary importance of maize, using these results to propose the greater importance of mast resources would be inappropriate. It also should be recognized that preservational biases may in fact be operating in such a way as to cause overrepresentation of nutshell relative to maize. However, the data do indicate that mast resources were close in importance to maize in the northeastern Piedmont, although they would have filled a somewhat different set of nutritional needs.

Over time, there is no strong pattern of directional change in the relative importance of these major plant foods. In both drainages, maize ubiquity fluctuates but neither decreases nor increases in regular fashion. The same lack of clear patterning is apparent in values for maize as percentage of identified seeds, percentage of plant food remains, and quantity per liter of fill (Tables 11-14, 19-20).

The patterns that do emerge seem to be functions of site-specific properties. For instance, in the Haw and Eno drainages, representation of maize is extremely low in the Late Prehistoric. However, three of the four sites represented produced relatively small samples of plant food remains. The remaining site, Holt, produced relative quantities of maize comparable to those found at the Protohistoric George Rogers site. Frequency and abundance of maize is greatest at the sites with the greatest density of plant food remains, Fredricks, Edgar Rogers, and Lower Saratown. Thus representation of maize on these sites appears to be more a function of overall density of plant food remains than of regional or chronological placement.

Although maize was the most important crop, remains of common bean occurs with some regularity as well. Common bean cotyledons were found in all three major time periods in both regional datasets. Although its representation varies in the Haw/Eno dataset, this variability does not suggest directional change. The same is generally true for the Dan drainage sites, except that ubiquity of common bean is markedly higher at the two Historic sites than it is earlier. How to interpret this pattern is not clear, but change in utilization of common bean is not evident.

The pattern for pepo rind is also difficult to interpret. Like bean, pepo is expected to be seriously underrepresented relative to its utilization because of poor preservability. Small sample size also makes any conclusive

interpretation of the representation of pepo rind suspect. The only observation about it that might prove relevant in further research is that pepo rind was found in all time periods in the combined Eno/Haw dataset, whereas in the Dan drainage it was recovered only from Middle and Late Saratown phase contexts (Lower Saratown and Upper Saratown, respectively).

The Eastern Tradition grains do exhibit some variability both temporally and regionally. Sunflower and maygrass occur in all three time periods in the Eno and Haw drainages and little barley is present in the Late Prehistoric and Historic there. Sumpweed was found only at the Wall site (Table 78). The Dan drainage sites produced sunflower, little barley and sumpweed but no maygrass. Quantities of these starchy and oily grains are small at most sites, indicating that none of them approached maize in importance, except perhaps seasonally and/or under special circumstances of scarcity. Regional variability in the occurrence and abundance of particular species is just as likely to be explicable as a function of small sample size as it is of variation in subsistence.

However, temporal patterning of use of Eastern Tradition grains taken as a group varies between drainages in a way that does suggest contrasting plant use patterns. The Eastern Agricultural Tradition seems to have been more important in the Historic period in the Haw drainage than in the Eno or Dan drainages, although confirmation of this

pattern awaits additional evidence. Eastern Tradition plants are absent from the Dan drainage in the Historic period, with the exception of the Upper Saratowen sunflower seed. Sunflower, maygrass, and little barley are present in the Historic period at the Mitchum site, and sunflower and maygrass have antecedents in the Hillsboro and Haw River phases. Thus there is some evidence that the Eastern Agricultural Tradition was more persistent in the Haw River drainage than it was along the Dan.

#### Mast Resources

Comparison of the importance of various types of nuts is complicated by preservational biases and the need to resort to quantification of food wastes. However, comparison of taxa with similar durability is relatively straightforward. For example, walnut is never as abundant as hickory nutshell at project sites, a difference that probably mirrors differential use of these taxa. Preparation of hickory "milk" and other products by crushing and boiling gives hickory a preservational advantage over walnut, but the feasibility of these forms of preparation for hickory is one of the characteristics that makes the genus attractive as a food source. Walnut, on the other hand, was less important than hickory throughout the temporal sequence, based upon percentage and ubiquity (Tables 11-12, 17-18). However, walnut does appear to have

been more important in the Dan drainage than it was to the south.

Hickory and acorn were the most important of mast resources in the study area, but discerning relative importance of these taxa requires attention to their very different ratios of food to waste. The acorn:hickory ratio (g acorn x 50/g hickory) provides a ready method of comparing the two in terms of the food utilized. Results appear in Tables 11 and 12 by site. Variability in the acorn:hickory ratio is considerable, but chronological patterning is evident only in the Dan drainage. There, ratios are greater than one in the Dan River phase and less than one for Protohistoric and Historic components. An increase in the importance of hickory relative to acorn is therefore indicated. Nutshell percentages tend to support this interpretation. Haw and Eno River sites all produced acorn:hickory ratios greater than one throughout the sequence with the exception of the two small samples from Webster and Guthrie. The most plausible interpretation of these data is that acorn was more important relative to hickory in the Eno and Haw drainages than it was in the Dan, and remained so after contact. Eno and Haw data show some decline in the acorn:hickory ratio, indicating that its relative importance decreased somewhat, but it does not appear to have been superceded by hickory as it was in the Dan drainage.

Thus, for mast resources, both regional and temporal variation in utilization are evident. Acorn and hickory were the primary mast resources, with acorn more important than hickory early in the Dan River sequence and temporally throughout in the Haw and Eno/Flat drainages. Walnut was less important than either but was utilized to a greater extent at Dan River drainage sites. Other nut types recovered (hazelnut and chestnut) were apparently minor resources.

#### Fleshy Fruits

As with other categories of plant resources, little regular variability in use through time is apparent. Maypops, discussed in Chapter V, is exceptional in appearing only late in the temporal sequence, probably due to its reliance on human disturbance for suitable habitats. In addition to maypops, grape and persimmon are the most visible fleshy fruit types. Black gum is also quite abundant at Eno and Haw River sites.

#### Summary

Subsistence contributions of various plant foods seem to have been broadly similar before and after European contact in both drainages. In fact, variability between drainages in this respect is more evident than change over time. The best indications of change in relative importance of traditional plant foods are the decreasing emphasis on

acorn relative to hickory (and perhaps maize as well), especially at the Dan River sites; the correlation of maypops with Protohistoric and Historic occupations; and possibly a deemphasis of traditional Eastern grain crops.

#### ASSEMBLAGE DIVERSITY

Another way of measuring differences between plant remains assemblages involves calculation of diversity. Diversity formulas are used in ecology to measure attributes of behavior such as diet breadth as well as species diversity, a property of organic communities. Formulas used to measure species diversity and diet breadth vary as to their disciplinary origins and appropriateness for particular circumstances. They have in common the characteristic of assessing both the richness (number of types) and heterogeneity (evenness of distribution of individuals between types) of a resource set.

For application to paleoethnobotanical data, the assumption is made that identified taxa were utilized. However, assemblage diversity is not to be considered equivalent to diet breadth. The reasons for this cautious approach are that, first, some of the plant taxa may not represent plant foods; and second, proportions of various items may not be representative of dietary importance. Subsistence importance is assumed to be represented to some extent by proportions, which are based upon ubiquity, but

enter the formula without being qualified in any way. Each occurrence of a taxon in a feature is counted as an identification. Proportions are calculated for each taxon as the percentage of total such identifications for a site. Ubiquity tables therefore readily provide the information needed. The formula used to calculate diversity is a modified version of the Simpson index (Peet 1974), in which  $D = 1 - \sum p_i^2$ , where  $p$  is the proportion of each item in the assemblage. The value of  $D$  ranges from 0 (least diversity) to 1 (greatest diversity).

Diversity indices were calculated based upon entire site assemblages, as well as within categories (nuts, fleshy fruits, crops). Results of these calculations appear in Table 22. Diversity between sites is somewhat more apparent when comparing the major categories of plant resources. Fleshy fruits show a wider range of values (.69 to .89) than overall diversity, but again temporal and spatial patterning are not evident. The Fredricks site does have an unusually high diversity of fleshy fruits at .89. Diversity of nut types similarly shows no evidence of patterning temporally or regionally. Of the three categories, cultigens show the lowest diversity. Since maize is always the highest-ranked cultigen, low diversity largely reflects the dominance of maize, although number of cultigen taxa is also expressed. Again, however, between-site variability is not correlated with temporal or spatial position. The lowest diversity of cultigens is found at two Late Prehistoric sites

Table 22. Diversity of Plant Resources Represented  
Archaeologically

Phase/Site	Plant Resource Group			
	All Plant Re- sources	Nuts	Fleshy Fruits	Cultigens
<u>Late Prehistoric</u>				
Holt	0.91	0.66	0.78	0.61
Powerplant	0.82	0.65	0.64	0.32
Kluttz	0.85	0.66	0.63	0.34
<u>Protohistoric</u>				
G. Rogers	0.89	0.69	0.73	0.54
E. Rogers	0.88	0.63	0.70	0.49
Wall	0.88	0.57	0.73	0.32
<u>Historic</u>				
Mitchum	0.84	0.61	0.73	0.33
Fredricks	0.92	0.62	0.89	0.44
Lower Saratown	0.87	0.70	0.71	0.35
Klutz	0.89	0.73	0.78	0.38

Note: Diversity calculated using a modified Simpson index.  
Values range from 0 (low) to 1 (high).

(Powerplant, Klutz), one Protohistoric site (Wall) and one Historic site (Mitchum).

In general, assessment of plant resource diversity does not indicate any directional trend. Cultigen diversity is quite low at most of the sites, due largely to an emphasis on maize. Higher cultigen diversity can be attributed to inclusion of Eastern Tradition crops such as sunflower and sumpweed. Consideration of maygrass and little barley as cultigens raises cultigen diversity to a fairly high level for some sites. However, this variation occurs by site but not by drainage or temporal position. Throughout the sequence, diversity of fleshy fruits and mast resources is moderately high for all sites. As with values calculated for all plant resources, the major plant resource categories show no evidence of directional change in diversity.

#### ROLE OF INTRODUCED PLANTS

So far, characteristics of the plant resource base that have implications for diet composition (resource number and type, diversity) have been examined without much reference to introduced plants. Europeans did introduce a number of plant species, including many domesticates, to North America (Hendry 1934; Sauer 1971; Crosby 1972, 1986). Some of these plants were adopted by native populations, with various implications for change in traditional subsistence. In some regions, adoption of new grain crops and livestock

transformed aboriginal subsistence despite the persistence of many traditional crops and farming techniques. For the northeastern Piedmont, only two such introductions have been identified archaeologically, peach and watermelon. These plants represent added resources and thus expansion of the plant resource base. However, it is hypothesized that in the Piedmont the plant species adopted were those that fit comfortably into the existing plant management system, acting as additions to but not replacements for traditional plant foods. Such a tendency would help to explain why Piedmont groups seem not to have adopted other European crops if in fact they were made available.

### Peach

Peaches were first introduced to the Southeast by the Spanish, who grew them at missions in Florida and Georgia in the sixteenth and seventeenth centuries (Sheldon 1978:1). Peach pits are commonly found archaeologically at mission sites of this time period (Ruhl 1988). The earliest archaeological evidence of peach in the Southeast comes from a well at St. Augustine utilized between 1594 and 1623 (Sheldon 1978:5). Later seventeenth and eighteenth century aboriginal sites in Alabama, Georgia, Florida and North Carolina also have produced peach pits.

Early documents from La Florida mention a number of crops, including peach, that were brought to the New World by Spanish colonists (Ruhl 1988). By the time the English

had begun their later explorations of the coastal regions of South Carolina and Georgia in the mid-seventeenth century, peach trees were growing in considerable numbers (Salley 1911c:44; Salley 1911d:100). Near Charles Town in 1682, Thomas Ashe noted that "The Peach Tree in incredible Numbers grows Wild" (Salley 1911b:143). Beverley reports peaches growing near villages and dried for storage (Wright 1949:181). Later observers, such as Bartram (Van Doren 1928:46, 251, 326) make frequent mention of peach trees growing alongside plums and mulberries (as well as figs and oranges in warmer climates) in Indian old fields and "orchards".

There is evidence that peaches reached some interior aboriginal groups before Europeans made direct, sustained contact with them. This notion is supported by statements made by Indians to European travellers that peaches were indigenous. Lawson, for example, expresses curiosity about "one sort of this Fruit, which the Indians claim as their own, and affirm, they had it growing amongst them, before any Europeans came to America" (Lefler 1967:115). Differences in fruit and seed between Indian-grown and other sorts of peaches lead him to suspect that peach is "a spontaneous Fruit of America" (Lefler 1967:115). However, Lawson also observed that peaches did not grow "in the Woods" in areas inhabited by the English, and that more remote Indian groups only had this one distinctive sort, the "Indian-peach" (Lefler 1967:116), which led him to question

its indigenous character. Beverley also believed peaches, and nectarines, to be "Spontaneous some-where or other on that Continent; for the Indians have, and ever had greater variety, and finer sorts of them than the English" (Wright 1947:315). Later in the eighteenth century, Kalm heard from travellers to the Mississippi valley that "the woods there abound with peach trees which bear excellent fruit, and that the Indians of those parts say that the trees have been there since time immemorial" (Benson 1987:416).

A diffusion pattern involving middleman trade can be proposed to account for the Indians' belief that peaches were native and the fact that they seem to have been naturalized before English settlement of the interior Southeast. The Spanish first introduced peaches to the continent, so the peach trees found by Hilton and others already on the Carolina and Georgia coasts presumably originated from stock grown in mission gardens. The precise method by which peaches were transmitted from Europeans to Indians, whether as fruits or seeds, is not known. However, it is entirely possible that the seeds or fruits made their way into the interior Southeast by way of trade with Indian middlemen as did other trade items (Waselkov 1986b). Lack of face-to-face contact with the European dispersal agents would explain the frequent insistence that peaches preceded Europeans. Dispersal of Spanish peach stock to the interior would also explain the differences Lawson noted between English and Indian peaches.

The ecological requirements and reproductive strategy of the peach plant also contributed to its spread somewhat independently of direct interethnic contact. Like fruit trees in general, peach produces better in open habitats and therefore was well-adapted to the forest edges, thickets, and other open lands around Indian settlements. Peach is similar to weeds in its tendency to colonize such disturbed habitats, thus allowing for its dispersal independently of intentional planting by humans. Lawson remarks that discarded peach seeds "come up so thick from the Kernel, that we are forced to take a great deal of Care to weed them out; otherwise they make our Land a Wilderness of Peach-Trees" (Lefler 1967:115). Although undoubtedly exaggerated as a lure for prospective settlers (as is his assertion that most of the trees' limbs break with the weight of the fruit), the colonizing ability of peach trees, often sprouting from discarded seeds, is well known.

Fruit productivity and short generation time, as well as spontaneous growth, would have made peaches attractive resources to aboriginal groups. Peaches bear fruit within three to five years after germination. The short period between seed germination and production of the next generation surely facilitated migration of this species by way of dispersal of the fruit by humans. Short generation time would also have made management through weeding, planting, and protection profitable. Husbandry of peach trees would have been even more likely to take place if

founded upon an existing arboriculture tradition. But even if not cared for, peach was a prime candidate for adoption in the aboriginal Southeast due to their palatability, productivity, and colonization ability.

In the study area, peach pits were recovered from Historic sites in all three drainages (Fredricks, Mitchum and Upper Saratown). No Protohistoric sites produced peach pits, but these sites also produced few or no trade goods. Also, only a Late Saratown phase component produced peach pits in the Dan drainage. The Middle Saratown component at Lower Saratown, which is contemporaneous with the Mitchum site, produced no evidence of peach despite a thorough search of waterscreened material in 1/2 in and 1/4 in size classes. In contrast, 21.2% of Mitchum site features contained some peach pit, totalling 0.82 g. Peach pit is even more ubiquitous and abundant at the Fredricks site, appearing in 48.1% of features and totalling 8.69 g.

Access to European trade networks and familiarity with trade goods is therefore associated with all sites that produced peach pits. This fact indicates that, despite the weediness of peach and its minimal care requirements as a crop, it was transmitted via the same networks as European artifacts. Different degrees of trade interaction at sites of the same time period might be assumed to account for the absence of peach from sites such as Lower Saratown, where it would be expected to occur given its temporal position. If this explanation were accurate, sites without peaches would

have fewer trade goods than sites with them. The trade goods assemblage at Lower Saratown is in fact composed exclusively of glass and brass beads, items typically associated with early exchanges. But the contemporaneous Mitchum site, which in contrast to Lower Saratown did produce peach pits, has a similar assemblage of trade goods. A recently discovered earlier component at the Fredricks site seems to duplicate this pattern. Thus differences in the mere presence of trade goods or the inferred volume of trade with Europeans do not appear to provide adequate bases for prediction of the presence of peach pits in archaeological assemblages. Instead, the hypothesis that access to different trade networks explains the earlier appearance of peaches in the Eno and Haw drainages will be explored in the next chapter. An alternative explanation for the absence of peach from Lower Saratown, that peaches were known but not utilized, seems unlikely because historically peaches were readily adopted by aboriginal groups everywhere (as they were, in fact, elsewhere on the Dan River at Upper Saratown some decades later). The absence of peach pits from the Klutz site, on the other hand, is probably due to the brief occupation of the site.

#### Watermelon

Watermelon is a cucurbit of African origin. It was introduced to the Southeast by Spanish colonists. Historical sources place its introduction as early as 1576

based on records from the colony at Santa Elena on the South Carolina coast (Blake 1981). The presence of watermelon on the Atlantic coast by the last quarter of the sixteenth century is confirmed by the recovery of one seed from a well at that site (Gardner 1982) and of several seeds from sixteenth century wells at St. Augustine (Reitz and Scarry 1985). Watermelon was grown inland in the province of Ocuta as early as 1597 (Blake 1981). A century later, Beverley provided a description of several types of watermelons grown by Indians on the Carolina coast that impressed him both by being "very pleasant to the Taste, as also to the Eye" (Wright 1947:141). Lawson, too, mentions "Water-melons of several sorts, very good" in his "Description of North Carolina" (Lefler 1967:83), though not specifically as Indian cultigens. He does, however, list "Melons" in his catalogue of Indian foods (Lefler 1967:182).

The ready acceptance of watermelons by Indians in the United States is attributable partly to its ability to grow as a volunteer, a characteristic it shares with the peach. The similarity of its growth and care requirements to those of familiar cucurbits also probably contributed to its spread (Blake 1981). Palatability and high water content would have made it as attractive as a summer fruit in the hot Southeast as it is today. The Lincecum Manuscript, a Choctaw folk narrative, probably echoes the response of many Southeastern groups in stating that "They were so much delighted with the watermelon that they saved every seed and

cleared large plots of ground for the next year" (Campbell 1959:16).

Watermelon seeds are less likely to be recovered archaeologically than durable items such as peach pit because of their relative fragility and the fact that watermelons would not have been dried for storage, thus exposing the seeds to fire. Watermelon rind is quite thin and unlikely to survive charring in recognizable form. Despite these obstacles to preservation, carbonized watermelon seeds have been found at a number of seventeenth to eighteenth century sites in the Midwest (Blake 1981). In the Southeast, archaeological watermelon seeds are rarer, perhaps because of the lower volume of plant remains analyzed there. Extensive analyses of plant remains from Historic Cherokee sites, however, have not produced any (Chapman and Shea 1981; Schroedl and Shea 1986).

Two sites in the northeastern Piedmont (Upper Saratow and Fredricks), however, produced one watermelon seed apiece. Like peach, watermelon is associated only with Historic period sites dating primarily to the second half of the seventeenth century (although peach may be somewhat earlier at the Mitchum site). Also like the peach, although its weediness facilitated its spread throughout the interior Southeast, some form of contact with Europeans through the medium of exchange is presupposed by its presence. In both cases, such contact could well have been indirect and originating with early Spanish colonization, a fact that

would explain the later discovery by the English of both species among interior groups.

#### SUMMARY

Responses to temporal variability and spatial heterogeneity have important consequences for diet composition. The types of plant foods used, their number, and their relative importance can be assessed using paleoethnobotanical evidence. This evidence is used to evaluate the hypotheses about diet composition proposed earlier. The main hypothesis is that a relatively diverse set of plant resources was utilized by northeastern Piedmont groups both before and after contact. A related hypothesis proposes that introduced plants were incorporated into the diet with little or no disruption of traditional plant use patterns.

These hypotheses were in part derived from ethnohistoric accounts describing a variety of plant foods utilized by Indians of the Southeast. The fact that maintaining a broad potential diet enhances a population's resistance to crises caused by failure of primary resources is also relevant to interpreting diversity in plant food remains. Knowledge of a large number of resources allows for the expansion of diet breadth following a decrease in abundance of highly-ranked resources, as predicted by the diet breadth model.

Evaluation of the archaeological record of Piedmont plant use indicates general continuity in the type and number of plant food resources. Plants of the Eastern Agricultural Tradition show a greater tendency to persist in the Eno/Flat and Haw drainages, although sunflower, at least, continued to be cultivated on the Dan River as well. Maize remained the primary plant food, although it was accompanied by other crops (beans and cucurbits) whose subsistence importance is difficult to assess. Of mast resources, hickory and acorn continued to share the dominant role, with acorn probably more important early in the Dan River sequence and throughout the Eno and Haw sequences. Diversity of plant resources was high and remained so after contact.

Adoption of introduced plants was restricted to two fleshy fruits rather than staple foods. Both peach and watermelon colonize human-disturbed habitats but do not require great inputs of time and energy when husbanded. Historical sources report their rapid spread throughout the interior Southeast, which often preceded direct European-aboriginal contact. Other European domesticates, if they were made available to Piedmont Indians, were apparently not grown by them. Some expansion of diet breadth occurred as the result of addition of these two plants. However, this expansion was more relevant to the low cost and high return of the new resources than to diminished availability of other fleshy fruits.

Thus despite some evidence of change (decreasing emphasis on acorn, adoption of introduced species, and possibly some deemphasis of Eastern Tradition plants), continuity in type, number, and importance of plant food resources is more evident than change in the northeastern Piedmont. The hypothesis that a diverse set of plant resources was maintained after European contact is confirmed by archaeological evidence. With few exceptions, plant resources retained their traditional subsistence roles. The occurrence and relative quantities of remains of watermelon and peach indicate that introduced species did, in fact, function as additions to the diet and not as replacements for other foods. The adoption of these useful (but non-staple), easily husbanded plant resources did not necessitate extensive reworking of existing subsistence patterns. The model of Piedmont subsistence emphasizing overall continuity in the face of potentially destabilizing change therefore seems appropriate based upon evaluation of hypotheses regarding diet composition.

CHAPTER VII  
DISCUSSION AND CONCLUSIONS

The preceding three chapters have been concerned primarily with the sets of related hypotheses originally proposed regarding stability and change in plant use in the northeastern North Carolina Piedmont. In general, these hypotheses regarding responses to temporal variability, spatial heterogeneity, and diet composition are supported by paleoethnobotanical evidence. Archaeological evidence confirms that many aspects of traditional plant use persisted after contact. Later patterns that do differ from earlier ones may represent the continuation of trends that were initiated prior to European contact. Aspects of the data that weaken rather than strengthen the original hypotheses have been discussed and will be explored as part of the ensuing explanation. However, evidence in support of hypothesized continuity preceding collapse so far outweighs that indicating change.

The role of explanation in this context is to account for continuity rather than change. In some respects this is a more difficult task, requiring as it sometimes does a negative approach to explanation. Factors relevant to a specific event are more easily discerned than those relevant

to its non-occurrence. Alternatively, of course, maintenance of traditional patterns should be viewed as a process rather than as the absence of change, which presents too simplistic a view. By examining continuity of subsistence patterns in the context of potentially disruptive influences it may be possible to isolate the factors that tended to counteract disruption and maintain the status quo. In this way the validity of a "Romer's Rule" model of change can be assessed.

An initial step in this direction involves evaluating the functional significance of the three aspects of subsistence isolated for study. Factors relevant to these aspects of plant use can be drawn from ecological and economic theory and are used given the assumption that humans act in large part to maximize the ratio of material gains to amount of time and energy expended in acquisition of resources. This assumption, although not always justified, is firmly based in the observation that humans do not in most instances select subsistence options that cost more and result in relatively lower returns than alternatives, although they may be maintained after they have become less appropriate than when first adopted. That aboriginal Americans were not inclined to maximize material gain is attested to by complaints that raising fur prices, rather than stimulating the volume of trade, resulted in less hunting activity by Indians, who were able to acquire the same quantity of trade goods with less effort (Bishop

1981:48-9). Indians were not immune to acquisitiveness, however; late in the eighteenth century Bartram lamented that their hunting is "indeed carried to an unreasonable and perhaps criminal excess, since the white people have dazzled their senses with foreign superfluities" (Van Doren 1928:184).

Comments of this sort might well be attributed to the Romantic reluctance to see the "noble savage" corrupted by European materialism. Frequent complaints of native "laziness", such as Adair's somewhat resentful observation that "they are so desirous of having multum in parvo, without much sweating" that they plant corn so close together as to "choak up the field" (Williams 1930:438-9), rather indicate a quite natural inclination to work only hard enough to fill perceived needs. Such statements also reflect the ethnocentric biases of the observers' society, in which toil and virtue were linked. Thus it is reasonable to assume that subsistence decisions were made in such a way as to favor choices that met community needs with relatively less expenditure of time and energy than available alternatives.

## DISCUSSION OF RESULTS

### Responses to Temporal Variability

A survey of ethnohistoric sources for the Southeast in general indicates a seasonal pattern of plant exploitation

in which most plant collecting and processing activity took place in late summer and fall. Archaeological evidence confirms this pattern. A large part of the explanation for this aspect of subsistence can be found in the environmental fact of seasonality, which constrains availability of plant resources. Even crops have growing-season requirements, since their life cycles can be manipulated only to a limited extent without greenhouses.

Scheduling of seasonal movements in accord with resource availability is a more sophisticated response than simply focusing on locally available resources. Ethnohistoric evidence of winter site abandonment for the purpose of deer hunting is abundant. Archaeological evidence for the study area is restricted to the distribution of subterranean storage features that tend to be correlated with periodic site abandonment. That some sites in the study area have many such features indicates that sites were in fact temporarily abandoned, assuming that storage pits functioned to conceal food. A winter hunt pattern, with an intended return in springtime to stored resources, is the most plausible explanation of this pattern.

Evidence of long-term change in this inferred scheduling is unclear. For the Eno and Haw drainages, evidence of seasonal site abandonment is apparent both early and late in the sequence, with a possible hiatus in the Protohistoric. In the Dan drainage, seasonal site

abandonment seems to have been maintained from the Late Prehistoric into the Historic. Thus there is no evidence of unidirectional change in this aspect of subsistence in either subarea.

This aspect of the subsistence system obviously continued to function after introduction of European trade goods and the acceleration of the deerskin trade throughout the Southeast. Artifactual evidence indicates that Historic period aboriginal villagers were involved in trade networks either directly or through native middlemen. Those communities not functioning in this intermediary capacity themselves probably were hunting deer specifically for the trade. Various historical sources do in fact allude to the time and energy devoted to deer hunting for skins, often with carcasses left to rot and sometimes resulting in local depletion of deer populations (Van Doren 1928:181; Wright 1949:154-5; Lefler 1967:65; White 1983:87; Merrell 1982).

Zooarchaeological evidence does not indicate any increase in time and energy devoted to deer hunting in the Historic period in the northeastern Piedmont (Holm 1987). This fact, along with the maintenance of scheduling of the annual hunt, attests to the incorporation of trade-related hunting into existing patterns. Adequate skins for perceived needs (both subsistence and trade-related) were apparently obtainable on the winter hunt. Alternatively, the length of the hunt may have been extended on either end

(Wright 1981:172), or accomplished by small forays, neither of which would be traceable archaeologically.

The apparent lack of any shift in scheduling due to involvement in the deerskin trade might be otherwise explained by the temporal patterning of the deerskin market itself. Emphasis in the aboriginal/European trade was upon slaves rather than deerskins before the eighteenth century. It was only in 1708 that English interest in the Southeast shifted from slaves to deerskins (White 1983:47). The slave trade in the Southeast was at its peak between 1680 and 1730, being superseded by the South Carolina deerskin trade, although the Virginia skin trade was active before 1730 (Wright 1981:141, 172). In 1700 in central Alabama, the greatest traffic with the English was still in slaves (Waselkov 1986b:7).

The latest sites in the study area, Fredricks and Upper Saratown, date to not later than about 1710. Thus it is possible that even these late villages were more involved with traffic in slaves than in skins, although commerce between the Virginia traders and Piedmont groups apparently was only occasionally in slaves (Merrell 1987:24). At any rate, the disruption of scheduling did not occur, whether because deer were not being hunted specifically trade or simply because hunting for purposes of trade could be comfortably incorporated into the current subsistence pattern.

Despite the lack of evidence of unidirectional change, the Eno and Haw sequence shows a pattern of change in seasonal movement that deserves some attention. Prehistoric and Historic sites show more evidence of periodic abandonment in the form of subterranean storage pits than do Protohistoric sites. Assuming that this pattern is significant and reveals scheduling variation, change is implied. The Protohistoric period is characterized both by lack of direct contact with Europeans, and, in many areas, depopulation resulting from Old World pathogens. In the Historic period, aggregation of remnant groups was common (M. Smith 1987:59) and allowed for community sizes large enough to facilitate maintenance of traditional subsistence and social activities. This phenomenon provides an example of the operation of Romer's Rule, change in the form of amalgamation of different ethnic groups and various social adjustments being accepted as the cost of continuation of a group size effective for carrying out traditional activities.

In the Eno/Haw sequence, severe depopulation may be relevant to explanation of the temporary abandonment of preexisting scheduling patterns. Its establishment as a relevant factor is securely based upon correlation. However, the existence of more severe depopulation in the Protohistoric than the Historic is based largely upon evidence from outside the study area (Dobyns 1983; Ramenovsky 1987), some of which has been contested (Henige

1986). Thus the following explanation should be regarded as an hypothesis until the factor of depopulation can be established for the sites in question.

How might a drop in population have interacted with subsistence needs in such a way as to render seasonal site abandonment impossible, unnecessary, or costly? Smaller groups travelling together would make subterranean storage more likely, assuming that villages were left completely uninhabited. This interpretation, however, assumes return to the original site after a short period. Smaller groups might have more effectively exploited available resources by remaining at a single location year-round, then abandoning the site completely. This situation would favor above-ground storage of staple foods, which is generally preferable and safer given a resident population to ensure its protection.

Storage continued to be used to temporally extend the availability of plant resources, whether or not site abandonment took place. There is little archaeological evidence to indicate that nuts and maize became scarce early in the warm season of the year, a fact that may be attributable simply to good planning the previous year. The site that does show a strong correlation between unusually low quantities of nutshell and maize and a strong spring-early summer seed profile (Mitchum) is also unusual in producing large quantities of starchy grains (maygrass and little barley). Given the correlation between these aspects

of the data, the sparsity of staple foods is probably relevant to the unusual abundance of the starchy grains. The reliance on maygrass at Mitchum is best explained as a response to unanticipated food shortage.

The diet breadth model predicts that as higher ranked resources become relatively scarce in the environment, encounter rate decreases and associated costs increase. Diet breadth is expanded to include lower-ranked resources when their associated costs become lower relative to these highly ranked (but relatively scarce) resources (Winterhalder 1980:25). This model is applicable to the role of cool-season grasses, which are most abundant in seasonal deposits formed when important crop plants (such as maize) were available only as stores from the previous harvest.

In the northeastern Piedmont, the cool-season grasses (little barley and maygrass) were retained at least as secondary foods for seasonal or unexpected food shortages. Their utility as buffers against famine, their minimal care requirements, and their nutritional characteristics explain the occasional appearance of starchy and oily grains archaeologically in late sites in the Piedmont. Continuity of responses to temporal variability in resource abundance is indicated by these findings.

### Responses to Spatial Heterogeneity

Evaluation of habitat preferences of the taxa found on Piedmont sites confirms the hypothesis that exploitation of disturbed and managed plant communities characterized subsistence in the Late Prehistoric, Protohistoric, and Historic periods. There is little indication of change in the nature or extent of anthropogenic disturbance or in utilization of different plant communities by human populations. The presence of metal agricultural tools is not associated with any paleoethnobotanical evidence of increased disturbance. The chronological distribution of maypops seeds does indicate that this plant's preferred habitats (fields, clearings, and other open habitats) were more abundant in late Protohistoric and thereafter than they were earlier.

The emphasis upon anthropogenically disturbed habitats can be explained largely in terms of the time and energy costs of exploiting different types of plant communities. It has been noted that most plants, including mast-producing hardwoods, are more productive in the open than in closed-canopy or partial shade situations (Munson 1986; Yarnell 1982). Thus in relatively open habitats, transportation and collecting costs will be reduced compared to less productive communities. In addition, larger size and greater nutritional and caloric content of individual items such as fruits would increase net energy gain compared to a similar enterprise conducted in a less favorable habitat.

Agricultural fields and gardens present a special case of enhanced productivity. Planting can increase the productivity of a given unit of land many times over what it might provide for human consumption otherwise, but costs increase also. Domestication generally enhances the properties of the domesticate that favor its mutualistic relationship with humans (Rindos 1984). These traits tend to be ones that stimulate consumption (and consequent dispersal) of the plant by humans, such as caloric and nutrient content, propagule size, and palatability. Much of the gain is offset by time and energy devoted to managing the artificial ecosystem created as a part of agricultural production. However, agricultural production also reduces search costs by keeping resource location predictable, and probably also collection costs by packing resources relatively tightly within the patch.

Cost concerns thus render use of agricultural, and other anthropogenically disturbed, plant communities an effective strategy in many contexts. Continuation of such a pattern in the Piedmont should thus be no surprise, given the continued availability of disturbed plant communities. This apparent continuity contrasts, however, with results of historical research elsewhere in the East. For instance, the paleoethnobotanical record does not provide evidence of changes in the environmental mosaic in the Piedmont such as occurred in New England, where depopulation resulted in loss of much old field habitat, which eventually reverted to

forest (Cronon 1983:91). In Choctaw country, a similar pattern of depopulation in river valleys opened up abandoned lands, kept open by burning, to deer (White 1983:10). Consolidation of villages left abandoned fields in the South (Wright 1981:101).

Perhaps the paleoethnobotanical record should not be expected to reveal such changes, reflecting as it does utilization of plants but not of animal resources (which would also indicate utilization of certain habitats). Frequencies and quantities of plant remains may not be sensitive enough to vegetational variability to be used to assess it. But assuming that the interpretation of continuity in the overall distribution of disturbed plant communities is correct, a relevant factor appears to be the lack of Euroamerican settlement within aboriginal catchment areas, which contrasts with the cases of the Choctaw and New England.

In the North Carolina Piedmont, White settlement did not commence until about 1740, when a few families settled along the Eno and Haw Rivers. By the early 1750s over 800 immigrants had appeared along the Yadkin, Catawba and Eno Rivers. Orange County was founded in 1753 (Robinson 1979:176). So, at the time the latest of the northeastern Piedmont sites were occupied, local White settlement was still decades away. The proximity of European settlement and the accompanying environmental disturbances that altered

the vegetational mosaic in other regions were not operating as agents of change in the Piedmont.

Some evidence of an increase in anthropogenic habitat area is provided by the occurrence and frequency of maypops in Piedmont assemblages. Opening up of more agricultural land seems to be indicated by this finding. Judging by evidence from the Southeast as a whole, this trend in the frequency of maypops seeds and of other indicators of disturbance in the archaeological record began as early as the Late Archaic. Thus there is no reason to suppose that European contact had anything to do with continuation of this trend. In addition, European settlements were spatially distant from aboriginal villages in the northeastern Piedmont at the time Siouan Project sites were occupied. Direct interference by Whites is therefore an unlikely candidate for causing any increased environmental disturbance.

#### Diet Composition

The hypothesis that a diverse set of plant resources was maintained after contact was confirmed archaeologically. Similar subsistence importance of different major plant foods has also been inferred. Exceptions to this generalization are the adoption of two European domesticates, which were added to the existing resource set; some evidence of the diminishing importance of small grains

in the Dan drainage; and an apparent decline in the importance of acorn relative to other nut types.

Relative diversity in the resource base (generalization as opposed to specialization) has a number of advantages for human groups, particularly agriculturalists. First, maintenance of a relatively large number of resources, including some potential staple foods normally of only minor importance, acts as a risk-avoidance strategy. Piedmont groups seem to have settled on a compromise between a focus on crops (especially high-yielding maize) and inclusion of nuts in a dietary role as staples in addition to crops. This lack of narrow specialization on one or a few plant resources averted catastrophic famines, or at least moderated their severity, since in cases of crop failure alternative resources might still be available. Retention of minor grain crops, or at least knowledge of their usefulness, probably acted as a buffer against famine as well. Animal foods were also important in offsetting the effects of poor crop years; the Catawba in 1755 complained that "the near Neighborhood of the English they say drives away their Game and deprives them of the means of subsisting in such emergencies" (quoted in Merrell 1982:362).

Historical records show that in some parts of the East the resource base of aboriginal groups narrowed rather than remaining relatively broad. For instance, in New England, increased sedentism resulting from threat of attack by hostile groups placed hunting and planting range in

relatively short supply. This shortage, according to White, led to a "narrowing range of foodstuffs" (1983:102), presumably due to abandonment of some seasonally specific subsistence activities away from permanent settlements. In parts of the Southeast Euroamerican settlement near Indian communities facilitated narrowing of the aboriginal resource base by creating competition for land and game animals, as was the case among the Catawbas in the 1750s (Merrell 1982:356).

Escalation of warfare between aboriginal groups during the Historic period also affected resource diversity. Bartram, for example, speculates that concentration of villages for purposes of defense among the Creeks resulted in local scarcity of deer and bear (Van Doren 1928:181). Lawson noted a similar relative scarcity of game for one Tuscarora group he encountered, although he attributed it only to "the great Number of their People" (Lefler 1967:65).

One reason for maintenance of a diverse plant resource base among Piedmont groups can be found in the tendency of growing populations to add resources to the diet. Increase in output is accomplished by adding resources until decreasing availability of some resources or scheduling conflicts stimulate intensification of one or more resources (Christenson 1980). This model of change in the human "food niche" has been developed specifically in the context of expanding populations. The tendency for diet breadth to expand as human population grows and resource populations

decline has been documented archaeologically for both the Old World Mesolithic (Dennell 1985, Flannery 1965) and the North American Archaic (Cleland 1976). Even if population increase is proposed as a consequence rather than a cause of domesticates entering the diet, focus on domesticates is preceded by a long-term trend of diet breadth expansion (Rindos 1984). Optimal foraging theory similarly predicts that diet breadth will expand as search time increases relative to pursuit time (the situation that pertains when encounter rates of prey decrease due to declining numbers of prey individuals, subject to certain constraints) (Winterhalder 1981).

Thus expanding diet breadth is a pattern expected for the Piedmont prior to contact, at least to the extent that population was increasing at some time in the past. But if population decline due to disease and warfare took place in the Protohistoric, why would it not correspond to a narrowing of the plant resource base? Few studies have been done on the effects of sharp declines in population upon subsistence. However, there does not seem to be any compelling material reason why some resources should be abandoned in such a situation, unless group size was too small to carry out specific activities (such as surround hunting). Increases in prey populations might allow for greater specialization, but need not mandate it. Extremely costly items would surely be eliminated; however, these items would have been the last to enter the diet, and then

only under situations of extreme population/resource imbalance.

European settlement tended to alter human population/resource relationships in such a way as to cause changes in resource diversity within aboriginal subsistence systems. But in the Piedmont, competition with Whites for resources was not a factor in the Historic period, since aboriginal groups dispersed or were largely assimilated by the time of permanent Euroamerican settlement.

The question of resource diversity also has relevance to the retention of Eastern Agricultural Tradition grains within the Piedmont subsistence system after contact. Although not abundant at any of the other sites studied, their inclusion at all in a relatively productive maize-based agricultural system merits some consideration. The indigenous starchy and oily grains show some tendency to diminish archaeologically in later time periods, particularly in the Dan drainage. The same can be said of the Historic period in the Eno and Haw drainages if Mitchum is excluded as an exceptional case. However, the productivity of all those considered here as cultigens (sunflower, sumpweed, little barley and maygrass) is much less than that of maize. Figures on harvest rates are not available for little barley and maygrass. However, harvest yields for maize in kg/ha have been estimated in one case at 1250, as compared to 350 and 295 for sunflower and sumpweed, respectively (Asch and Asch 1978:314). Estimates of

prehistoric maize yields are difficult to calculate, but B. Smith (1987a) finds a range of 358 to 1344 kg/ha reasonable based upon data from the Upper Missouri region. Harvest yields for little barley and maygrass are probably closer to those for cultigen populations of Chenopodium berlandieri, which have been estimated at 500 to 1000 kg/ha (B. Smith 1987a:48).

Thus, even though maize has greater harvest yield potential, its yield estimates overlap those of the Eastern Tradition grains. In addition, nutritional qualities of these minor grain crops are different in many respects from those of maize, despite the overall similarity in carbohydrate content of maize and starchy grains. For instance, maygrass is high in rather low-quality protein and is a rich source of thiamin and dietary iron (Crites and Terry 1984). Sunflower and sumpweed both are high in fats and low quality protein (Asch and Asch 1978; Buikstra 1983).

Indeed there are additional examples of retention of starchy or oily Eastern Tradition plants both in North Carolina prehistory and at Historic sites elsewhere in the Southeast. At the Late Woodland Donnaha site three cultigen-size sumpweed seeds were recovered along with abundant maize and evidence of common bean and cucurbits (Mikell 1987). At the mid-sixteenth century Berry site (31Bk22) in the southwestern Piedmont, abundant maize is associated with little barley and large numbers of chenopod seeds (although occurrence of many other types of weed seeds

raises the possibility that the starchy grains were weeds on the site rather than crops) (Gremillion 1989b).

A similar situation was found at the Historic Creek village of Fusihatchee in central Alabama where little barley, chenopod, and weed seeds were found in association with maize, bottle gourd, pepo, common bean, and two European-introduced plants [peach and cowpea, Vigna unguiculata (L.) Walpers] (Gremillion 1989c). In the Tellico Reservoir of eastern Tennessee, Cherokee sites have produced chenopod, sunflower, sumpweed, maygrass, maize, common bean, pepo and the introduced species peach, cowpea, and field pea (Pisum sativum L.) (Chapman and Shea 1981).

It is apparent that maize would had to reach an exceptionally high level of productivity to have supplanted starchy and oily grains as staples (B. Smith 1987a) and that it should not be expected to replace them completely. In fact, it seems to have been the case in the East in general that maize was added to plant resources and incorporated into an existing agricultural system (Rindos and Johanessen 1988; B. Smith 1985a; Gremillion and Yarnell 1986). Although competing activities related to maize agriculture caused the importance of less-productive grain crops to diminish eventually, there is no reason to suppose that they would be dropped from the diet entirely. The fact that Sonoran groups continued to sow wild grasses, which required minimal care, even after the introduction of maize, beans, and squash, illustrates this possibility (Doebley 1984:62).

The issue of relative contribution of various plant foods to subsistence mostly presents the challenge of explaining maintenance of old patterns rather than change. The continuing importance of maize and nuts and continued utilization of a number of fleshy fruits, as well as apparent fluctuations in the relative importance of acorn, can be examined with reference to other paleoethnobotanical data from outside the study area. Where plant use patterns retained similar features, relevant explanatory factors can be sought in aspects of European-aboriginal interaction and in other cultural and historic variables.

Maize appears to have retained its primary role after contact throughout the East, even after use of a variety of introduced crops became commonplace. Statements of European observers, as well as archaeological data, attest to this fact. Postcontact sites in the Southeast typically contain a high proportion of maize kernels and cupules among plant food remains; Table 23 lists a few examples along with comparative figures from Historic period sites in the Piedmont. Maize percentages vary a great deal at Piedmont sites, as previous analyses have shown, but not directionally. Data from the Tellico Reservoir in the lower Little Tennessee River valley show high maize percentages from the Late Mississippian Dallas phase as well as the Cherokee period (Table 23). If any change took place in maize production after contact, it was in the positive direction, judging by the typically high percentages for

Table 23. Plant Remains from Selected Late Prehistoric and Historic Sites

Location/ Site	Period	Maize (% of Plant Food Remains)	Maize Ubi- quity <sup>1</sup>	<u>Percentage of Identified Nutshell</u>				Acorn: Hickory <sup>2</sup>
				Hick- ory	Acorn	<u>Jug- lans</u>	Hazel- nut	
<u>CENTRAL ALABAMA</u>								
Fusihatchee 1EE191 (Gremillion 1989c)	Proto- historic (1680-1710) Late Creek (ca. 1785)	24.7 40.6	89.5 78.6	96.6 98.5	2.2 1.1	1.2 0.4		1.10 0.50
<u>EASTERN TENNESSEE</u>								
Tanassee 40Mr2 (Schroedl & Shea 1986)	Cherokee (ca. 1710- 1745)	49.5	87.1	69.7	0.2	30.0	tr	0.16
Toqua 40Mr6 (Chapman & Shea 1981)	Dallas phase	36.2	?	87.0	2.9	10.1		1.70
<u>WESTERN NC PIEDMONT</u>								
Berry 31Bk22 (Gremillion 1989b)	Late Pre- historic (ca. 1500?)	39.4	100.0	68.9	26.7	4.5		20.00

Table 23 continued

Location/ Site	Period	Maize (% of Plant Food Remains)	Maize Ubi- quity <sup>1</sup>	<u>Percentage of Identified Nutshell</u>					Acorn: Hickory <sup>2</sup>	
				Hick- ory	Acorn	<u>Jug- lans</u>	Hazel- nut	Chest- nut		
<u>NORTHEASTERN NC PIEDMONT</u>										
Mitchum 31Ch452	Mitchum phase (1620-1670)	7.9	57.6	89.3	5.1	5.7				2.84
Lower Saratown 31Rk1	M. Sara- town phase (1620-1660)	44.0	53.8	85.5	0.7	13.4	0.1	0.3		0.41
Upper Saratown 31Sk1a (Wilson 1985)	L. Sara- town phase (1660-1710)	37.5	91.7	96.2	1.4	2.2	0.1			0.75
Klutz 31Sk6	L. Sara- town phase (1660-1710)	12.6	75.0	95.6	1.2	3.2				0.62
Fredricks 31Or231	Fredricks phase (1670-1710)	23.2	84.6	95.2	3.2	1.6				1.67

<sup>1</sup>Calculated as percentage of contexts in which an item occurs.

<sup>2</sup>Grams acorn shell x 50/grams hickory shell.

late sites. Mitchum is unusual in this regard, but other paleoethnobotanical evidence from this site indicates that at least some of the deposits represent activity at a specific time of year.

What explains this continued reliance on maize? Productivity relative to other crops, both traditional and novel, has been mentioned previously. Its degree of adaptation to local environmental conditions as well as cultural valuation of maize assured its continued importance. Material considerations led Euroamericans to take on maize as an important crop rather than transmitting their own domesticates, which were largely unsuitable for the growing conditions they found in the East. The same characteristics (i.e., productivity, drought resistance, and adaptation) that facilitated the adoption of maize by Europeans made its retention by aboriginal groups a cost-effective decision.

Mast resources remained important too, although a shift in the direction of less utilization of acorn can be detected for the Piedmont. In the Dan drainage, it diminishes greatly in the archaeological record after the Late Prehistoric, being supplanted in importance largely by hickory and maize. In the Haw and Eno/Flat drainages, acorn seems to have remained the most important of the nut types, or at least codominant with hickory, throughout the sequence. However, its relative importance seems to have decreased.

A similar decline in the utilization of acorn relative to other nut types is apparent elsewhere in the Southeast. In the Tellico Reservoir, the acorn-hickory ratio is 1.7 at the Dallas phase Toqua site but only 0.2 at the Cherokee site of Chota (Table 23). Other values for the acorn:hickory ratio from Cherokee sites are extremely low, including Citico (40Mr7), less than 0.1; Wear Bend (40Ld107), 0.4; and Tomotley (40Mr5), 0.2 (Chapman and Shea 1981). Fusihatchee shows a decrease in the dominance of acorn over hickory between earlier and later components at the site. In some cases, such as the Dallas phase compared to Cherokee components, the difference is slight. However, in the Piedmont it is often quite dramatic, with Late Prehistoric values as high as 15.6 (Holt), 22.8 (Edgar Rogers), and 15.9 (Powerplant).

In general, sites with acorn:hickory ratio values lower than one are Historic period sites. However, a survey of data from a large number of Southeastern sites indicates that the relative decline in acorn began in the Mississippian, when it was largely replaced by maize (Yarnell and Black 1985:97). Why did this replacement process not affect all nut types equally? Probably all important plant foods, including hickory and small grain crops, were displaced to some extent as maize came to appropriate increasing amounts of time and energy on the part of human communities. Acorn, where it was in fact the most important plant food, had more subsistence importance

to lose, which renders its decline more dramatic. In addition, acorn, as important as it was earlier, has two important traits that may have favored its relatively rapid replacement by maize.

The first of these traits is acorn's nutritional similarity to maize. Like maize, it is relatively high in carbohydrates; it is low in fat and protein compared to hickory nuts and walnuts (Buikstra 1983:5). For instance, protein percentage (dry weight) of several species of oak ranges from 6.1% to 8.5%; for hickories, values range from 13.3% to 16.0%. Protein content of maize is comparable to acorn at about 8.9%. Carbohydrate percentages are also more similar between maize (70.2%) and acorn (61.8% to 83.2%) than either is to hickory (8.8% to 9.7%). In addition to being relatively high in protein, hickory nuts are high in fat (70.0% to 72.7%). Considering the fact that maize and acorns contain similar proportions of carbohydrates and protein, the substitution of one for the other is at least nutritionally feasible (Petruso and Wickens 1982:370; Talalay et al. 1982:344; B. Smith 1987a:50).

The other relevant property of acorns that favors their replacement by maize is the relatively high cost involved in preparing them for consumption. Hickory nuts can be relatively quickly processed by crushing the nuts and allowing the meats to float, a process that was in fact used by Southeastern Indians. Using this method to extract the meat, a yield of between 200 and 500 grams of meat/hour can

be obtained (Talalay et al. 1982:356). Initial stages of acorn processing, including separation of meat from shells, can result in anywhere from 100 to 1500 grams/hour (Petruoso and Wickens 1982:367). However, if relative caloric content is taken into account, calories acquired per hour are in general higher for hickory nuts (about 2000 to 3600 Cal./h) than for acorns (200 to 3500 Cal./h). A very important point to consider is that these caloric returns from processing do not include the time that must be spent additionally on leaching the acorn meat to remove tannins. Therefore the only advantage of exploiting acorns instead of hickory nuts is nutritional, assuming similar transportation and collection costs.

This advantage does not hold up when comparing acorns to maize. Maize meets the same nutritional needs and does not require the additional process of leaching, although costs of processing it for consumption and storage might otherwise be similar. Harvest yield is difficult to estimate for nut crops because of the need to account for predation by squirrels and other animals. One yield estimate based upon southern Appalachian stands cut in the past is 125 lb/acre, though some other estimates are considerably higher (Petruoso and Wickens 1982:372). Maize production can be estimated at between 320 and 1200 lb/ac.

Even if maize yields more per acre than oak trees do, which reduces transportation and collection costs, it requires a greater outlay of labor per acre in field

preparation, planting, weeding and other agricultural activities. These costs are in no danger of making acorns more cost-effective to exploit if the difference between the actual yields of oak trees and the quantity of acorns available for collection by humans is considered. Based upon high-yielding bottomland stands, it is estimated that only about 10% of total mast production may be available to humans due to predation, weevil infestation, and disease. Given these factors, harvest yields of acorn at 10% of total production for forests in Louisiana and Mississippi has been estimated at 230.05 lb/acre (Keller 1987). Although this estimate is relatively high even at 10% of yield, it still does not reach the lower limit of harvest yield estimated for maize.

Replacement of acorns by maize because of superior cost-effectiveness and nutritional similarity is therefore quite plausible. Retention of acorns in the diet may be attributable to the fact that the replacement process was gradual and need not have been completed. Available time during the period when acorns became ripe, time not allocated for agricultural activities, could continue to be so utilized without appropriating time and energy from maize production. Keeping the potential plant resource base relatively broad acted as a risk-avoidance mechanism. As with small grains, occasional use would have maintained the knowledge necessary to allow for their exploitation in times of food shortage.

Thus the long-term trend of decline in acorn's importance is explicable in terms of its nutritional content and exploitation costs relative to maize. For the Tellico Reservoir, utilization of acorn peaks in the Early Woodland. The decline down to its lowest levels in the Historic period begins in the Middle Woodland (Yarnell and Black 1985), which is when maize first appears in the regional archaeological record (Chapman and Crites 1986). There is no reason to suppose that European contact was instrumental in bringing about this particular change, at least for the Cherokee area. The Piedmont sites do not have sufficient temporal depth to determine the extent of the trend to displacement of acorn. Since acorn:hickory ratios are still rather high until the Historic, some aspect of contact may be implicated. However, it is at least equally likely that maize did not increase in importance enough to begin replacing acorn until late in the Prehistoric.

Other nuts seem never to have been very important as resources in the Southeast (Yarnell and Black 1985), although walnut comes closer to rivalling acorn and hickory than chestnut, hazelnut, butternut, or beechnut. The relative unimportance of walnut as a food can be attributed to the relative costliness of processing and low abundance in the environment. Although they do not require leaching as acorns do, walnuts are not amenable to quick separation of shell from meat, as are hickory nuts. Consequently, their yield is relatively low (95 grams/hour as compared to

about 250 to 500 g/hour for various species of hickory) (Talalay et al. 1982:356). Walnuts, like hickory nuts, are high in fat but low in carbohydrates (Talalay et al. 1982:344), so hickory fills similar nutritional needs at lower cost.

In the northeastern Piedmont, although quantities of walnut shell are low relative to hickory, they are higher throughout the temporal sequence in the Dan drainage than in the Eno/Flat and Haw drainages. Forest composition, if it varied between the two areas, would have had consequences for transportation and collection costs for walnut. If more abundant near the Dan River sites, a contrast in its exploitation costs relative to hickory and/or acorn would have made it a potentially more important resource there than farther south.

In fact, walnut does tend to appear more regularly and abundantly at sites in the southern Appalachians and Ridge and Valley provinces than in the Piedmont and Coastal Plain (Gremillion 1988; Chapman and Shea 1981). However, it does not appear to be considerably more abundant in those regions (Braun 1964), being only a minor forest component in the Ridge and Valley as well as in the Piedmont (Braun 1964, Radford et al. 1968). More mountainous regions probably do provide greater area of sites favored by black walnut (well-drained slopes with rich soil). If differential transportation and collection costs are not relevant factors, processing technology might be important.

Introduction of new plants into aboriginal subsistence systems served to expand the resource base, not simply alter its components. Why were only peach and watermelon apparently added, but not grain crops? Why did they function as additions rather than as replacements? Relevant factors for explaining the role of these introduced species include cost considerations, crop adaptations, and the nature of contact with Europeans.

Both watermelon and peach are low-cost plant foods providing relatively high returns nutritionally and calorically compared to many of the other fleshy fruits utilized (Watt and Merrill 1975). Neither requires a great deal of care, once planted; and both commonly germinate spontaneously as well. Since both foods can be eaten fresh, preparation costs are minimal. Peaches can be dried for storage, a practice that added to the costs of utilizing it, but which could be accomplished with minimal additional effort, since other fruits were processed in this manner as well. Watermelon is not amenable to processing, although Kalm (Benson 1987:516) notes that they could be stored for months in the Northeast. The addition of these species to the diet was easily accomplished without displacement of other plant foods.

A related issue is the apparent lack of interest in, or lack of acquisition of, any European-introduced grain crops in the Piedmont. One reason is that throughout the Southeast, many of these Old World grains grew only poorly.

This was particularly true in the hot and humid southern Atlantic coastal region, where early attempts to grow wheat, barley, oats and rye met with little success (Ruhl 1988:3). More northerly climates proved more suitable for such crops; but maize appeared to have superior ability to resist drought and was more productive, facts which contributed to local Indians' preference for maize, though "he [the Indian] likes wheat buns as much as the Europeans do" (Kalm 1974:107). As late as the late eighteenth century, the Creeks and Cherokees did not grow wheat, barley, rye, or buckwheat, refusing to adopt plowing in the Euroamerican fashion (Swanton 1946:286).

Despite this resistance to Old World grain crops, some Southeastern groups went considerably farther than Piedmont groups in incorporating introduced species into their subsistence systems. For instance, the Cherokees and Creeks had domestic poultry, cattle, goats, and hogs as well as various introduced legumes and cucurbits, watermelons, peaches, and rice, (as well as oranges and figs in Lower Creek country) (Swanton 1946:286). Archaeological evidence of cowpea and field pea as well as peach has been found on late eighteenth to early nineteenth century Cherokee sites (Chapman and Shea 1981). Cowpea and peach were present at the Creek village of Fusihatchee as early as 1680; hogs and cattle were important sources of meat at the Creek village of Hoilethewaulee by 1736 (Waselkov 1985).

What features distinguish these populations from those of the Piedmont that might prove to be relevant to explaining the limited acceptance of introduced plants by the latter? Except for the earlier (ca. 1680-1700) component at Fusihatchee, the foregoing archaeological and ethnohistoric evidence is placed later in time than any of the Piedmont sites. This time difference allows for consideration of a number of aspects of the European presence not yet encountered by the people of the Piedmont, including competition for land and game. It was depletion of the local deer population, caused by the introduction of livestock into lands once chiefly populated by deer, and severe social disruption that led eventually to the importance of hogs and chickens for Choctaw farmers. Before that, domesticated animals were only peripheral to traditional subsistence (White 1983:99-103), much in the way that peach and watermelon functioned as dietary supplements in the Piedmont.

Proximity to European settlers, as opposed to contact primarily through traders or native middlemen, probably made adoption of a wider variety of new crops more likely. Watermelon and peach, which can act as volunteers, are much more likely to spread because of unintentional seed dispersal than domesticates such as cereal grains, whose dispersal relies upon intentional planting. Proximity to European farms would have allowed for observation of

planting, harvesting, and processing of food plants for which there was no aboriginal analog.

The presence of cowpeas at Fusihatchee is of particular interest because of their diffusion during the period of transition from middleman trade to direct trade in the interior Southeast. This occupation at the site is contemporaneous with Fredricks and Upper Saratown in the Piedmont. What distinguishes Fusihatchee that might explain the presence of this Old World domesticate there? One possibility is a difference in the source of trade goods. Although the Charles Town trade dominated in central Alabama in the late seventeenth century, some trade with the French and Spanish took place through middlemen. There is no archaeological evidence of cowpeas among the Cherokees until about a century later (Chapman and Shea 1981).

Another relevant factor is that cowpea has the same ability as peach and watermelon to act as a volunteer in open habitats. In the Carolinas, the species is naturalized to some extent, being found in fields, roadsides and waste places in the Piedmont and Coastal Plain (Radford et al. 1968:98). Thus this legume shares with peach and watermelon traits that facilitated dispersal independently of careful husbandry. Like the two fruit species, cowpea was similar in its growth requirements to domesticates with which Indians were already familiar.

Although probably not having access to as wide a trade network as the Creeks and proto-Creeks, the people of the

Piedmont apparently had sufficient indirect contact with the Spanish and/or French to allow for dispersal of watermelon and peach. There are some important differences between the Dan and Haw River drainages in the occurrence of peach that may prove to be informative about trade interactions in the two areas. In the Dan drainage, peach is restricted to one site postdating about 1670, when the Charles Town trade began and when the Virginia traders began making serious inroads into the Piedmont (Merrell 1982). On the Haw River, the Mitchum site has moderately abundant peach pit although it dates to the period 1620 to 1670, when exchange operated largely through native middlemen. Perhaps the Saxapahaw and their contemporaries living in villages along the Eno had better access to trade routes to the south during the pre-1670 period when Virginia monopolized trade with the Piedmont.

These comparisons suggest that considerable distance from English settlements, and perhaps for the Dan drainage access to a more restricted set of European trade sources, is responsible for the limited use of introduced domesticates in the Piedmont. In both Cherokee and Creek society, a wide variety of Old World crops and domesticated animals were adopted relatively late in the Historic period, after European settlement had made significant inroads into their lands. Even during the Late Creek period at Fusihatchee (1750-1780), archaeological evidence of European domesticates is limited to peach (Gremillion 1989c). Crops

accepted prior to local White settlement are restricted to those that were easily cared for, productive, and readily accessible through existing trade networks.

#### SUMMARY AND CONCLUSIONS

Originally, given what was known historically about the disruptive foci initiated by the European invasion of North America, considerable transformation of aboriginal subsistence systems during the Historic period was expected. Preliminary archaeological research in the northeastern North Carolina Piedmont resulted in the development instead of a non-aculturative model of European-aboriginal interaction. In conjunction with initial examination of paleoethnobotanical evidence, a series of hypotheses was formulated that embodied certain assumptions about human ecology and subsistence. These hypotheses reflected an expectation of relative continuity in plant use patterns from the Late Prehistoric to the Historic.

Most of these hypotheses were supported by archaeological evidence. The behavioral patterns revealed archaeologically and used to evaluate these hypotheses were examined with the aim of identifying historical and ecological factors relevant to their occurrence. Correlation of subsistence patterns inferred archaeologically with other behavioral, historical and environmental factors was sought. These so-called relevant

factors, which tend to co-occur with the patterns requiring explanation, have relatively high potential as causal elements. In some cases, continuity rather than change was the subject of explanation and was assumed to be largely independent of disruptive environmental factors such as cultural contact. The enlistment of "Romer's Rule" (conservative functions of innovation) as an explanatory concept acknowledges that continuity in subsistence may reflect change in some other cultural subsystem. In cases of obvious change (adoption of foreign crops), European contact proved to be a distinct relevant factor, although the manner of adoption required reference to other historical and ecological factors. In other cases (such as the apparent decline in importance of acorn, and continued utilization of anthropogenic plant communities) relevant factors proved to be costs not necessarily related to contact. The functional explanation of the patterns observed emphasized overall subsistence continuity.

Responses to temporal variability in the form of scheduling and food storage were maintained after contact. The winter hunt, an important seasonal event throughout the Southeast, seems to have remained important in the Piedmont, although there is some indication of a cessation of seasonal site abandonment during the Protohistoric. Plant procurement in anthropogenically disturbed and managed plant communities continued to be emphasized, although there is no evidence that these types of habitats (except perhaps

gardens and fields) increased in extent. Plant resource diversity remained high overall, although crop diversity was relatively low and largely focused on maize. A varied set of fleshy fruits, nuts, and minor grain crops were exploited. Grain crops of the Eastern Agricultural Tradition were only minor resources but remained in the diet as secondary foods, perhaps serving to offset seasonal or unexpected shortages of staple plant foods. As a group, nuts remained important, though acorn experienced a relative decline. The only introduced species used were watermelon and peach, both of which functioned as low-cost additions to the existing plant resource base.

Explanation of the changes noted rests upon comparison of data sets from both within and outside the study area to identify relevant factors. This method was applied to the adoption of watermelon and peach, and to the declining importance of acorn. Examination of data from other Historic sites revealed that for the most part, involvement of aboriginal communities with a large number of Old World crops did not commence until relatively late in the Historic period, concomitant with local settlement by Euroamericans. Thus, the limitation of Old World crops to two partly naturalized species that were easily dispersed in a casual fashion incidental to other trade contacts should be anticipated for the late-seventeenth century Piedmont. Lack of other introduced crops, especially grains, is attributed to lack of sustained social interaction with the source

populations of these crops, as well as limited access to the appropriate trade networks.

Explanation of the decline in acorn is possible without reference to aspects of European contact. Other regions of the Southeast show a similar relative decline in the importance of acorn, but this decline commences before the appearance of Europeans on the continent. It is more closely linked temporally to the entry of maize into the subsistence system in the Tellico Reservoir. Given the nutritional similarity of maize and acorns coupled with the greater yields (and perhaps greater overall cost-effectiveness) of maize production, a dropoff in exploitation of acorn is to be expected. In the Piedmont, the greatest contrast in the relative representation of acorn archaeologically is between pre-Historic and Historic sites. This fact implies a relatively late intensification of maize agriculture in the area, although some aspect of contact may be involved. However, the latter need not be invoked to provide a satisfactory explanation.

Beyond these two examples of change, explanation must focus on the maintenance of patterns rather than their alteration. Human populations do not appear to embrace change merely because the potential for it exists, although individuals may. Instead, history has shown a tendency for tradition to act as a strong force for continuity in cultural systems. Innovations may appear as part of a cultural trait repertoire without being amplified or even

maintained via intergenerational transmission or they may function to maintain the system under changed conditions. Such a pattern is probably the rule rather than the exception, unless environmental conditions favor the selection and amplification of a novel trait. All human societies represent some degree of successful adaptation. Selection is expected to operate to maintain these adaptations in the absence of environmental factors that might render them less appropriate.

A number of novel elements entered the environment of the Piedmont Indians with the arrival of Europeans. The consequences of disease (e.g., depopulation) often provided stimuli for change in settlement and social organization. This type of situation, in which the European presence stimulated change indirectly, is relevant to subsistence change as well as more direct influences. For example, disease and slave raids in river valleys resulted in a shift to upland settlement by the Choctaw (White 1983). Other stimuli for change were material, such as trade goods and domesticates. These influences required the exercising of options that have clear and relatively direct causal connections to the European presence.

But how can the "decision" not to change (or at least the act of retaining the basic elements of an existing cultural system) be explained? It certainly seems to be the case that Southeastern groups primarily chose innovative elements (such as artifacts and plants) that did not

initially require a restructuring of existing patterns. Hunting for deerskins for the trade at first fit comfortably with traditional subsistence patterns (Merrell 1982:80). Acceptance of trade goods required little acculturation early in the Historic period, though some replacement of aboriginal artifacts with European-made goods occurred (M. Smith 1987:122). Likewise in the Northeast, European tools appear to have been incorporated into existing patterns (Cronon 1983:93). In general, early relative isolation "permitted native groups of the interior to gradually absorb material culture in a selective fashion, allowing acceptable items to be integrated into their traditional socio-cultural systems" (Waselkov 1986a:3).

In some situations, however, change became inevitable. Insofar as it was possible, some Piedmont groups tended to "adapt to dramatic change while remaining securely anchored in past ways" (Merrell 1987:20). This statement does not seem to apply to the northeastern Piedmont, where cultural extinction occurred without considerable adaptation or acculturation. The pattern revealed through examination of paleoethnobotanical evidence is one of minimal impact of European influences, although some of the more subtle causal connections may have eluded this analysis. By the time European settlement in the Piedmont would have required confrontation with additional potential innovations and adaptive challenges, aboriginal sociocultural systems in the area were largely extinct.

The picture of Piedmont plant use patterns that has emerged from this study does emphasize continuity over change. However, a model in which "the initial survival value of a favorable innovation is conservative" in allowing maintenance of traditional patterns (Hockett and Ascher 1964) does not seem particularly relevant to the northeastern Piedmont. Other groups elsewhere in the Southeast who did experience extensive acculturation (e.g., the Catawbas) do in many ways exemplify this pattern. Selective incorporation of material elements was at first limited to items that had little power to transform existing sociocultural systems. Acceptance of innovations favoring maintenance of the overall cultural pattern, or of its most basic material elements, was a subsequent stage for surviving aboriginal populations. The aboriginal societies of the northeastern Piedmont seem not to have survived the initial selective/incorporative stage of confrontation with European cultures. Even for surviving groups, choices became increasingly limited and the boundaries within which this sort of conservative change was possible were exceeded. Ultimately, aboriginal sociocultural systems that retained some measure of their original identity underwent extensive modification as the price of survival.

APPENDIX

PLANT REMAINS TABLES

Table 24. Guthrie Site, Plant Remains

Context	Soil Volume (Liters)	Total Plant Remains	Wood/ Stem	Unknown	Plant Food Remains
Burial pits					
Fea. 3	10.0	1.01	0.45	0.03	0.53
Fea. 5	20.0	1.71	1.26	0.05	0.40
Fea. 8/Bu. 1	30.0	1.78	1.41	0.07	0.30
Total	60.0	4.50	3.12	0.15	1.23
Pits and basins					
Fea. 1	20.0	4.48	3.45	0.09	0.94
Fea. 2	30.0	0.13	0.12	0.01	x
Fea. 6	52.0	0.24	0.21	0.02	0.01
Total	102.0	4.85	3.78	0.12	0.95
Site Total	162.0	9.35	6.90	0.27	2.18

Note: All weights in grams; x=less than 0.005 g.

Table 25. Guthrie Site, Plant Food Remains

Context	Total Plant Food Remains	Hickory Shell	Acorn Shell	Walnut Shell	Seeds
Burial pits					
Fea. 3	0.53	0.51	x	0.02	x
Fea. 5	0.40	0.39	0.01		
Fea. 8/Bu. 1	0.30	0.29	0.01		x
Total	1.23	1.19	0.02	0.02	x
Pits and basins					
Fea. 1	0.94	0.88	x		0.06
Fea. 6	0.01	0.01			
Total	0.95	0.89	x		0.06
Site total	2.18	2.08	0.02	0.02	0.06

Table 26. Guthrie Site, Seed Counts

Context	Black Gum	Grass Family	Unknown	Total
Burial pits				
Fea. 3			1	1
Fea. 5			3	3
Fea. 8/Bu. 1			1	1
Total			5	5
Pits and basins				
Fea. 1	2	1		3
Total	2	1		3
Site Total	2	1	5	8

Table 27. Webster Site, Plant Remains

Context	Soil Volume (Liters)	Plant Remains	Wood/ Stem	Unknown	Plant Food Remains
Pits and basins					
Fea. 1	35.0	23.37	6.66	0.21	16.50
Fea. 2	10.0	2.40	1.30	0.24	0.86
Site Total	45.0	25.77	7.96	0.45	17.36

Table 28. Webster Site, Plant Food Remains

Context	Total Plant Food Remains	Hickory Shell	Acorn Shell	Maize Kernels	Maize Seeds Cupules	
Pits and basins						
Fea. 1	16.50	16.48	0.02	x	x	x
Fea. 2	0.86	0.74	0.10	0.01	0.01	x
Site Total	17.36	17.22	0.12	0.01	0.01	x

Table 29. Webster Site, Seed Counts

Context	Maize Kernels	Unknown	Total
Pits and basins			
Fea. 1	1	1	2
Fea. 2	1		1
Site Total	2	1	3

Table 30. 310r233, Plant Remains

	Fea. 30
Soil vol. (liters)	10.0
Total plant remains	7.83
Wood/stem	2.85
Unknown	0.29
Plant food remains	4.69
Hickory shell	4.05
Acorn shell	0.41
Maize cupules	x
Common bean	0.01
Seeds (grams)	0.22
Seeds (number)	
Bedstraw	94
Unid. "A"	23
Bearsfoot	6
Unknown	1
Total No.	124

Table 31. Holt Site, Plant Remains

Context	Soil Volume (Liters)	Plant Remains	Wood/ Stem	Unknown	Root or Tuber	Plant Food Remains
Pits and basins						
Fea. 1	20.0	31.30	24.17	3.58		3.55
Fea. 2	50.0	115.01	82.87	3.58	0.01	28.55
Fea. 3	40.0	32.92	25.56	1.62		5.74
Fea. 4	20.0	24.95	23.24	0.61		1.10
Fea. 5	10.0	3.45	2.58	0.13		0.74
Fea. 6	10.0	12.43	10.73	0.08		1.62
Site Total	150.0	220.06	169.15	9.60	0.01	41.30

Table 32. Holt Site, Plant Food Remains

Context	Total Plant Food Remains	Hickory Shell	Acorn Shell	Acorn Meat	Walnut Shell	Pepo Rind	Maize Kernels	Maize Cupules	Common Bean	Seeds
Pits and basins										
Fea. 1	3.55	1.92	0.67	0.48	0.02		0.19	0.04	0.01	0.22
Fea. 2	28.55	20.32	4.00		3.18	x	0.32	0.60	0.06	0.07
Fea. 3	5.74	1.05	2.84	1.00	0.72		0.04	0.05	0.04	x
Fea. 4	1.10	0.38	0.41		0.22		0.03	0.02		0.04
Fea. 5	0.74	0.67	0.03				0.03	0.01		
Fea. 6	1.62	1.31	0.03		0.27		0.01	x		
Site Total	41.30	25.65	7.98	1.48	4.41	x	0.62	0.72	0.11	0.33

Table 33. Holt Site, Seed Counts

Context	Maize Kernels	Common Bean	Sun- flower	Cheno- pod	Knot- weed	Little Barley	May- grass	Persim- mon	Bram- ble
Pits and basins									
Fea. 1	5	1		5	1		1	2	
Fea. 2	11	3	2	23					1
Fea. 3	6	2		4		1			
Fea. 4	2						1		1
Fea. 5	1								
Fea. 6	2								
Site Total	27	6	2	32	1	1	1	3	2

Table 33 continued

Context	Haw- thorn	Sumac	Black Gum	Bed- straw	Legume fam.	Grass fam.	Night- shade fam.	Rose fam.?	Un- known	Total
Pits and basins										
Fea. 1		1		1	1				11	29
Fea. 2	1				8		2		11	62
Fea. 3								1	1	15
Fea. 4			1						1	6
Fea. 5										1
Fea. 6						1				3
Site Total	1	1	1	1	9	1	2	1	24	116

Table 34. Holt Site, Ubiquity of Plant Foods

Plant food	No. of Features	% of Features
Maize	6	100.0
Hickory	6	100.0
Acorn	6	100.0
Walnut	5	83.3
Common bean	3	50.0
Chenopod	3	50.0
Sumac	2	33.3
Persimmon	2	33.3
Bramble	2	33.3
Sunflower	1	16.7
Pepo	1	16.7
Maygrass	1	16.7
Little barley	1	16.7
Knotweed	1	16.7
Hawthorn	1	16.7
Black gum	1	16.7
Bedstraw	1	16.7
Total features	6	100.0

Table 35. Wall Site, Plant Remains

Context	Soil Volume (Liters)	Total Plant Remains	Wood/ Stem	Mono- cot Stem	Un- known	Plant Food Remains	Other
Burial pits							
Bu. 1-83	15.0	4.90	4.21		0.39	0.30	
Pits and basins							
Fea. 1	10.0	0.15	0.03		0.04	0.08	
Fea. 2	10.0	0.17	0.10		0.03	0.04	
Fea. 3	13.0	13.49	12.46		0.43	0.60	
Fea. 4	28.0	3.70	3.32		0.25	0.13	
Fea. 5	10.0	1.32	0.95		0.09	0.28	
Total	71.00	18.83	16.86		0.84	1.13	
Midden	200.0	106.94	67.75	0.19	8.09	30.91	0.17 Root/tuber
Site total	286.0	130.67	88.82	0.19	9.32	32.34	0.17

Table 36. Wall Site, Plant Food Remains

Context	Total Plant Food Remains	Hickory Shell	Acorn Shell	Acorn Meat	Walnut Shell	Maize Kernels	Maize Cupules	Common Beans	Seeds
Burial pits									
Bu. 1	0.30	0.21	0.04				0.04		0.01
Pits and basins									
Fea. 1	0.08						0.06		0.02
Fea. 2	0.04	0.04							
Fea. 3	0.60	0.42	0.09	0.08					0.01
Fea. 4	0.13	0.04	0.05						0.04
Fea. 5	0.28	0.24	0.04			x			
Total	1.13	0.74	0.18	0.08		x	0.06		0.07
Midden	30.91	23.07	2.76	0.23	1.10	0.45	2.69	0.25	0.36
Site total	32.34	24.02	2.98	0.31	1.10	0.45	2.79	0.25	0.44

Table 37. Wall Site, Seed Counts

Context	Maize Kernels	Common Bean	Poke	Grape	May- pops	Persim- mon	Haw- thorn	Bed- straw	Dog- wood
Burial pits									
Bu. 1-83				1	1				
Pits and basins									
Fea. 1									
Fea. 2									
Fea. 3									
Fea. 4							1		
Fea. 5	1								
Total	1						1		
Midden	26	4	1	21	8	1	1	1	1
Site total	27	4	1	22	9	1	2	1	1

Table 37 continued

Context	Bears- foot	Legume fam.	Pink fam.	Night- shade	Un- fam known	Total
Burial pits						
Bu. 1-83						2
Pits and basins						
Fea. 1			1		2	3
Fea. 2						
Fea. 3	1				1	2
Fea. 4	1	1		1	1	5
Fea. 5						1
Total	2	1	1	1	4	11
Midden		1			26	91
Site total	2	2	1	1	30	104

Table 38. Wall Site, Ubiquity  
of Plant Foods

Plant food	No. of Features	% of Features
Hickory	6	85.7
Maize	4	57.1
Acorn	5	71.4
Walnut	1	14.3
Grape	2	28.6
Bedstraw	1	14.3
Maypops	2	28.6
Common bean	1	14.3
Poke	1	14.3
Hawthorn	2	28.6
Bearsfoot	2	28.6
Dogwood	1	14.3
Persimmon	1	14.3
Total features	7	100.0

Table 39. Edgar Rogers Site, Plant Remains

Context	Soil Volume (Liters)	Plant Remains	Wood/ Stem	Unknown
Burial pit				
Fea. 6/B. 1	20.0	9.21	6.57	0.70
Pits and basins				
Fea. 1	106.0	256.13	148.18	7.61
Fea. 2	10.0	7.33	6.02	0.47
Fea. 3	20.0	4.70	3.43	0.42
Fea. 4	10.0	6.98	4.92	0.23
Fea. 5	10.0	1.54	1.45	0.06
Fea. 7	10.0	7.80	7.19	0.21
Fea. 8	12.0	4.81	3.68	0.24
Fea. 9	10.0	1.41	1.06	0.05
Fea. 10	20.0	1.69	1.55	0.03
Total	208.0	292.39	177.48	9.32
Site total	228.0	301.60	184.05	10.02

Table 39 continued

Context	Root or Tuber	Pedicel/ Peduncle	Plant Food Remains	Other
Burial pit				
Fea. 6/B. 1	0.02		1.92	
Pits and basins				
Fea. 1	0.27	0.02	99.11	0.94 Twigs
Fea. 2	0.03		0.81	
Fea. 3			0.85	
Fea. 4	0.06		1.77	
Fea. 5			0.03	
Fea. 7			0.40	
Fea. 8		x	0.89	
Fea. 9			0.30	
Fea. 10			0.11	
Total	0.36	0.02	104.27	0.94
Site total	0.38	0.02	106.19	0.94

Table 40. Edgar Rogers Site, Plant Food Remains

Context	Total plant Food Remains	Hickory Shell	Acorn Shell	Acorn Meat	Walnut Shell
Burial pit					
Fea. 6	1.92	1.73	0.05		0.07
Pits and basins					
Fea. 1	99.11	42.01	21.13	0.48	0.32
Fea. 2	0.81	0.53	0.01		
Fea. 3	0.85	0.05	0.03		0.02
Fea. 4	1.77	1.68	0.09		
Fea. 5	0.03	0.02	0.01		
Fea. 7	0.40	0.38	0.02		
Fea. 8	0.89	0.23			
Fea. 9	0.30	0.17			0.11
Fea. 10	0.11	0.07	x		
Total	104.27	45.14	21.29	0.48	0.45
Site total	106.19	46.87	21.34	0.48	0.52

Table 40 continued

Context	Maize Kernels	Maize Cupules	Common Bean	Seeds	Grape Pedicel	Other	
Burial pit							
Fea. 6		0.03	0.01	0.03			
Pits and basins							
Fea. 1	0.11	24.26	0.10	9.67	0.01	1.02	Unid. nutmeat
Fea. 2		0.26	0.01				
Fea. 3	0.01	0.01		0.73			
Fea. 4				x			
Fea. 5				x			
Fea. 7		x		x			
Fea. 8	0.01	0.14		0.26	0.25		
Fea. 9		x		0.02			
Fea. 10	x	0.01		0.03			
Total	0.13	24.68	0.11	10.71	0.26	1.02	
Site total	0.13	24.71	0.12	10.74	0.26	1.02	

Table 41. Edgar Rogers Site, Seed Counts

Context	Maize Kernels	Common Bean	Pepo	Cheno- pod	May- grass	Grape	Persim- mon	Plum
Burial pits								
Fea. 6/Bu. 1		1			1		1	
Pits and basins								
Fea. 1	4	5	1	2		5	26	1
Fea. 2		1						
Fea. 3	1					1	7	
Fea. 4								
Fea. 5								
Fea. 7								
Fea. 8	2					25		
Fea. 9							1	
Fea. 10	1							
Total	8	6	1	2	0	31	34	1
Site total	8	7	1	2	1	31	35	1

Table 41 continued

Context	Black Bears- Gum	Bears- foot	Horse Gentian	Legume Fam.	Grass Fam.	Un- known	Total
Burial pits							
Fea. 6/Bu. 1						1	4
Pits and basins							
Fea. 1	220			8	2	45	319
Fea. 2							1
Fea. 3	1					11	21
Fea. 4						1	1
Fea. 5						1	1
Fea. 7						1	1
Fea. 8	3	1		1			32
Fea. 9			1				2
Fea. 10	1					1	3
Total	225	1	1	9	2	60	381
Site total	225	1	1	9	2	61	385

Table 42. Edgar Rogers Site, Ubiquity of Plant Foods

Plant food	No. of Features	% of Features
Hickory	10	100.0
Acorn	8	80.0
Walnut	4	40.0
Maize	8	80.0
Common bean	3	30.0
Pepo	1	10.0
Persimmon	4	40.0
Black gum	4	40.0
Grape	3	30.0
Plum	1	10.0
Chenopod	1	10.0
Maygrass	1	10.0
Bearsfoot	1	10.0
Horse gentian	1	10.0
Total features	10	100.0

Table 43. George Rogers Site, Plant Remains

Context	Soil Volume (Liters)	Total Plant Remains	Wood/ Stem	Un- known	Root or Tuber	Plant Food Remains	Other
Pits and basins							
Fea. 1	50.0	57.35	34.07	2.93	0.03	20.32	x Bud
Fea. 2	60.0	59.48	50.63	1.40	0.03	7.42	
Fea. 3	40.0	15.49	4.63	0.58		10.28	
Fea. 4	21.0	15.00	9.29	0.60		5.11	
Fea. 5	10.0	0.30	0.17	0.05		0.08	
Fea. 6	10.0	0.17	0.10			0.07	
Fea. 7	60.0	53.77	41.47	2.39	0.01	9.90	
Fea. 8	10.0	0.57	0.51	0.02		0.04	
Site total	261.0	202.13	140.87	7.97	0.07	53.22	x

Table 44. George Rogers Site, Plant Food Remains

Context	Total Plant Food Remains	Hickory Shell	Acorn Shell	Acorn Meat	Walnut Shell
Pits and basins					
Fea. 1	20.32	14.46	1.03	0.09	
Fea. 2	7.42	6.73	0.37		0.18
Fea. 3	10.28	9.24	0.10		0.10
Fea. 4	5.11		0.06		3.59
Fea. 5	0.08	0.08			
Fea. 6	0.07	0.07			
Fea. 7	9.90	7.93	0.66		0.12
Fea. 8	0.04		0.02		0.01
Site total	53.22	38.51	2.24	0.09	4.00

Table 44 continued

Context	Maize Kernels	Maize Cupules	Common Bean	Seeds	Other
Pits and basins					
Fea. 1	0.02	0.04		1.86	2.82 Hickory meat
Fea. 2	0.01	0.01		0.12	
Fea. 3	0.04	0.42		0.38	
Fea. 4	0.27			1.19	
Fea. 5					
Fea. 6					
Fea. 7	0.27	0.75	0.06	0.11	
Fea. 8		0.01		x	
Site total	0.61	1.23	0.06	3.66	2.82

Table 45. George Rogers Site, Seed Counts

Context	Maize Kernels	Common Bean	Sun- flower	Cheno- pod	Knot- weed	Grape	Persim- mon	Straw- berry
Pits and basins								
Fea. 1	1		1	1			5	
Fea. 2	1					1	2	
Fea. 3	5					1	7	1
Fea. 4	9		1				20	
Fea. 7	12	1	1		1	2	4	
Fea. 8						1		
Site total	28	1	3	1	1	5	38	1

Table 45 continued

Context	Haw- thorn	Sumac	Bed- straw	Legume Fam.	Night- shade Fam.	Un- known	TOTAL
Pits and basins							
Fea. 1	2	1		5		12	28
Fea. 2				3		2	9
Fea. 3			1	7		12	34
Fea. 4						6	36
Fea. 7				2	2	11	36
Fea. 8							1
Site total	2	1	1	17	2	43	144

Table 46. George Rogers Site,  
Ubiquity of Plant Foods

Plant Food	No. of Features	% of Features
Hickory	7	87.5
Acorn	6	75.0
Walnut	5	62.5
Maize	6	75.0
Common bean	1	12.5
Strawberry	1	12.5
Persimmon	5	62.5
Grape	4	50.0
Sumac	1	12.5
Hawthorn	1	12.5
Chenopod	1	12.5
Knotweed	1	12.5
Sunflower	3	37.5
Bedstraw	1	12.5
Total features	8	100.0

Table 47. Mitchum Site, Plant Remains

Context	Soil Volume (Liters)	Total Plant Remains	Wood/ Stem	Un- known	Plant Food Remains
Burial pits					
Bu. 1	10.0	1.92	0.70	0.20	1.02
Fea. 26/Bu. 2	20.0	1.93	1.08	0.22	0.63
Total	30.0	3.85	1.78	0.42	1.65
Pits and basins					
Fea. 1	10.0	2.42	1.53	0.05	0.84
Fea. 2	10.0	0.38	0.24		0.14
Fea. 3	20.0	1.70	1.34	0.17	0.19
Fea. 4	10.0	0.27	0.25	0.02	x
Fea. 5	10.0	2.16	1.66	0.20	0.30
Fea. 6	50.0	39.06	37.55	0.73	0.78
Fea. 8	10.0	21.84	21.66	0.14	0.04
Fea. 9	10.0	2.50	2.44	0.04	0.02
Fea. 10	10.0	13.22	12.34	0.30	0.58
Fea. 13	30.0	13.16	11.62	0.87	0.67
Fea. 14	10.0	0.91	0.62	0.09	0.20
Fea. 15	14.5	2.30	1.30	0.09	0.91
Fea. 16	26.0	8.77	6.92	0.61	1.24
Fea. 17	30.0	5.86	4.62	0.37	0.87
Fea. 18	10.0	18.94	18.71	0.12	0.11
Fea. 19	8.0	1.27	0.86	0.31	0.10
Fea. 20	10.0	3.18	2.67	0.40	0.11

Table 47 continued

Context	Soil Volume (Liters)	Total Plant Remains	Wood/ Stem	Un- known	Plant Food Remains
Fea. 21	10.0	0.94	0.17	0.13	0.64
Fea. 22	20.0	3.86	2.86	0.27	0.73
Fea. 24	20.0	8.67	8.63		0.04
Fea. 25	10.0	2.33	2.29	0.03	0.01
Fea. 28	12.5	2.37	2.10	0.10	0.17
Fea. 29	20.0	7.82	5.26	0.65	1.91
Fea. 30	10.0	1.14	1.10	0.01	0.03
Fea. 32	28.0	4.68	3.90	0.16	0.62
Fea. 33	10.0	0.48	0.48	x	
Fea. 34	10.0	0.16	0.09	0.06	0.01
Fea. 35	10.0	2.01	1.64	0.16	0.21
Fea. 36	10.0	4.60	4.19	0.17	0.24
Fea. 37	10.0	0.36	0.25	0.07	0.04
Fea. 38	20.0	3.26	2.49	0.15	0.62
Total	479.0	180.62	161.78	6.47	12.37
Site total	509.0	184.47	163.56	6.89	14.02

Table 48. Mitchum Site, Plant Food Remains

Context	Total Plant Food Remains	Hickory Shell	Acorn Shell	Walnut Shell	Peach Pit	Maize kernels	Maize cupules	Common Seeds Bean
Burial pits								
Bu. 1	1.02	0.96	0.03				0.03	
Fea. 26/Bu. 2	0.63	0.52	0.02	0.01		0.02	0.01	0.05
Total	1.65	1.48	0.05	0.01		0.02	0.04	0.05
Pits and basins								
Fea. 1	0.84	0.77	0.01			0.02	0.02	0.02
Fea. 2	0.14	0.13	0.01					
Fea. 3	0.19	0.08	x		0.04		0.07	x
Fea. 4	0.00	x	x					
Fea. 5	0.30	0.05		0.04	0.14		0.07	
Fea. 6	0.78	0.51	x		0.05	0.01		0.21
Fea. 8	0.04	0.04						x
Fea. 9	0.02	0.02						
Fea. 10	0.58	0.48				0.10		x
Fea. 13	0.67	0.28	0.24		0.08	0.07		x
Fea. 14	0.20	0.19					0.01	
Fea. 15	0.91	0.89	0.01					0.01
Fea. 16	1.24	1.20	x	0.01			0.02	0.01
Fea. 17	0.87	0.82	x	0.01			0.03	0.01
Fea. 18	0.11	0.11						
Fea. 19	0.10	0.10						
Fea. 20	0.11	0.03	0.02			0.06		

Table 48 continued

Context	Total Plant Food Remains	Hickory Shell	Acorn Shell	Walnut Shell	Peach Pit	Maize kernels	Maize cupules	Common Bean	Seeds
Fea. 21	0.64	0.55		0.09					
Fea. 22	0.73	0.57	0.03	0.11				0.02	x
Fea. 24	0.04	0.03							0.01
Fea. 25	0.01						0.01		
Fea. 28	0.17	0.04	0.06	0.01		x		0.05	0.01
Fea. 29	1.91	1.26	0.06	0.04	0.47	x	0.08		x
Fea. 30	0.03	0.03	x						
Fea. 32	0.62	0.33	x	0.21		0.01	0.06	0.01	
Fea. 33									
Fea. 34	0.01	0.01	x				x		
Fea. 35	0.21	0.10	0.03	0.07			0.01		x
Fea. 36	0.24	0.10	0.03		0.02	0.02	0.07		x
Fea. 37	0.04	0.03							0.01
Fea. 38	0.62	0.17	0.04	0.06	0.02		0.31		0.02
Total	12.37	8.92	0.54	0.65	0.82	0.29	0.76	0.08	0.31
Site total	14.02	10.40	0.59	0.66	0.82	0.31	0.80	0.13	0.31

Table 49. Mitchum Site, Seed Counts

Context	Maize Kernels	Common Bean	Sun- flower	Knot- weed	Little Barley	May- grass	Grape	May- pops
Burial pits								
Bu. 1	1							
Fea. 26/Bu. 2		1	1					
Total	1	1	1					
Pits and basins								
Fea. 1	1							1
Fea. 2								
Fea. 3								
Fea. 4								
Fea. 5	1					2		
Fea. 6	2				27	436		
Fea. 8								
Fea. 9								
Fea. 10								
Fea. 13	2					2		
Fea. 14								
Fea. 15								
Fea. 16								2
Fea. 17							1	
Fea. 18								
Fea. 19								
Fea. 20	1							

Table 49 continued

Context	Bram- ble	Haw- thorn	Black Gum	Bed- straw	Grass Fam.	Unid. A	Un- known	Total
Burial pits								
Bu. 1								1
Fea. 26/Bu. 2			1				1	4
Total			1				1	5
Pits and basins								
Fea. 1								2
Fea. 2								
Fea. 3							1	1
Fea. 4								
Fea. 5								3
Fea. 6	1			1	30	11		508
Fea. 8								
Fea. 9							3	3
Fea. 10							1	1
Fea. 13					2			6
Fea. 14								
Fea. 15							2	2
Fea. 16			1					3
Fea. 17							1	2
Fea. 18								
Fea. 19								
Fea. 20							1	2

Table 49 continued

Context	Maize Kernels	Common Bean	Sun- flower	Knot- weed	Little Barley	May- grass	Grape	May- pops
Fea. 21								
Fea. 22		1						
Fea. 24							1	1
Fea. 25								
Fea. 28	1	1						
Fea. 29	1							1
Fea. 30								
Fea. 32	1							2
Fea. 33								
Fea. 34								
Fea. 35						1		
Fea. 36	1							1
Fea. 37				1				
Fea. 38								
Total	11	2	0	1	27	441	2	8
Site total	12	3	1	1	27	441	2	8

Table 49 continued

Context	Bram- ble	Haw- thorn	Black Gum	Bed- straw	Grass Fam.	Unid. A	Un- known	Total
Fea. 21								
Fea. 22							1	2
Fea. 24								2
Fea. 25								
Fea. 28							5	7
Fea. 29							1	3
Fea. 30								
Fea. 32		1						4
Fea. 33								
Fea. 34								
Fea. 35								1
Fea. 36								2
Fea. 37							1	2
Fea. 38			1					1
Total	1	1	2	1	32	11	17	557
Site total	1	1	3	1	32	11	18	562

Table 50. Mitchum Site, Ubiquity  
of Plant Foods

Plant food	No. of Features	% of Features
Hickory	32	93.9
Acorn	21	63.6
Maize	20	60.6
Walnut	11	33.3
Peach	7	21.2
Maypops	6	18.2
Maygrass	4	12.1
Common bean	4	12.1
Black gum	3	9.1
Grape	2	6.1
Sunflower	1	3.0
Little barley	1	3.0
Knotweed	1	3.0
Hawthorn	1	3.0
Bramble	1	3.0
Bedstraw	1	3.0
Total features	33	100.0

Table 51. Fredricks Site, Plant Remains

Context	Soil Volume (Liters)	Plant Remains	Wood/ Stem	Un- known	Total Plant Food Remains	Other Remains
Burial pits						
Bu. 1	20.0	8.60	7.89	0.28		0.43
Bu. 2	10.0	0.98	0.85	0.06		0.07
Bu. 3	10.0	4.93	3.06	0.53		1.34
Bu. 4	90.0	23.58	20.13	0.80		2.65
Bu. 5	82.0	16.10	11.23	0.56		4.31
Bu. 6	65.0	7.23	4.45	0.30		2.48
Bu. 7	30.0	0.91	0.67	0.06		0.18
Bu. 8	118.0	20.51	13.37	0.86		6.28
Bu. 9	42.0	7.17	3.65	0.56		2.96
Bu. 10	20.0	5.68	4.65	0.24		0.79
Bu. 11	60.0	6.99	3.95	0.37		2.67
Bu. 13	60.0	5.77	4.63	0.20		0.94
Bu. 14	20.0	16.84	16.33	0.22		0.29
Fea. 1	10.0	5.63	4.85	0.39		0.39
Fea. 31	30.0	12.04	10.58	0.29		1.17
Fea. 49	20.0	15.18	13.34	1.18		0.66
Total	687.0	158.14	123.63	6.90		27.61
Fire pit						
Fea. 9 Zone I	40.0	17.24	4.11	0.83		12.30
Fea. 9 Zone II	30.0	10.01	3.61	0.33		6.07
Fea. 9 Zone III	70.0	113.87	51.89	2.97		59.01
Total	140.0	141.12	59.61	4.13		77.38
Wall trenches						
Structure 1	10.0	0.49	0.11			0.38
Structure 5	30.0	6.38	4.21	0.57		1.60
Total	40.0	6.87	4.32	0.57		1.98

Table 51 continued

Context	Soil Volume (Liters)	Plant Remains	Wood/ Stem	Un- known	Total Plant Food Remains	Other
Charcoal-filled pits						
Fea. 35	12.0	9.87	9.64	0.03	0.20	
Fea. 36	8.0	74.80	53.30	1.00	20.50	
Fea. 37	15.0	11.15	11.10	0.03	0.02	
Total	35.0	95.82	74.04	1.06	20.72	
Pits and basins						
Fea. 10	40.0	31.67	28.63	0.70	2.34	
Fea. 11	10.0	2.16	2.15		0.01	
Fea. 12	30.0	6.51	3.39	0.26	2.86	
Fea. 13	15.5	14.19	13.04	0.14	1.01	
Fea. 15	10.0	2.70	2.05	0.07	0.58	
Fea. 16	10.0	0.60	0.49	0.03	0.08	
Fea. 17	40.0	46.50	41.77	1.15	3.58	x Pedicel/peduncle
Fea. 18	20.0	1.11	0.27	0.11	0.73	
Fea. 19	40.0	15.24	13.23	0.50	1.51	
Fea. 20	20.0	12.45	8.55	1.17	2.73	
Fea. 23	20.0	6.40	5.30	0.27	0.83	
Fea. 24	10.0	1.85	1.37	0.13	0.35	
Fea. 25	10.0	2.65	2.59	0.06		
Fea. 28	70.0	42.93	24.41	1.99	16.53	
Fea. 29	70.0	40.75	30.10	2.88	7.73	0.04 Root or tuber
Fea. 33	20.0	7.67	6.90	0.24	0.53	
Fea. 41	50.0	54.60	40.17	3.55	10.88	
Fea. 42	40.0	14.41	11.84	1.16	1.41	
Fea. 44	60.0	140.30	86.50	2.49	51.31	x unid. bud
Fea. 45	20.0	15.04	11.25	0.82	2.89	0.08 Root or tuber
Fea. 46	20.0	17.85	16.07	0.46	1.32	
Fea. 47	30.0	38.08	34.46	0.56	3.05	0.01 Root or tuber

Table 51 continued

Context	Soil Volume (Liters)	Plant Remains	Wood/ Stem	Un- known	Total Plant Food Remains	Other	
Fea. 51	30.0	32.04	28.65	1.41	1.98	x	Root or tuber
Fea. 53	90.0	136.19	113.09	6.96	16.12	0.02	Root or tuber
Fea. 55	10.0	0.38	0.25	0.04	0.07	0.02	Root or tuber
Fea. 56	60.0	35.96	29.43	1.97	4.56		
Fea. 57	10.0	1.47	1.30	0.12	0.05		
Fea. 58	20.0	5.40	3.08	0.45	1.87		
Fea. 59	30.0	22.72	19.64	1.73	1.34	0.01	Pedicel/peduncle
Fea. 61	10.0	0.88	0.71	0.04	0.13		
Total	915.5	750.70	580.68	31.46	138.38	0.18	
Site total	1817.5	1152.65	842.28	44.12	266.07	0.18	

Table 52. Fredricks Site, Plant Food Remains

Context	Total Plant Food Remains	Hickory Shell	Acorn Shell	Acorn Meat	Walnut Shell	Jugland- aceae Shell
Burial pits						
Bu. 1	0.43	0.37				
Bu. 2	0.07	0.01	x			
Bu. 3	1.34	0.43			0.51	
Bu. 4	2.65	2.12	0.01		0.06	
Bu. 5	4.31	2.68	0.03	0.05		
Bu. 6	2.48	1.83	x		0.03	
Bu. 7	0.18	0.14	0.01			
Bu. 8	6.28	4.69	0.02		0.03	
Bu. 9	2.96	2.02	0.07			
Bu. 10	0.79	0.36	x			
Bu. 11	2.67	2.14	0.01			
Bu. 13	0.94	0.48	0.02			
Bu. 14	0.29	0.14	0.14			
Fea. 1	0.39	0.20	x			
Fea. 31	1.17	1.00	0.04			
Fea. 49	0.66	0.19	0.15			
Total	27.61	18.80	0.50	0.05	0.63	
Fire pit						
Fea. 9 Zone I	12.30	10.00	x		0.02	
Fea. 9 Zone II	6.07	4.46				
Fea. 9 Zone III	59.01	15.81	0.29		0.01	
Total	77.38	30.27	0.29		0.03	
Wall trenches						
Structure 1	0.38	0.37	x			
Structure 5	1.60	1.32	0.10			
Total	1.98	1.69	0.10			

Table 52 continued

Context	Total Plant Food Remains	Hickory Shell	Acorn Shell	Acorn Meat	Walnut Shell	Jugland- aceae Shell
Charcoal-filled pits						
Fea. 35	0.20	0.20				
Fea. 36	20.50					
Fea. 37	0.02	0.02				
Total	20.72	0.22				
Pits and basins						
Fea. 10	2.34	2.22	0.04			
Fea. 11	0.01	0.01				
Fea. 12	2.86	2.66	0.01		0.04	
Fea. 13	1.01	0.86	x			
Fea. 15	0.58	0.48				
Fea. 16	0.08	0.08				
Fea. 17	3.58	3.31	0.06		0.08	
Fea. 18	0.73	0.38	0.06			
Fea. 19	1.51	1.29	0.10		0.03	
Fea. 20	2.73	2.04	0.21			
Fea. 23	0.83	0.55	0.02		0.11	
Fea. 24	0.35	0.30				
Fea. 25	0.00					
Fea. 28	16.53	11.00	0.02		0.94	
Fea. 29	7.73	2.96	0.16		0.01	
Fea. 33	0.53	0.39	0.02		0.02	
Fea. 41	10.88	2.11	2.62	1.61	0.07	
Fea. 42	1.41	1.04	0.14		0.02	
Fea. 44	51.31	50.02	0.01			0.02
Fea. 45	2.89	2.78	0.02			
Fea. 46	1.32	0.85	0.03			
Fea. 47	3.05	2.47	x			

Table 52 continued

Context	Total Plant Food Remains	Hickory Shell	Acorn Shell	Acorn Meat	Walnut Shell	Jugland- aceae Shell
Fea. 51	1.98	1.42	0.05		0.01	
Fea. 53	16.12	8.59	0.53	4.42	0.51	0.11
Fea. 55	0.07		0.03			0.04
Fea. 56	4.56	3.70	0.03		0.07	
Fea. 57	0.05					0.05
Fea. 58	1.87	1.68	0.05		0.08	
Fea. 59	1.34	0.96	0.09			0.05
Fea. 61	0.13	0.12				
Total	138.38	104.27	4.30	6.03	1.99	0.27
Site total	266.07	155.25	5.19	6.08	2.65	0.27

Table 52 continued

Context	Peach Pit	Maize Kernels	Maize Cupules	Pepo Rind	Common Bean	Seeds
Burial pits						
Bu. 1		0.01	0.03			0.02
Bu. 2		0.02	0.01			0.03
Bu. 3		0.01	0.35	0.02		0.02
Bu. 4	0.02	0.01	0.40		0.03	x
Bu. 5	0.29	0.12	1.05			0.09
Bu. 6	0.02		0.44			0.16
Bu. 7		0.02	0.01			
Bu. 8	0.23	0.03	1.03		0.07	0.18
Bu. 9	0.30	0.03	0.51			0.03
Bu. 10	0.19	0.04	0.17			0.03
Bu. 11	0.06	0.02	0.40		0.01	0.03
Bu. 13	0.10	x	0.28		0.05	0.01
Bu. 14		0.01				
Fea. 1		0.01	0.18			
Fea. 31		0.01				0.12
Fea. 49	0.07	0.15	0.07	x		0.03
Total	1.28	0.49	4.93	0.02	0.16	0.75
Fire pit						
Fea. 9 Zone I	0.07	1.11	0.80		0.22	0.08
Fea. 9 Zone II	0.15	0.88	0.49		0.05	0.04
Fea. 9 Zone III	2.00	36.84	3.45		0.17	0.44
Total	2.22	38.83	4.74		0.44	0.56
Wall trenches						
Structure 1		0.01				x
Structure 5	0.13	0.02	0.02			0.01
Total	0.13	0.03	0.02			0.01

Table 52 continued

Context	Peach Pit	Maize Kernels	Maize Cupules	Pepo Rind	Common Bean	Seeds
Charcoal-filled pits						
Fea. 35						
Fea. 36		0.03	20.47			
Fea. 37						
Total		0.03				
Pits and basins						
Fea. 10	0.05	0.01	0.02			x
Fea. 11						
Fea. 12	x	0.01	0.08		0.04	0.02
Fea. 13	0.09	0.04	0.01			0.01
Fea. 15	0.07		x			0.03
Fea. 16						
Fea. 17		0.12	x	x		0.01
Fea. 18		0.22			0.07	
Fea. 19		0.03	0.06			x
Fea. 20	0.27	0.05	0.03			0.13
Fea. 23			0.05			0.10
Fea. 24		0.05				
Fea. 25						
Fea. 28	0.04	0.16	2.46		0.05	1.86
Fea. 29	1.26	0.52	2.74			0.08
Fea. 33	0.06	0.01	0.03			x
Fea. 41	2.11	0.42	1.57		0.08	0.29
Fea. 42		0.02	0.17			0.02
Fea. 44	0.19	0.72	0.23			0.12
Fea. 45		0.02	0.05			0.02
Fea. 46	0.16		0.23			0.05
Fea. 47		0.12	0.42			0.04

Table 52 continued

Context	Peach Pit	Maize Kernels	Maize Cupules	Pepo Rind	Common Bean	Seeds
Fea. 51	0.09	0.24	0.16			0.01
Fea. 53	0.47	0.75	0.30		0.01	0.43
Fea. 55						
Fea. 56	0.20	0.05	0.31			0.20
Fea. 57						
Fea. 58		x	0.03			0.03
Fea. 59		0.11	0.10			0.03
Fea. 61		x	0.01			x
Total	5.06	3.67	9.06	x	0.25	3.48
Site total	8.69	43.05	18.75	0.02	0.85	4.80

Table 53. Fredricks Site, Seed Counts

Context	Maize Kernels	Common Bean	Pepo Water- melon	Ama- ranth	Cheno- pod	Knot- weed	Poke Spurge	Morning Glory	Grape
Burial pits									
Bu. 1	1								1
Bu. 2	2								
Bu. 3	1								1
Bu. 4	2	1							1
Bu. 5	6		1						2
Bu. 6									
Bu. 7	1								
Bu. 8	4		1				1		1
Bu. 9									
Bu. 10	1								3
Bu. 11	2	1				1			
Bu. 13	1	2							1
Bu. 14	1								
Fea. 1	1								
Fea. 31	1								
Fea. 49	6								
Total	30	4	2			1	1		10
Fire pit									
Fea. 9 Zone I	19	3					1		1
Fea. 9 Zone II	15	1					2		1
Fea. 9 Zone III	378	4	1			17	3		18
Total	412	8	1			17	6		20

Table 53 continued

Context	May- pops	Persim- mon	Bram- ble	Huckle- berry	Elder- berry	Straw- berry	Blue- berry	Haw- thorn	Night- shade	Sumac	Vibur- num
Burial pits											
Bu. 1											
Bu. 2								1			
Bu. 3							5				
Bu. 4	1						2				
Bu. 5	1	1					1			1	
Bu. 6		2									
Bu. 7											
Bu. 8	2	5					1				
Bu. 9		1							2		
Bu. 10	1		4								
Bu. 11		1							2		
Bu. 13											
Bu. 14											
Fea. 1											
Fea. 31	2	2	1								
Fea. 49	1								1	4	
Total	8	12	5	0	0	0	9	1	5	5	
Fire pit											
Fea. 9 Zone I	4		2					1			
Fea. 9 Zone II	2							1			
Fea. 9 Zone II	20		1		1				4	2	
Total	26		3		1			2	4	2	

Table 53 continued

Context	Black Gum	Bed- straw	Bears- foot	Horse Gentian	Legume Fam.	Grass Fam.	Night- shade Fam.	Unid. A	Un- known	Total
Burial pits										
Bu. 1								1		3
Bu. 2								2		5
Bu. 3		4						2		13
Bu. 4								4		11
Bu. 5							1	2		16
Bu. 6							1	2		5
Bu. 7										1
Bu. 8					1	1	6	5		28
Bu. 9		1						2		6
Bu. 10		1						1		11
Bu. 11				1				1		9
Bu. 13					1					5
Bu. 14										1
Fea. 1								3		4
Fea. 31										6
Fea. 49					4			9		25
Total		6		1	6	1	8	34		149
Fire pit										
Fea. 9 Zone I		1					1	3		36
Fea. 9 Zone II								1		23
Fea. 9 Zone III		1			1			19		470
Total		2			1		1	23		529

Table 53 continued

Context	Maize Kernels	Common Bean	Pepo	Water- melon	Ama- ranth	Cheno- pod	Knot- weed	Poke Spurge	Morning Glory	Grape
Wall trenches										
Structure 1	1					1				
Structure 5	1									1
Total	2					1				
Charcoal-filled pits										
Fea. 35										
Fea. 36	1									
Fea. 37										
Total	1									
Pits and basins										
Fea. 10	1									
Fea. 11										
Fea. 12	1							2		
Fea. 13	2									1
Fea. 15										1
Fea. 16										
Fea. 17	3									
Fea. 18	5	1								
Fea. 19	2					1				
Fea. 20	1						1	1		
Fea. 23	1									
Fea. 24	1									
Fea. 25										
Fea. 28	4	1					2			4
Fea. 29	13						4			6
Fea. 33	1									
Fea. 41	9	1	1							13

Table 53 continued

Context	May- pops	Persim- mon	Bram- ble	Huckle- berry	Elder- berry	Straw- berry	Blue- berry	Haw- thorn	Night- shade	Sumac	Vibur- num
Wall trenches											
Structure 1											
Structure 5											
Total											
Charcoal-filled pits											
Fea. 35											
Fea. 36											
Fea. 37											
Total											
Pits and basins											
Fea. 10											
Fea. 11											
Fea. 12								1			
Fea. 13											
Fea. 15											
Fea. 16											
Fea. 17											
Fea. 18											
Fea. 19										1	
Fea. 20			1					3			1
Fea. 23			1							1	
Fea. 24											
Fea. 25											
Fea. 28	3	11	1	1				24	1		
Fea. 29		1	1					2			
Fea. 33											
Fea. 41	4		1	2				4	1		1

Table 53 continued

Context	Black Gum	Bed- straw	Bears- foot	Horse Gentian	Legume Fam.	Grass Fam.	Night- shade	Unid. A	Un- known	Total
Wall trenches										
Structure 1										2
Structure 5									2	4
Total										3
Charcoal-filled pits										
Fea. 35										
Fea. 36										1
Fea. 37										
Total										1
Pits and basins										
Fea. 10									1	2
Fea. 11										
Fea. 12									1	5
Fea. 13									2	5
Fea. 15								1		2
Fea. 16										
Fea. 17					1				2	6
Fea. 18										6
Fea. 19									2	6
Fea. 20	2								2	12
Fea. 23				1					2	6
Fea. 24										1
Fea. 25										0
Fea. 28	3	2							15	76
Fea. 29		1	1						3	32
Fea. 33					1				1	3
Fea. 41	1	3			3	2			10	56

Table 53 continued

Context	Maize Kernels	Common Bean	Pepo	Water- melon	Ama- ranth	Cheno- pod	Knot- weed	Poke Spurge	Morning Glory	Grape	
Fea. 42	4										
Fea. 44	10										
Fea. 45	1			1							
Fea. 46							2				
Fea. 47	4									1	
Fea. 51	11				1					2	
Fea. 53	13	1					1			11	
Fea. 55											
Fea. 56	4									1	
Fea. 57											
Fea. 58	2									2	
Fea. 59	3									1	
Fea. 61											
Total	96	4	1	1	1	1	9	2		2	43
Site total	541	16	4	1	1	19	10	8	1	2	73

Table 53 continued

Context	May- pops	Persim- mon	Bram- ble	Huckle- berry	Elder- berry	Straw- berry	Blue- berry	Haw- thorn	Night- shade	Sumac	Vibur- num
Fea. 42											
Fea. 44		2		2							
Fea. 45						1				1	
Fea. 46						2		1			
Fea. 47	1		1								
Fea. 51											
Fea. 53	19		1	7	2		1			3	
Fea. 55											
Fea. 56		1	1	1	1				1		
Fea. 57											
Fea. 58	1	1	2						1		
Fea. 59	1	1									
Fea. 61											
Total	29	19	8	13	3	3	1	1	36	8	2
Site total	63	31	16	13	4	3	10	4	45	15	2

Table 53 continued

Context	Black Gum	Bed- straw	Bears- foot	Horse Gentian	Legume Fam.	Grass Fam.	Night- shade	Unid. A	Un- known	Total
Fea. 42										4
Fea. 44	4	1	1			1				21
Fea. 45		1						1		6
Fea. 46	1	1			1			3		11
Fea. 47	2	1						5		15
Fea. 51		1	1					3		19
Fea. 53		35	2			2		14		112
Fea. 55										
Fea. 56	1				1			5		17
Fea. 57										
Fea. 58						1		1		11
Fea. 59		1					1	1		9
Fea. 61		1								1
Total	14	48	5	1	7	10	1	1	74	444
Site total	14	56	5	2	14	11	10	1	131	1126

Table 54. Fredricks Site, Ubiquity  
of Plant Foods

Plant Food	No. of Features	% of Features
Hickory	48	92.3
Maize	44	84.6
Acorn	40	76.9
Peach	25	48.1
Walnut	18	34.6
Grape	16	30.8
Persimmon	14	26.9
Bedstraw	14	26.9
Maypops	11	21.2
Sumac	10	19.2
Common bean	10	19.2
Nightshade	9	17.3
Bramble	9	17.3
Pepo	7	13.5
Black gum	7	13.5
Huckleberry	5	9.6
Blueberry	5	9.6
Knotweed	4	7.7
Poke	3	5.8
Hawthorn	3	5.8
Elderberry	3	5.8
Chenopod	3	5.8
Bearsfoot	3	5.8
Viburnum	2	3.8
Strawberry	2	3.8
Horse gentian	2	3.8
Watermelon	1	1.9
Spurge	1	1.9
Morning glory	1	1.9
Amaranth	1	1.9
Total features	52	100.0

Table 55. Lower Saratown Site (Dan River Features), Plant Remains

Context	Soil Volume (Liters)	Total Plant Remains	Wood/ Stem	Unknown	Root or Tuber	Plant Food Remains
Pits and basins						
Fea. 14	10.0	6.01	4.89	0.24		0.88
Fea. 18	10.0	5.13	4.23	0.10		0.80
Fea. 32	10.0	6.29	5.64	0.23	0.02	0.40
Fea. 41	10.0	2.14	1.70	0.03		0.41
Component total	40.0	19.57	16.46	0.60	0.02	2.49

Table 56. Lower Saratown Site (Dan River Features), Plant Food Remains

Context	Total Plant Food Remains	Hickory Shell	Acorn Shell	Walnut Shell	Hazelnut Shell	Maize Kernels	Maize Cupules	Seeds
Pits and basins								
Fea. 14	0.88	0.78	0.01	0.01		0.01	0.03	0.04
Fea. 18	0.80	0.72	x	0.02	0.01	0.04	0.01	x
Fea. 32	0.40	0.18	0.06			0.02	0.14	
Fea. 41	0.41	0.23	0.03			0.08	0.07	
Component total	2.49	1.91	0.1	0.03	0.01	0.15	0.25	0.04

Table 57. Lower Saratown Site (Dan River Features),  
Seed Counts

Context	Maize Kernels	Grape	Night- shade	Bed- straw	Un- known	Total
Pits and basins						
F. 14	1	2			2	5
F. 18	2		1	1		4
F. 32	2					2
F. 41	6					6
Component total	11	2	1	1	2	17

Table 58. Powerplant Site (Dan River Features), Plant Remains

Context	Soil Volume (Liters)	Total Plant Remains	Wood/ Stem	Cane	Un- known	Plant Food Remains
Pits and basins						
Fea. 1	10.0	1.24	0.82		0.04	0.38
Fea. 2	10.0	5.01	4.48		0.01	0.52
Fea. 3	10.0	1.77	1.34		0.07	0.36
Fea. 4	10.0	15.32	13.12		0.12	2.08
Fea. 6	20.0	22.17	19.95		0.27	1.95
Fea. 7	10.0	1.55	1.19	0.05	0.02	0.29
Fea. 8	10.0	1.18	0.67		0.46	0.05
Fea. 10	20.0	2.02	1.81		0.05	0.16
Fea. 12	10.0	1.35	1.10		0.10	0.15
Fea. 13	10.0	1.79	1.12		0.07	0.60
Fea. 15	10.0	0.33	0.28			0.05
Fea. 16	10.0	1.66	1.55		0.03	0.08
Fea. 20	10.0	0.12	0.09		0.03	
Fea. 21	10.0	1.15	1.08			0.07
Fea. 22	10.0	0.07	0.02			0.05
Fea. 24	10.0	0.11	0.11			
Fea. 25	10.0	1.08	1.04		0.02	0.02
Fea. 28	10.0	0.01	0.01			
Fea. 29	10.0	3.80	3.40		0.05	0.35
Fea. 30	10.0	7.16	6.49		0.37	0.30
Fea. 31	10.0	0.77	0.75		0.02	
Site total	230.0	69.66	60.42	0.05	1.73	7.46

Table 59. Powerplant Site (Dan River Features), Plant Food Remains

Context	Total Plant Food Remains	Hickory Shell	Acorn Shell	Acorn Meat	Walnut Shell	Maize Kernels	Maize Cupules	Common Bean	Seeds
Pits and basins									
Fea. 1	0.38	0.21	0.06	0.08	0.02	x			0.01
Fea. 2	0.52	0.22	0.03		0.22	0.03	0.02		x
Fea. 3	0.36	0.26	x		0.06	0.04	x		x
Fea. 4	2.08	2.05			0.02		0.01		
Fea. 6	1.95	0.44	0.86	0.35	0.02	0.16	0.07	0.01	0.04
Fea. 7	0.29	0.18			0.10	x	0.01		
Fea. 8	0.05				0.02	0.03			
Fea. 10	0.16	0.10	x		0.05		0.01		
Fea. 12	0.15	0.04	0.10		0.01		x		
Fea. 13	0.60	0.08	0.25	0.21	0.06				
Fea. 15	0.05	0.02				0.01	0.02		
Fea. 16	0.08	0.03	0.01		0.03		0.01		
Fea. 21	0.07	0.07							
Fea. 22	0.05	0.05	x						
Fea. 25	0.02	0.02					x		
Fea. 29	0.35	0.31				0.03	x	0.01	x
Fea. 30	0.30	0.04	x	0.11		0.02	0.13		
Site total	7.46	4.12	1.31	0.75	0.61	0.32	0.28	0.02	0.05

Table 60. Powerplant Site (Dan River Features), Seed Counts

Context	Maize Kernels	Common Bean	Sun- flower	Cheno- pod	Grape	Bram- ble	Sumac	Night- shade Fam.	Legume Fam.	Un- known	Total
<b>Pits and basins</b>											
Fea. 1	1				1			1			3
Fea. 2	3			1						2	6
Fea. 3	2								1		3
Fea. 6	8	1	1	2	1		4			1	18
Fea. 7	1										1
Fea. 8	2										2
Fea. 13	1										1
Fea. 15	1										1
Fea. 29	4	1					1			1	7
Fea. 30	1										1
Site total	24	2	1	3	2	1	4	1	1	4	43

Table 61. Powerplant Site  
(Dan River Features)  
Ubiquity of Plant Foods

Plant food	No. of Features	% of Features
Hickory	16	94.1
Maize	13	59.1
Walnut	11	50.0
Acorn	10	45.5
Grape	2	9.1
Chenopod	2	9.1
Bramble	2	9.1
Bean	2	9.1
Sunflower	1	4.5
Sumac	1	4.5
Total features	17	100.0

Table 62. Klutz Site (Dan River Feautres), Plant Remains

Context	Soil Volume (Liters)	Total Plant Remains	Wood/ Stem	Cane	Un- known	Root or Tuber	Plant Food Remains
Pits and basins							
Fea. 4	10.0	4.57	4.22		0.09		0.26
Fea. 5	10.0	2.29	1.82		0.01		0.46
Fea. 6	10.0	10.04	9.49		0.23		0.32
Fea. 7	10.0	3.94	2.88		0.72		0.34
Fea. 8	10.0	0.14	0.11				0.03
Fea. 15	30.0	10.79	8.64	0.14	0.90		1.11
Fea. 17	10.0	6.49	6.16		0.13		0.20
Fea. 55	10.0	11.89	11.58		0.12	0.07	0.12
Component total	100.0	50.15	44.90	0.14	2.20	0.07	2.84

Table 63. Klutz Site (Dan River Features), Plant Food Remains

Context	Total Plant Food Remains	Hick-ory Shell	Acorn Shell	Walnut Shell	Chest-nut Shell	Maize Kernels	Maize Cupules	Common Seeds	Bean
<b>Pits and basins</b>									
Fea. 4	0.26	0.13		0.08		0.03	0.01		0.01
Fea. 5	0.46	0.33	0.01	0.07		0.02	0.03		x
Fea. 6	0.32	0.22	0.03			0.01	0.06		x
Fea. 7	0.34	0.17	x	0.11	x	x	0.05		0.01
Fea. 8	0.03					x	0.03		
Fea. 15	1.11	0.26	x	0.14		0.18	0.29	0.17	0.07
Fea. 17	0.20	0.11	0.02	0.04		0.01	0.02		x
Fea. 55	0.12	0.07					0.05		
<b>Component total</b>	<b>2.84</b>	<b>1.29</b>	<b>0.06</b>	<b>0.44</b>	<b>x</b>	<b>0.25</b>	<b>0.54</b>	<b>0.17</b>	<b>0.09</b>

Table 64. Klutz Site (Dan River Features), Seed Counts

Context	Maize Kernels	Common Bean	Sump- weed	Cheno- pod	Knot- weed	Grape	Persim- mon	Night- shade	Unid. A	Un- known	Total
<b>Pits and basins</b>											
F. 4	2					2				2	6
F. 5	1			1							2
F. 6	1									1	2
F. 7	1						1				2
F. 8	1										1
F. 15	12	6	5	1			1			4	29
F. 17	1							1	1		3
<b>Component total</b>	19	6	5	1	1	2	2	1	1	7	45

Table 65. Klutz Site  
 (Dan River Features),  
 Ubiquity of Plant Foods

Plant food	No. of Features	% of Features
Maize	8	100.0
Hickory	7	87.5
Walnut	5	62.5
Acorn	5	62.5
Persimmon	2	25.0
Sumpweed	1	12.5
Nightshade	1	12.5
Knotweed	1	12.5
Grape	1	12.5
Chestnut	1	12.5
Chenopod	1	12.5
Common bean	1	12.5
Total features	8	100.0

Table 66. Powerplant Site (Protohistoric Features), Plant Remains

Context	Soil Volume (Liters)	Total Plant Remains	Wood/ Stem	Cane	Un- known	Plant Food Remains
Pits and basins						
Fea. 9	10.0	2.82	2.40	0.03	0.05	0.34
Fea. 11	10.0	2.18	1.92	0.02	0.03	0.21
Fea. 14	10.0	0.12	0.04			0.08
Fea. 19	10.0	2.35	1.90	0.07	0.01	0.37
Fea. 27	10.0	8.67	7.44	0.02	0.03	1.18
Component total	50.0	16.14	13.7	0.14	0.12	2.18

Table 67. Powerplant Site (Protohistoric Features), Plant Food Remains

Context	Total Plant Food Remains	Hickory Shell	Acorn Shell	Walnut Shell	Maize Kernels	Maize Cupules	Seeds
Pits and basins							
Fea. 9	0.34	0.34	x				
Fea. 11	0.21	0.10		0.09		0.02	
Fea. 14	0.08	x				0.08	
Fea. 19	0.37	0.25		0.05	0.05	0.02	
Fea. 27	1.18	0.94	x	0.21	0.03		
Component total	2.18	1.63	x	0.35	0.08	0.12	x

Table 68. Powerplant Site  
(Protohistoric Features),  
Seed Counts

Context	Maize Kernels	Little Barley	Total
Pits and basins			
Fea. 19	5		5
Fea. 27	1	1	2
Component total	6	1	7

Table 69. Lower Saratown Site (Historic Features), Plant Remains

Context	Soil Volume (Liters)	Total Plant Remains	Wood/ Stem	Cane	Un- known	Root or Tuber	Plant Food Remains
Burial pits							
Fea. 20/Bu. 1	50.0	11.05	9.77	0.03	0.27	x	0.98
Pits and basins							
Fea. 1	20.0	17.00	16.13	0.06	0.18		0.63
Fea. 2		0.30	0.16				0.14
Fea. 6	20.0	18.60	16.64	0.07	0.50	x	1.39
Fea. 7	10.0	3.84	3.50	0.06	0.07		0.21
Fea. 8	20.0	14.94	13.72	0.07	0.44		0.71
Fea. 10	20.0	9.83	5.30		0.15		4.38
Fea. 11	30.0	47.35	27.68	0.10	1.21		18.36
Fea. 13	10.0	2.52	2.17		0.10		0.25
Fea. 15	10.0	29.14	12.87	0.72	0.09		15.46
Fea. 16	10.0	36.05	4.19	15.84	0.30		15.72
Fea. 17	10.0	3.62	2.56	0.25	0.09		0.72
Fea. 21	10.0	73.43	9.83	24.27	0.18		39.15
Fea. 24	20.0	2.91	2.38	0.02	0.08		0.43
Fea. 25	10.0	10.25	6.68		0.26	0.02	3.29
Fea. 30	20.0	74.35	17.16	0.21	1.46	x	55.52
Fea. 31	10.0	8.07	6.95		0.27		0.85
Fea. 33	30.0	12.23	9.31		0.30		2.62
Fea. 34	10.0	10.42	8.66		0.10	0.01	1.65
Fea. 35	20.0	7.08	6.34	0.01	0.16		0.57
Fea. 38	10.0	3.93	3.38		0.03		0.52
Fea. 39	10.0	1.23	1.19				0.04
Fea. 40	10.0	2.95	2.25	0.04	0.16		0.50
Fea. 45	10.0	6.91	1.37	1.89	0.05		3.60
Fea. 46	10.0	10.34	7.41	0.08	0.62		2.23
Total		407.29	187.83	43.69	6.80	0.03	168.94
Old humus	20.0	4.21	3.81		0.02		0.38
Component total	415.0	422.55	201.41	43.72	7.09	0.03	170.30

Table 70. Lower Saratown Site (Historic Features), Plant Food Remains

Context	Total Plant Food Remains	Hickory Shell	Acorn Shell	Acorn Meat	Walnut Shell	Hazelnut Shell
Burial pits						
Fea. 20/Bu. 1	0.98	0.40	x			
Pits and basins						
Fea. 1	0.63	0.47	0.02			x
Fea. 2	0.14	0.13	0.01			
Fea. 6	1.39	0.69	0.09		0.18	
Fea. 7	0.21	0.16	0.01			
Fea. 8	0.71	0.29	0.04	0.06	0.19	
Fea. 10	4.38	1.38	0.03		1.69	
Fea. 11	18.36	14.37	0.03		3.02	0.06
Fea. 13	0.25	0.22				
Fea. 15	15.46					
Fea. 16	15.72	0.03				
Fea. 17	0.72	0.62	0.04			
Fea. 21	39.15	0.38	x		2.99	0.01
Fea. 24	0.43	0.11	0.03		0.17	
Fea. 25	3.29	2.75	0.01	0.02	0.41	
Fea. 30	55.52	52.16	0.04		3.11	
Fea. 31	0.85	0.30	0.05			
Fea. 33	2.62	1.71	0.01		0.38	
Fea. 34	1.65	1.22	0.04		0.23	0.01
Fea. 35	0.57	0.32	0.01		0.06	
Fea. 38	0.52	0.46	0.03		0.02	
Fea. 39	0.04	0.03				
Fea. 40	0.50	0.43			0.02	
Fea. 45	3.60	0.18				
Fea. 46	2.23	1.59	0.15		0.12	
Total	168.94	80.00	0.64	0.08	12.59	0.08
Old humus	0.38	0.23	0.02		0.01	
Component total	170.30	80.63	0.66	0.08	12.60	0.08

Table 70 continued

Context	Maize Kernels	Maize Cupules	Common Bean	Seeds	Other
Burial pits					
Fea. 20/Bu. 1	0.06	0.49	0.01	0.02	
Pits and basins					
Fea. 1	0.02	0.11		x	0.01 Pepo rind
Fea. 2					
Fea. 6	0.06	0.28	0.02	0.07	
Fea. 7	0.02	0.02	x		
Fea. 8	0.01	0.12		x	
Fea. 10	0.03	1.22		0.03	
Fea. 11	0.30	0.16		0.42	
Fea. 13		0.01		0.02	
Fea. 15	0.01	15.44		0.01	
Fea. 16	0.22	15.47			
Fea. 17	0.01			0.05	
Fea. 21	0.07	35.63		0.07	
Fea. 24	0.04	0.02		0.06	
Fea. 25	0.01	0.09			
Fea. 30	0.04	0.10		0.07	
Fea. 31	0.06	0.13			0.31 Chestnut shell
Fea. 33	0.01	0.50		0.01	
Fea. 34	0.02	0.13	x	x	
Fea. 35	0.08	0.09	0.01	x	
Fea. 38	0.01				
Fea. 39		0.01			
Fea. 40	0.03	0.02			
Fea. 45	0.04	3.38			
Fea. 46	0.15	0.10	0.08	0.04	
Total	1.24	73.03	0.11	0.85	0.32
Old humus	0.04	0.07		0.01	
Component total	1.34	73.59	0.12	0.88	0.32

Table 71. Lower Saratown Site (Historic Features), Seed Counts

Context	Maize Kernels	Common Rag- Bean	Cheno- weed pod	Poke?	Spurge	Grape	May- pops	Persim- mon	
Burial pits									
Fea. 20/Bu. 1	8	1	2	1		1	1		
Pits and basins									
Fea. 1	4					2			
Fea. 6	4	1				1	1	2	
Fea. 7	1								
Fea. 8	3					1			
Fea. 10	2	1				2			
Fea. 11	10							8	
Fea. 13						1			
Fea. 15	2								
Fea. 16	16								
Fea. 17	1					5	1		
Fea. 21	3					1	1	1	
Fea. 24	2							1	
Fea. 25	1								
Fea. 30	5	1				1	3	1	
Fea. 31	3								
Fea. 33	3					1			
Fea. 34	2						1		
Fea. 35	3					2			
Fea. 40	2								
Fea. 45	4								
Fea. 46	4	1			1			1	
Total	75	4			1	3	17	4	14
Old humus	3								
Component total	86	5	2	1	1	3	18	5	14

Table 71 continued

Context	Bram- ble	Bed- straw	Legume Fam.	Night- shade	Un- Fam. known	Total
Burial pits						
Fea. 20/Bu. 1					1	16
Pits and basins						
Fea. 1						6
Fea. 6						9
Fea. 7					1	2
Fea. 8						4
Fea. 10	6	6			3	20
Fea. 11			1		4	23
Fea. 13		1				2
Fea. 15					2	4
Fea. 16						16
Fea. 17					1	8
Fea. 21					1	7
Fea. 24						3
Fea. 25						1
Fea. 30	1	1	1		7	21
Fea. 31						3
Fea. 33					1	5
Fea. 34	1				1	5
Fea. 35					1	6
Fea. 40						2
Fea. 45						4
Fea. 46					1	8
Total	8	8	2		23	159
Old humus					5	8
Component total	8	8	2	1	29	183

Table 72. Lower Saratown Site  
(Historic Features),  
Ubiquity of Plant Foods

Plant food	No. of Features	% of Features
Maize	25	96.2
Hickory	25	96.2
Acorn	20	76.9
Walnut	14	53.8
Grape	9	34.6
Persimmon	5	19.2
Bean	6	23.1
Maypops	5	19.2
Hazelnut	4	15.4
Spurge	3	11.5
Bramble	3	11.5
Bedstraw	3	11.5
Ragweed	1	3.8
Poke	1	3.8
Pepo	1	3.8
Chestnut	1	3.8
Chenopod	1	3.8
Total features	26	100.0

Table 73. Klutz Site (Historic Features), Plant Remains

Context	Soil Volume (Liters)	Total Plant Remains	Wood/ Stem	Cane Un- known	Root or Tuber	Plant food remains
Burial pits						
Fea. 28/Bu. 11	30.0	1.44	1.29		x 0.02	0.13
Fea. 30/Bu. 12	20.0	3.72	3.53		0.01	0.18
Bu. 6	10.0	0.04	0.04			
Total	60.0	5.20	4.86		0.01	0.02
Pits and basins						
Fea. 10	120.0	144.83	127.56	0.04	2.05	15.18
Fea. 21	10.0	0.23	0.19	0.02	x	0.02
Total	130.0	145.06	127.75	0.06	2.05	15.20
Component total	190.0	150.26	132.61	0.06	2.06	0.02

Table 74. Klutz Site (Historic Features), Plant Food Remains

Context	Total plant Food Remains	Hickory Shell	Acorn Shell	Walnut Shell	Maize Kernels	Maize Cupules	Common Seeds Bean	
Burial pits								
Fea. 28/Bu. 11	0.13	0.07		0.01	0.01	0.04		
Fea. 30/Bu. 12	0.18	0.04		0.03	0.01		0.10	
Total	0.31	0.11		0.04	0.02	0.04	0.10	
Pits and basins								
Fea. 10	15.18	12.00	0.15	0.37	1.00	0.90	0.16	0.60
Fea. 21	0.02	0.02						
Total	15.20	12.02	0.15	0.37	1.00	0.90	0.16	0.60
Component total	15.51	12.13	0.15	0.41	1.02	0.94	0.16	0.70

Table 75. Klutz Site (Historic Features), Seed Counts

Context	Maize Kernels	Common Bean	Knot- weed	Grape	May- pops	Persim- mon	Bram- ble	Plum	Bul- rush?	Un- known	Total
Burial pits											
Fea. 28/Bu. 11	2								1		3
Fea. 30/Bu. 12	1		3				1	1		3	9
Total											
Pits and basins											
Fea. 10	35	5	27	1	1	9				14	92
Total	38	5	27	4	1	9	1	1	1	17	104

Table 76. Waterscreened Samples, Plant Remains

Drainage/Phase	Site	Plant Remains	Wood/Stem	Cane	Un-known	Total Food Remains	Plant Remains	Other
Eno/Flat & Haw								
Hillsboro	Wall	108.70	90.04		5.30	13.31	0.05	root/tuber
Fredricks	Fredricks	180.79	158.23		4.24	18.12	0.20	rhizome
Mitchum	Mitchum	193.21	179.04		4.33	9.84		
Dan								
Early Saratown	Early Upper Saratown	11.92	9.51		0.23	2.18		
Late Saratown	Upper Saratown	542.46	301.58	8.53	1.44	224.04	6.87	leaf

Sources: Wilson (1977, 1985) for Upper Saratown; all others analyzed by the author.

Table 77. Waterscreened Samples, Plant Food Remains

Drainage/Phase	Site	No. of Features	Total Plant Food Remains	Hickory Shell	Acorn Shell	Acorn Meat	Walnut Shell	Hazelnut Shell
Eno/Flat & Haw								
Hillsboro	Wall	4	13.31	9.00	0.78			
Fredricks	Fredricks	4	18.12	11.19	0.04			
Mitchum	Mitchum	11	9.84	7.10	0.34		0.30	
Dan								
Early Saratown	Early Upper Saratown	1	2.18	1.87	0.13		0.12	
Late Saratown	Upper Saratown	11	224.04	126.20	1.89	0.47	2.93	0.17

Table 77 continued

Drainage/Phase	Site	Unid. Nutshell	Peach Pit	Maize Kernels	Maize Cupules	Pepo Rind	Common Bean	Seeds
Eno/Flat & Haw								
Hillsboro	Wall			0.22	3.17		0.05	0.09
Fredricks	Fredricks		5.81	0.11	0.97			
Mitchum	Mitchum		1.08	0.49	0.30	0.01		0.22
Dan								
Early Saratown	Early Upper Saratown			0.03	0.03			
Late Saratown	Upper Saratown	0.03	15.29	8.05	64.16	0.04		4.81

Table 78. Waterscreened Samples, Seed Counts

Drainage/Phase	Site	Maize Kernels	Common Bean	Sun- flower	Sump- weed	Pepo	Water- melon	Rag- weed	Knot- weed	Poke
Eno/Flat & Haw										
Hillsboro	Wall	9	1		1					
Fredricks	Fredricks	28	1					3		
Mitchum	Mitchum	11								
Dan										
Early Saratown	Early Upper Saratown	3								
Late Saratown	Upper Saratown	P	3	1		1	1	1	1	5

Note: P=present but not counted.

Table 78 continued

Drainage/Phase	Site	Copper- leaf	Grape	May- pops	Persim- mon	Bram- ble	Blue- berry	Haw- thorn
Eno/Flat & Haw								
Hillsboro	Wall		1		1			1
Fredricks	Fredricks		11	1	7	2		
Mitchum	Mitchum		5	4	4			
Dan								
Early Saratown	Early Upper Saratown				2			
Late Saratown	Upper Saratown	1	176	13	30	2	6	3

Table 78 continued

Drainage/Phase	Site	Ground- cherry	Sumac	Bed- straw	Legume Fam.	Un- known	Total
Eno/Flat & Haw							
Hillsboro	Wall			1		2	17
Fredricks	Fredricks		1	6		9	69
Mitchum	Mitchum				1	5	30
Dan							
Early Saratown	Early Upper Saratown						5
Late Saratown	Upper Saratown	3		2	2	163	414

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