

Continuity and Change: The Zooarchaeology of Aboriginal Sites in  
the North Carolina Piedmont

Draft II

Mary Ann Holm  
3/6/94

Continuity and Change: The Zooarchaeology of Aboriginal Sites in  
the North Carolina Piedmont

by

Mary Ann Holm

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

1994

Approved by:

\_\_\_\_\_  
Advisor

\_\_\_\_\_  
Reader

\_\_\_\_\_  
Reader

\_\_\_\_\_  
Reader

\_\_\_\_\_  
Reader

\_\_\_\_\_  
Reader

## TABLE OF CONTENTS

	Page
LIST OF TABLES.....	
LIST OF FIGURES.....	
Chapter	
I INTRODUCTION.....	1
The Siouan Project.....	2
Site Descriptions.....	5
Wall.....	5
Fredricks.....	7
Early Upper Saratown.....	7
Upper Saratown.....	9
Excavation and Recovery Techniques.....	12
Sampling and Analytic Procedures.....	13
Contact Chronology for the Piedmont.....	14
Research Questions.....	23
II ENVIRONMENTAL SETTING.....	
Sources of Information.....	
Physiography.....	
Climate.....	
Plants and Animals of the Piedmont.....	
III CULTURAL ENVIRONMENT.....	
Disease.....	
Trade and Warfare.....	
Summary.....	
IV ANIMALS USED BY PIEDMONT INDIANS.....	
Mammals.....	
Birds.....	
Reptiles and Amphibians.....	
Fish.....	
Conclusions.....	
V ASSEMBLAGE COMPARISONS: TAXON ABUNDANCE.....	
Analytical Procedures.....	
Quantification Techniques.....	
Number of Identified Specimens.....	

Minimum Number of Individuals.....	
Meat Weights.....	
Allometry and Biomass.....	
The Faunal Assemblages.....	
Wall.....	
Fredricks.....	
Early Upper Saratown.....	
Upper Saratown.....	
Comparison of Assemblages.....	
VI ASSEMBLAGE COMPARISONS: HETEROGENEITY.....	
Comparison of the Assemblages.....	
VII ELEMENT DISTRIBUTION AND BONE MODIFICATION.....	
Element Distribution: Previous Research.....	
Element Distribution: Results.....	
Bone Modification: Previous Research.....	
Bone Modification: Results.....	
VIII SUMMARY AND CONCLUSIONS.....	
Continuity and Change.....	
Conclusions.....	



## CHAPTER I

### INTRODUCTION

When the first Europeans arrived in the North Carolina Piedmont, many of the native inhabitants of the region lived in small palisaded villages located in the floodplains of rivers and streams. These palisaded villages generally consisted of 10 to 25 round or rectangular houses of wattle and daub construction. Storage pits, above-ground grain cribs, hearths and burials were associated with each of these structures. The villages themselves were surrounded by fields in various stages of succession in addition to rolling hills covered by oak and hickory forest. The inhabitants of these villages lived in relatively egalitarian societies and depended on a mixed subsistence economy. They relied heavily on hunting wild animals and gathering wild plants in addition to growing crops such as corn, squash, and beans.

Until recently little was known about the response of piedmont tribal groups to the presence of Europeans in their midst. The arrival of Europeans is known to have wreaked havoc on native populations throughout the New World. Ethnohistoric and archaeological sources indicate that in many regions almost every aspect of native life was altered as populations struggled to survive during the tumultuous Contact period. Increased activities

associated with trade and warfare, massive depopulation, and the introduction of European domesticates led to a dramatic change in the subsistence of many groups. The relationship of these groups with the natural world was profoundly altered. Were the tribes of the Piedmont also wrenched away from the traditional dance with nature that had sustained them for so long? Ethnobotanical analysis has answered this question in terms of plant remains (Gremillion 1989). The following study addresses the issue of contact as it affected the faunal portion of the subsistence strategy employed by native groups in the North Carolina Piedmont.

#### THE SIOUAN PROJECT

In 1981, the Research Laboratories of Anthropology began a project to investigate culture change among Indian groups that occupied the northern part of the Carolina Piedmont during the Late Prehistoric and Historic Periods (ca. 1300-1740). This project combined survey, testing and excavation in the field, and extensive laboratory and documentary research. It focused on three drainage basins of the northern North Carolina Piedmont (the Upper Dan, Haw, and Eno-Flat) which were occupied by such groups as the Occaneechi, Eno, Shakori, Saxapahaw, and Sara. These groups have usually been classified as Siouan speakers (Mooney 1894; Swanton 1946) although controversy over this classification has existed for some time (Miller 1957; Binford 1959; Hogue 1988; Simpkins 1992). In spite of the imprecision surrounding the use of the term "Siouan" as a designation for the Indians of the North Carolina Piedmont, this

term will be used in the present study to conform with the majority of publications referring to this subject. At this time, the phase of the Siouan Project concerned with the archaeological investigation of these northern Piedmont sites has been completed. The data recovered from survey, testing, and excavation has been integrated into studies of intrasite and intersite settlement patterns, aboriginal and European artifacts, human skeletal remains, ethnobotanical remains, faunal remains, and historic documents. The unifying theme of this project is "culture change precipitated by the interaction between Indians and English traders" (Ward and Davis 1993:10).

This study presents an analysis and interpretation of the faunal remains recovered from four of the sites investigated as a part of the Siouan Project (Figure 1.1). The Wall site (31Or11) and the Fredricks site (31Or231) are located along the Eno River and represent, respectively, a protohistoric and a historic site. The other two sites, Early Upper Saratown (31Sk1) and Upper Saratown (31Sk1a), are located on the Dan River and also represent protohistoric and historic occupations, respectively. The purpose of this study is twofold. A primary goal is to define and describe the pattern(s) of faunal utilization practiced by the inhabitants of each of these sites. A second goal is to compare precontact and postcontact use of animal resources to examine the effect of European presence on the subsistence-related activities of the piedmont Indians. The two sites on the Eno River, as well as those on the Dan River are close to each other. Thus, each pair of sites shares a nearly identical natural environment and provides an

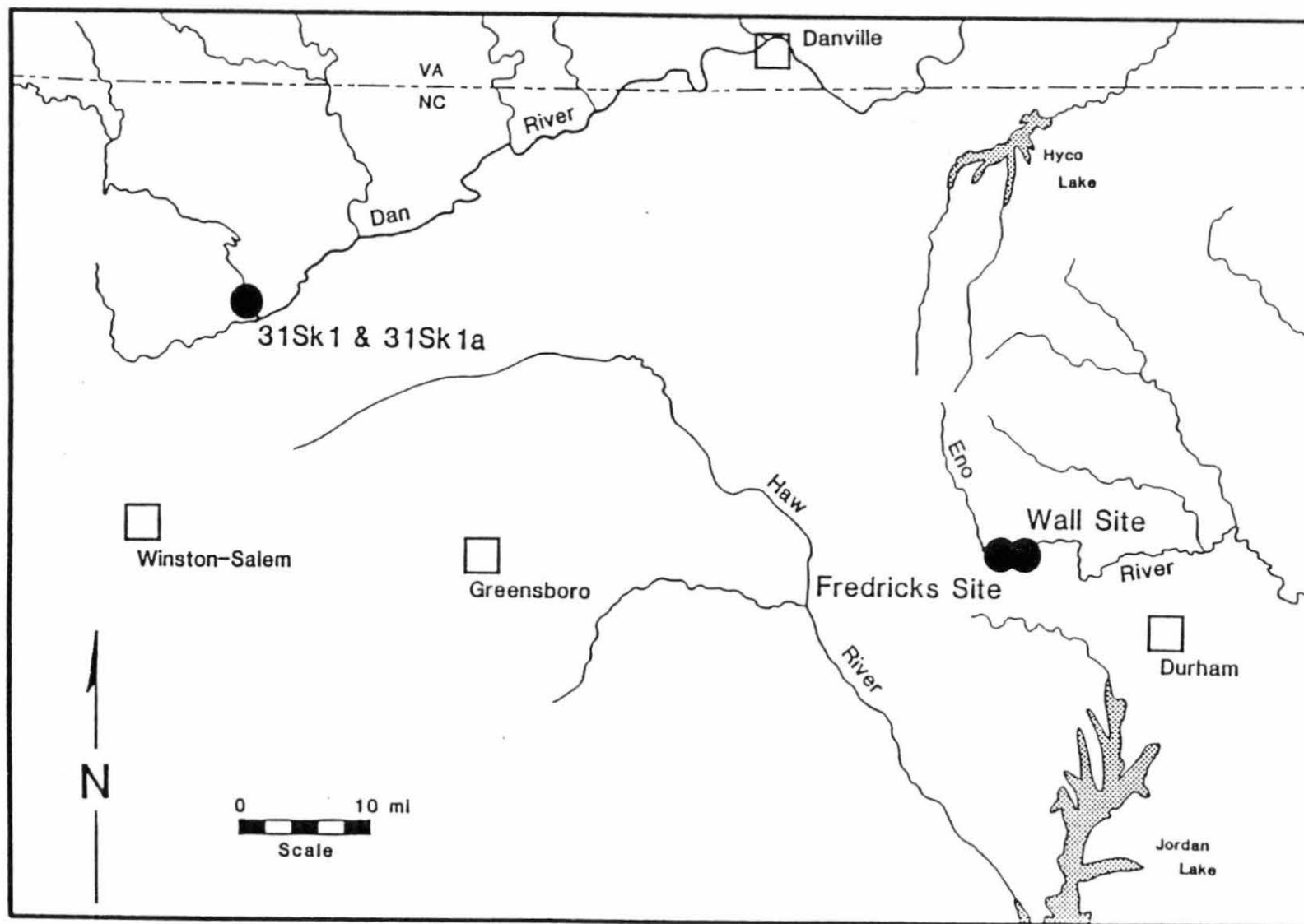


Figure 1.1 Locations of the Wall and Fredricks Sites.

Site  
Source

excellent opportunity for comparing protohistoric and historic subsistence patterns. Further, all four sites were excavated and recorded utilizing the same field techniques; and the faunal remains from each were processed, sampled, and analyzed in an identical manner.

## SITE DESCRIPTIONS

### Wall Site

The Wall site (31Or11) is located within a horseshoe-shaped bend of the Eno River in Orange County. Excavations were initially conducted at this site between 1938 and 1941. Further excavations were conducted in 1983 and 1984. Three radiocarbon determinations were obtained from the later excavations and yielded an average corrected date of A.D. 1545  $\pm$ 80 years.

Approximately 25% (14,300 sq ft) of the village has been excavated (Figure 1.2). The stratigraphy consisted of a plowzone approximately 0.5 ft to 1.0 ft thick overlying a sandy clay subsoil. A midden up to 1.25 ft thick was preserved beneath the plowzone along the palisade lines in the northern third of the site. This midden contained a large quantity of organic as well as inorganic cultural remains. A total of five separate palisade lines and twelve structures have been identified at the Wall site and eight burials and 17 non-structural features have been excavated (Petherick 1987:30-45).



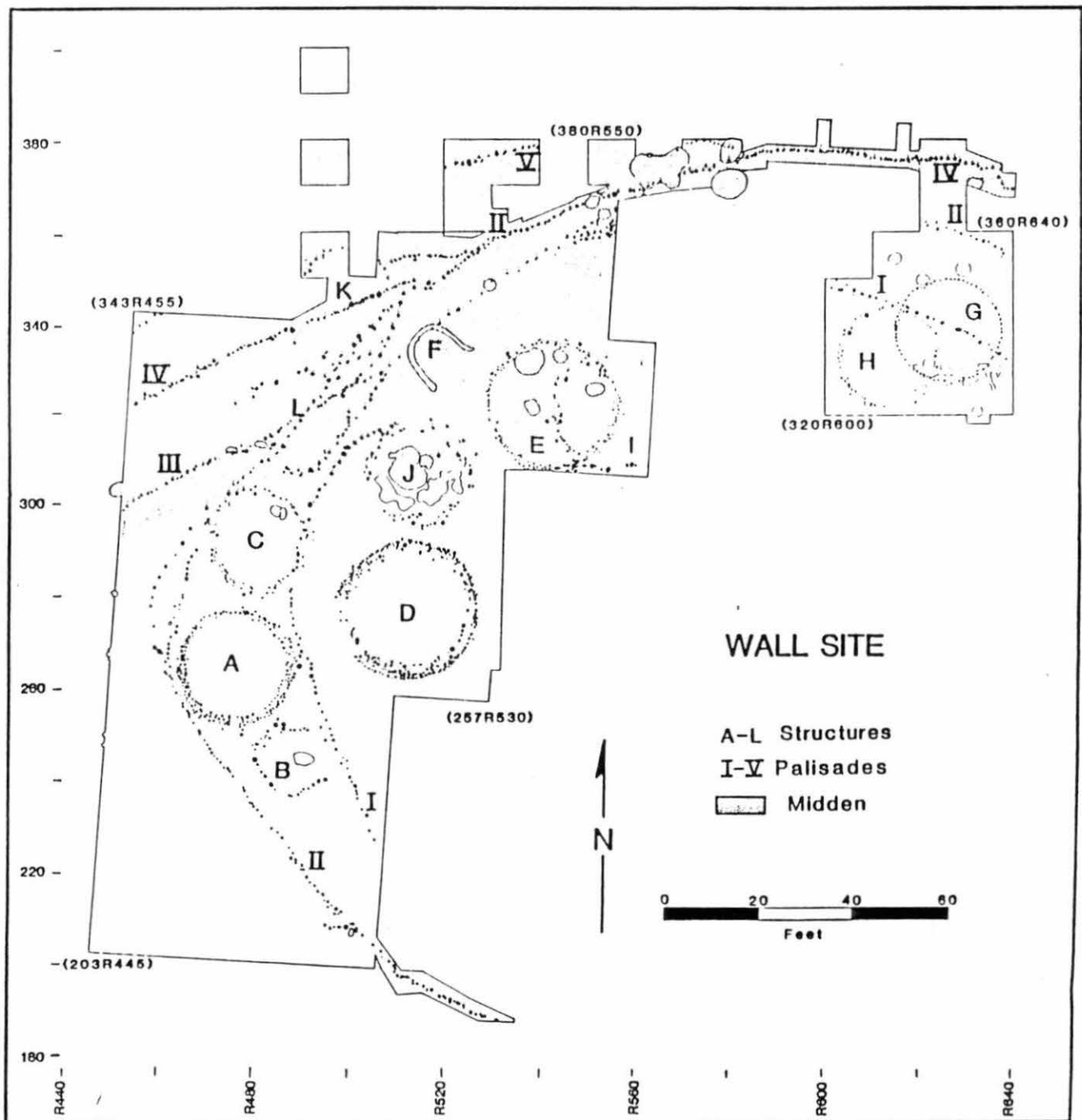


Figure 1.2 *caption?*  
Areal extent of the midden at the Wall site.

*site some*

### Fredricks Site

The Fredricks site (31Or231) is located in the same horseshoe-shaped bend and less than 450 ft away from the Wall site. The Fredricks site was excavated between 1983 and 1986. Numerous European artifacts found at this site have been dated to the late 1600s and very early 1700s. These goods, coupled with information from historical accounts have led to the identification of the Fredricks site as the town occupied by the Occaneechi Indians ca. 1680-1710 and visited by John Lawson in 1701 (Lefler 1967:59-61).

All of the palisaded area of this village has been excavated except for a small portion in the southwest which was covered by large trees (Figure 1.3). Excavation of 15,900 sq ft has revealed a single palisade enclosing at least ten and possibly twelve structures. Another structure dating to a slightly earlier occupation is bisected by the palisade. A total of 14 burials and 46 features was excavated. Stratigraphy at this site consisted of a plowzone approximately 1.0 ft thick overlying a sandy clay subsoil (Petherick 1987:58-60; Ward and Davis 1988:6).

### Early Upper Saratown

Early Upper Saratown (31Sk1) is located on the banks of the Dan River in Stokes County. This site has been extensively pot-hunted since the middle 1960s. Professional excavations were conducted in 1981 and, based on European trade materials recovered, the site has been dated to about A.D. 1450-1620 (Wilson 1983:225; Davis and Ward 1989:5).



Excavation of 1,250 sq ft was concentrated on the area of the site believed to be the southeastern section of the palisade around the village (Wilson 1983:379). In addition to a single palisade, portions of at least two large circular structures were identified. A total of six burials and forty features, many of which were potted, was excavated (Figure 1.4).

Stratigraphy at this site consisted of a plowzone approximately 1.5' deep overlying a midden approximately 0.5 ft in depth which appears to have been plowed. Both of these zones overlie an orange clay subsoil.

#### Upper Saratown

Upper Saratown (31Skla) is located on the Dan River within a quarter mile of Early Upper Saratown. Excavations were conducted at this site from 1972 to 1981. Based on trade materials recovered, occupation of this site has been placed between 1680 and 1690 (Wilson 1983:225).

Over 16,400 sq ft of the site has been excavated (Figure 1.5). Stratigraphy consists of a plowzone overlying an old humus zone which in turn overlies an orange clay subsoil. In most areas of the site, the plowzone is approximately 1.0 ft in depth. Along the riverbank, however, an overburden has been created by flooding and plowing. This overburden varies in depth from five to eight feet above the original surface of the site. The old humus zone reaches a depth of up to 0.5 ft in the center of the village and tapers off entirely at the eastern and western edges of the site (Wilson 1983:414).

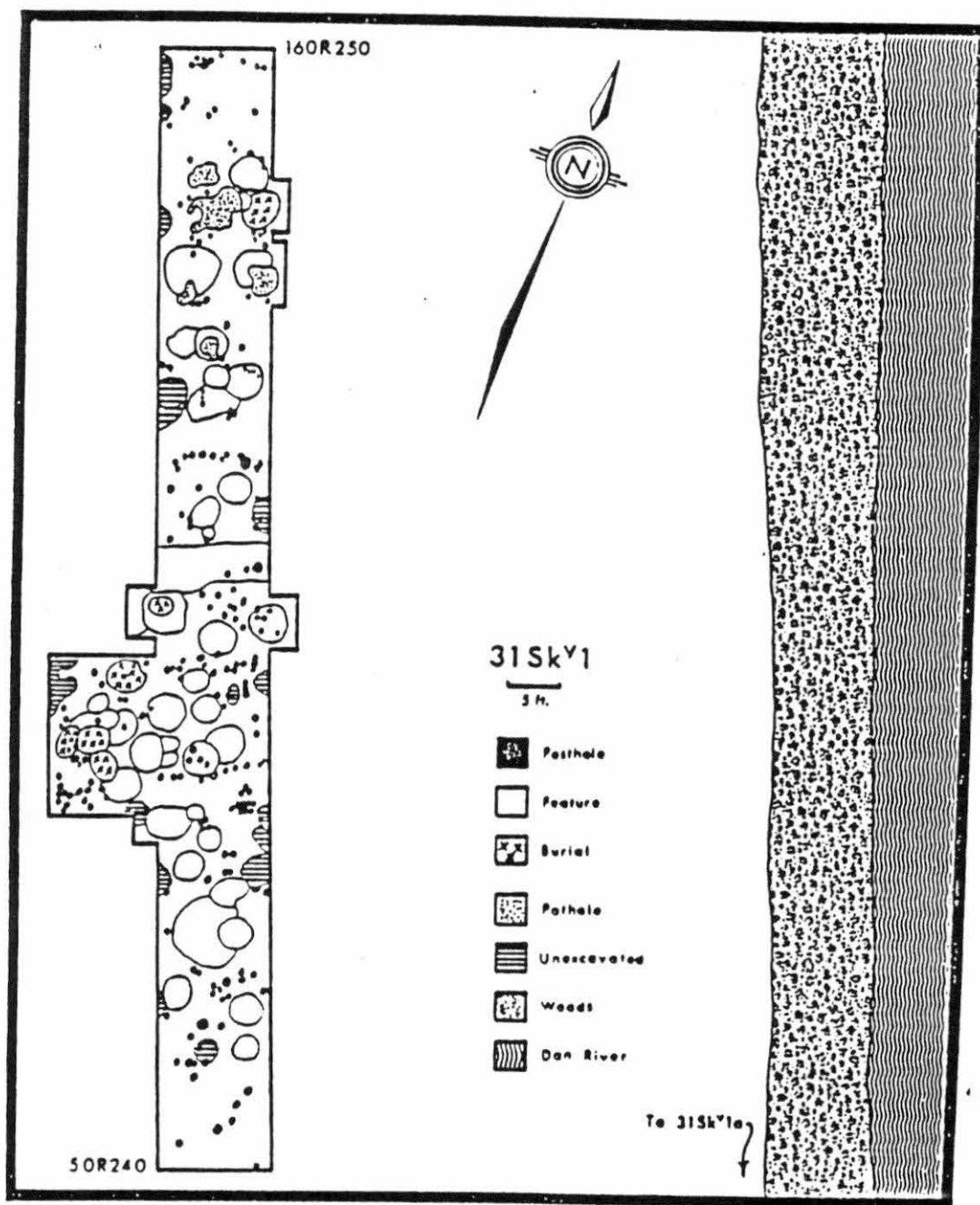


Figure 28:--Plan of features, burials, and postholes at the base of the plowzone based on the work through the 1981 field season, 31Sk1.

*Joe Jones*



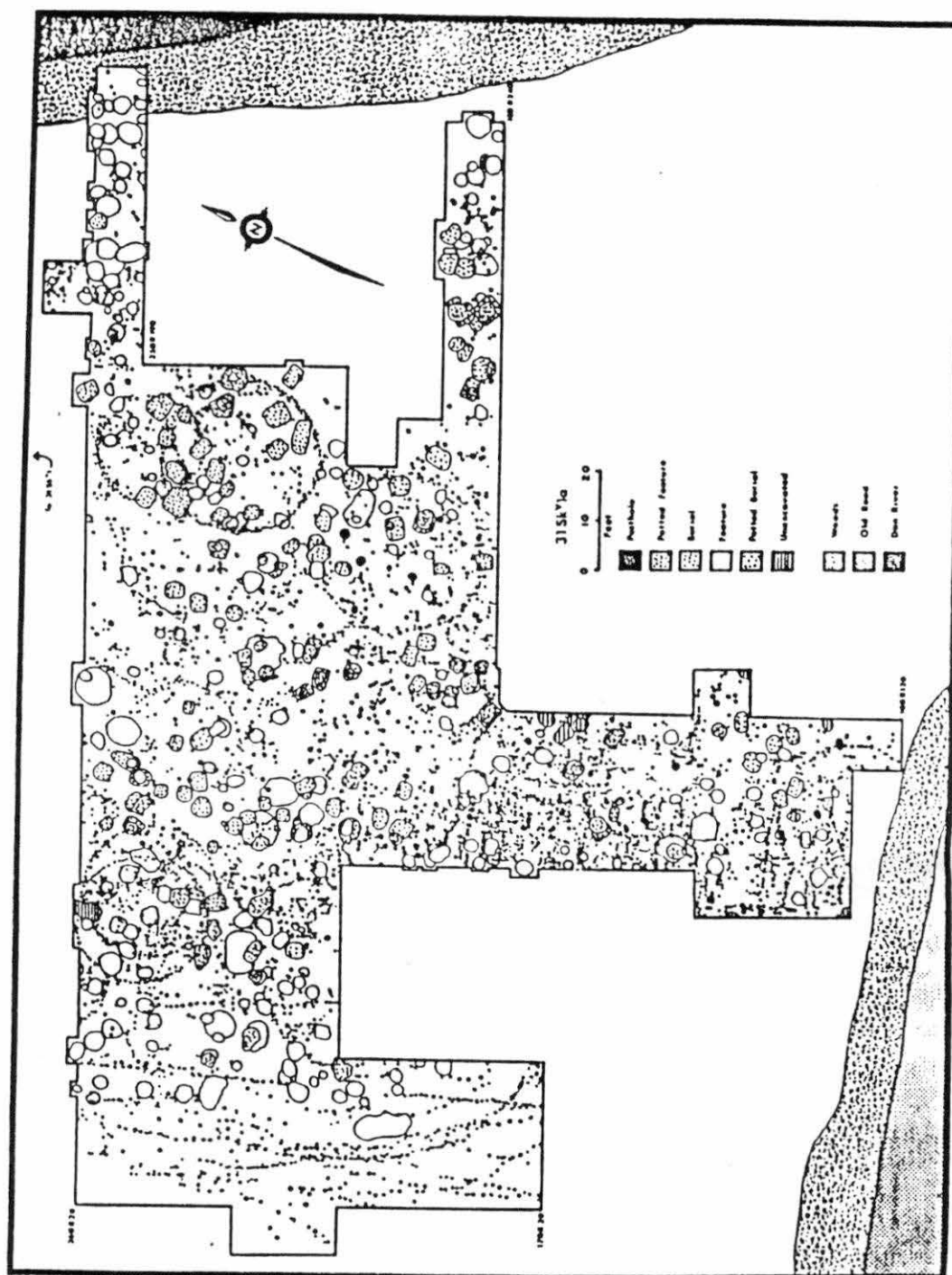


Figure 31.--Plan of features, burials, and postholes at the base of the plowzone based on the work through the 1981 field season, 31Skla.

Four palisade lines and 13 house structures have been identified at Upper Saratown. A total of 225 features and 111 burials has been excavated. As at Early Upper Saratown, a large number of these features and burials has been disturbed by pot hunters.

#### EXCAVATION AND RECOVERY TECHNIQUES

At all four of the sites, a grid system of 10 x 10 ft units was utilized for horizontal control. Within each 10 x 10 ft square, the plowsoil was removed manually and sifted through 0.5-in screens. At the Wall site, after the removal of the plowzone, the midden was removed in two levels. These levels correspond with a slight change in color between the upper and lower midden soil. The soil from each level in each square was kept separate and waterscreened through a sluice box equipped with a sequence of graduated screens. At Early Upper Saratown the midden zone was excavated separately from the plowzone and dry-screened through 0.5-in screens.

Burials and other features were excavated by natural zones. The fill from each zone was waterscreened as a unit through the sequence of graduated screens. At the Wall and Fredricks sites, 0.5-in, 0.25-in, and 0.0625-in screens were utilized in the sluice box. At Early Upper Saratown and Upper Saratown, 0.5-in and 0.0625-in screens were used in the sluice box. Bones from these latter two sites were subsequently screened in the laboratory through 0.25-in screen to facilitate comparison with the

assemblages from the Wall and Fredricks sites. At these two Eno River sites, 10-liter samples of soil from each zone in each feature were processed by flotation. No flotation was performed at Early Upper Saratown and Upper Saratown.

#### SAMPLING AND ANALYTIC PROCEDURES

Only those bone fragments recovered from undisturbed contexts were included in the material analyzed. Bone from the plowzone was excluded from analysis.

Most of the faunal material from the Wall site came from four 10 x 10 ft units of undisturbed sheet midden. Only one of the pits excavated during the 1983 excavations of this site contained more than a few poorly preserved bone fragments. Jeannette Runquist (1979) analyzed the faunal remains from the 1938, 1940, and 1941 excavations of the Wall site. The majority of the remains examined by Runquist was recovered from a zone of midden that was sifted through 0.25-in mesh screen. Much of the more fragmented bone from the 1938-1941 excavations was discarded and thus not included in the assemblage examined by Runquist. Because of these differences in recovery and sampling techniques, the results of Runquist's analysis will not be combined with the results of the analysis of the 1983 assemblage.

The faunal assemblage from the Fredricks site was recovered from the fill of 47 pits. As excavation of the Fredricks site was completed in 1986, this assemblage represents all of the bone

preserved and recovered from undisturbed contexts for the entire site.

The faunal assemblages from Early Upper Saratown and Upper Saratown were obtained by sampling the larger collections recovered through excavation of these sites. Both of these sites were badly disturbed by the activity of pot hunters. Features which were more than minimally disturbed by potting were eliminated from the sample of potential features to be analyzed. The remaining features were placed in functional categories using criteria set forth by Ward (1980). A random sample of features was selected from each of these types. These samples consisted of 17 features from Early Upper Saratown and 26 features from Upper Saratown.

Table 1.1 provides a summary of the sites and assemblages analyzed.

Table 1.1. Sites Examined

Site	Period	Context	Screen	Total Bone	MNI
			Size	Count	
Wall (310r11)	1545±80	midden	0.0625-in	29,792	103
Early Upper Saratown (31Sk1)	1550-1650	feature	0.0625-in	42,709	268
Upper Saratown (31Sk1a)	1660-1680	feature	0.0625-in	18,282	70
Fredricks (310r231)	1680-1710	feature	0.0625-in	70,597	179

#### CONTACT CHRONOLOGY FOR THE PIEDMONT

Contact occurred at different times and proceeded at different rates in various parts of the North Carolina Piedmont. The spread of European influence in the Piedmont was erratic. It has been

possible, however, to construct a basic chronology of contact for the region that shows the similar stages through which the Indians of this region passed during this time of cultural upheaval. The investigation of a number of sites in the Piedmont indicates the occurrence of four archaeological periods between the arrival of the first Europeans until the ultimate demise of the piedmont Siouans (Ward and Davis 1993). The details of this chronology have been articulated by Davis and Ward (1989) and Eastman (1992:442-444) and will be summarized here.

The Protohistoric period (A.D. 1400-1600) begins with the first arrival of explorers in North America. There is no archaeological evidence of direct contact at either of the sites (Wall and Early Upper Saratown) included in this study occupied during this time.

The Early Contact period (A.D. 1600-1660) includes the earliest sites in the region which contain European trade goods. Jamestown was established in 1607 and English colonists began to trade indirectly with groups in the North Carolina Piedmont. It was not until around 1650 and the depletion of game in the Chesapeake area, however, that European colonists began to concentrate their efforts on the region south of the Chesapeake. During the Early Contact period, sites in the northern Piedmont show little evidence of sustained intercultural interaction. The presence of glass beads, wire, and sheet brass may be evidence for the "initial impact of the fur and deerskin trade, without any extraneous effects from the introduction of European technology" (Eastman 1992:442). It appears that during the Early Contact



period, intercultural exchange had little impact on the Indians of the Piedmont.

The Middle Contact period (A.D. 1660-1680) has been identified as a transitional period during which interactions between the Indians of the Piedmont and the Virginians intensified (Eastman 1992:443). New regulations concerning the export of tobacco decreased the profitability of this enterprise and enhanced the appeal of trade with the Indians as a way to acquire wealth (Phillips 1961:166-167, Silver 1990:71-72). Competition between settlers in Virginia and those in Maryland, Delaware, and Pennsylvania provided the incentive for locating potential trading partners in the south. The founding of Charles Town in 1670 brought increased competition for the products supplied by Indians and further pressured Virginians to attempt direct trade with Indians of the North Carolina Piedmont. These pressures resulted in a rapid intensification of the fur and deerskin trade between Virginia colonists and piedmont Indians (McManus 1989:12). Until 1670, the Virginia trade was conducted primarily with those Indians living to the east of the Fall Line. In the 1670s, prosperous Virginia planters began to send factors into the Indian territory to trade for deerskins and beaver pelts. In addition to beads and wire or sheet brass, archaeological sites from this time period contain bottle glass, kaolin pipes, cast brass items, metal gunflints, and lead shot (Eastman 1992:444).

Although scanty, information about the involvement of the Occaneechi in the deerskin trade is more complete than for many other piedmont groups. The Occaneechi maintained a powerful

position as middlemen in the trade during the early half of the Middle Contact period and acquired a reputation for fierceness and hostility toward both Europeans and other Indians during the 1670s. In part this position of dominance arose because of the unique location of the Occaneechi along the trading path. Ward (1987:81,89) further suggests that the Occaneechi's prominence may have been enhanced during the Contact period because of their preexisting ties with the Susquehannocks to the north. John Lederer visited the Occaneechi in 1670 but cut short his stay on the island when, on the second day of his visit, the Occaneechi murdered six Indians who had traveled from the mountains to trade with them (Alvord and Bidgood 1912:68). Davis and Ward (1991) hypothesize that the Occaneechi suspected that these Indians (probably Cherokees) were planning to attempt to establish direct trade with the Virginians and were killed to prevent them from doing so. Needham and Arthur (Alvord and Bidgood 1912:68) stated that the Occaneechi were "but a handful of people" who increased their numbers by recruiting "vagabonds and rogues" to their fortified island home. Although their position on an island in the Roanoke River adjacent to the trading path gave the Occaneechi a unique advantage in controlling the deerskin trade, this statement indicates that by 1673 they may have been suffering depopulation as a result of disease and/or warfare. In one of their last recorded acts of hostility, the Occaneechi murdered James Needham in 1674, during his second voyage from Virginia to the Appalachians (Alvord and Bidgood 1912:215).

Davis and Ward (1991) have studied both the ethnohistoric and

the archaeological evidence for the role played by the Occaneechi as middlemen in the trade and have found a correspondence between the advice given by John Lederer to prospective Virginia traders and the trade artifacts recovered from some piedmont sites. Lederer (1672:26-27) recommended that, when dealing with the less remote Indians such as the Occaneechi, the trader should supply "a sort of course Trading Cloth ... Axes, Hoes, Knives, Sizars, and all sorts of edg'd tools. Guns, Powder and Shot, etc. are Commodities they will greedily barter for." He goes on to say that "To the remoter Indians you must carry other kinde of Truck, as small Looking-glasses, Pictures, Beads, and Bracelets of Glass, Knives, Sizars, and all manner of gaudy toys and knacks for children." Davis and Ward (1991) note that "Lederer's observations here probably are more a reflection of the *status quo* imposed by the Occaneechi than the unsophisticated desires of their southern and western neighbors."

A comparison of the artifacts recovered from the Fredricks site, occupied by the Occaneechi, and Upper Saratown, occupied by the Sara, provides support for Lederer's statements. "When compared with the trade artifact assemblage from the Fredricks site, it is clear that the Upper Saratown traders received mostly ornaments and trinkets from the English and not the full range of utilitarian goods and weapons that was available to the Occaneechi" (Ward and Davis 1993:426). The ethnohistoric and archaeological evidence indicates that the Occaneechi "were able to dictate the kinds of European manufactures that were available to their neighbors" and "by controlling access to firearms and using

intimidation when necessary, the Occaneechi were able to maintain their dominant position as middlemen" (Davis and Ward 1991:13).

Partly as a result of their dominance in the deerskin trade, the Occaneechi were attacked and defeated by Nathaniel Bacon's militia in 1676 (Alvord and Bidgood 1912:124). Reduced in numbers, military strength, and probably in wealth, they were no longer able to maintain their powerful position on the Roanoke River island. Retreating southward, the Occaneechi established a new village on the Eno River by about 1680. Prior to Bacon's Rebellion, traders from Fort Henry in Virginia rarely travelled beyond Occaneechi Island (Franklin 1932). With the removal of the barrier to trade imposed by the Occaneechi while they occupied their island stronghold, the Virginians and both mountain and piedmont tribes were free to pursue direct trade with one another and the trading path extended to the south and the west (Franklin 1932). By the end of the seventeenth century, 50-60 traders were leaving Virginia annually in order to pursue trade in the southern Piedmont (Merrell 1989:29).

Davis and Ward (1989:2) suggest that the Iroquois began raiding the Piedmont as early as the fifteenth century and palisaded villages have been identified archaeologically dating from this period. It is thus clear that the arrival of Europeans intensified rather than introduced the experience of raiding and warfare among native groups in this region. Although warfare between Native American populations had been raging in the Northeast for decades, the Iroquois did not begin to penetrate the South intensively until the 1670s. The Susquehannock, who were

incorporated within the Five Nations, were forced from Maryland by colonial militia in 1675 and, armed with guns, began to raid other groups in Virginia (Merrell 1987:24-25). Thus, another result of the downfall of the Occaneechi in 1676 was the increase of raiding activity by aggressive northern warriors in the region. In addition to frequent attacks from the north, during the Middle Contact period piedmont groups were also subjected to frequent raids from the well-armed "Westoes" from the south (Merrell 1989:41).

The Middle Contact period, though brief, marked a crucial time of transition for the Indians of the North Carolina Piedmont. During this period, the Indians were forced to adjust from a period of sporadic, indirect trade with Europeans, to a period of intense but indirect trade, to a time of more intense, direct trade. Many native groups were forced to relocate and this physical displacement may have been a source of considerable cultural stress. In an approximately 20-year period, the tribes of the Piedmont changed from groups which were barely touched by the European presence to groups that were forced to participate heavily in the deerskin trade in order to obtain the weapons necessary to defend themselves against warriors from the north who had themselves received firearms through trade with the Europeans.

The Late Contact period dates from A.D. 1680 to 1710 and was a time of incredible devastation from European diseases and considerable cultural disruption. Participation in the deerskin trade reached an all-time high among piedmont groups and the use of firearms and metal tools of European manufacture became common.



Byrd noted that during this time the "Indians [were] at war with each other" and that the Indians of the Dan River drainage were being raided "incessantly" by the Seneca (Bassett 1970).

Sustained, direct contact with the Europeans brought the Indians into constant exposure to their deadly diseases. The effect of these diseases, coupled with depopulation due to warfare, dramatically reduced native populations. Because of this drastic depopulation, some remnants of formerly independent tribes were forced to band together in order to obtain sufficient manpower to defend and provide for themselves. Lawson provides the first mention of the amalgamation of different tribes into single villages (Lefler 1967:50-53).

During the first decades of the 1700s the effects of disease, warfare, and rum overwhelmed the Occaneechi and other piedmont Indian groups. Evidence of remnants of a diversity of ethnic groups living together and a high mortality rate at both the Late Contact period Fredricks site (31Or231) and the William Kluttz site (31Sk6) are archaeological manifestations of these changes (Eastman 1992:444; Ward and Davis 1991; Hogue 1988). Also, a greater diversity of European trade goods is recovered archaeologically from Late Contact sites than had been recovered from piedmont sites dating to earlier periods. As at some of the earlier sites, glass beads, bottle glass, kaolin pipes and wire or sheet brass were recovered. In addition to these items were iron implements such as hoes and axes and manufactures associated with weapons such as gun parts, gun flints and lead shot (Eastman 1992:444).

By the early eighteenth century however, the piedmont Indians

had lost much of the power that had characterized their earlier relations with Virginia traders. After 1700, traders were roaming the Piedmont at will rather than waiting for Indians to summon them. They ceased to obey Indian customs when visiting native villages and the Indians, who were dependent on European merchandise by this time, feared that reprimanding the sometimes abusive traders would result in the loss of trade (Merrell 1989:65).

After about 1710, most of the remaining members of the piedmont Siouan groups seem to have moved out of the Piedmont to join either the Catawba in South Carolina or other fragmented groups living around Fort Christanna in Virginia. By 1730, virtually all of the Indians who had formerly occupied what Lawson (Lefler 1967:61) referred to as the "Flower of Carolina" had either died or been forced to move out of the area.

To summarize, it is possible to define four stages of contact between Europeans and the Indians of the Piedmont (Merrell 1987:19; Eastman 1992). The first stage (1600-1660) was a period of indirect contact in which the Indians were first exposed to lethal European diseases and to European trade goods. During the second stage (1660-1680) the defeat of Powhattan's Confederacy, the depletion of fur-bearing mammals around settlements and later, the founding of Charles Town, increased the interest of Virginians in the fur and deerskin trade. During this time, the Virginians and the Indians were in direct contact with one another. The third stage (1680-1710) began after the defeat of the Occaneechi during Bacon's Rebellion and their eventual loss of power. The downfall

of the Occaneechi freed traders and more remote Indians to have more intense contact than at any previous time. This period marks the height of the trading activity in the Piedmont. The fourth period (1710-1740) saw the nearly complete depopulation of Native American groups in the Piedmont. Although a few isolated families may have remained (Hazel 1992), the majority of the remnant populations which survived the ravages of disease and nearly continuous raiding by Indian foes emigrated either north to Fort Christanna or south to join the more populous Catawba.

#### RESEARCH QUESTIONS

At the outset of the Siouan Project, a series of research questions, based on information from the ethnohistorical record and from previous archaeological work, was formulated concerning the aboriginal use of faunal resources both before and after Contact. The patterns of exploitation of faunal resources defined for a number of prehistoric North Carolina and Virginia sites (e.g., Waselkov 1977; Barber and Williams 1978; Runquist 1979; Egloff et al. 1980; Coleman et al. 1982) indicated that inhabitants of the Piedmont utilized the animals in their environment in a manner similar to the pattern reported by Smith (1974) for Middle Mississippi sites in the Mississippi Valley. In addition to concentrating on many of the same species as Smith's groups, the North Carolina and Virginia assemblages reflect a similar pattern of selective, seasonally oriented exploitation. During the Early Contact period there is little archaeological evidence that the

presence of Europeans was having much of an effect on the lives of the piedmont Indians. Thus, it was hypothesized that the faunal assemblages, at least from the protohistoric sites (Wall and Early Upper Saratow), would display a "procurement strategy that concentrated on those sections of the biotic community that would provide a maximum meat yield for a minimum of expended energy" (Smith 1974:288). The faunal assemblages from the Wall and Early Upper Saratow sites would represent the continuation of a general subsistence strategy which had been successfully used by the occupants of inland sites in the Southeast for hundreds of years (Wing 1977).

The Upper Saratow site was occupied during the Middle Contact period (A.D. 1660-1680) and the Fredricks site was occupied during the Late Contact Period (A.D. 1680-1710). As mentioned above, inhabitants of sites occupied during these two periods are likely to have witnessed cultural upheaval unlike anything seen previously in the Piedmont. It was assumed that the faunal assemblages from these two sites would reflect this disruption in some way. It was hypothesized that these historic faunal assemblages would provide at the very least, evidence of an increase in the hunting of deer and fur-bearers for trade, and probably evidence that animals were being slaughtered primarily for their hides rather than for meat. The possession of firearms by the residents of these sites may have led to an increase in the proportion of large animals hunted. Finally, the rapid decline in native populations and the need for small remnant populations to band together for subsistence and defensive purposes was expected to have disrupted traditional

procurement strategies. Evidence of this might include less specialization and more variability in the faunal assemblages, and evidence of more opportunistic hunting patterns and less seasonally oriented hunting.

A preliminary comparison of faunal remains from the Wall and Fredricks sites, however, yielded no direct evidence of participation in the deerskin trade by the inhabitants of Occaneechi Town (Holm 1985). The faunal assemblages from these two sites were very similar to each other and to the pattern identified for a variety of aboriginal sites in the interior Southeast. Also, the presence of only two fragments of bone from European-introduced species indicates that domesticated animals were probably not a major portion of the diet of the inhabitants of the historic site. At the time of the first study, there were at least three plausible explanations for the presence of a large number of European artifacts at the Fredricks site and a lack of evidence for participation in the deerskin trade in the faunal assemblage. Because the majority of the remains from the Fredricks site were recovered from the fill of burial pits, they may have reflected special ceremonial behavior rather than hunting activities associated with either normal subsistence or the deerskin trade. A second possibility was that hunting activities associated with the deerskin trade were carried out in hunting camps far from the village and none of the bones of animals killed for such purposes were returned to the village. A third possibility was that, as middlemen, the Occaneechi were not directly involved in the hunting activities associated with the deerskin trade.

Analysis of the ethnobotanical remains from a number of piedmont sites revealed considerable continuity in plant use despite disruptive European activities in the northern Piedmont (Gremillion 1989). Acorns, hickory, corn, beans and squash were important plant resources at both protohistoric and historic sites and peach was the only European-introduced species identified from the Fredricks assemblage. The survival of traditional subsistence practices involving plant resources suggested the possibility that, in spite of the tremendous social upheaval of the Historic period, the Indians of the North Carolina Piedmont did not experience change in all aspects of life.

In late prehistoric times, northern Piedmont groups utilized a subsistence strategy which minimized risk by relying heavily on one or two animal species and to a lesser extent upon a wide variety of other taxa. The continued use of this resilient strategy is a likely explanation for the similarities between the Wall and Fredricks faunal assemblages. With the analysis of the entire faunal assemblage from the Fredricks site, it is possible to test the hypothesis that subsistence was one aspect of Siouan life that was not dramatically disrupted by the Europeans. The assemblages from the protohistoric and historic Dan River sites provide information concerning subsistence practices at locations farther from the powerful Occaneechi and the Virginia trading path. Although the focus of the original Siouan Project research was culture change, in terms of subsistence, the concept of continuity deserves equal attention. Thus, the following study examines both change and continuity in the ways in which piedmont Indians

utilized animal resources and discusses the natural and cultural forces which influenced decisions to retain or reject aspects of a long-standing subsistence system.



## CHAPTER II

### ENVIRONMENTAL SETTING

One purpose of the present study is to explore the relationship between aboriginal inhabitants of the North Carolina Piedmont and the animals in their natural environment. Was this relationship characterized by continuity or change through time? Did the arrival of European settlers and the introduction of firearms, the deerskin trade, and new diseases alter existing patterns of interaction? Did the aborigines adapt their practices in order to maintain a traditional mode of interaction with their environment in spite of disruptive influences? There is no way to identify what constitutes change or continuity in the Historic period without first exploring the dynamic interaction between the Indians and their environment prior to the arrival of the Europeans.

The link between any cultural group and its environment is characterized by instability rather than stasis. The prehistoric inhabitants of the Piedmont did not simply adapt to a static environment and stay adapted until the Europeans altered the balance of things. Instead, the aboriginal populations were engaged in a complex, dynamic interrelationship with their natural setting. Not only did the setting consist of spatially heterogeneous communities of plants and animals, it also exhibited temporal variability in the form of both predictable seasonal changes and non-predictable

climatic changes (Winterhalder 1980). In addition to the variability supplied by the natural world, it is important to recognize the influence that humans exerted on their own environment. Hunting and horticultural practices, the use of fire, and especially the presence of human settlements all altered environmental conditions. Thus, any attempt to identify the effects of the European presence on piedmont Indians must be preceded by an understanding of not only the basic components of the environmental setting but also of the dynamic interrelationship between these human populations and their environment.

#### SOURCES OF INFORMATION

One may follow numerous avenues in understanding human-environment interaction in North Carolina. Sources of information include modern studies of vegetation and animals of the Piedmont, ethnohistoric documents, and archaeological references. All of these sources of information are biased in one way or another. Ethnohistoric sources for example, frequently provide over-glorified descriptions of the plant and animal life of the New World because the authors were trying to entice new settlers to the area. For the same reason, these accounts emphasized information that was important to colonists but not necessarily to native inhabitants of the region. Modern biological studies present data on current environmental conditions which are frequently very much altered from those of prehistoric times. Archaeological information

is necessarily constrained by problems of sampling biases and differential preservation. Also, because these sources are so diverse, it is difficult to unite them in a cohesive discussion of ecological interrelationships without additional support from a broader theoretical framework. For this reason, I will utilize the terms and concepts of ecological anthropology and evolutionary ecology to provide a more cohesive picture than could be obtained by using each of the three sources of information separately.

Just as it is important to view human-environmental interaction as dynamic, it is also important to remember that the environment itself is not homogeneous. Even within a given physiographic province such as the Piedmont, the environment is characterized by spatial heterogeneity and temporal variance (Winterhalder 1980:136). Thus, any ecosystem consists of "patches" that differ from one another spatially and temporally and also exhibit differences in diversity and density of resources. Wiens (1976:83) defines patch as an area "distinguished by discontinuities in environmental character states from [its] surroundings." He also points out that patchiness is organism-defined. In other words, "the patch structure of an environment is that which is recognized by or relevant to the organisms under consideration" (Wiens 1976:83). In this instance, most of the organisms under consideration are terrestrial, so the environmental qualities defining relevant patches include landform, soils, vegetation, and local climate (Winterhalder 1980:153). Organisms within a patch not only interact with one another but also contribute to heterogeneity. Often, organisms prevent equilibrium states through disturbance activities

such as burrowing through, grazing upon, or (in the case of human beings) burning portions of the environment. Localized disturbances such as tree falls and erosion, in addition to those mentioned above, introduce a temporal component to the definition of patchiness. As these disturbances occur, they produce patches of vegetation that differ in successional status from the surrounding vegetation (Wiens 1976:82). Thus, both temporal and spatial aspects of natural disturbance produce heterogeneity.

In addition to spatial heterogeneity, another important characteristic of the environment is temporal variability. Temporal variability can be measured along three scales: seasonal, interannual, and long-term. Seasonal variation refers to variations occurring within a single year, interannual refers to changes from one year to the next, and long-term refers to variations that occur no more frequently than once in a generation (Rowley-Conwy and Zvelebil 1989:40). Diversification, mobility, storage, and exchange are some of the ways in which temporal variation in resource abundance can be accommodated (Minc and Smith 1989:10). A cultural response to variation is effective only if it entails a strategy which matches the perturbation in terms of capacity and scale (Halstead and O'Shea 1989:1). For example, seasonal changes create a yearly variation in the abundance and availability of both plants and animals. Indians in the Piedmont coped with this variability by relying on a wide variety of both plant and animal resources and by scheduling their activities to correspond to the seasonal availability of these resources. They also relied on the storage of plant foods to provide food during times of scarcity.

As "the spatio-cultural scale of the perturbation increases, the size of (a) the spatial area over which a given strategy operates, and (b) the social unit integrated by that response must correspondingly increase" (Minc and Smith 1989:10). Noncyclical (and therefore unpredictable) variability of environmental conditions in the form of droughts, floods, prolonged winters and similar events also affect the abundance and availability of resources. If these conditions were severe or lasted over a long time they would have prompted responses on a scale much greater than those elicited by predictable seasonal changes. For example, if it was not possible to rely on stored foods during a period of severe stress it is likely the Indians would have responded by becoming more mobile (perhaps migrating to another, unaffected region) or by relying upon exchange with groups unaffected by the perturbation. It was just as important for the Indians to possess an effective means of contending with prolonged or unpredictable periods of environmental stress as it was for them to cope with seasonal changes.

It is not possible to obtain the kind of detailed description of past environmental conditions necessary for a complete understanding of the interaction between the piedmont Indians and their environment. Every variation in temperature or rainfall that occurred cannot be considered. It is important though, to keep in mind that even before the arrival of the Europeans, Indians of the northern Piedmont were interacting with and adapting to a world of constantly changing environmental conditions. Environmental stability was probably more characteristic of the Piedmont in the

past than was unpredictability. However, the Indians did not acquire a single adaptation to an "average" environment. Instead, they were engaged in a relationship in which both components, human and environmental, were affecting one another. In some cases, the Indians themselves were responsible for changing the environmental conditions in a particular area, as when they burned underbrush in order to hunt deer. Even though the Indians were directly responsible for the change and may have planned it meticulously, they still had to adapt to the changed environmental conditions that their actions created.

#### PHYSIOGRAPHY

The four sites that are the focus of this study lie within the Piedmont physiographic province. The Piedmont is located between the coastal plain to the east and the Blue Ridge Mountains to the west and occupies approximately 45% of the total area of North Carolina. The Piedmont is characterized by rolling hills and low ridges with elevations of about 300 to 600 ft above sea level in the east, rising to about 1,500 ft above sea level at the base of the Blue Ridge Mountains (Clay et al. 1975:113). The gently rolling topography is occasionally punctuated by monadnocks, or small mountains of erosion-resistant rock. The Sauratown Mountains, examples of monadnocks, lie within a few miles of the Stokes County sites (Early Upper Saratown and Upper Saratown). These two sites are located on the Dan River which, along with its tributaries, drains the northern portion of the North Carolina Piedmont. The

Central part of the Piedmont is drained by the Tar, Neuse, and Cape Fear rivers, and the southwest is drained by the Yadkin, Catawba, and Broad rivers.

## CLIMATE

North Carolina is located within the humid subtropical climatic region. This climatic type is characterized by hot, humid summers; short, mild winters; and fairly high precipitation. At present the maximum temperatures across the Piedmont average between 88°F and 92°F in the summer and minimum temperatures hover around the freezing point in the winter (Clay et al. 1975:93-101). Rainfall averages approximately 40-50 inches annually and is usually heaviest in mid-summer and lightest during the fall (Moore and Wood 1976). Although similar climatic conditions prevailed in the past, there has been some change from conditions existing during the period under study and those existing today. From approximately 1430 to 1850 North America was in a period now known as the "Little Ice Age" when temperatures averaged more than 3°C lower than at present (Lamb 1963). Rountree (1989) indicates that this difference was evidenced in harsher winters and fewer frost-free days than this area currently experiences. For the last fifty years the frost-free season in this area has generally been between 180 and 210 days (Moore and Wood 1976). Because of the cooler temperatures, the growing season during the time under study would have been somewhat shorter than it is now. Lamb (1963, 1977) and Ogilvie (1984) believe that during the Little Ice Age exceedingly cold years



alternated with uncommonly warm years. Either way, the Indians and colonists living during that time were responding to environmental conditions at least somewhat different than those predominating today.

#### PLANTS AND ANIMALS OF THE PIEDMONT

The normative description of the Piedmont is one which is well known to archaeologists in this region. A typical description states that originally the Piedmont was covered by oak-hickory forests and that dominant species of this forest type included various species of oak (white, black, scarlet, southern red, and post), mockernut and smooth hickory, black gum and tulip poplar. It will note that understory species included dogwood and sourwood and that occasionally shortleaf and loblolly pine were present (Clay et al. 1975:132-133). If one is concerned only with the presence or absence of certain species, this sort of description will suffice. If, however, one is interested in the dynamic interaction between plants, animals, people and the environment, a different sort of description is necessary.

Recently, some authors (Hammett 1986; Gremillion 1989) have produced studies describing how the aboriginal inhabitants of the Piedmont were actively and intentionally involved in creating and maintaining patches within their landscape that were especially productive. Horticultural clearing, maintenance of fields, shifting cultivation and the use of fire drives as an aid to hunting all created clear patches of land in varying stages of succession

throughout the region. These patches, rather than the seemingly uniform conditions of the ubiquitous oak-hickory forest were the areas which provided the most diverse and plentiful sources of both plant and animal resources. The Piedmont of the past, like that of the present, consisted of a complicated mosaic of pastures and fields, bottomland and upland forests, swamp forests and scrub communities (Moore and Wood 1976:27-48; Gremillion 1989:131-141). The aboriginal inhabitants of this region played an important and active role in altering their environment through burning and clearing.

As with the climate, it is not possible to reconstruct precisely the vegetational mosaic existing in the past around the sites under study. However, modern vegetational studies can provide much of the information needed to gain an adequate picture of past vegetation in the Piedmont. Moore and Wood (1976) provide one of the most useful studies of the modern vegetation in the area being studied. Gremillion (1989:131-141) has combined their work with ethnohistoric accounts (Boyd 1967, Lefler 1967, Van Doren 1928, Bland 1966) and paleoethnobotanical evidence to identify the types of plant communities in the northeastern Piedmont for the Late Prehistoric and Historic periods (A.D. 1400-1740).

Fields and pastures cleared by fires or resulting from abandoned or fallow agricultural lands exhibit a succession of vegetation types. Many of the herbaceous taxa found in cleared areas today are the same as those found archaeologically (Gremillion 1989:137). Crabgrass, however, is an example of one of the many Eurasian weeds that colonize open habitats today but were not

present in the past. At later successional stages, these cleared areas would have been covered by such plants as broomsedge, aster, goldenrod, and pine (Moore and Wood 1976:29; Gremillion 1989:137). A variety of animals prefer the habitat provided by these "old fields." Immediately after a crop is harvested or abandoned, mice and moles will make themselves at home. As broomsedge begins to dominate, rats, shrews, cottontails and bobcats will appear. When pines become dominant, cotton rats move on, and short-tailed shrews and gray squirrels make their appearance. Rabbits may utilize the area for shelter but will continue to rely on fields at an earlier stage of succession for food (Webster et al. 1985:5-8).

Scrub communities are characteristically forested but have no canopy layer. These forests appear successional after pine forests or old fields. In pine scrub forests at least 85% of the trees present are pine. Hardwood scrub is usually located in bottomlands or mesic areas and consists of at least 85% hardwoods. Mixed scrub is usually a result of timbering and consists of a community including both pines and hardwoods (Moore and Wood 1976:31-38). Animal species associated with these communities include gray squirrels, southern flying squirrels, eastern chipmunks, short-tailed shrews, gray foxes, raccoons, and white-footed mice (Webster et al. 1985:5-8).

Alluvial forests and swamp forests make up the two categories of bottomland forest identified by Moore and Wood (1976:38-40). Alluvial forests are characterized by a closed canopy of river birch, sweet gum, ash, sycamore, box elder, hackberry, red maple, southern sugar maple, oak, hickory and loblolly pine. Ironwood,

pawpaw, American holly, red mulberry, elm and buckeye are included in the subcanopy. Swamp forests are characterized by a canopy consisting of swamp chestnut oak, overcup oak, willow oak, swamp spanish oak, sweetgum, swamp red oak, hickory and elm. The subcanopy is made up of ironwood, hawthorne and black haw. Beavers, minks, muskrats and river otters prefer these floodplain forests when they retain some areas of shallow water for most of the year. Muskrats, raccoons, minks and star-nosed moles are found in shallow marshlands adjacent to these forests (Webster et al. 1985:5-8).

Moore and Wood (1976:45) divide upland forests into two categories. Upland hardwood forests are dominated by species of oak and hickory and at least 85% of the trees present are hardwoods. In mixed upland forests, pines make up at least 15% of the forest canopy. Other species present are those found in upland hardwood forests, including various species of oak, maple, sweetgum and hickory. Animals found in these forests include raccoons, weasels, opossums, white-tailed deer, and white-footed mice (Webster et al. 1985:5-8).

Although the terrestrial plant community types are characterized by their dominant tree species, it is important to remember that the vegetation of the Piedmont also consisted of a wide variety of shrubs, herbs, and vines. These subcanopy plants such as blueberry bushes, strawberry plants, blackberries, wild ginger, and reeds provided many important resources for the aboriginal inhabitants of this area.

The animal species populating the Piedmont today are, for the most part, the same as those occupying the area during the Late

Prehistoric and Historic periods (Fowler 1945; Martoff et al. 1980; Manooch 1988; Potter et al. 1980; Webster et al. 1985). Some animals, such as wolves and bears, which were observed in the past (Lefler 1967:54-56, 124) are rarely, if ever encountered today. Lawson (Lefler 1967:140-141) listed over 110 birds that could be found in North Carolina at the time of his journey. Of these, the turkey and the passenger pigeon were the most important to the Indians as sources of food. The passenger pigeon was observed in large flocks in early historic times (Lefler 1967:50-51; Boyd 1967:216) but is now extinct. Lawson described the presence of a variety of reptiles, amphibians and fish found in the Piedmont (Lefler 1967). He mentioned that the Indians sometimes ate snakes and utilized the skin of the king snake for belts and the teeth of rattlesnakes to create an instrument for scarifying (Lefler 1967:137, 182, 223). Lawson also mentioned the presence of frogs in North Carolina (listing them under his category of insects) and listed 20 types of freshwater fish he encountered during his travels (Lefler 1967:155-156).

#### SUMMARY

Through the use of fire and the clearing and abandonment of fields, Indians in the Piedmont played an active role in creating a patchy environment that included many open areas. These areas produced a wide variety of plants preferred by humans and provided deer with an abundance of browse (Hammett 1986). Also, this patchy landscape abounded in edge areas which are generally characterized by a greater variety of species than any of the single zones at

their boundaries (Gremillion 1989:138). Crops and stored foods also attracted many animals to the vicinity of villages. Practices such as burning to clear fields were obviously intentional actions on the part of the aboriginal inhabitants of the Piedmont. These people may or may not have burned areas with the explicit intention of creating patches with a higher diversity or density of desirable resources. What is clear however, is that they were not simply responding in a passive manner to conditions of an "average" environment. Instead, they were involved in an interaction with the environment in which each side influenced the other.

A similarly reciprocal relationship existed between the piedmont Indians and the Europeans. The Indians, in addition to adjusting to changes produced by the Europeans, also played an active role in the relationship. Unfortunately, a variety of forces (such as the introduction of new diseases, firearms, and alcohol) eradicated most of the piedmont Siouans before they had a chance to adapt to the new cultural conditions. These new conditions and the relationships between the piedmont Indians and the Europeans are the topics to which we now turn.

### CHAPTER III

#### CULTURAL ENVIRONMENT

There is considerable information about the English-Indian trade relations in Virginia, starting with the founding of Jamestown in 1607. Likewise, information about the South Carolina deerskin trade, which began after the founding of Charles Town in 1670, is available. Information about the trade relations between the English and the Indians of the northern North Carolina Piedmont, however, is scarce. Contact between the Indians of North Carolina and Europeans began in the early 1500s when attempts were made by Europeans to explore the coast. During this early period, interaction between piedmont Indians and Europeans was the result of indirect contact facilitated by Indian middlemen. A more formal middleman trade was probably initiated by European explorers of the interior of Virginia during the early and middle 1600s (Merrell 1987:20-21). The first English traders and explorers did not actually arrive in the northern Piedmont of North Carolina until the middle of the seventeenth century. By 1722, the Indian groups living in this region had either moved out of the area or had been badly decimated by disease and warfare (Dickens et al. 1987:3).



Swanton (1924) divides the Siouan speakers of the North Carolina Piedmont into two groups: a northern division and a southern division. The northern division includes the Tutelo, Saponi, and Occaneechi, groups which, during the Historic period, moved to Fort Christanna in Virginia. The southern division includes the Eno, Shakori, and Sara, groups which fled south to join the Catawba during the Historic period. The most prominent Indians of the northern Piedmont during the Historic period appear to have been the Occaneechi. Other groups, such as the Eno, Shakori, Sissipahaw, and Sara appear to have played less powerful roles in the interplay between the Europeans and the indigenous groups of the Piedmont and are mentioned less frequently in the ethnohistoric accounts.

Written sources documenting the approximately 200 years of contact are somewhat scarce and frequently unreliable. Before the Revolutionary War, British accounts of the New World were very often propaganda, written to entice settlers to the New World. Other early accounts of the New World (such as John Brickell's and Samuel Jenner's) were fairly blatant plagiarisms written by authors who had never actually observed the scenes they described (Adams 1962). John Lederer, James Needham and Gabriel Arthur, and John Lawson left more reliable written accounts than other travelers through the region.

In A New Voyage to Carolina, Lawson described his exploration of the region from Charleston, South Carolina, through the Piedmont of North Carolina to New Bern (Lefler 1967). In addition to presenting the scenes and events of his trip, Lawson also wrote

about the "Vegetables," "Beasts," "Insects" (including alligators, frogs, snakes, and lizards), "Birds," and "Fish" of North Carolina. Although Lawson provided a wealth of information on the use of faunal resources by piedmont (and coastal) Indians, he provided very little information about the ways in which these animals were procured. With the exception of Lawson's account, none of the ethnohistoric sources mentioned above provided detailed information about hunting, fishing, and other subsistence activities of the historic North Carolina Indians.

In spite of the relative paucity of ethnohistoric information on the culture of the Siouan Indians during the Historic period, all accounts from this time indicate that the Indians of the region were experiencing dramatic changes in their ways of life as a result of their contact with the Europeans. The accounts from the Historic period indicate that there were three major factors involved in the dramatic cultural change experienced by these Indians: the introduction of Old World diseases, participation in the deerskin trade, and nearly continuous warfare and raiding by Iroquois groups from the North. The result of this upheaval included the consolidation of many different ethnic groups into single nucleated villages, the depopulation of entire river drainages, and dramatic population decline (Davis and Ward 1989).

#### DISEASE

The first stage of contact between the Europeans and the

Native Americans of the interior Southeast involved only the indirect exchange of trade goods and the transmission of disease organisms. Indian communities of the interior were frequently exposed to European diseases through contact with infected Indians long before they ever set eyes on an explorer or trader. The devastating effect of European diseases on North American Indians is a topic which has received considerable attention over the last several years. It is common knowledge that the Indians of North America had little immunity to a wide array of deadly European diseases such as typhus, yellow fever, diphtheria, influenza, dysentery, and smallpox. Even the common childhood diseases such as chicken pox, measles, mumps, and whooping cough wreaked devastation on the aboriginal populations which had never before been exposed to the organisms causing these diseases. The prolonged isolation of the populations of the New World from those of the Old created a situation in which great numbers of the native inhabitants of the New World were killed by diseases which many European newcomers survived.

The dramatic decline in population caused by these diseases would have had a significant impact on many aspects of Southeastern Indian life. The deaths of children and young men and women of child-bearing age would have threatened the very capacity of a society to reproduce itself physically. Milner (1980:47) suggests that the high mortality in regions affected by these diseases would have dramatically altered subsistence practices and that the disruption of food procurement and distribution activities could have led to famines. Or, he

suggests, the epidemics would have reduced the labor force to such a degree that formerly discrete and self-sufficient groups of people would have been forced to join forces in order to have adequate manpower to procure sufficient food. The deaths of community leaders and craft specialists would have created gaps in political organization and in the flow of knowledge from one generation to the next. Crosby (1972:56) adds that the "psychological effect of epidemic disease is enormous, especially of an unknown disfiguring disease which strikes swiftly." Eruptive diseases such as smallpox, typhus, and measles can "within a few days ... transform a healthy man into a pustuled, oozing horror, whom his closest relatives can barely recognize" (Crosby 1972:56). Other researchers note that the unprecedented destruction of Native American populations coupled with the apparent immunity of Europeans brought about a crisis of faith in Indian religious practices in many communities (Axtell 1981:252). Thus, the disease organisms introduced by the Europeans into the New World would have affected far more than just the physical health of those afflicted. Political and social institutions collapsed and the Native American groups attacked by these diseases found, to their horror, that their subsistence, their morale, their spiritual faith, and even their ability to reproduce themselves (both physically and culturally) were threatened.

There appears to be a scholarly consensus on the ultimate, devastating effects of these newly introduced diseases on the populations of the New World. However, the timing and patterning of these "virgin soil" epidemics has been hotly debated as has the

more immediate effects of these disease episodes on the cultures of individual southeastern groups. The major debate seems to pivot around two predominant opinions. One group of researchers, including Dobyns (1983), Ramenofsky (1987), and Smith (1987), argues that the arrival of the Spanish in the New World set off a series of pandemics that swept through the Southeast, creating drastic population decline in areas far removed from the camps and settlements of the new arrivals. The other group, including Blakely and Detweiler-Blakely (1989), Milner (1980), and Snow and Lanphear (1989), believe that the European diseases should be viewed not as pandemics, but as "torrents following corridors of least resistance, occasionally dying out in cul-de-sacs" (Blakely and Detweiler-Blakely 1989:62). Those opposed to Dobyns's views feel that these "torrents" did not truly decimate Southeastern populations until after direct contact was established with Europeans. They also believe that "community size, inter-village interaction, and the degree and intensity of trade and contact all affected the rapidity and scope of the spread of epidemic diseases" (Ward and Davis 1991:180).

The distinction between pandemics sweeping the land before the Europeans or more sporadic and limited epidemics arriving with them is an important one. Attempts to produce accurate estimates of the population of the New World before the arrival of the Europeans depend on this information. Also, any attempt to analyze the impact of contact with the Europeans on these groups must consider whether or not the groups were already severely weakened by disease prior to direct contact. Finally, this

information is vital to the construction of any regional cultural history.

The northern Piedmont of North Carolina provides an excellent case study of the impact of European diseases on aboriginal cultures. A fairly comprehensive cultural chronology has been developed for this region that spans the period of earliest contact to the demise of most of the Indians in the region, from approximately 1500 to 1700 (Dickens et al. 1987; Ward and Davis 1992; Eastman 1992). Coupled with knowledge of community patterns, mortuary data, and ethnohistoric accounts, this chronology can be utilized to produce a fairly complete picture of the timing and effects of epidemic disease episodes on the Indians in this region.

Ward and Davis (1991) have compiled data on sixteenth and seventeenth century villages located in the Haw, Eno, and Dan River drainages in order to determine if depopulation in this area began, as Dobyns suggests, with the arrival of the Spanish in the Southeast. Relying primarily on archaeological data, they predict that regions affected by major epidemics will differ from those that were spared in a number of ways. Evidence that a region was affected during a particular period includes significantly fewer and/or smaller settlements than during earlier periods, fewer and/or less permanent structures within each settlement, and the presence of more and/or multiple burials (Ward and Davis 1991:173). Analysis of sixteenth century sites does not reveal any of the archaeological evidence indicating precipitous decline in population in the northern Piedmont. In fact, in this region

there is no archaeological evidence of epidemics until the middle of the seventeenth century. At this time, English explorers and traders were beginning to travel down the Virginia trading path on a regular basis. When combined, the ethnohistoric and archaeological data of the seventeenth century indicate that piedmont Indians experienced the same high mortality rates as described for other populations encountering European diseases for the first time (Hogue 1988).

The effects of these epidemics, however, were not spread uniformly across North Carolina. Those groups which were in sustained and direct contact with the English appear to have experienced the well-known cataclysmic effects of the epidemics while more isolated groups in southern North Carolina did not (Ward and Davis 1991:176). Thus, contrary to Dobyn's scenario, the epidemics that wiped out the Indian populations of North Carolina did not sweep uniformly across the state decades before the first Europeans arrived in the Piedmont. Instead, it appears that the decimation of Native American populations in the Piedmont proceeded in a manner much more reminiscent of the scenario predicted by Milner.

#### TRADE AND WARFARE

Some of the Indian groups of the southern Piedmont may have been affected by the pathogens introduced by indirect contact with Europeans as early as the sixteenth century. The Spanish were the first Europeans to establish direct contact with Indians of the



North Carolina Piedmont. These explorers did not come to establish permanent settlements or to engage in trade with the Indians they encountered. Instead, De Soto entered the southern Piedmont in 1540 in search of gold and other riches (Hudson 1976:107). Juan Pardo traveled through the same general area in 1566 on a military mission to discourage any incursions by the French into the region (Wilson 1983:43). Although the pathogens introduced by these early explorers had a profound effect on some populations of the southeast, the effect of trade between native groups and the Spanish intruders was insignificant.

The English colonists planned to make Indians "commercial partners in a worldwide exchange network" (Ward and Davis 1993:426). They were the first European group to engage in sustained contact with the Indians of the Piedmont of Virginia and North Carolina. The settlement of the colony at Jamestown in 1607 marked the beginning of continuous contact between Europeans and the natives of this area. However, the English did not begin to explore and exploit the resources of the interior of North Carolina until the 1670s. It was not until this time that a well-established system was in place in which the piedmont Indians could trade deerskins and furs for European goods.

Trade between European explorers and settlers and native inhabitants was established at different times across the New World. In spite of differences in the dates when this trade occurred and in the participants and locations of the exchange, certain characteristics appear to be common in most of these situations.

One of these characteristics is that no matter where this intercultural exchange took place, it generally did not represent the introduction of a totally novel concept. European-Indian exchange usually represented an expansion or intensification of an interregional exchange network in existence long before the arrival of the first explorers (Cronon 1983; Bradley 1987; Waselkov 1989; Rogers 1990; Ward and Davis 1993; Merrell 1989).

In his discussion of Southeastern Indians, Merrell (1987:23) notes "whereas European goods and colonial intruders were certainly novelties, traders and trade were not and piedmont natives fitted the new men and the new merchandise into established patterns of exchange and existence." In New England prehistorically, highly valued trade goods were moved across hundreds of miles through interconnected exchange networks and the "European fur trade could come into existence only by being assimilated into this earlier context" (Cronon 1983:93). In discussing the Onondaga Iroquois of the Northeast, Bradley (1987:89) notes that "the evidence indicates that a series of overlapping exchange networks operated across northeastern North America during the Late Woodland stage." By the middle of the sixteenth century changes occurred in the types and quantities of goods exchanged but "the same basic network continued to function" (Bradley 1987:93).

The fact that most trade was in deerskins and furs was also a continuation or expansion of traditional behavior. In the Northeast, Indians with a surplus of skins and furs frequently traded these items for corn and other agricultural products from

groups to the south (Bradley 1987). In the southeast Piedmont, "Indians were in the habit of storing surplus deerskins for future use or for trade with peoples near the coast, where the quality of deerskins was poorer" (Merrell 1989:35).

Also, in many instances, Indian manufactures persisted in spite of the introduction of exotic trade goods (White 1991:139; Bishop 1981). Rogers (1990:10) notes that "rather than overwhelming Euro-American technological superiority, it may be argued that native technologies were initially superior, in at least some cases." Early in the Historic period, when European trade goods did replace native goods, they often served as "simple substitutions for traditional items: manufactured cloth for animal skins, metal tools for stone, bone, and wooden tools" (Axtell 1981:256). In the Northeast, Indians initially equated European copper, brass, and glass with traditional symbolic materials such as native copper and crystal and valued European goods for their symbolic rather than utilitarian properties (White 1991:99). "In the beginning, native North Americans viewed European materials as a part of their own world, not someone else's" (Bradley 1987:66). Axtell (1981:256) notes that "the mere presence of English goods in native society, even on a large scale, did not necessarily denote a significant change in Indian culture." Instead he asserts, "material objects, no less than people, receive their cultural status only by being assigned meaning and value by the members of a society. An artifact may be made of several alternative materials, but if its traditional form and function do not change, neither does its cultural meaning" (Axtell 1981:256).

Merrell (1984:549) concurs and suggests that because European goods were initially incorporated into familiar functional categories, the effects of the new technology on aboriginal ways of life were significantly delayed. According to Cronon (1983:93), "European tools did not instantly increase Indian productivity in any drastic way. Most were readily incorporated into subsistence practices and trade patterns that had existed in precolonial times. They were in fact, often reconverted into less utilitarian but more highly valued Indian objects." It was not until decades after first contact that the Indians experienced "an erosion of craft skills" and became dependent on European goods (Merrell 1989:59).

Another feature commonly found in these situations is the differences in the perceptions of Europeans and Indians participating in trade. It was rare for the intent of either party to remain static for any length of time. The political and economic goals of both parties shifted frequently. At various times, trade could be seen as a political activity, a means for forming and maintaining alliances through reciprocal exchange. Before contact, trade was often viewed as "reciprocal exchange rather than a desire for material gain" (Bradley 1987:89). Trade served to define and maintain cordial relationships with other groups, as Indians refused to trade with groups with whom they were not at peace (Ray and Freeman 1978:22). White (1991:98) lists several ways in which Algonquian trade departed from the goal of the maximization of profit. Among the Algonquians, the purpose of trade was primarily to satisfy the needs of both

parties. "The greater the need--provided a social relationship had been established--the greater the claim of the buyer on the seller" (White 1991:98). Most importantly, "the relation of the buyer and the seller was not incidental to the transaction; it was critical" (White 1991:98). If no formal relationship existed, one had to be created. This perception of the trade as a political activity designed to establish and maintain alliances has been identified among many other native American groups and seems to have persisted well into the Historic period (Bradley 1987:89; Cronon 1983:92; Calloway 1991:181, Martin 1978, Snow 1981, White 1983).

At other times, especially in the later years of contact, trade was viewed as an economic activity, a way to acquire the necessities of life and possibly wealth. Often, trade was simultaneously an economic and a political activity and thus served to fulfill a variety of needs.

In nearly all trade situations there was a period when the Europeans and the Indians either misunderstood one another or disagreed about the purpose and thus the character of the trade. The European traders were frequently at a loss when they discovered that the native groups with which they were interacting did not share in their own desire to acquire possessions in excess of their immediate needs. When dealing with the Choctaw, the English struggled to increase consumption of goods and thus the volume of trade but discovered that once the Choctaw had satisfied their immediate needs they had little incentive to continue hunting (White 1983:57). This was also true among the Algonquians

of the Great Lakes region whose desire for trade goods was limited even when the fur trade had reached its peak in that area (White 1991:131). In order to stimulate the trade, the Europeans would sometimes provide lavish gifts and better rates of exchange only to find that the Indians responded by hunting less frequently because they were able to purchase the goods they desired with fewer skins and hides than before (Ray and Freeman 1978:221; Ray 1974:67-68).

In discussing Native American groups of the Northeast, Bishop (1981:39-58) notes that the Indians of this region placed a high value on leisure and would not continue to hunt for skins and hides after their immediate needs were met. Invoking Romer's rule, Bishop (1981:49-50) notes that the Indians involved in the early fur trade in the Northeast "wished to alter their behavior only to the extent that they could maximize traditional values through the medium of new goods."

During the earlier periods of contact, the only trade item provided by Europeans that the Indians desired in unlimited quantities was alcohol. Rum prompted the Indians to hunt when no other goods provided this incentive. The use of credit to purchase rum also led the Indians to become increasingly indebted to the colonial traders (White 1983:57). Later firearms and ammunition became important to survival. Eventually the need for guns, ammunition, and rum controlled the pace of hunting and contributed to change the way in which these native groups interacted with their environment (White 1983:69-96). It usually was not until the Indians began to view these materials as

necessities that the trade, in their eyes, became primarily an economic rather than a political activity.

Recent scholars have begun to shift the portrayal of Euro-Indian trade away from one in which the Indians are viewed as being totally victimized by the relationship and unable to cope with the changing conditions around them. Usner (1992:191) notes that "the economic activities of Indian and colonial societies have long been separated by prevalent conceptions of frontiers either as boundaries between primitive and commercial economies or transitional zones through which stages of economic development rapidly progress." Recent work has begun to recognize the dynamic and complex roles and relationships that both the Europeans and the Indians were obliged to adopt in their interactions with one another. Bradley (1987:165) notes that the Onondaga "were not passive in their response to the Europeans, their ideas, and their materials." He further supports the concept voiced by Usner in stating that the "Onondaga data suggest that there was no single donor or recipient culture; Native Americans and Europeans taught and learned from one another, modifying both their respective cultures in the process. The interaction was dynamic and reciprocal, not linear and in one direction only" (Bradley 1987:165).

In many instances, Indians exerted a great deal of power over their European counterparts in the trade. In the North Carolina Piedmont, Indians refused to interact on purely economic terms and encouraged European traders to modify their lifestyles by adopting more traditional social roles in their society through marriage

and adoption (Merrell 1989:31, Wright 1986:41). In the early stages of trade, it was frequently the Indians who informed the traders when they would be allowed to enter the territory away from European settlements in order to trade with the native inhabitants of the interior (Merrell 1989:30, 63). It was not until the trade had become much better established that European traders began to move freely through the countryside at any time of the year. Indians also wielded considerable power in these exchange relationships because they served as both guides and translators. They were frequently "discriminating shoppers" in that they insisted upon receiving a particular type of cloth; beads of a certain color, shape and size; hoes of a particular type; gun powder of high enough quality; and improvements in the quality of the limited range of goods they desired (Merrell 1989:32, 82; Ray and Freeman 1978:225-226).

In many regions, the Indians were able to play off rivalries between competing groups of Europeans in order to achieve better terms of exchange (Calloway 1991:182; Ray 1978:255-271). Thus the Indians of the Great Lakes and those of the Lower Mississippi Valley were able to capitalize on the rivalries between French and English traders and improve the quality, quantity and/or price of the goods they obtained. In order to prevent the Cree and Assinboine from trading with French traders, English agents of the Hudson Bay Company were forced to comply with the Indians' terms of trade throughout the seventeenth and eighteenth centuries (Ray 1974:61). As these groups refused to trade with people who were not their allies, they refused to trade with English colonists



unless these newcomers participated in the reciprocal exchange of gifts which, to the Indians, reaffirmed and maintained alliances (Ray 1974:67-68). Because the posts of the Hudson Bay Company were widely scattered and the Indians were unable to repair or replace their metal tools easily, they began to make demands for more durable goods. In this way these Native Americans became more than mere consumers, they also became "agent[s] of technological change" (Ray 1978:268). Indians of the North Carolina Piedmont were able to exert similar power with competing traders from Virginia and South Carolina (Merrell 1989:55).

Indians also successfully intimidated explorers, traders, and settlers with threats of death which were sometimes carried out (references for the northern Piedmont include Alvord and Bidgood 1912:209-226; Crane 1981:169-170, Craven 1970:373-374, 380; Harrison 1922; Lefler 1967:xxxiv). It is clear that the Indians were not passive victims of the onslaught of Europeans and their technology. The arena in which this transcultural drama was played out can no longer be viewed as "a traditional world seeking to maintain itself unchanged or eroding under the pressure of whites. It [was] a joint Indian-white creation" (White 1991:xiv).

At times, some groups of Indians were able to achieve positions of considerable wealth and power by acting as middlemen between the Europeans and Indians who were too distant to participate in direct trade. White (1991:106) cites three reasons for the presence of middlemen in the Great Lakes region in the late seventeenth century: the inability of some groups to manufacture canoes needed for transporting trade goods, the great

distance separating many native groups from European traders, and, finally, intimidation by certain groups who wanted to monopolize the trade. The latter two causes were common occurrences prompting the emergence of middlemen in many areas throughout the New World.

In addition to these factors, there were others that commonly insured the presence of middlemen. The overhunting of fur-bearing mammals in the vicinity of European settlements often moved the Indians living near those settlements to begin collecting the products of the hunt from more distant groups rather than hunting themselves. Advantages in the location of native settlements and uneven access to European arms are two other common reasons for the ability of some groups to monopolize the trade through their roles as middlemen (Ray and Freeman 1978:45). Because of their monopoly over the trade, the groups performing the role of middlemen in the trade were often able to determine the type of goods received by more remote groups (Ray 1974:67-68, Ward and Davis 1993:427). Along the Middle Missouri, the Arikaras were among the communities that took on the role of middlemen (Rogers 1990:44); in the Great Lakes area, it was the Ottawas, the Cree and the Assinboine (White 1991:106, Ray 1974:26,59).

In the North Carolina Piedmont, the Occaneechi Indians acted as middlemen between Virginians and other piedmont groups during much of the Historic period (Merrell 1989:40). Davis and Ward (1991:2) propose that "the Occaneechis acted as a filter on the Virginia trade and sorted out arms, armaments, and possibly other items for their own use while allowing mostly nonutilitarian goods

to pass through to their neighbors." At the Fredricks site, the historic home of the Occaneechi, the assemblage of historic artifacts consists of a much higher proportion of utilitarian to ornamental goods than do assemblages from other historic piedmont sites (Davis and Ward 1991:9-12). The uneven distribution of trade goods among piedmont groups, coupled with the dramatic depopulation due to epidemic disease was likely to have resulted in disruption of traditional alliances and social organization (McManus 1989:34).

The frequent presence of middlemen points out another feature common to many trade situations. In many instances, at least during the initial stages of trade, it was possible to define three zones of trade (Ray and Freeman 1978:48-53). The first zone was located in the region immediately adjacent to a European settlement. The Indians in this zone participated in direct trade with the people living in the settlement. The Indians living in areas that were the most distant from these settlements were involved in indirect trade and utilized Indian middlemen to facilitate the exchange of their skins and hides for European trade goods. The Indians living in the zone between the most distant groups and the groups participating in direct trade served the function of middlemen.

Frequently, those groups participating in trade networks with the Europeans provided slaves in addition to furs and skins. During some periods, these Indian slaves were the basic commodity of the trade. These slaves were usually victims of warfare between native groups. This warfare, coupled with a desire to

participate actively in trade, caused mass dislocations. For example, the Susquehannocks were prompted to move south during the Historic period because of their desire to be closer to European trade centers and also because of the warfare initiated by the aggressive Iroquois to the north (Bradley 1987:98). This scenario of forces both pulling and pushing native groups to move to new areas was played out repeatedly throughout the New World.

Frequent warfare was not a new concept introduced with the arrival of the Europeans, however. White (1983:9) suggests that for some populations, including the Choctaw, warfare served as a mechanism to prevent the overhunting of local populations of deer. Whether intentional or not, buffer zones were maintained between groups which were hostile with one another and served as refuges for the deer. Also, warfare between human groups prevented hunters from traveling through certain areas or shortened the duration of their expeditions, thus allowing deer populations to increase. In the Piedmont, the presence of palisaded villages dating from the Woodland period bear testimony to prehistoric warfare (Davis and Ward 1989).

The arrival of the Europeans appears to have uniformly increased the intensity of warfare throughout the country and to have escalated the use of force among some groups in order to maintain monopolies within the trade system (Bradley 1987; White 1983; Rogers 1990; Ray 1974). In the South, this process accelerated during the late seventeenth century when northeastern warriors armed with guns and both Indian and European slavers raided the region (Smith 1987:142). Although piedmont warriors

had "habitually captured enemy Indians for adoption, torture, and servitude," this activity was greatly increased after contact and peaked during the latter half of the seventeenth century (Merrell 1987:24). Indians who were living anywhere in the vicinity of European settlements were faced with the choice of either "buying guns to defend themselves, or else of being killed or enslaved" (Hudson 1981:162). In virtually all trade situations, the need for protection from raiding groups increased the need for the possession of firearms and the need for weapons intensified the need to hunt both people and animals for the trade.

#### Summary

As stated earlier, there is a series of common elements frequently found in a variety of contact situations. Trade between Europeans and Indians usually represented an expansion of an interregional trade network which existed prior to the arrival of the Europeans. At least initially, goods traded by the Indians to the Europeans were the same as those traded prehistorically: skins, furs, and agricultural surplus. European goods often were not considered totally alien by Native Americans who interpreted the goods within traditional contexts and placed them in traditional categories. There was generally some discrepancy between the intent of the Europeans and that of the Indians in their participation in the trade. At varying times and places trade was viewed as either a political activity used to cement alliances or it was deemed an economic activity. Often, it served

both purposes. Frequently the Indians differed dramatically from European expectations in that they did not seem to desire European goods other than those that furnished their immediate needs. Eventually rum, firearms, and ammunition became highly prized goods desired in almost unlimited quantities.

One of the characteristics of the trade situation that has only recently received widespread attention is the fact that the Indians were neither barbarians, nor were they simply naive victims of unscrupulous white traders. It has become apparent that the Indians often wielded considerable power within the trade relationship. Generally the most powerful groups of Indians trading with the Europeans were those groups which were able to maintain positions of middlemen and thus had considerable control over both the Europeans, and the other Native American participants in the trade. A final commonality is that, in addition to trade in furs and skins, Native American slaves were a highly valued commodity. In order to obtain greater numbers of slaves, Europeans often supplied certain Indian groups with firearms and encouraged them to wage war with other groups. These raiding activities caused the dislocation of large numbers of Native American groups and eventually made the possession of firearms, and thus participation in the trade, a necessity for survival.

## CHAPTER IV

### ANIMALS UTILIZED BY PIEDMONT INDIANS

A variety of written sources has provided information that helps to clarify the interaction between the piedmont Indians and the animals in their environment. One of the most important of these is the travel account written by John Lawson (Lefler 1967), the only ethnohistoric account of the Piedmont which provides detailed information about subsistence activities of the historic North Carolina Indians. In describing his voyage through the Piedmont, Lawson gave considerable attention to the ways in which the piedmont (and coastal) Indians utilized faunal resources but provided only scanty information about the ways in which these animals were hunted and trapped. Thus, in the discussion below, it is necessary to turn to additional sources of information such as modern studies of the ecology and behavior of the animals of the Piedmont, ethnographic documents and archaeological data.

#### MAMMALS

As mentioned previously, white-tailed deer was the single most important mammalian resource of the North Carolina Indians. Lawson noted this fact during his travels and wrote of "barbaku'd" and roasted venison; venison broth thickened with acorn meal; and

and roasted venison; venison broth thickened with acorn meal; and "a Dish, in great Fashion amongst the Indians, which was Two young Fawns, taken out of the Doe's Bellies, and boil'd in the same slimy Bags Nature had plac'd them in" (Lefler 1967:51, 58). Parts of the deer were utilized in a variety of ways in addition to food. For example, deer hides were used for clothing and shoes, and as covers for drums, and historically, were also an important commodity for trade with the Europeans. "The Bone of a Deer's Foot" was used for scraping the hair off hides, and deer brains (after being baked and then soaked in water) were used in tanning hides (Lefler 1967:217). Lawson also mentioned the use of the "Head of a Buck" as a decoy with which to hunt other deer (Lefler 1967:29).

Swanton (1946:249) lists a number of ways in which Southeastern Indians used various parts of the deer in addition to those mentioned by Lawson. Horns were boiled for glue and made into projectile points, ornaments, and needles; hooves were made into rattles; and sinews and skins were used to make fish nets and bowstrings. Ribs were made into bracelets and tibiae into flutes. Tools constructed from deer bones include metatarsal beamers, ulna awls, and antler flakers.

In addition to describing the technique of stalking deer using a decoy, Lawson mentioned that the Indians also made use of fire drives. Other techniques used by North Carolina and Virginia Indians for hunting deer were stalking them without the use of a decoy, and driving them to water without the use of fire (Waselkov 1977:108).



The white-tailed deer is a browser which feeds primarily on leaves and twigs but also eats acorns and other mast, and a variety of herbaceous plants. The weight of adult deer can vary from 45 kg to 73 kg, and the average weight of an adult male is approximately 68 kg (Osborne 1992). White-tailed deer prefer a habitat consisting of broken areas of mixed young forests, old fields, and crop lands (Webster et al. 1985). In the process of clearing and later abandoning fields for their crops and firing the woods to hunt, the Indians of the Piedmont created the type of habitat required by the most intensively utilized animal in their assemblage of faunal resources. Hammett (1986:35) notes that "current range management research indicates that a pattern of prescribed burning in small patches, leaving adequate cover and edge areas, can increase the productivity of many game animals. Aboriginally, such a practice would have increased the richness and yield of many important animal and plant crops in the Native Southeast." In addition to deer, bears, turkeys, and rabbits would have responded favorably to a regime of occasional prescribed burning (Hammett 1986:39).

Although hunting was a year-round activity, Swanton (1946:255-265) indicates that the major hunting season occurred during the late fall and winter. There are numerous reasons why hunting deer is more advantageous during the fall and winter than at any other time of the year. Deer generally mate in the autumn. Bucks are considerably more active and aggressive at this time and the use of decoys in hunting is more successful in the fall than at any other time of the year. Deer tend to attain their maximum

weight during the fall and they also tend to aggregate in areas of mast concentration when other food resources are less available. It is easier to see and chase deer when there is less foliage and, most importantly, fall and winter hunting did not conflict with planting and harvesting activities. Lawson provides a description of a winter hunt:

When these savages go a hunting, they commonly go out in great Numbers, and oftentimes a great many Days Journey from home, beginning at the coming in of the Winter; that is, when the Leaves are fallen from the Trees, and are become dry. 'Tis then they burn the Woods, by setting Fire to the Leaves, and wither'd Bent and Grass... Thus they go and fire the Woods for many Miles, and drive the Deer and other Game into small Necks of Land and Isthmus's, where they kill and destroy what they please. In these Hunting-Quarters, they have their Wives and Ladies of the Camp, where they eat all the Fruits and Dainties of that Country, and live in all the Mirth and Jollity, which it is possible for such People to entertain themselves withal [Lefler 1967:215-216].

Lawson goes on to mention that it is during these winter hunts that the Indians "get their Complement of Deer-Skins and Furs to trade with the English" (Lefler 1967:216). Early explorers stated that historically, Indians of the Piedmont killed large numbers of deer during communal hunts and that they made "all this Slaughter only for the sake of the Skins, leaving the carcasses to perish in the Woods" (Robert Beverly 1705, quoted in Swanton 1946:318). If the meat was considered valuable enough to transport over any distance, the venison would have been dried over a fire and most of the bones would have been discarded prior to the drying process (Swanton 1946:377-378). Thus, if deer were hunted at long distances from the Indian villages, or if deer were

being hunted primarily for their hides rather than for the meat, it is likely that most of the bones of the skeleton would be abandoned at the kill site and would never accumulate in the archaeological record. Thus, the four piedmont assemblages could display continuity as the result of a lack of archaeological evidence for increased deer hunting even though this increase may have occurred.

Black bears are the only bears native to eastern North America. At the present time, bears are rarely encountered in the Piedmont. Males living in the mountains of North Carolina can weigh between 125 and 236 kg and females generally weigh between 70 and 149 kg (Warburton 1993). Coastal bears tend to weigh somewhat more. Because they are omnivorous, bears consume a very wide variety of plant and animal foods. In the spring they consume quantities of grasses and forbs and in the summer and fall they concentrate on berries and other fruit. Nuts, especially acorns, are important in the winter. Insects, fish, frogs, rodents and other small mammals and carrion are also potential sources of food for the bear. Because they rely on such a diversity of foods, bears tend to thrive in areas where there are many different environments, as long as they also have large areas of dense cover where they are not easily accessible to human beings. Like deer, bears do well in regions where they have access to the edge areas between mature forests and cleared areas such as old fields or burned over areas. Although bears generally do not hibernate in the Southeast, they do go into a period of inactivity in the winter and are thus more easily found and killed

during this time. Even during this period of inactivity, however, bears may become fully alert if they are disturbed (Webster et al. 1985).

In his study of bear ceremonialism, Hallowell (1926:42) quotes a letter he received from Swanton stating that, in the Southeast:

They usually hunted the bear before he came forth from his winter quarters in a hollow tree or cave. In the former case, one hunter threw or dropped fire into the hollow and his companions killed the animal after it had been driven forth. In the latter case, some men would go into the cave bearing a torch.

In his account of his journey through North and South Carolina, Lawson mentioned only one method of capturing bear and this entailed killing the animals that were flushed during the fire drives used for hunting deer (Lefler 1967:17).

While visiting Occaneechi Town, Lawson was served "good fat Bear" and the next day, in Adshusheer, he feasted upon "hot Bread, and Bears-oil." The Indians considered the paws to be the most edible part of the bear, whereas the head was always discarded (Lefler 1967:122). In addition to being eaten, bear's oil was used for frying fish, and was mixed with "a certain red Powder" and daubed on the body and used for greasing the hair (Lefler 1967:121,174). Fat was also used with black powder in guns (Elizabeth Reitz, personal communication 1993). Lawson also mentioned that the "Oil of the Bear is very Sovereign for strains, Aches, and old Pains" and that bear's fur was used for making muffs and facing caps (Lefler 1967:122-123).

It is apparent from Lawson's statements, that bear was a

valued resource for the Indians in the northern Piedmont. Like deer, bears provide a sizeable amount of meat, fat, and inedible material. The pelts, large bones, and sinews of both bears and deer could be used as raw material for a variety of products. However, "bears compare unfavorably with deer for ease of procurement because they were less abundant, more mobile, less sociable, and less docile in temperament" (Styles 1981:86). In the eastern United States, bear remains tend to be fairly scarce in archaeological settings (Smith 1975a:119). Hallowell (1926) has documented the details of bear ceremonialism across North America and notes that specific procedures were followed by many Indian groups in the preparation, eating and disposal of bear carcasses. He states that the skull was frequently preserved and that the other skeletal elements were disposed of in such a way as to prevent dogs from gnawing them and, in so doing, offending the spirit of the animals. Offending the spirit or "owner" of the animals was said to create bad luck in hunting (Hallowell 1926:136). Skeletal remains of black bear were fairly scarce in the assemblages from the piedmont sites in this study, with the exception of the assemblage from the historic Fredricks site.

Unlike plant foods, most animal species may be exploited throughout the year, although it is more efficient to hunt certain species during particular seasons. Swanton (1946) provides a description of the seasonal rounds of activities of the Southeastern Indians based on the accounts of European observers. Smith (1975a) has determined the most likely season of exploitation of particular species on the basis of ecology and

animal behavioral studies. Others (cf. Keene 1979; Reidhead 1980) have made predictions based upon the nutritional needs of human populations and the labor required to fulfill these needs. While these studies provide evidence that is both substantial and logical, archaeological evidence either supporting or refuting these models is hard to attain. In the Southeast, where most animals do not actually hibernate, it is especially difficult to use seasonal availability estimates. Thus, the seasons and methods of capture of a wide variety of smaller animal species is still unclear.

Opossums are present in a wide variety of habitats but prefer bottomlands near streams and other sources of water. Like so many animals utilized by the Indians they prefer a habitat in which woodlands are interspersed with open fields. Opossums are nocturnal and they are most active in the spring and summer. With the onset of cold weather their activity level drops dramatically. Male opossums weigh an average of 2.25 kg and females weigh about 1.8 kg (Webster et al. 1985). Smith (1975a:88) states that opossums would be less susceptible to capture by the Indians than animals such as raccoons. Opossums, unlike raccoons, are not habitual in their movements along streams and ponds and seldomly occupy the same den for more than a few days at a time. Opossum was /used as food by the Indians, but the fur of this animal was "not esteemed nor used" except when it was spun to make baskets, mats, and girdles (Lefler 1967:125-126,195).

Wetlands are the preferred habitats of raccoons but they also frequently are found in forests alongside streams, and in

agricultural land. They are nocturnal and omnivorous, eating crayfish, crabs, fruits, berries and other plant and animal materials. Raccoons are active throughout the year in the South but may remain in dens when the weather is especially cold. The average weight for a raccoon is 3.6-4.5 kg (Webster et al. 1985). Smith (1975a:52) mentions that both the weight and the pelt quality of raccoons peaks in late fall and early winter. It is likely that raccoons were captured in snares or traps in fields or along small bodies of water. They were also captured in the vicinity of their dens (Smith 1975a:45). Raccoon meat was served to Lawson on several occasions during his voyage, and raccoon skins and fur were used by the Indians for clothing and blankets (Lefler 1967:23,126,200).

Unlike raccoons and opossums, striped skunks are rarely associated with wetlands. They prefer upland habitats but are also found in other habitats such as upland forests, cultivated lands, and old fields. The skunk is much more common in the mountains than it is in the Piedmont or on the coast. Skunks are nocturnal and, although they eat mostly insects, they also eat small animals, fruits, and berries. In the winter skunks will spend most of the day in their dens. Adult striped skunks can weigh anywhere from 1.1 to 5.2 kg (Webster et al. 1985). Although skunks (or polecats, as Lawson called them) were used for food, Lawson stated that their skins were not used in any way (Lefler 1967:124).

Cottontail and swamp rabbits are similar in many ways, but swamp rabbits require a habitat consisting of flooded areas of

undisturbed climax forest in which to live (Smith 1975a:95). They are accomplished swimmers and depend on the close availability of water in which they can escape their predators (Smith 1975a:94). Cottontail rabbits prefer disturbed environments such as old fields, forest edges, and other areas characterized by a mixture of herbaceous and shrubby plants. Although swamp rabbits tend to be somewhat larger, individuals of both species usually weigh between 0.9 and 1.8 kg (Webster et al. 1985). Rabbits were probably most easily caught by traps placed along the paths they normally followed. Swanton (1946:330) mentions that Indians of the Southeast were known to have snared rabbits with "stout strings which lift the feet off the ground and a noose of strong cord fastened to which is a joint of cane, which runs to the neck of the Rabbit, so that it can not gnaw the cord." Lawson also mentioned that rabbits were caught during fire drives (Lefler 1967:200). He stated that rabbits (or hares) were roasted without being gutted, and their skins were used for clothing and blankets (Lefler 1967:182,200).

As with rabbits, the species of squirrel present in an assemblage can provide information about the type of habitat previously present in the vicinity of an archaeological site. Gray squirrels, fox squirrels, and flying squirrels all prefer habitats consisting of mature hardwood and mixed hardwood-conifer forests. These habitats provide the large, older trees with the cavities necessary for their nests and the nuts, fruits, and insects that they eat (Webster et al. 1985). The habitat requirements of both gray and fox squirrels are identical if only



one species is present. However, if both species are present in an area, the distribution of both species is reduced. When both gray and fox squirrels are present in an area, gray squirrels prefer the deep forest with plenty of shrubs and small trees in the understory. Fox squirrels, on the other hand, are more abundant in mature longleaf pine-oak forests with open understories. Fox squirrels spend more time on the ground than do gray squirrels and their preferred foods are pine seeds (Webster et al. 1985). Gray squirrels tend to be smaller than fox squirrels. As with swamp and cottontail rabbits, the distribution of gray and fox squirrels is not mutually exclusive (Smith 1975a:111).

Swanton (1946:441) states that the Indians of Virginia were known to use the claws of squirrels, as well of those of raccoons and bears as ornaments for their ears. Lawson (Lefler 1967:182,200) stated that squirrels, like rabbits, were roasted without being gutted, and their skins were used for clothing and blankets. Ethnohistorical accounts of the Southeast do not mention how these animals were captured, but it is likely that snares and traps could have been used, especially during the winter breeding season when the squirrels' activity levels would have been at their highest (Smith 1975a:113). Lawson (Lefler 1967:130) mentioned the flying squirrel saying that "He is made very tame, is an Enemy to the Cornfield, (as all Squirrels are) and eats only the germinating Eye of that Grain". Swanton (1946:441) states that in the Southeast "squirrels were widely hunted as accessories to the table, and their pelts were worked

into bowstrings. Chipmunks, which were identified in the assemblage from the Wall site, were described by Lawson (Lefler 1967:130) as a type of squirrel "which may be kept tame, in a little Box with Cotton."

Red and gray foxes are both usually associated with relatively open habitats as opposed to dense woods. Like so many other taxa utilized by the Indians these foxes are attracted to edge areas, cropland and old fields. Gray foxes are more often associated with woodlands than are red foxes but they still prefer woods that are in the early stages of succession as opposed to mature forests. Gray foxes usually weigh between 3.15 and 4.72 kg, while red foxes vary from about 4.0 to 5.4 kg. Both species eat rabbits, mice, insects, and fruits and are active throughout the year (Webster et al. 1985). Lawson stated that although the foxes of the region were "generally very fat; yet I never saw any one eat them" . He noted that "when hunted, they make a sorry Chace, because they run up Trees, when pursued." Fox fur was used in the manufacture of "Muffs and other Ornaments" (Lefler 1967:130).

Lawson stated that the Indians he encountered kept dogs "which are seemingly Wolves, made tame with starving and beating" (Lefler 1967:44). He mentioned both hearing and seeing wolves during his journey saying that "they are neither so large, nor fierce as the European Wolf" and "when they hunt in the Night, that there is a great many together, they make the most hideous and frightful Noise, that ever was heard" (Lefler 1967:124). It is apparent from this description that Lawson was describing gray

wolves which are known to hunt for large prey in packs at night. The smaller red wolves hunt individually and feed primarily on rabbits and rodents. Gray wolves are known to have ranged throughout the eastern part of the United States during early colonial times but since then, they have been completely eliminated from the East. The original distribution of the red wolf is not known but it too has been extirpated from the East since at least early Historic times (Webster et al. 1985). Lawson mentioned that the fur from wolves made good muffs, and that the skin "dress'd to a parchment makes the best Drum-Heads, and if tann'd makes the best sort of Shoes for the Summer-Countries" (Lefler 1967:124).

The beaver is the largest rodent in North America and can weigh as much as 27 kg. Beavers are semiaquatic, nocturnal animals which eat the soft tissues of bark and herbaceous plants. Their preferred habitat is along wooded streams which they often dam. Beavers were prized by the Indians for their thick fur, and their skins were used in making shoes, mittens, and other clothes (Lefler 1967:125, 200). Beaver meat was also eaten, and its tail was considered a delicacy (Lefler 1967:66, 125). During his travels, Lawson encountered a Saponi Indian who maintained traps for capturing beaver (Lefler 1967:54). Beaver fur was also in great demand for making hats in Europe from approximately 1638 until the late nineteenth century (Merchant 1989:42). Lawson noted that beavers were numerous in North Carolina at the time of his travels (Lefler 1967:125), but by the beginning of the nineteenth century beavers were extirpated from most of eastern

North America (Webster et al. 1985:136).

Muskrats are also semiaquatic, nocturnal mammals which were valued for their pelts. They are much smaller than beavers, generally weighing about 1.0 kg, and they prefer brackish or freshwater marsh habitats (Webster et al. 1985:159). Swanton (1946:250) notes that the Indians of the Southeast both ate muskrat and used its skin to manufacture clothing.

Woodchucks were probably scarcer in North Carolina at the time of Lawson's trip than they are today. These animals, which can weigh up to 5.4 kg, prefer to build their dens along the edges of cleared fields, along stream banks, and within grassy fields. The field-clearing activities of the Indians would have attracted these large rodents which increased in number as the European settlers cleared even more land (Webster et al. 1985:119). Although neither Lawson, nor Swanton mention this animal, it seems likely that it would have been prized by the Indians for its thick fur.

Long-tailed weasels occupy a wide variety of habitats including woodlands, but, like so many of the animals utilized by the Southeastern Indians, they prefer brushy areas and the borders between woodlands and cleared fields. The weasel tends to be secretive in behavior and is thus seldom seen (Webster et al. 1985:193). This could account for Lawson's description of this animal as being "very scarce" (Lefler 1967:131). Swanton (1946:251, 441) mentions that weasel skins were used to decorate headdresses and Indian priests in Virginia used them as ear ornaments.

Bobcats are opportunistic predators which feed primarily on rabbits and rodents. They occupy a wide variety of habitats but prefer forested areas with extensive brushy thickets. Lawson did not mention the presence of bobcats by name, but he does mention a "Mountain Cat" which is "nimble and fierce," has a tail that "does not exceed four Inches," and "is spotted as the Leopard is." He mentioned that the Indians he encountered utilized the fur "as a Stomacher, for weak and cold Stomachs," and as a lining for muffs and coats (Lefler 1967:123-124).

Mountain lions occur primarily in undisturbed habitats and rely heavily on white-tailed deer as their major source of food. Lawson (Lefler 1967:123) noted that to hunt a mountain lion (or "panther", as he called it), it was necessary to tree the animal first and then shoot it. He also observed that the skin of the mountain lion was utilized by the Indians as a warm covering in the winter but that it was "not esteem'd among the choice Furs." Swanton (1946:250) mentions that mountain lion meat was sometimes eaten and that its claws were used as ornaments by the Indians of the Southeast.

Lawson listed a variety of rodents and insectivores that were found around the houses and fields of the Indians (Lefler 1967:120, 130-131). Commensal animals such as moles, mice, shrews, voles, and rats may have been used for food, although there is no ethnohistoric record of such a practice in the Southeast.

European-introduced animals present in North Carolina and utilized by the Indians encountered by Lawson include horses and

pigs. Lawson also mentioned that stocks of cattle in Carolina owned by individual settlers were large but it is not clear whether the Indians of the North Carolina Piedmont were using this animal. Most of the horses in the Piedmont came directly from Britain or France, arriving in Virginia as early as 1620. By the end of the seventeenth century, feral horses were considered a nuisance in Virginia (Crosby 1986:184). According to Lawson, no use was made of the horse by the Indians except for carrying deer back to their villages (Lefler 1967:44). The pigs introduced into Virginia thrived and by 1700 "did swarm like 'Vermaine' upon the Earth" (Beverly 1947:153, 318). Although Lawson alluded to hog stealing by the Indians, he did not indicate that hogs were raised by them (Lefler 1967:64). He did mention, however, that the "Paspitank" Indians kept cattle at one time, although he was not sure if they were still raising them at the time of his travels.

#### BIRDS

John Lawson's list of the birds of North Carolina was the first published list of birds in North America (Feduccia 1985:9). Lawson recognized 129 birds that could be found in North Carolina at the time of his journey. This total comprises both the birds included in his list (Lefler 1967:140-141) and those mentioned only in the text of his book. Of these, the turkey and the passenger pigeon were the most important as sources of food for the Indians.

In the Southeast, the feathers of a variety of birds were

utilized in the manufacture of arrows, wrist guards, fans, and cloaks. Down from other birds was used as body decoration by men but rarely by women. Bird bills were occasionally used as arrowheads, quills were used to etch designs onto pots, and bird claws were used as ear ornaments (Swanton 1946:253).

Swanton (1946:251) states that turkeys seem to have been "the most utilized birds." Turkey meat was offered as food to Lawson so often that it eventually "began to be loathsome" (Lefler 1967:34). Turkey bones were made into many different kinds of tools (e.g., awls and beamers) and ornaments (e.g., beads). Turkey feathers were used by Southeastern Indians in making feather mantles and fans, and in feathering arrows. Arrow points were also manufactured from turkey spurs (Swanton 1946:251).

Turkeys are permanent residents of North Carolina and prefer habitats consisting of open deciduous woodland with scattered clearings (Bull and Farrand 1977). In the summer and early fall, they feed on insects, berries, seeds, and herbaceous vegetation. In the winter and early spring, they rely on mast (primarily acorns), which at times, makes up 60% of their diet (Smith 1975a; Potter et al. 1980). As mast is a fairly localized source of food, turkeys occur in the largest flocks during the winter, and break up into smaller flocks at the beginning of the breeding season in March. Individual turkeys reach their greatest weights just before the breeding season begins. Most historic accounts indicate that the Indians took advantage of these peak conditions and hunted turkey primarily in the late fall and winter.

Turkeys are fast runners and tend to react to danger by

rapidly scattering on foot. This behavior makes capture of these birds quite difficult unless they can be startled and forced to fly and then roost in trees, where they become easier targets (Smith 1975a:80). In addition to driving turkeys, hunters waited for turkeys to appear in customary feeding spots, and sometimes used a decoy or call to lure the birds into closer range.

Passenger pigeons were, at one time, very abundant in the mountains and Piedmont of North Carolina during the fall (Potter et al. 1980, Schorger 1955). Although the passenger pigeon is now extinct, Lawson's description provides a vivid picture of this bird and the way it was hunted and used by the Indians.

Pigeons ... were so numerous in these parts that you might see many millions in a flock... You may find several Indian Towns, of not above 17 Houses, that have more than 100 Gallons of Pigeons Oil, or Fat; they using it with Pulse, or Bread, as we do Butter...The Indians take a Light, and go amongst them in the Night, and bring away some thousands, killing them with long Poles, as they roost in the Trees. At this time of the Year, the Flocks, as they pass by, obstruct the Light of the Day [Lefler 1967:50-51].

The bobwhite quail was also a valued source of food and provided feathers which could have been used for clothing and decoration. The bobwhite is a fairly common permanent resident in the Carolinas and prefers an open habitat of pastures, farmlands, and old fields. During the winter, bobwhites gather in coveys of as many as 30 individuals at night, and it is on these occasions that they were most probably hunted (Bull and Farrand 1977; Potter et al. 1980).

Other birds that were probably utilized for food include ruffed grouse, and migratory ducks such as lesser scaup and



mallard. The ruffed grouse is an illusive but common resident of the western portion of the North Carolina Piedmont and prefers a habitat of deciduous forests with scattered clearings. The lesser scaup is a common winter resident of North Carolina and is rarely found here in the summer. It is found on freshwater lakes, ponds, and rivers and is often found in large flocks on bodies of salt water on the coast in winter (Bull and Farrand 1977; Potter et al. 1980). Mallards are common winter residents of North Carolina in freshwater habitats such as ponds, lakes, and marshes (Bull and Farrand 1977; Potter et al. 1980). They may also leave the water on occasion to forage for food such as acorns and grain crops, making it possible to capture them with snares and traps on land (Smith 1975a). Lawson saw "Feather Match-Coats" manufactured from "the green Part of the Skin of a Mallard's Head, which they sew perfectly well together, their Thread being either the Sinews of a Deer divided very small, or Silk-Grass" (Lefler 1967:200). "When these are finished," according to Lawson, "they look very finely, though they must needs be very troublesome to make."

Swanton (1946) mentions specific uses for several birds, such as the great horned owl, turkey vulture, and sharp-shinned hawk which may not have been used for food. The skins and feathers of these birds were used as ornaments and the skins of vultures and owls were used by "medicine men" as symbols of their special skills. Vulture feathers were said to indicate that the person displaying them was adept at curing gunshot wounds because these feathers were used to clean these wounds. Other birds were

probably valued for their feathers. These birds include the blue jay, yellow-shafted flicker, red-bellied woodpecker, and brown thrasher. It is interesting to note that Lawson stated that "all small game, such as Turkeys, Ducks, and small Vermine, they [the Indians] commonly kill with Bow and Arrow, thinking it not worth throwing Powder and Shot after them" (Lefler 1967:216).

#### REPTILES AND AMPHIBIANS

The box turtle is a common find in Southeastern faunal assemblages. This terrestrial turtle is generally found in open woodlands near streams or ponds and was probably the most important reptile utilized by the Indians that Lawson encountered. Lawson stated that box turtles (which he called "Land-Terebins") were "good Meat...provided they are not musky" (Lefler 1967:138). The shell of box turtles was also utilized to make rattles, cups, and dippers (Lefler 1967:138). Other turtles often represented in faunal assemblages are snapping turtle, painted turtle, musk turtle, cooter or river turtle (Pseudemys sp.), soft-shelled turtle, and mud turtle. All of these species are aquatic and none was mentioned specifically by Lawson. He did, however, make note of the utilization of aquatic turtles by the Indians, stating that "Water Terebins are small; containing about as much meat as a Pullet, and are extraordinary Food, especially in May and June (Lefler 1967:138). It is likely that these aquatic turtles were most frequently exploited during the summer months and collected while fishing. All of these turtles probably were utilized in the

same manner as the box turtle.

In discussing snakes, Lawson mentioned that "all Indians will not eat them, tho' some do," that the skin of the king snake was used to make girdles and sashes, and that rattlesnake teeth were used in an instrument for scarifying (Lefler 1967:137, 182, 223). He also noted that the coastal Indians avoided killing snakes "because their Opinion is, that some of the Serpents Kindred would kill some of the Savages Relations, that should destroy him" (Lefler 1967:219). Swanton (1946:252) notes that some Indians in Virginia "ornamented their heads with snake skins stuffed with moss, with the rattles of rattlesnakes, and even wore live green snakes."

Although Lawson noted the presence of frogs and toads in North Carolina and listed them among the "Insects," he did not mention whether they were used by the Indians for food or for any other purpose.

#### FISH

A wide variety of fish was available to the aboriginal residents of the Piedmont. These include bowfin, gar, white shad, minnows, sunfish, suckers, catfish, American eel, and largemouth bass. Lawson listed 20 types of freshwater fish in North Carolina , adding pike, sturgeon, trout, "pearch," "grindals," "Old-Wives'" and "Fountain-Fish" to the list (Lefler 1967:156). Swanton (1946:277,252) states that southeastern Indians ate many of these taxa, specifically excluding only the lamprey eel from their

diets. In addition to their use as food, Swanton (1946:253) states that fish bones and teeth and gar scales were used to make points for arrows and spears and that fish remains were utilized in the manufacture of glue.

The wide variety of water conditions preferred by these taxa indicate that Southeastern Indians made use of numerous aquatic habitats (Manooch 1988; Walden 1964; Smith 1975a; Page and Burr 1991). For example, bowfin and gar both prefer warm sluggish rivers and shallow lakes; members of the minnow family, such as chubs, prefer the clear and rocky pools and runs of creeks and smaller rivers while catfish generally avoid upland streams. Suckers are bottomfeeders that prefer the cold waters of lakes and rivers and fliers prefer the warm sluggish waters of coastal swamps and backwaters. Flounders are saltwater fish and inhabit shallow coastal waters in the spring and summer in North Carolina. The presence of flounder at Early Upper Saratown, in addition to the soft-shelled turtle and the musk turtle which are more common in the coastal plain than in the Piedmont, indicate that the inhabitants of this site may well have made trips to the coast or conducted trade with the Indians who lived there.

Because of the many habitats and habits of these fish, the Indians used a wide variety of methods to harvest them. Fishing with hooks, weirs, and with bow and arrow (on the coast) were all described by Lawson (Lefler 1967:218). Swanton (1946:332-342) mentions the use of nets, snares, poison (frequently with crushed chestnuts), trot lines and capture by hand in addition to these methods. He also notes that Indians during historic times

sometimes fired their guns into the water near the fish in order to stun them and thus make their capture less difficult. It is frequently stated that Southeastern Indians utilized fish primarily in the summer. From late spring to late summer several species, such as eels, sunfish, bowfin, suckers, and shad, are found concentrated in shallow waters during spawning. Other fish could have been taken more easily and efficiently in the summer when creeks and streams dried up and left only small pools of water in which the fish could live.

#### CONCLUSIONS

Although Lawson's descriptions of the ways in which the Indians of North Carolina utilized these animals are not consistently detailed, they do provide information that cannot be obtained from the archaeological record alone. In addition to the descriptions of the ways in which the individual species of animals were procured and utilized by the Indians, Lawson provided further information useful for interpreting the four assemblages. He mentioned that the Indians "boil and roast their Meat extraordinary much, and eat abundance of Broth" (Lefler 1967:231). He also stated that "All the Indians hereabouts carefully preserve the Bones of the Flesh they eat, and burn them, as being of the Opinion, that if they omitted that Custom, the Game would leave their Country, and they should not be able to maintain themselves by their Hunting" (Lefler 1967:58). Both of these statements provide information that is helpful in evaluating how accurately

the faunal assemblages from the Wall and Fredricks sites and the Upper and Early Upper Saratown sites reflect the original assemblages of bone produced at these sites and in interpreting any patterns observed in the surviving archaeological assemblages. Identifying, interpreting, and comparing patterns in the assemblages is the goal of the following chapters.

## CHAPTER V

### ASSEMBLAGE COMPARISONS: TAXON ABUNDANCE

Ethnohistoric accounts (Lefler 1967:182-184; Swanton 1946:256-257) suggest considerable continuity between prehistoric and historic subsistence practices in North Carolina and Virginia. Given the rapidity with which European diseases and social upheavals disrupted and ultimately destroyed aboriginal culture in North Carolina however, it seems likely that the faunal remains from the two post-contact sites would show evidence of some change in patterns of faunal exploitation from prehistoric to historic times. The procedures and results of analysis are discussed below.

### ANALYTICAL PROCEDURES

Identical analytical procedures were used on the assemblages from all four sites. All of the bone recovered in the half-inch and quarter-inch screens was analyzed. As there were innumerable tiny, unidentifiable fragments of bone retrieved by the sixteenth-inch screen, only those bones and bone fragments that appeared to be identifiable were pulled from the sixteenth-inch washings. The bones and bone fragments from each excavation unit (either 10 x 10-ft square

of midden, or feature) and from each level or zone within each excavation unit were kept separate during analysis. Bones from the different screen sizes were not combined during analysis.

Initially, each bone fragment was sorted into one of three groups: unidentifiable, identifiable only to class, or identifiable as to skeletal element. Each of these fragments (whether identifiable or not) was examined for evidence of modification, such as butchering or cutting.

For those bones that could be identified beyond the level of class, the side of the body (when applicable) and the portion of the element (proximal, medial, or distal) was noted. Then, a taxonomic identification was made for each of the identifiable fragments. The faunal type collection of the Research Laboratories of Anthropology is primarily archaeological in origin. In order to overcome the shortcomings of this collection, bones which appeared to be identifiable but for which the Research Laboratories lacked comparative specimens were segregated from the other bone fragments. Bones falling into this category from the Wall and Fredricks sites were sent for identification to Elizabeth Reitz, at the Zooarchaeological Laboratory, University of Georgia. Bones from this category from Early Upper Saratow and the entire assemblage from Upper Saratow were analyzed by this author, utilizing the type collection in Georgia. In addition to determining the total number of fragments in each taxonomic category, I weighed all of the fragments in each category.

When possible, the age and sex of the animal represented by a particular fragment was assessed. In most cases, these



characteristics could be determined only for the remains of white-tailed deer. Attempts to determine age in several other species, such as rabbits, squirrels, and raccoons, were less successful than for deer. This problem resulted, in large part, from characteristics of the faunal assemblages themselves. Many of the bones, or portions of bones, that display the characteristics used to distinguish between animals of different ages (cf. Carson 1961; Grau et al. 1970; Hale 1949; Marks and Erickson 1966) simply were not present in the remains being studied. For white-tailed deer, age was estimated using Severinghaus's (1949) criteria of tooth development and wear. Sex of the deer was determined by using the pelvis criteria set forth by Edwards et al. (1982).

#### QUANTIFICATION TECHNIQUES

Several methods were utilized to determine the relative abundance of each taxon. The number of identified specimens (NISP) and the weight of these specimens constitute primary data. Secondary data, "which involve interpretation, extrapolation, or estimations based on primary data" (Wing and Brown 1979:118) were obtained through estimations of the minimum number of individuals (MNI) represented and estimations of biomass using skeletal mass allometry.

All methods currently used for quantifying zooarchaeological material are flawed in one way or another (Grayson 1984). In part, this stems from the fact that any collection of archaeological bone will represent only a portion of the faunal remains originally associated with the site. A variety of factors influence how accurately the analyzed assemblage will reflect the assemblage of bone

originally present at any particular site. The basic physical structure of the bone plays a major role in determining its chances of survival. Some bones, such as teeth and phalanges, are inherently stronger than others and thus are more likely to be preserved. The condition of the bone at the time of disposal (whether it was burned or boiled for example), and the manner in which it was discarded (whether it was left exposed on the surface or buried in a trash pit) will also affect its chances of preservation. The portion of the site excavated and excavation and sieving techniques utilized will also affect the sample. Primary data provides a reasonable accounting of the bones present in any given faunal assemblage. Secondary data represents an attempt to bypass some of the biases discussed above in order to arrive at more accurate interpretations of what each assemblage represents in terms of past behavior.

#### Number of Identified Specimens

The number of identified specimens (NISP) is simply a count of the bones of different animals present in an assemblage. As an index of species abundance, NISP has the advantage of being extremely simple to calculate. Another advantage lies in the fact that NISP values can be added to one another in order to combine the results of analyses of assemblages from different excavation units within a site (Klein and Cruz-Urbe 1984:25).

Until the 1950s, NISP was often used as the only measure of species abundance within archaeological assemblages (Grayson 1984:20). After 1953, when the concept of minimum numbers of individuals was introduced (White 1953a) and became more popular, the number of

perceived flaws in the use of NISP began to multiply (Grayson 1984:20).

One of the most obvious problems with NISP is that it ignores the fact that some species have more skeletal elements than others. Another problem is that it ignores the role of differential preservation. Use of specimen counts depends upon the assumption that:

all the individual bones of all the species are equally affected by chance or deliberate breakage and will survive equally well the hazards of different methods of cooking, preservation in the soil, excavation, and transport [Chaplin 1971:64].

Even if this assumption could be made, it would also be necessary to assume that all species were affected equally by fragmentation. Butchering practices may have a considerable effect on NISP of different species. For example, entire carcasses, and thus all the skeletal elements, of smaller species may be brought back to a site, whereas larger animals may be butchered in the field and only some of their skeletal elements returned to the site. If one were to rely solely on NISP to interpret this kind of data, it would appear that the small animals, represented by a greater number of bones, were more important to the inhabitants of the site than were the large animals. Producing a similar situation, it should be noted that the bones of the larger animals in an assemblage are frequently found to be broken into more pieces than the bones of smaller animals. Also, differences in butchering practices may exist between different sites. Thus, one of the most serious flaws of NISP is that it is so strongly affected by bone fragmentation (Klein and Cruz-Urbe 1984:25).

A number of other problems have been identified with NISP. The number of bones of a particular species represented in an assemblage does not necessarily indicate what percentage of the diet of the inhabitants of that site was made up of the meat from the animal. Only the broadest of questions about subsistence can be answered using NISP. Also, NISP cannot be used as the basis upon which to apply inferential statistics because many such methods depend upon the assumption that items in the assemblage are completely independent of one another. In reality, it is likely that many of the bones in an assemblage derive from the same animal, but it is impossible to determine which bones are codependent (Grayson 1984:23). Finally, NISP cannot be the only method of quantification used in comparing assemblages from different sites or even different analytic units within a single site because it is difficult to either detect or to define accurately where bias has been introduced (Chaplin 1971:67).

In spite of these disadvantages, NISP is still considered a valuable tool for measuring species abundance. Ultimately, it is the basic unit from which almost all other measures of abundance will be derived. Although it is not appropriate to use NISP as the only method of quantification, it can be used in conjunction with other measures, such as bone weights and minimum numbers of individuals to arrive at the most accurate index of species abundance possible.

#### Minimum Number of Individuals

The concept of minimum numbers of individuals (MNI) was being utilized by Russian archaeologists as early as the 1880s and by paleontologists by the 1930s (Casteel 1977:125). It was not adopted

by American researchers, however, until the 1950s when White (1953a) introduced the concept as a step toward estimating the relative dietary contribution made by each species. In its simplest form, the minimum number of animals of each species is determined by counting the maximum number of any particular element. When possible, the age, sex, and size of the animal is taken into account to increase the method's accuracy. MNI is, in several ways, superior to other methods of quantification. Its primary advantage over NISP lies in the fact that it provides units that are completely independent of one another (Grayson 1973:70). For example, the presence of two left radii in an assemblage necessarily indicates the presence of two individuals; the fact that the skeletons of some species have more elements than those of others does not affect MNI. Also, unlike NISP, MNI is not altered by differential butchering practices. Whether the entire carcass of an animal was returned to the site or only a portion, the number of individuals of that species will remain the same. Finally, differences in the degree of fragmentation of different species or of different faunal assemblages will have a much less intense effect on MNI than upon NISP.

In spite of its advantages, the MNI method displays several shortcomings. One of these is that it tends to overestimate the importance of rarer species, especially within relatively small assemblages. This situation arises because there is an inverse relationship between the number of identified specimens and the ratio of the minimum number of individuals to the number of identified specimens (Casteel 1977:126). The most severe shortcoming stems from the fact that there is more than one way to derive the minimum number

figure from an assemblage. Variations in methods of aggregation can have profound effects on the results of analysis. If the material is separated into clusters according to the stratum and excavation unit, it will yield the largest estimation of MNI. If the excavation unit is ignored, the minimum number decreases, and if neither excavation unit nor stratigraphy is used in grouping the material, the number will be even smaller (Grayson 1973:433). This would not be a problem if the changes in abundance produced by different methods of aggregation were uniform across the various taxa. However, the distribution of various species and various elements is usually not even within a site. Also, preservation in one stratum may be better than in another. Any consistent difference among species in terms of preservation or of butchering practices will create errors (Payne 1972:69). Thus, "absolute abundances indicated by minimum numbers are dependent on aggregation method; ratios of taxonomic abundance based on those numbers are dependent on the nature of the distribution of most abundant elements within the site" (Grayson 1984:34).

In the analysis of the assemblages from both the Dan River and the Eno River sites, I have chosen to use each site as a whole as the basis for computing the minimum numbers of individuals. Although it yielded the smallest number of individuals, this method of aggregation made it possible to compare the assemblages from all four sites even when the contexts (midden versus pit fill) from which these assemblages were recovered differed quite dramatically.

It is apparent that neither NISP nor MNI provides a very satisfactory method for quantifying archaeological fauna. Neither method is inherently better than the other. NISP is very sensitive to

the effects of bone fragmentation and MNI is highly sensitive to the effects of aggregation. An awareness of these different biases, however, makes it possible to compare the results using each method of quantification in order to derive information that would not have been available had only a single method of quantification been used.

#### Meat Weights

Although the use of measures such as NISP and MNI is important in assessing the relative abundance of species, simple abundance is not sufficient to answer some of the most important questions asked of archaeological faunal assemblages. It is helpful to know, for example that species of fish made up 40% of the individuals represented in an assemblage and deer made up 20%. This information however, is not sufficient for assessing whether fish or deer contributed the most to the diet. Assessing the relative dietary contribution of the animal species represented in an assemblage is essential to reconstructing past foodways. There are numerous methods available for obtaining this information.

White (1953a) proposed a method that was a simple extension of the concept of MNI. He provided a list of the average weight of each of several common mammals and birds and the average percentage of that weight that he considered usable by human beings. Using this technique, one simply calculates MNI for each species in the assemblage and multiplies that by the appropriate weight and percentage. One of the problems with this method is that considerable error can be introduced if the faunal assemblage is derived from a population of animals smaller or younger than average (Wing and Brown

1979:126). If corrections could be made for the size differences correlated with age and sex, this method would be considerably more accurate. However, it is frequently not possible to determine the age or the sex of the individuals represented in an archaeological faunal assemblage. Error is also introduced when use is made of the average weights of animals (such as fish and reptiles) that continue to grow during their entire life span.

Another method, known as the weight method, involves weighing the bone from each species and then multiplying that weight by a factor to determine the amount of meat originally represented. This method has several shortcomings as a method of estimating meat yield. Every scrap of bone must be utilized in order to arrive at an unbiased approximation of the amount of meat available (Daly 1969:149). Because of the extensive fragmentation of most faunal assemblages however, it is not possible to place each scrap of bone in its appropriate taxonomic category. Furthermore, all the bones originally deposited at the site will not be preserved, and in most cases, all those bones that do survive will not be recovered during excavation. Other problems occur because the weights of bones will vary if they are burned or mineralized or leached. More importantly, the weight method assumes "that bone weight is a fixed percentage of meat weight" (Grayson 1984:172), but this is not true. Although there is a correlation between the weight of an animal and the weight of its bones, the relationship is variable. This is especially true of species such as deer, in which there is considerable variation in weight between members of the same population (Smith 1975b:100). Because of these problems, and others, the weight method has been



rejected by most analysts as a method of calculating meat weights (Casteel 1978, Chaplin 1971, Daly 1969, Klein and Cruz-Urbe 1984, Smith 1975b).

Reed (1963) introduced another method that is appealing in its simplicity. He assumed that the skeletal weight of mammals is 7.5% of body weight and that the body weight of a mammal could thus be easily determined from the weight of its bones. Ziegler (1973) proposed a similar method in which the ratio of skeletal weight to body weight is calculated, therefore allowing the proportion of skeletal weight to be determined. Both of these methods suffer from all of the problems plaguing the weight method.

#### Allometry and Biomass

Two final methods of calculating biomass or meat weight are based on the fact that a "systematic and quantifiable relationship exists between the relative size of different body parts and the size of individuals" (Jackson 1989:602). Skeletal mass allometry and dimensional allometry are based on the "rationale that supporting structures must be proportional to the weight they support in order to function" (Wing and Brown 1979:127). This relationship can be expressed in terms of a power function:

$$\log(y) = \log(a) + b \log(x)$$

Where  $y$  is the weight of the individual;  $x$  is a linear dimension or weight of a particular element of the individual;  $a$  is the  $y$ -intercept, determined for each taxon through the use of least squares regression; and  $b$  is the slope of the line, which is also determined separately for each taxon (Jackson 1989:602; Reitz and

Cordier 1983:237).

With dimensional allometry, a variety of measurements can be obtained from selected elements of vertebrates in order to arrive at an estimate of the size of the individual represented by each element. For example, Casteel (1974:94-97) has presented a method using measurements of fish elements, such as the centrum width of vertebrae or the length of the otolith, that can be used in allometric formulae in order to estimate the live weight of fish. Similarly, allometric values have been determined for use in estimating the size of other vertebrates. These values were derived from measurements including the greatest width of the femur head, the greatest breadth of the occipital condyle, or the greatest length of the lateral half of the astragalus (Reitz and Cordier 1983:240).

Wing and Brown (1979:127) list two drawbacks to the use of linear dimensional allometry. The first concerns the fact that correlations between body weight and linear dimensions must be based on the body weight of a large number of specimens. The second drawback is that, to be truly useful, the linear measurements must be taken from elements which are frequently preserved in measurable condition in the archaeological context.

Skeletal mass allometry makes use of the relationship that exists between total body weight and bone weight. This technique is utilized to determine the body mass that could be supported by a given weight of bone. In this approach, "the equations that predict body weight from bone weight are determined for any taxon by regression analysis of a sample for which both variables are known" (Barrett 1993:4). Numerous advantages have been attributed to the use of allometric

techniques rather than the methods mentioned above for determining the relative dietary contribution of various taxa in an archaeological faunal assemblage. Proponents believe that allometry provides a method of estimating biomass that is both biologically accurate and more reliable than other methods (Reitz et al. 1987; Wing and Brown 1979:130-131). The use of skeletal mass allometry bypasses the interdependence problem that Grayson (1984) identified with MNI and, with the use of this technique, it is not necessary to assume that the entire carcass of an animal was returned to and then consumed at a site (Jackson 1989:604). Skeletal mass allometry also provides a means of comparing bone fragments from animals of different sizes and it makes it unnecessary to calculate an average size for each taxon (Reitz et al. 1987:306). Finally, the use of allometry makes it possible to use portions of the archaeological faunal assemblage that are frequently of little use to the analyst (Jackson 1989:604; Reitz et al. 1987:314). This is because allometric values can be calculated for more inclusive taxonomic levels, such as genus rather than species (Jackson 1989:604).

As with all quantification techniques, there are several drawbacks to the use of skeletal mass allometry as a means of assessing the relative dietary contribution of various species in an archaeological assemblage. Some of these problems are the same as those that occur with other methods of quantification. Obviously, the weight of the bone used in the allometric formulae will be affected if the bone is dirty, mineralized, or leached. These factors will affect bones from separate deposits or even different portions of the same deposit differentially. Also, like dimensional allometry, the

formulation of allometric values depends on a data base consisting of a large number of specimens.

One of the stated advantages of the use of skeletal mass allometry is that it takes into account the fact that the ratio of bone weight to body weight is not a constant. Instead, this relationship is generally exponential rather than linear or isometric (Reitz et al. 1987:305). The acknowledgement of this fact however, reveals one of the difficulties inherent in the use of this method. Because skeletal weight and body weight are not directly proportional, the skeletal weight of an animal that is half the body weight of another is not equal to half of the skeletal weight of the larger animal. Therefore, a body weight estimate based on half of the skeleton of an animal found in an archaeological context will not necessarily be identical to exactly half of that animal's total body weight (Wing and Brown 1979:127-129).

Another disadvantage of skeletal mass allometry is that it operates as though every skeletal element of an animal supports the same amount of meat (Jackson 1989:604). An estimate of body weight based upon the skeletal weight of a given quantity of non-meat-bearing elements (such as skulls or metapodials) will be the same as an estimate based on the same weight of skeletal elements that do support meat. However, the presence of a large number of rabbit skulls at a site may mean something very different, in terms of the behavior of the inhabitants of that site, than an equivalent biomass estimate derived from the fore- and hindquarters of a rabbit. This problem can be alleviated, to some extent, by an examination of the frequency of various elements in an assemblage, but comparisons of the dietary

contributions of animals butchered at a site with those that were butchered in the field are still problematic (Jackson 1989:604). These problems, however, are not evident only when allometric formulae are utilized, but occur with any method attempting to quantify the amount of meat represented by an archaeological assemblage of bones.

Finally, Jackson (1989:604-607) discusses a variety of potentially serious problems that all stem from a single characteristic of the use of allometric formulae in the archaeological context as opposed to the use of the same principles in the way they were originally intended to be applied in biology. Allometry is designed to estimate the relationship between the skeletal mass and the body weight of a single individual. Instead, "zooarchaeologists use the allometric relationship ... to derive what is regarded as an aggregate value for the weight of body tissue (or, alternatively, 'meat') that could have adhered to or been supported by any given quantity of bone for a particular taxon" (Jackson 1989:604). In other words, although allometric formulae handle bone weight as if it came from a single individual, zooarchaeologists apply these allometric principles to bone elements and fragments of elements that come from an unknown number of animals. Thus, sample size becomes a major factor in the archaeological applications of allometry.

As Wing and Brown (1979:131) state, "an estimation is by definition an approximation ... and it has an inherent error." In spite of the above criticisms, allometry still provides results which are more useful than many other techniques. Calculations of the range of error for several methods of estimating body weight indicate that skeletal mass allometry produces more accurate estimates with a

smaller range of error than does any of the other methods discussed above (Wing and Brown 1979:131). In fact, Reitz and Cordier (1983) found that the relationship between bone weight and total weight accounted for 94% of the variability in samples of mammals, 97% for birds and 80-85% percent in fishes. For this reason, skeletal mass allometry will be used in the present study to arrive at estimates of the relative dietary contributions of the species represented in the faunal assemblages.

#### THE FAUNAL ASSEMBLAGES

Previous analysis of samples of the faunal and ethnobotanical assemblages from the Wall and Fredricks sites indicated that there was considerable continuity in the utilization of faunal resources from prehistoric to contact times (Gremillion 1984; Holm 1985). It appears that, along the Eno River at least, basic subsistence practices were not dramatically different after the appearance of Europeans in the area than they were before. Analysis of the ethnobotanical remains from a number of other piedmont sites yielded similar results (Gremillion 1989) and suggest that the analysis of larger faunal samples from the Eno River sites and faunal assemblages from Dan River sites will also provide evidence of continuity.

##### Wall

The faunal assemblage from the Wall site (31Or11) was obtained from three 10 x 10 ft squares of sheet midden. This assemblage contained 29,792 bone fragments, representing a minimum of 103 individuals (Table 5.1). Mammals contributed 64% of the individuals and 95% of

Table 5.1. Faunal Remains From The Wall Site (310r11)

SPECIES	COUNT	MNI	%MNI	WEIGHT(g)	BIOMASS(kg)	%BIOMASS
Unidentified mammal	6,824	-	-	4,530.37	51.35	25.86
<u>Didelphis virginiana</u> opossum	23	2	1.94	12.25	0.25	0.13
<u>Blarina</u> sp. short-tailed shrew	12	2	1.94	0.20	0.01	0.00
<u>Sylvilagus</u> sp. rabbit	86	4	3.88	7.80	0.17	0.08
Unidentified rodent	46	-	-	0.48	0.01	0.01
<u>Tamias striatus</u> chipmunk	1	1	0.97	0.10	0.00	0.00
<u>Sciurus carolinensis</u> gray squirrel	30	1	0.97	5.18	0.12	0.06
<u>Glaucomys volans</u> flying squirrel	1	1	0.97	0.11	0.00	0.00
<u>Sciurus</u> sp. squirrel	297	9	8.74	45.09	0.81	0.41
<u>Castor canadensis</u> beaver	1	1	0.97	1.30	0.03	0.02
<u>Peromyscus leucopus</u> white-footed mouse	22	3	2.91	0.63	0.02	0.01
<u>Sigmodon hispidus</u> Hispid cotton rat	24	3	2.91	0.90	0.02	0.01
<u>Microtus pennsylvanicus</u> meadow vole	13	2	1.94	0.48	0.01	0.01
<u>Ondatra zibethicus</u> muskrat	1	1	0.97	0.10	0.00	0.00
Canidae dog, wolf, fox	5	1	0.97	0.40	0.01	0.01
<u>Ursus americanus</u> black bear	1	1	0.97	21.70	0.42	0.21

Table 5.1. (continued)

SPECIES	COUNT	MNI	%MNI	WEIGHT(g)	BIOMASS(kg)	%BIOMASS
<u>Procyon lotor</u> raccoon	101	4	3.88	51.85	0.92	0.46
<u>Odocoileus virginianus</u> white-tailed deer	4,654	30	29.13	13,288.90	135.25	68.13
Total mammal	12,142	66	64.08	17,967.84	189.41	95.41
Unidentified bird	513	-	-	126.41	1.67	0.84
<u>Colinus virginianus</u> bobwhite	4	1	0.97	0.40	0.01	0.00
<u>Meleagris gallopavo</u> turkey	103	3	2.91	199.25	2.53	1.27
<u>Bubo virginianus</u> great horned owl	1	1	0.97	2.00	0.04	0.02
<u>Cyanocitta cristata</u> blue jay	4	1	0.97	0.27	0.01	0.00
<u>Ectopistes migratorius</u> passenger pigeon	2	1	0.97	0.10	0.00	0.00
Total bird	627	7	6.80	328.43	4.25	2.14
Unidentified turtle	1,252	-	-	248.68	1.27	0.64
<u>Chelydra serpentina</u> snapping turtle	8	1	0.97	8.50	0.13	0.07
<u>Kinosternon subrubrum</u> mud turtle	2	2	1.94	0.20	0.01	0.01
<u>Terrapene carolina</u> box turtle	1,631	5	4.85	677.21	2.49	1.26
<u>Chrysemys picta</u> painted turtle	6	1	0.97	13.20	0.18	0.09
Unidentified snake	705	-	-	32.56	0.47	0.23



Table 5.1. (continued)

SPECIES	COUNT	MNI	%MNI	WEIGHT(g)	BIOMASS(kg)	%BIOMASS
Colubridae nonpoisonous snakes	7	1	0.97	0.40	0.01	0.00
Crotalidae poisonous snakes	1	1	0.97	0.90	0.01	0.01
Total reptiles	3612	11	10.68	981.65	4.57	2.30
<u>Rana/Bufo</u> sp. frog/toad	7	-	-	0.13	-	-
<u>Bufo</u> sp. Toad	17	4	3.88	1.09	-	-
<u>Scaphiopus holbrooki</u> eastern spadefoot toad	1	1	0.97	0.10	-	-
<u>Rana</u> sp. frog	81	4	3.88	3.55	-	-
Total amphibians	7	9	8.74	4.87	-	-
Unidentified fish	642	-	-	10.36	0.20	0.10
<u>Lepisosteus</u> sp. gar	9	1	0.97	0.25	0.01	0.01
Catostomidae suckers	10	1	0.97	0.64	0.02	0.01
<u>Ictalurus</u> sp. catfish	194	7	6.80	2.95	0.06	0.03
Centrarchidae sunfish	3	1	0.97	0.30	0.01	0.01
Total fish	855	10	9.71	14.50	0.28	0.14
Unidentified	12,447	-	-	22,98.25	-	-
Total	29,792	103	100.00	21,595.54	198.53	100.00

the biomass. Deer (Odocoileus virginianus) was the most abundantly represented mammal, contributing 29% of the MNI for the assemblage and 68% of the biomass. Numerous other mammalian species were identified from this assemblage, including opossum (Didelphis virginiana), rabbit (Sylvilagus sp.), chipmunk (Tamias striatus), gray and flying squirrels (Sciurus carolinensis and Glaucomys volans), beaver (Castor canadensis), muskrat (Ondatra zibethicus), wolf/dog/fox (Canidae), black bear (Ursus americanus), and raccoon (Procyon lotor). None of these taxa contributed more than 0.5% of the total biomass for the assemblage. Commensal animals identified include short-tailed shrew (Blarina sp.), white-footed mouse (Peromyscus leucopus), Hispid cotton rat (Sigmodon hispidus), and meadow vole (Microtus pennsylvanicus).

Birds made up only 7% of the individuals and only 2% of the biomass. The seven individuals identified included bobwhite quail (Colinus virginianus), turkey (Meleagris gallopavo), great horned owl (Bubo virginianus), blue jay (Cyanocitta cristata), and passenger pigeon (Ectopistes migratorius).

Reptiles made up 11% of the individuals but only 2% of the biomass for the assemblage. These reptiles consisted of box turtle (Terrapene carolina), snapping turtle (Chelydra serpentina), mud turtle (Kinosternon subrubrum), painted turtle (Chrysemys picta), and both nonpoisonous and poisonous snakes (Colubridae and Crotalidae). Amphibians (Rana/Bufo) made up 9% of the individuals but contributed nothing to the biomass.

Fish identified included gar (Lepisosteus sp.), suckers (Catostomidae), catfish (Ictaluridae), and sunfish (Centrarchidae). Fish made up 10% of the individuals in the assemblage but made almost

no contribution to the biomass.

### Fredricks

The faunal assemblage from the Fredricks site (310r231) was recovered from the fill of 47 pits. This assemblage consisted of 70,597 bone fragments representing a minimum of 179 individuals (Table 5.2).

Deer (Odocoileus virginianus) was the most abundantly represented species, providing 25% of the individuals and 47% of the biomass. Black bear (Ursus americanus) was also significant in that this species contributed 8% of the total biomass of the assemblage. A variety of medium and small mammals was also identified. Included among these mammals were opossum (Didelphis virginiana), rabbit (Sylvilagus sp.), gray and fox squirrels (Sciurus carolinensis and Sciurus niger), wolf/dog (Canis sp.), red and gray foxes (Vulpes fulva and Urocyon cinereoargenteus), raccoon (Procyon lotor), striped skunk (Mephitis mephitis), and mountain lion (Felis concolor). Each of these mammalian taxa contributed less than 1% of the total biomass for the assemblage.

Commensal mammals included short-tailed shrew (Blarina sp.), white-footed mouse (Peromyscus leucopus), and Hispid cotton rat (Sigmodon hispidus). It is interesting to note that a minimum of 22 white-footed mice was identified and these mice account for 5% of the MNI for the assemblage.

Although this assemblage is derived from a historic site, there was very little indication of the use of domestic animals. One fragment of a pig (Sus scrofa) femur and a single horse (Equus

Table 5.2. Faunal Remains From the Fredricks Site (310r231)

SPECIES	COUNT	MNI	%MNI	WEIGHT(g)	BIOMASS(kg)	%BIOMASS
Unidentified mammal	35,086	-	-	18,812.80	184.93	34.76
<u>Didelphis virginiana</u> opossum	5	2	1.12	6.10	0.13	0.03
<u>Blarina</u> sp. short-tailed shrew	5	2	1.12	0.39	0.01	0.00
<u>Sylvilagus</u> sp. rabbit	10	1	0.56	4.20	0.10	0.02
Unidentified rodent	11	-	-	0.58	0.02	0.00
<u>Sciurus carolinensis</u> gray squirrel	24	2	1.12	22.21	0.43	0.08
<u>Sciurus niger</u> fox squirrel	19	3	1.68	11.30	0.23	0.04
<u>Sciurus</u> sp. squirrel	521	-	-	69.53	1.20	0.22
<u>Peromyscus leucopus</u> white-footed mouse	420	22	12.29	5.32	0.12	0.02
<u>Sigmodon hispidus</u> Hispid cotton rat	78	6	3.35	2.08	0.05	0.01
<u>Canis</u> sp. wolf, dog	11	1	0.56	4.60	0.10	0.02
<u>Vulpes fulva</u> red fox	1	1	0.56	0.10	0.00	0.00
<u>Urocyon cinereoargenteus</u> gray fox	1	1	0.56	0.10	0.00	0.00
<u>Ursus americanus</u> black bear	558	5	2.79	3,805.60	43.89	8.25
<u>Procyon lotor</u> raccoon	52	2	1.12	44.94	0.81	0.15

Table 5.2. (continued)

SPECIES	COUNT	MNI	%MNI	WEIGHT(g)	BIOMASS(kg)	%BIOMASS
<u>Mephitis mephitis</u> striped skunk	3	1	0.56	2.5	0.06	0.01
<u>Felis concolor</u> mountain lion	1	1	0.56	2.50	0.06	0.01
<u>Sus scrofa</u> pig	1	1	0.56	24.50	0.47	0.09
<u>Odocoileus virginianus</u> white-tailed deer	5,477	45	25.14	26,221.49	249.34	46.87
<u>Equus caballus</u> horse	1	1	0.56	22.70	0.44	0.08
Total mammal	42,285	97	54	4,9064	482.39	91
Unidentified bird	2,161	-	-	960.90	10.57	1.99
<u>Aythya affinis</u> lesser scaup	2	1	0.56	0.30	0.01	0.00
Anatidae duck	2	-	-	1.70	0.03	0.01
<u>Meleagris gallopavo</u> turkey	1,102	27	15.08	2,900.03	28.89	5.43
Charadriidae plovers	1	1	0.56	0.10	0.00	0.00
Scolopacidae sandpipers	1	1	0.56	0.10	0.00	0.00
<u>Centurus carolinus</u> red-bellied woodpecker	1	1	0.56	0.02	0.00	0.00
Picidae woodpeckers	1	-	-	0.08	0.00	0.00
Fringillidae sparrows	21	3	1.68	0.42	0.01	0.00

Table 5.2. (continued)

SPECIES	COUNT	MNI	%MNI	WEIGHT(g)	BIOMASS(kg)	%BIOMASS
<u>Ectopistes migratorius</u> passenger pigeon	89	8	4.47	23.16	0.36	0.07
Total bird	3,381	42	23.46	3,886.81	39.88	7.50
Unidentified turtle	2,647	-	-	743.71	2.65	0.50
<u>Chelydra serpentina</u> snapping turtle	7	1	0.56	35.00	0.34	0.06
<u>Kinosternon subrubrum</u> mud turtle	2	1	0.56	0.13	0.01	0.00
<u>Sternotherus odoratus</u> musk turtle	3	1	0.56	0.60	0.02	0.00
<u>Terrapene carolina</u> box turtle	2,168	8	4.47	2,163.10	5.43	1.02
<u>Chrysemys picta</u> painted turtle	6	1	0.56	12.20	0.17	0.03
Unidentified snake	306	-	-	16.17	0.23	0.04
Colubridae nonpoisonous snakes	1	1	0.56	0.05	0.00	0.00
Crotalidae poisonous snakes	3	1	0.56	1.61	0.02	0.00
Total reptiles	5,143	14	7.82	2,972.57	8.87	1.67
<u>Rana/Bufo</u> sp. frog/toad	17	-	-	0.74	-	-
<u>Bufo</u> sp. toad	14	-	-	1.19	-	-
<u>Scaphiopus holbrooki</u> eastern spadefoot toad	53	2	1.12	1.12	-	-
<u>Rana</u> sp. frog	94	5	2.79	3.03	-	-
Total amphibians	178	7	3.91	6.08	-	-

Table 5.2. (continued)

SPECIES	COUNT	MNI	%MNI	WEIGHT(g)	BIOMASS(kg)	%BIOMASS
Unidentified fish	938	-	-	22.99	0.37	0.07
<u>Lepisosteus</u> sp. gar	185	4	2.23	22.24	0.35	0.07
Cyprinidae minnows	1	1	0.56	0.01	0.00	0.00
Catostomidae suckers	59	1	0.56	1.66	0.05	0.01
<u>Ictalurus</u> sp. catfish	126	8	4.47	3.82	0.07	0.01
Centrarchidae bass, sunfish	66	4	2.23	1.73	0.03	0.01
<u>Lepomis</u> sp. sunfish	4	1	0.56	0.30	0.01	0.00
Total fish	1,379	19	10.62	52.75	0.88	0.16
Unidentified	18,231	-	-	2,871.46	-	-
Total	70,597	179	100.00	58,853.21	532.02	100.00

caballus) tooth were the only remains of domestic animals identified.

Birds contributed 23% of the individuals in the assemblage and 7% of the biomass. Of the 42 individuals identified, 27 were turkeys (Meleagris gallopavo) and eight were passenger pigeons (Ectopistes migratorius). Other birds identified include lesser scaup (Aythya affinis), plover (Charadriidae), sandpiper (Scolopacidae), red-bellied woodpecker (Centurus carolinus), and sparrow (Fringillidae).

Reptiles accounted for 8% of the individuals but only 2% of the biomass. Of the 14 reptiles identified, eight were box turtles (Terrapene carolina). Other reptiles included snapping turtle (Chelydra serpentina), mud turtle (Kinosternon subrubrum), musk turtle (Sternotherus odoratus), and painted turtle (Chrysemys picta). Both poisonous (Crotalidae) and nonpoisonous snakes (Colubridae) were also identified. Two eastern spadefoot toads (Scaphiopus holbrooki) and five frogs (Rana sp.) were the only amphibians identified.

Fish contributed 11% of the total MNI for the assemblage but less than 1% of the biomass. Fish taxa identified included gar (Lepisosteus sp.), minnows (Cyprinidae), suckers (Catostomidae), catfish (Ictalurus sp.), and sunfish (Centrarchidae).

#### Early Upper Saratown

The faunal assemblage from Early Upper Saratown (31Sk1) contained 42,709 bones representing a minimum of 268 individuals (Table 5.3). This assemblage was recovered from the fill of 17 pit features. Although mammals accounted for only 26% of the individuals, they made up 93% of the biomass. The most abundantly represented mammalian species in this assemblage was deer (Odocoileus virginianus), with a



Table 5.3. Faunal Remains From The Early Upper Saratown Site (31Sk1)

SPECIES	COUNT	MNI	%MNI	WEIGHT(g)	BIOMASS(kg)	%BIOMASS
Unidentified mammal	14,408	-	-	11,638.66	120.04	33.12
<u>Didelphis virginiana</u> opossum	16	2	0.75	23.34	0.45	0.12
<u>Scalopus aquaticus</u> eastern mole	16	3	1.12	1.80	0.04	0.01
<u>Sylvilagus</u> sp. rabbit	61	4	1.49	19.37	0.38	0.10
<u>Marmota monax</u> woodchuck	1	1	0.37	3.10	0.07	0.02
<u>Sciurus carolinensis</u> gray squirrel	44	3	1.12	26.50	0.50	0.14
<u>Sciurus niger</u> fox squirrel	28	3	1.12	9.68	0.20	0.06
<u>Sciurus</u> sp. squirrel	113	-	-	13.06	0.27	0.07
<u>Castor canadensis</u> beaver	8	1	0.37	18.61	0.37	0.10
Cricetidae mice, voles	21	-	-	0.83	0.02	0.01
<u>Peromyscus leucopus</u> white-footed mouse	23	5	1.87	0.78	0.02	0.01
<u>Sigmodon hispidus</u> Hispid cotton rat	6	2	0.75	0.42	0.01	0.00
<u>Microtus pennsylvanicus</u> meadow vole	18	4	1.49	0.64	0.02	0.00
<u>Canis</u> sp. wolf, dog	6	1	0.37	21.40	0.41	0.11
<u>Vulpes fulva</u> red fox	1	1	0.37	0.11	0.00	0.00

Table 5.3. (continued)

SPECIES	COUNT	MNI	%MNI	WEIGHT(g)	BIOMASS(kg)	%BIOMASS
<u>Urocyon cinereoargenteus</u> gray fox	3	1	0.37	10.10	0.21	0.06
<u>Ursus americanus</u> black bear	11	1	0.37	113.20	1.86	0.51
<u>Procyon lotor</u> raccoon	20	1	0.37	24.20	0.46	0.13
<u>Mephitis mephitis</u> striped skunk	5	2	0.75	9.80	0.21	0.06
<u>Felis concolor</u> mountain lion	1	1	0.37	16.99	0.34	0.09
<u>Odocoileus virginianus</u> white-tailed deer	2,626	34	12.69	22,230.42	214.91	59.30
<u>Artiodactyla</u> deer, pig	5	-	-	2.70	0.06	0.02
Total mammal	17,441	70	26.12	34,185.71	340.85	94.05
Unidentified bird	1,122	-	-	307.30	3.75	1.04
<u>Anas platyrhynchos</u> mallard	53	2	0.75	39.07	0.57	0.16
<u>Cathartes aura</u> turkey vulture	3	1	0.37	8.52	0.14	0.04
<u>Accipter striatus</u> sharp-shinned hawk	1	1	0.37	0.10	0.00	0.00
<u>Bonasa umbellus</u> ruffed grouse	1	1	0.37	1.00	0.02	0.01
<u>Colinus virginianus</u> bobwhite	5	1	0.37	0.76	0.02	0.00
<u>Meleagris gallopavo</u> turkey	89	5	1.87	210.20	2.65	0.73

Table 5.3. (continued)

SPECIES	COUNT	MNI	%MNI	WEIGHT(g)	BIOMASS(kg)	%BIOMASS
<u>Colaptes auratus</u> yellow-shafted flicker	4	1	0.37	0.54	0.01	0.00
Passeriformes perching birds	4	-	-	0.34	0.01	0.00
<u>Ectopistes migratorius</u> passenger pigeon	836	112	41.79	123.26	1.63	0.45
Total bird	2,118	124	46.27	691.09	8.81	2.43
Unidentified turtle	2,487	-	-	724.58	2.61	0.72
<u>Chelydra serpentina</u> snapping turtle	3	1	0.37	3.80	0.08	0.02
<u>Kinosternon subrubrum</u> mud turtle	457	5	1.87	507.10	2.05	0.57
<u>Sternotherus odoratus</u> musk turtle	86	5	1.87	17.98	0.22	0.06
<u>Terrapene carolina</u> box turtle	862	23	8.58	1,416.28	4.09	1.13
<u>Pseudemys</u> sp. cooter	9	1	0.37	19.40	0.23	0.06
<u>Apalone</u> sp. soft-shelled turtle	3	1	0.37	2.50	0.06	0.02
Unidentified snake	285	-	-	8.67	0.12	0.03
Colubridae nonpoisonous snakes	109	-	-	12.20	0.17	0.05
<u>Nerodia</u> sp. water snake	3	1	0.37	0.20	0.00	0.00
Crotalidae poisonous snakes	112	1	0.37	4.20	0.06	0.02
Total reptiles	4,416	38	14.18	2,716.91	9.69	2.67

Table 5.3. (continued)

SPECIES	COUNT	MNI	%MNI	WEIGHT(g)	BIOMASS(kg)	%BIOMASS
<u>Rana/Bufo</u> sp. frog/toad	74	-	-	3.32	-	-
<u>Bufo</u> sp. toad	3	-	-	0.10	-	-
<u>Scaphiopus holbrooki</u> eastern spadefoot toad	49	14	5.22	2.22	-	-
Total Amphibians	126	14	5.22	5.64	-	-
Unidentified fish	2,329	-	-	132.42	1.54	0.43
<u>Amia calva</u> bowfin	1	1	0.37	0.30	0.01	0.00
<u>Lepisosteus</u> sp. gar	13	1	0.37	1.20	0.03	0.01
<u>Alosa sapidissima</u> white shad	19	1	0.37	2.17	0.06	0.02
Cyprinidae minnows	8	-	-	2.25	0.06	0.02
<u>Nocomis</u> sp. chub	4	1	0.37	0.86	0.03	0.01
<u>Notropis coccogenis</u> warpaint	2	2	0.75	0.07	0.00	0.00
Catostomidae suckers	282	-	-	29.00	0.43	0.12
<u>Catostomus commersoni</u> white sucker	35	3	1.12	10.16	0.19	0.05
<u>Moxostoma duquesnii</u> black redbhorse	1	1	0.37	0.78	0.02	0.01
<u>Ictalurus</u> sp. catfish	35	4	1.49	0.99	0.02	0.01

Table 5.3. (continued)

SPECIES	COUNT	MNI	%MNI	WEIGHT(g)	BIOMASS(kg)	%BIOMASS
<u>Anguilla rostrata</u> American eel	2	1	0.37	0.04	0.00	0.00
Centrarchidae bass, sunfish	135	-	-	17.30	0.29	0.08
<u>Centrarchus macropterus</u> flier	25	2	0.75	3.50	0.08	0.02
<u>Lepomis</u> sp. sunfish	33	-	-	2.80	0.06	0.02
<u>Lepomis gulosus</u> warmouth	1	1	0.37	0.17	0.01	0.00
<u>Micropterus salmoides</u> largemouth bass	35	3	1.12	11.67	0.21	0.06
<u>Paralichthys</u> sp. flounder	1	1	0.37	0.20	0.01	0.00
Total fish	2,961	22	8.21	215.88	3.06	0.84
Unidentified	15,647	-	-	2,028.56	-	-
Total	42,709	268	100.00	39,843.79	362.40	100.00

minimum of 34 individuals. Noncommensal mammals identified in this assemblage included opossum (Didelphis virginiana), rabbit (Sylvilagus sp.), woodchuck (Marmota monax), gray and fox squirrels (Sciurus carolinensis and Sciurus niger), beaver (Castor canadensis), wolf/dog (Canis sp.), red and gray foxes (Vulpes fulva and Urocyon cinereoargenteus), black bear (Ursus americanus), raccoon (Procyon lotor), striped skunk (Mephitis mephitis), and mountain lion (Felis concolor). None of these taxa contributed more than 2% of the individuals and none contributed as much as 1% of the biomass. Commensal taxa identified included eastern mole (Scalopus aquaticus), white-footed mouse (Peromyscus leucopus), Hispid cotton rat (Sigmodon hispidus), and meadow vole (Microtus pennsylvanicus).

Although birds accounted for 46% of the individuals in the assemblage, they only made up 2% of the biomass. A minimum of 112 passenger pigeons (Ectopistes migratorius) was identified from 11 different features. While this species accounted for 42% of the MNI for the entire assemblage, passenger pigeon contributed less than 1% of the entire biomass. A fairly wide variety of other birds was identified in this assemblage including mallard (Anas platyrhynchos), turkey vulture (Cathartes aura), sharp-shinned hawk (Accipiter striatus), ruffed grouse (Bonasa umbellus), bobwhite (Colinus virginianus), turkey (Meleagris gallopavo), yellow-shafted flicker (Colaptes auratus), and a perching bird (Passeriformes).

Reptiles made up 14% of the individuals and 3% of the biomass in the Early Upper Saratow faunal assemblage. Of the 38 reptiles identified, 23 were box turtle (Terrapene carolina). A number of other species was identified including snapping turtle (Chelydra

serpentina), mud turtle (Kinosternon subrubrum), musk turtle (Sternotherus odoratus), cooter (Pseudemys sp.), and soft-shelled turtle (Trionyx sp.). Snakes identified include a water snake (Natrix sp.), nonpoisonous snakes (Colubridae), and poisonous snakes (Crotalidae). A minimum of 14 eastern spadefoot toads (Scaphiopus holbrooki) and the bones of a number of unidentifiable frog/toads (Rana/Bufo sp.) were also represented in this assemblage. These amphibians made a negligible contribution to the biomass. Fish contributed 8% of the individuals in the assemblage but provided less than 1% of the biomass. Among the fish identified were bowfin (Amia calva), gar (Lepisosteus sp.), white shad (Alosa sapidissima), chub (Nocomis sp.), warpaint (Notropis coccogenis), white sucker (Catostomus commersoni), black redhorse (Moxostoma duquesni), American eel (Anguilla rostrata), flier (Centrarchus macropterus), warmouth (Lepomis gulosus), and largemouth bass (Micropterus salmoides). One of the more interesting taxa identified in this assemblage was flounder (Paralichthys sp.), which was represented by a single bone. Flounders are saltwater fish and inhabit shallow coastal waters in the spring and summer in North Carolina. It would not have been possible for a flounder to live in the Dan River. The presence of this flounder bone, in addition to the soft-shelled turtle and the musk turtle which are more common in the coastal plain than in the Piedmont, demonstrates that the inhabitants of the Early Upper Saratown site either traveled to the coast or interacted with people with coastal connections.

#### Upper Saratown

The faunal assemblage from Upper Saratown (31Skla) was retrieved from the fill of 26 pit features and consisted of a total of 18,282 fragments. A minimum of 70 individuals was identified in this assemblage (Table 5.4). Mammals contributed 57% of the total number of individuals in the assemblage and 95% of the biomass. Deer (Odocoileus virginianus) was the most abundantly represented species, providing 33% of the individuals and 52% of the biomass. Other mammals identified were opossum (Didelphis virginiana), eastern cottontail (Sylvilagus floridanus), gray and fox squirrels (Sciurus carolinensis and Sciurus niger), beaver (Castor canadensis), red and gray foxes (Vulpes fulva and Urocyon cinereoargenteus), black bear (Ursus americanus), raccoon (Procyon lotor), long-tailed weasel (Mustela frenata), and bobcat (Lynx rufus). Commensal taxa included white-footed mouse (Peromyscus leucopus), Hispid cotton rat (Sigmodon hispidus), and meadow vole (Microtus pennsylvanicus). Although Upper Saratown is a historic site, no remains of domestic animals were identified in this faunal assemblage.

Birds contributed 16% of the individuals and 2% of the biomass. Turkey (Meleagris gallopavo) and passenger pigeon (Ectopistes migratorius) accounted for 5 of the 11 birds identified. Other birds represented in the assemblage include duck (Anatidae), bobwhite (Colinus virginianus), brown thrasher (Toxostoma rufum), woodpecker (Picidae), and sparrows (Melospiza sp.)

Reptiles contributed 11% of the individuals and 2% of the biomass. Turtles identified included snapping turtle (Chelydra serpentina), box turtle (Terrapene carolina), and painted turtle (Chrysemys picta). Water snakes (Nerodia sp.), corn snakes (Elaphe



Table 5.4. Faunal Remains from The Upper Saratown Site (31Sk1a)

SPECIES	COUNT	MNI	%MNI	WEIGHT(g)	BIOMASS(kg)	%BIOMASS
Unidentified mammal	10,016	-	-	5,409.37	60.23	39.10
<u>Didelphis virginiana</u> opossum	2	1	1.43	1.37	0.03	0.02
<u>Sylvilagus floridanus</u> eastern cottontail	2	1	1.43	0.65	0.02	0.01
<u>Sylvilagus</u> sp. rabbit	1	-	-	0.20	0.01	0.00
<u>Sciurus carolinensis</u> gray squirrel	15	4	5.71	4.63	0.10	0.07
<u>Sciurus niger</u> fox squirrel	3	1	1.43	1.10	0.03	0.02
<u>Sciurus</u> sp. squirrel	72	-	-	3.82	0.09	0.06
<u>Castor canadensis</u> beaver	15	1	1.43	39.16	0.71	0.46
Cricetidae mice, rats	26	-	-	0.25	0.01	0.00
<u>Peromyscus leucopus</u> white-footed mouse	8	1	1.43	0.15	0.00	0.00
<u>Sigmodon hispidus</u> Hispid cotton rat	1	1	1.43	0.10	0.00	0.00
<u>Microtus pennsylvanicus</u> meadow vole	2	1	1.43	0.02	0.00	0.00
Canidae wolf, dog, fox	3	-	-	0.73	0.02	0.01
<u>Vulpes fulva</u> red fox	17	1	1.43	5.50	0.12	0.08
<u>Urocyon cinereoargenteus</u> gray fox	6	1	1.43	2.60	0.06	0.04

Table 5.4. (continued)

SPECIES	COUNT	MNI	%MNI	WEIGHT(g)	BIOMASS(kg)	%BIOMASS
<u>Ursus americanus</u> black bear	6	1	1.43	171.60	2.70	1.75
<u>Procyon lotor</u> raccoon	8	1	1.43	6.20	0.14	0.09
<u>Mustela frenata</u> long-tailed weasel	1	1	1.43	1.50	0.04	0.02
<u>Lynx rufus</u> bobcat	1	1	1.43	0.90	0.02	0.02
<u>Odocoileus virginianus</u> white-tailed deer	1,405	23	32.86	7,372.17	79.59	51.67
Artiodactyla deer, pig	111	-	-	188.00	2.93	1.90
Total mammal	11,721	40	57.14	13,210.02	146.86	95.34
Unidentified bird	292	-	-	176.50	2.26	1.47
Anatidae duck	1	1	1.43	2.80	0.05	0.03
<u>Colinus virginianus</u> bobwhite	1	1	1.43	0.06	0.00	0.00
<u>Toxostoma rufum</u> brown thrasher	2	1	1.43	0.11	0.00	0.00
Picidae woodpeckers	2	1	1.43	0.13	0.00	0.00
<u>Meleagris gallopavo</u> turkey	50	3	4.29	74.14	1.03	0.67
<u>Melospiza</u> sp. sparrows	3	1	1.43	0.02	0.00	0.00
Fringillidae sparrows	10	1	1.43	0.20	0.00	0.00

Table 5.4. (continued)

SPECIES	COUNT	MNI	%MNI	WEIGHT(g)	BIOMASS(kg)	%BIOMASS
Passeriformes perching birds	13	-	-	0.22	0.01	0.00
<u>Ectopistes migratorius</u> passenger pigeon	13	2	2.86	1.34	0.03	0.02
Total bird	387	11	15.71	255.52	3.39	2.20
Unidentified turtle	770	-	-	176.74	1.01	0.66
<u>Chelydra serpentina</u> snapping turtle	5	1	1.43	5.40	0.10	0.06
<u>Terrapene carolina</u> box turtle	547	2	2.86	408.05	1.77	1.15
<u>Chrysemys picta</u> painted turtle	13	1	1.43	26.80	0.29	0.19
Unidentified snake	25	-	-	0.57	0.01	0.01
Colubridae nonpoisonous snakes	19	-	-	1.09	0.02	0.01
<u>Nerodia</u> sp. water snakes	2	1	1.43	0.19	0.00	0.00
<u>Elaphe</u> sp. corn snake, rat snake	4	1	1.43	0.14	0.00	0.00
<u>Lampropeltis</u> sp. king snake	2	1	1.43	0.17	0.00	0.00
Crotalidae poisonous snakes	3	1	1.43	1.20	0.02	0.01
Total reptiles	1,390	8	11.43	620.35	3.22	2.09
<u>Rana/Bufo</u> sp. frog/toad	4	-	-	0.08	-	-
<u>Bufo</u> sp. toad	1	1	1.43	0.06	-	-

Table 5.4. (continued)

SPECIES	COUNT	MNI	%MNI	WEIGHT(g)	BIOMASS(kg)	%BIOMASS
<u>Rana</u> sp. frog	1	1	1.43	0.04	-	-
Total amphibians	6	2	2.86	0.18	-	-
Unidentified fish	1,760	-	-	20.71	0.34	0.22
<u>Amia calva</u> bowfin	1	1	1.43	0.04	0.00	0.00
<u>Lepisosteus</u> sp. gar	4	1	1.43	0.58	0.02	0.01
<u>Alosa sapidissima</u> white shad	45	1	1.43	3.31	0.08	0.05
Catostomidae suckers	36	-	-	2.13	0.05	0.04
<u>Catostomus commersoni</u> white sucker	1	1	1.43	0.10	0.00	0.00
<u>Ictalurus</u> sp. catfish	8	1	1.43	0.38	0.01	0.01
<u>Anguilla rostrata</u> American eel	4	1	1.43	0.04	0.00	0.00
Centrarchidae bass, sunfish	19	1	1.43	0.92	0.03	0.02
<u>Lepomis</u> sp. sunfish	44	2	2.86	1.29	0.03	0.02
Total fish	1,922	9	12.86	29.50	0.57	0.37
Unidentified	2,856	-	-	355.54	-	-
Total	18,282	70	100.00	14,471.11	154.04	100.00

sp.), a king snake (Lampropeltis sp.), and a poisonous snake (Crotalidae) were also identified. Frogs and toads (Rana/Bufo sp.) were represented by a minimum of two individuals. Fish made up 13% of the total number of individuals but less than 1% of the biomass. Species identified included bowfin (Amia calva), gar (Lepisosteus sp.), white shad (Alosa sapidissima), white sucker (Catostomus commersoni), catfish (Ictalurus sp.), American eel (Anguilla rostrata), and sunfish (Lepomis sp.).

#### COMPARISON OF ASSEMBLAGES

An examination of the lists of species identified from these four sites indicates that there is considerable overlap in the species utilized by their inhabitants (Tables 5.1-5.4). MNI and biomass summaries for each assemblage are presented in Tables 5.5 and 5.6. These tables clearly indicate that the similarities among the four assemblages are more dramatic than are the differences. In all four assemblages, deer is the most abundantly represented taxon, contributing more than 46% of the biomass represented in each assemblage. A variety of other mammals also make significant contributions, providing between 27% (Wall) and 44% (Fredricks, Upper Saratown) of the total biomass for each assemblage. The similarity of the proportions of taxa represented in each faunal assemblage (as displayed in Figures 5.1 and 5.2) suggest a large degree of stability in exploitation of animal populations by piedmont Indians that continued from prehistoric to historic times. A variety of birds, reptiles, amphibians, and fish were represented in each assemblage but provided less than 10% of the biomass in each case. Figure 5.1



LOG % MNI

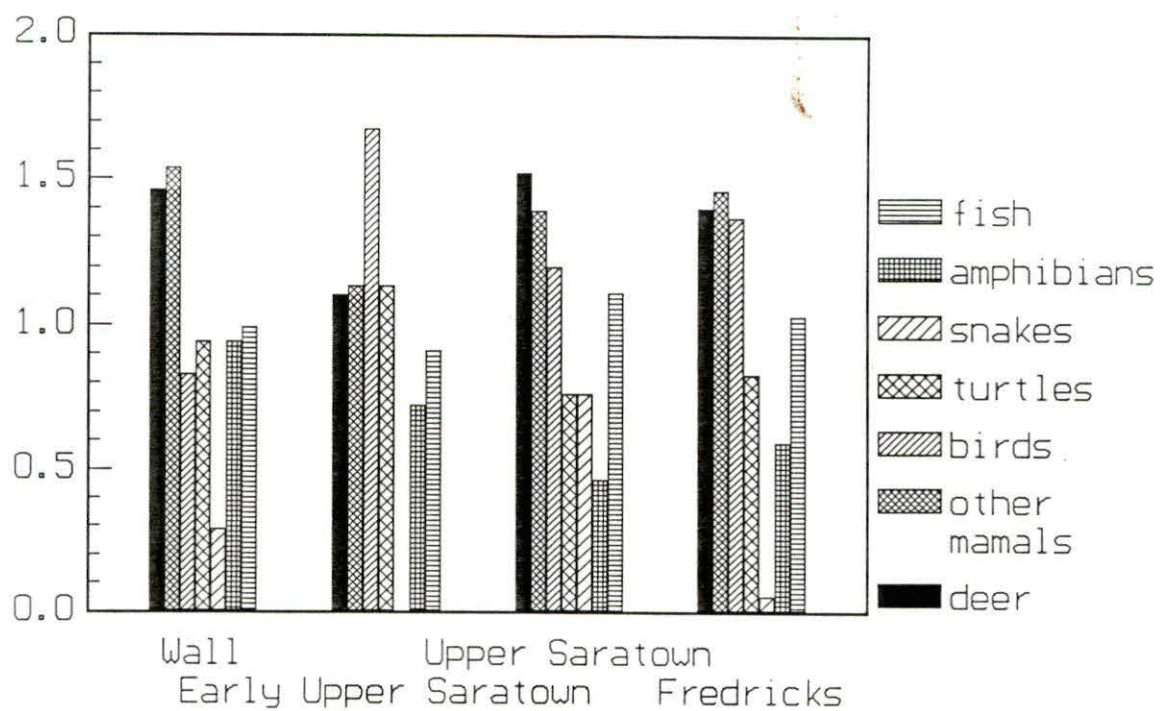


Figure 5.1 Percentage of MNI by Taxon

Log % Biomass

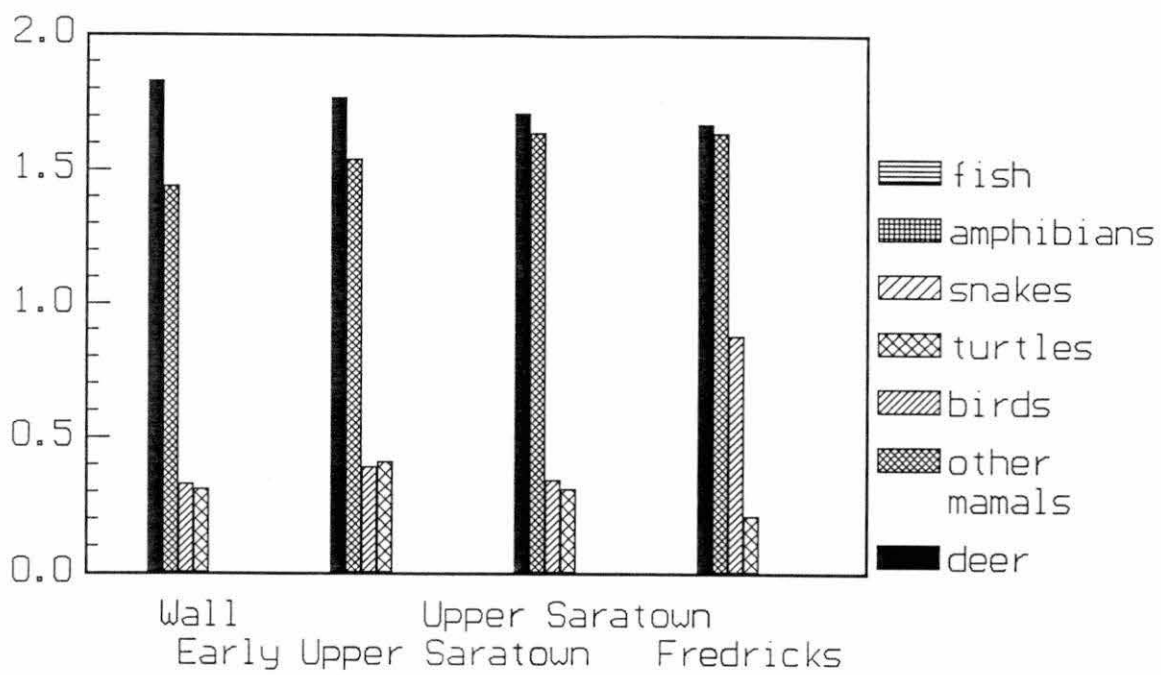


Figure 5.2. Percentage of Biomass by Taxon



Table 5.5. MNI Summaries

	31OR11		31OR231		31SK1		31SK1a	
	MNI	%	MNI	%	MNI	%	MNI	%
Deer	30	29.13	45	25.14	34	12.69	23	32.86
Other Mammals	36	34.95	52	29.05	36	13.43	17	24.28
Birds	7	6.80	42	23.46	124	46.27	11	15.71
Turtles	9	8.74	12	6.70	36	13.43	4	5.71
Snakes	2	1.94	2	1.12	2	0.74	4	5.71
Amphibians	9	8.74	7	3.91	14	5.22	2	2.86
Fish	10	9.71	19	10.62	22	8.21	9	12.86
Totals	103		179		268		70	

Table 5.6. Biomass Summaries

	31OR11		31OR231		31SK1		31SK1a	
	Kg	%	Kg	%	Kg	%	Kg	%
Deer	135.25	68.13	249.34	46.87	214.91	59.30	79.59	51.67
Other Mammals	54.16	27.28	233.05	43.80	125.94	34.75	67.27	43.67
Birds	4.25	2.14	39.88	7.50	8.81	2.43	3.39	2.20
Turtles	4.09	2.06	8.62	1.61	9.33	2.58	3.17	2.06
Snakes	0.48	0.24	0.25	0.04	0.36	0.10	0.05	0.03
Amphibians	-	-	-	-	-	-	-	-
Fish	0.29	0.15	0.88	0.16	3.05	0.84	0.57	0.37
Totals	198.53		532.02		362.40		154.04	

illustrates the fairly wide diversity of individuals identified in each assemblage. Figure 5.2, on the other hand, clearly illustrates the great similarity, in terms of biomass, that exists among the four assemblages.

The taxa identified for each site were ranked in order of their contribution to the total biomass and the five most important species are listed in Table 5.7. In each instance, deer is ranked first. Box turtle and turkey were also important resources at each of the sites and bear appears to have been important at all sites except Wall. Squirrels, raccoons, and mud turtles also made significant contributions. These species dominate the biomass represented in each assemblage and were the apparent staples of the aboriginal diet. A glance at the species lists, however, demonstrates that a wide variety of other taxa made minor contributions to the diet. While these taxa may not have provided an abundance of meat, it is clear they were consistently valued for the variety they provided.

Jochim (1976:19) has defined two major goals guiding resource-use decisions of hunter-gatherer populations: (1) the attainment of a secure level of food and manufacturing needs, and (2) the maintenance of energy expenditure within a preferred range. It appears that the Indians of the North Carolina Piedmont, although horticulturalists, were influenced by similar factors, even after the introduction of guns, the market economy, and tremendous social upheaval.

In addition to the two primary goals guiding resource-use decisions, Jochim (1976:20) notes that a desire for variety in the diet is common and that "apart from its risk-reducing influence, a heterogeneous resource base is valued for preventing monotony in the

Table 5.7. Most Abundant Species In Terms of Biomass

rank	Or11	Sk1	Sk1a	Or231
1	deer	deer	deer	deer
2	turkey	box turtle	black bear	black bear
3	box turtle	turkey	box turtle	turkey
4	squirrel	mud turtle	turkey	box turtle
5	raccoon	black bear	raccoon	squirrel

diet." In times of stress, he states, secondary goals in resource utilization go unmet, and "dietary variety, the tastiest and most prestigious foods, and even the traditions of sex role differentiation all may be sacrificed to the necessity of meeting the primary objectives" (Jochim 1976:21-22). The continuation of the same basic subsistence strategy from protohistoric to historic times, including the high value apparently placed on variety in the diet, indicates that the presence of Europeans did not force the Indians to sacrifice traditional goals in resource selection. Further evidence that the European presence did not dramatically alter the Indian diet is apparent in the virtual absence of domestic animals: the entire domestic assemblage comprised one horse tooth and one pig molar identified at Fredricks. Continuity, rather than change, appears to have characterized the subsistence patterns of Indians living in the Piedmont during one of the most turbulent periods in this region's past.

At the outset of this study, it was hypothesized that differences between the protohistoric and historic assemblages would reflect an increase in the procurement of deer in order to produce hides for trade with Europeans. Graphs portraying the relative contributions of various taxa at each site were constructed in order to test this hypothesis. Figure 5.3 presents the relative contribution of taxa in terms of biomass. This graph contradicts the hypothesis that there was an increase in deer hunting from protohistoric to historic times. In fact, the only clear trend exhibited in Figure 5.3 is a decrease in the contribution of deer (in terms of biomass) through time. Figure 5.4 presents the relative contribution of taxa in terms of MNI and

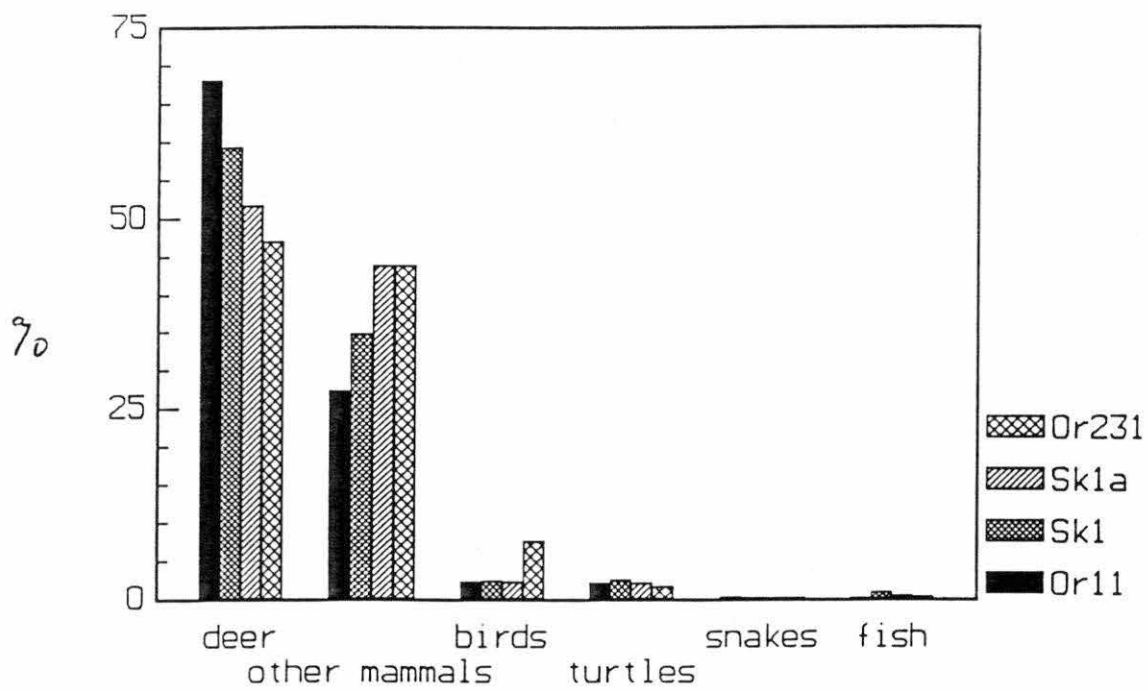


Figure 5.3. Relative Contribution of Taxa - Biomass

does not validate the results presented when biomass is considered. Figure 5.4 indicates that there is no decrease in the number of individual deer through time. Thus, the decrease in the biomass of deer could not be the result of hunting fewer deer. The size of Piedmont deer may have decreased through time but an investigation of this point would require a detailed morphometric analysis that is beyond the scope of this study. The apparent decrease in the relative contribution of deer can, however, be explained as a result of the increase in the contribution of other taxa.

Figure 5.5 illustrates the dramatic increase in biomass contributed by mammals other than deer from the Protohistoric to the Historic period. It is evident that there was a dramatic increase in the contribution of fur-bearing animals other than bear and deer from the protohistoric Early Upper Saratown village to the historic Upper Saratown village on the Dan River. The same trend is not exhibited in the assemblages from the sites on the Eno River. Instead, there is a dramatic increase in the representation of bear in the historic Fredricks site assemblage from that in the protohistoric Wall site assemblage. In a similar vein, a dramatic increase in the contribution of turkey to the assemblage from the Fredricks site is apparent in Figure 5.6. Turkeys account for 15% of the total MNI at this historic site but no more than 5% of the total MNI of each of the three other assemblages.

As mentioned earlier, the Occaneechi Indians inhabiting the Fredricks site were considerably more involved with trade activities with Europeans than were the inhabitants of the Upper Saratown site. Not only was the Occaneechi village located immediately along the

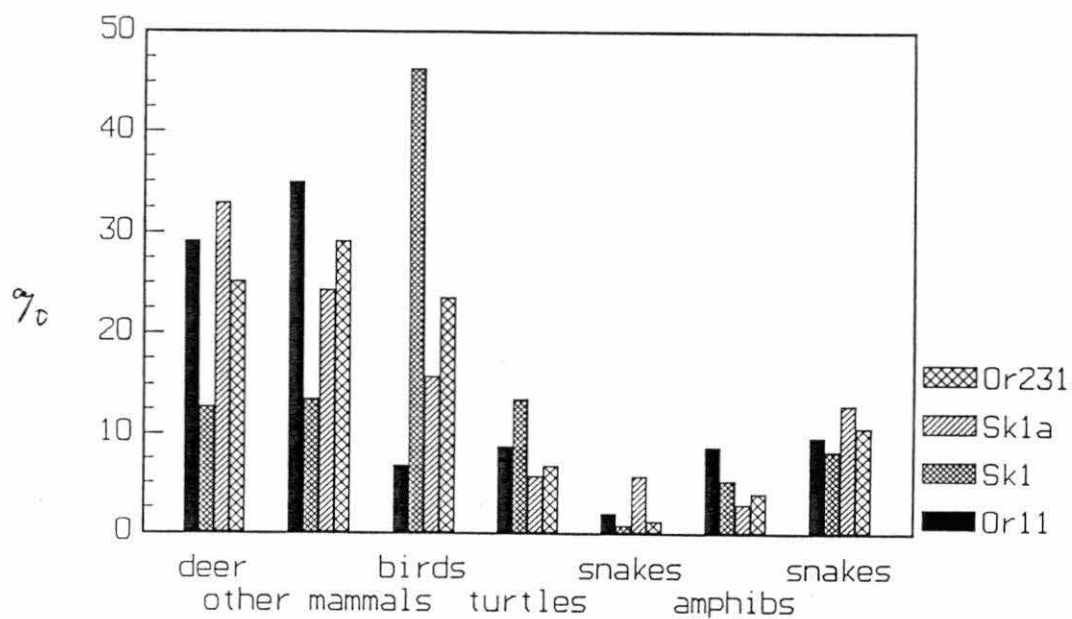


Figure 5.4. Relative Contribution of taxa - % MNI



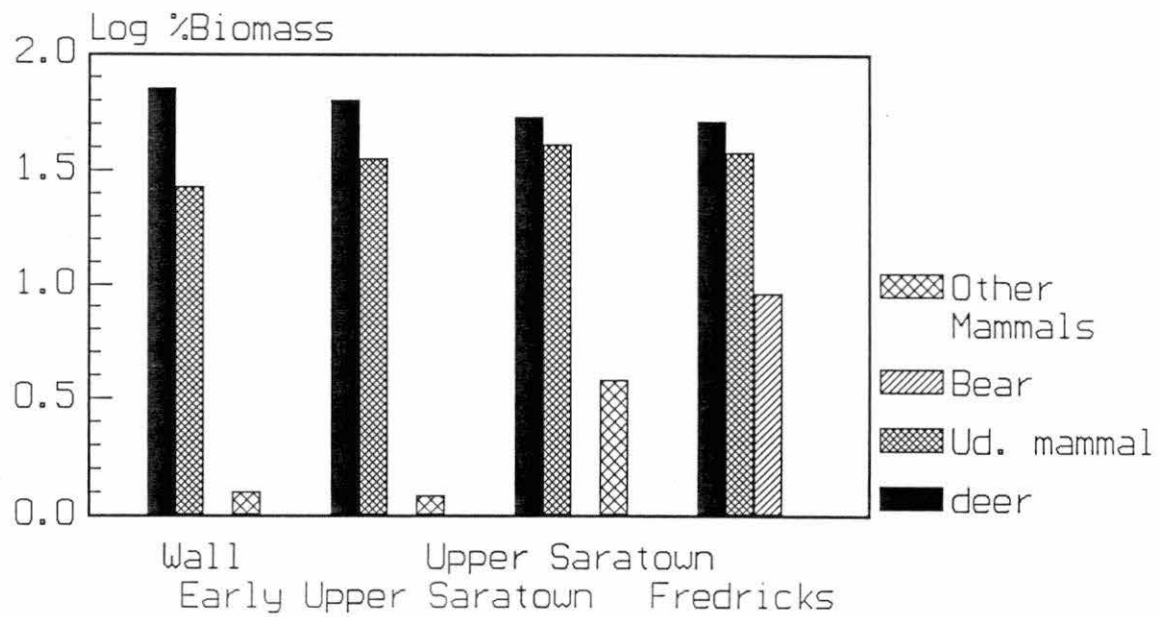


Figure 5.5. Percent Biomass Through Time - Mammals

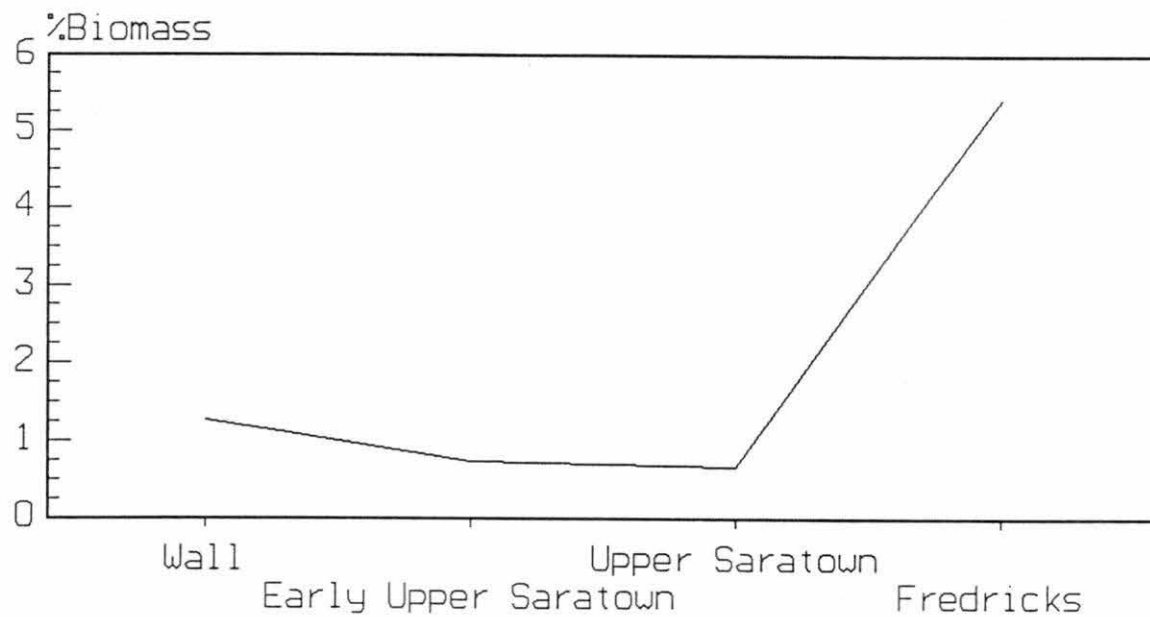


Figure 5.6. Percent Biomass Through  
Time - Turkey

trading path from Virginia, but the Occaneechi themselves fulfilled the role of middlemen between the European traders and Indians located further from the trading path. Apparently, this direct connection with traders provided the Occaneechi with freer access to guns and ammunition than more distant groups. The increase in the representation of bear and turkeys at this site may well be a reflection of the increased use of guns by the inhabitants of the Fredricks site. At Upper Saratown, mammals other than bear and deer were hunted to a greater extent than they had been at Early Upper Saratown. Many of these mammals could have been caught in traps, possibly expanding the time available for other activities such as hide preparation. The increased interest shown to small fur-bearing mammals may reflect the participation in the fur and deerskin trade by a village with limited access to guns. At Upper Saratown, the only gunparts and ammunition found were located either in the plowzone or in the fill of a single burial which has been dated to a time period later than the rest of the site (Ward and Davis 1993:426). In addition to this absence of artifacts related to firearms, there is evidence that considerably more stone projectile points were recovered at Upper Saratown than were recovered at other North Carolina sites (Ward 1980:244; Ward and Davis 1993:426). This evidence, coupled with that from the faunal assemblages, indicates that the residents of both historic sites had modified their hunting practices from protohistoric times in order to obtain skins and furs to be traded with Europeans.

## CHAPTER VI

### ASSEMBLAGE COMPARISONS: HETEROGENEITY

As stated earlier, one of the purposes of this study is to examine the ways in which the aboriginal inhabitants of the North Carolina Piedmont interacted with their environment. The concept of the ecological niche is one way in which to examine this relationship. The ecological niche has been defined as "a distinctive feeding strategy that sets one organism apart from another" (Hardesty 1977:109). The niche of a human population can be measured by quantifying the amount of variety present in the resources used for subsistence. A broad niche indicates a generalized subsistence strategy and a narrow niche indicates specialization (Hardesty 1977:115). Cleland (1976:59-76) outlined a continuum of subsistence strategies bounded at the extremes by "focal" adaptations and "diffuse" adaptations. A focal adaptation is one in which subsistence is centered on one or only a very few resources. A diffuse adaptation is much less specialized and utilizes a wide variety of resources. In reality, most subsistence strategies can not be defined as either purely focal or purely diffuse. Instead, they simply show a tendency toward being more or less specialized. Comparing the degree of specialization or diversification exhibited in the subsistence strategies of different human groups is one of the ways to define differences and

similarities in the ways in which they interact with their environments.

Diversity is a measure of variation related to the way in which quantities of objects (artifacts, animal bones, etc.) are distributed among classes (Leonard and Jones 1989:1). There has been some inconsistency in the literature in the way in which the term diversity has been used. In this study, the terms richness, equitability, and diversity will be used. Richness simply refers to the number of classes represented in a sample. Equitability refers to the way in which items are distributed among the classes. Many measures of diversity summarize, in a single index, the very different properties of richness and equitability. A diversity index combines these concepts and simultaneously refers to the variability in the number of classes and the abundance of items in each of those categories (Pielou, 1974:289). No matter how it is measured, diversity is usually employed to explore variation in a nominal variable and it is generally used as a comparative measure (Kintigh 1989:26). Differences in heterogeneity among archaeological assemblages are generally considered to reflect variety in human behavior in the past.

The relationship between diversity measures and variety in human behavior is not as straightforward as it initially appears. Diversity measures are often dependent upon sample size. In some cases, the larger an assemblage is, the more heterogeneous it may be (Grayson 1984:132, Ricklefs 1990:703). Other things being equal, a larger assemblage will have more artifact classes than a smaller assemblage because rare categories are more likely to be present.

Thus, apparent changes in artifact richness through time, for example, may be more indicative of a difference in the sizes of the assemblages representing those periods than of a difference in human behavior. The sample size problem is more pronounced with smaller assemblages than it is with larger assemblages, although there is no consensus on how large an assemblage needs to be in order to eliminate the "sample-size effect." Nothing can be said accurately about variety in the behavior of the humans who originally produced those assemblages until the relationship between sample size and assemblage diversity has been assessed.

Numerous methods have been proposed for measuring the heterogeneity present in archaeological assemblages (see Bobrowsky and Ball 1989:4-12). Richness is the simplest measure of variability and simply measures the number of classes of items present in an assemblage. Thus, if one assemblage consists of bones from animals identified to 15 taxa and another contains the bones of animals belonging to 50 different taxa, the latter will be considered the richer assemblage.

Many of the formulas used to measure species diversity have been borrowed from the fields of biology and ecology (Peet 1974; Odum 1971; Pielou 1974). One of the most commonly used measures of diversity is the Shannon-Weaver information statistic:

$$H' = -p_i \ln(p_i)$$

where  $p_i$  is the proportion of all items in class  $i$  and  $\ln(p_i)$  is its logarithm (Shannon and Weaver 1949:14; Shott 1989:286). With this statistic, the minimum value is 0, indicating that all of items belong to a single class. The maximum value is  $\ln(k)$  where  $k$  is the

maximum number of classes. The maximum value of the index occurs when the items are evenly distributed among the classes. Thus, a low diversity index indicates an assemblage that is relatively homogeneous and a high index is indicative of an assemblage that is highly varied.

Equitability is measured using the formula:

$$E = H' / H_{\max}$$

where  $H'$  is the diversity index and  $H_{\max}$  is the natural log of the maximum number of classes (Sheldon 1969):

$$H_{\max} = \ln(s)$$

A low equitability (approaching 0.0) is an indication that one species was relied upon much more heavily than the other species in the assemblage. The closer the equitability index is to 1.0, the more evenly distributed are the species within the assemblage (Reitz and Cumbaa 1983:174).

Using these indexes, diversity and equitability can be calculated for both MNI and biomass. In the estimation of the diversity and equitability of assemblages in terms of biomass, only biomass of species for which MNI was calculated was utilized.

Although the sample size problem does occur with the use of the Shannon-Weaver measure, Sheldon (1969:467) has concluded that the relationship between species count and equitability is fairly stable with samples of twenty or greater. More recently, Cruz-Urbe (1988:179-196) argues that the Shannon-Weaver index is a valid measure of diversity when samples composed of at least 25 individuals are used. Wing (1979:119) has suggested that samples of at least 200 individuals be used. It is interesting to note that

Wing's conclusions are based upon evidence from the Caribbean and Cruz-Uribe's conclusions are based on evidence from a more temperate environment. Tropical environments support a larger number of species than do temperate or arctic areas (Ricklefs 1990:705). Therefore, the number of species required to minimize the sample size problem will vary depending on the number of taxa available in any given environment.

Although the natural environments of the four sites utilized in this study are very similar, the faunal assemblages from these sites vary considerably in size (the largest assemblage contains over 70,000 fragments and the smallest about 18,000). Thus, it is especially important that the effects of sample size on the measure of diversity be carefully assessed in this case. Kintigh (1984) has developed a method for assessing the effects of sample size on diversity indexes that seems quite appropriate for use in the present study. Kintigh's approach involves the use of a computer simulation method that generates an expected value for richness for a given sample size which can then be compared with the actual value. In other words, Kintigh's approach attempts to answer the question "how many artifact classes would I expect if I took  $n$  artifacts at random from population  $p$ ?" (Rhode 1988:704). This approach depends upon a model of average values and average confidence levels derived from taking repeated samples of a particular size from a larger population. This model specifies the expected diversity of an assemblage of a given size. "The diversities of two assemblages are compared--not directly with each other--but with respect to the *expected* diversity for each size



sample" (Kintigh 1984:45). Thus, the Shannon-Weaver index will be utilized in this study in order to produce results that can be compared with the work of other zooarchaeologists in the Southeast, and Kintigh's approach will be utilized also, in order to assess the validity of these results.

#### COMPARISON OF THE ASSEMBLAGES

As discussed in the previous chapter, white-tailed deer is by far the most abundantly represented taxa at all four sites. Box turtle, turkey, and bear were consistently important, as were squirrels, raccoons, and mud turtles. After the five most abundant species (in terms of biomass), the assemblage from each of the four sites consisted of a wide variety of other animals. While these other animals made relatively minor contributions to the diet in terms of biomass, they appear to have been consistently important for providing variety in the diet. In addition to variety, these taxa may have been valued for other things such as availability, ease of acquisition, or qualities of the meat, fat, and fur they provided.

These results are similar to those found by Wing (1977) in her survey of 43 aboriginal sites. These sites were located predominantly in Florida, but several sites in Georgia, Alabama, North Carolina, and South Carolina were also represented. The dates of these sites ranged from 2000 B.C. to the Historic period. Wing noted that deer, a variety of turtles, turkey, and catfish were among the most important faunal resources at every inland site in

her study. At almost all of these sites, she also noted the presence of a wide diversity of taxa. Wing (1977:81) utilized the Shannon-Weaver Index to quantify the diversity of the assemblages from these sites.

For the nine sites in Wing's study dating from Late Prehistoric to Historic times, diversity ranged from 2.07 to 3.33 with an average diversity of 2.72. Using the Shannon-Weaver index, diversity (based on MNI), was calculated for the assemblages from the Wall, Fredricks, Early Upper Saratown, and Upper Saratown faunal assemblages. The results for these sites ranged from 2.49 to 3.03, with an average diversity of 2.80 (Table 6.1). Thus, the faunal remains from the four North Carolina sites fall well within the range of the diversity of other Southeastern sites from similar periods.

As mentioned above, one of the major drawbacks in the use of the Shannon-Weaver index arises from the difficulties in interpretation created by the problems of sample size. The four assemblages in this study range in size from 70 individuals (Upper Saratown) to 268 individuals (Early Upper Saratown). An examination of the figures in Table 6.1, however, indicates that sample size is unlikely to be affecting the results of the Shannon-Weaver index. Using this method, the largest assemblage appears to have the lowest diversity and the smallest assemblage exhibits more diversity than the three other assemblages. These results are directly counter to those one would expect if the "sample-size effect" was occurring.

In order to explore this issue more completely, Kintigh's (1984) simulation approach (which takes into account the size of

Table 6.1. Assemblage Diversity: Shannon-Weaver Index

Site	Sample Size (MNI)	Diversity Index		
		H'	E	R
31Sk1	268	2.49	0.64	48
31Sk1a	70	3.03	0.82	40
310r11	103	2.88	0.70	34
310r231	179	2.79	0.76	39

each assemblage) was utilized to calculate the expected diversity for each assemblage in terms of richness. Each of the four assemblages was then compared in terms of whether it is more or less diverse than these expected values. While the faunal assemblage from Upper Saratown is more diverse than expected, all of the other sites fall within the expected range (Figure 6.1). The assemblage from Early Upper Saratown exhibits the highest richness of the four sites although it has the lowest diversity measured by the Shannon-Weaver index.

An explanation for the apparent contradiction can be found by examining the equitability of the species represented in these two assemblages. The assemblage from Early Upper Saratown exhibits the lowest equitability (0.64) while that from Upper Saratown exhibits the highest (0.82). The low equitability of the Early Upper Saratown assemblage can be explained by the fact that 42% of the total MNI from this site consisted of passenger pigeons. Evidence from the ethnohistoric record indicates that the capture of passenger pigeons was an activity limited to a brief period in the fall when the migrating birds passed within a short distance of aboriginal villages. Although passenger pigeons were represented in all four assemblages, it is clear that the intensity of their use at Early Upper saratown was the result of a brief period of depredation of a flock or flocks passing through the area. Of the 112 individual passenger pigeons identified in the assemblage from Early Upper Saratown, 29 were recovered from a single feature.

The high numbers of passenger pigeons from Early Upper Saratown can thus be assumed to be the result of an isolated event in the

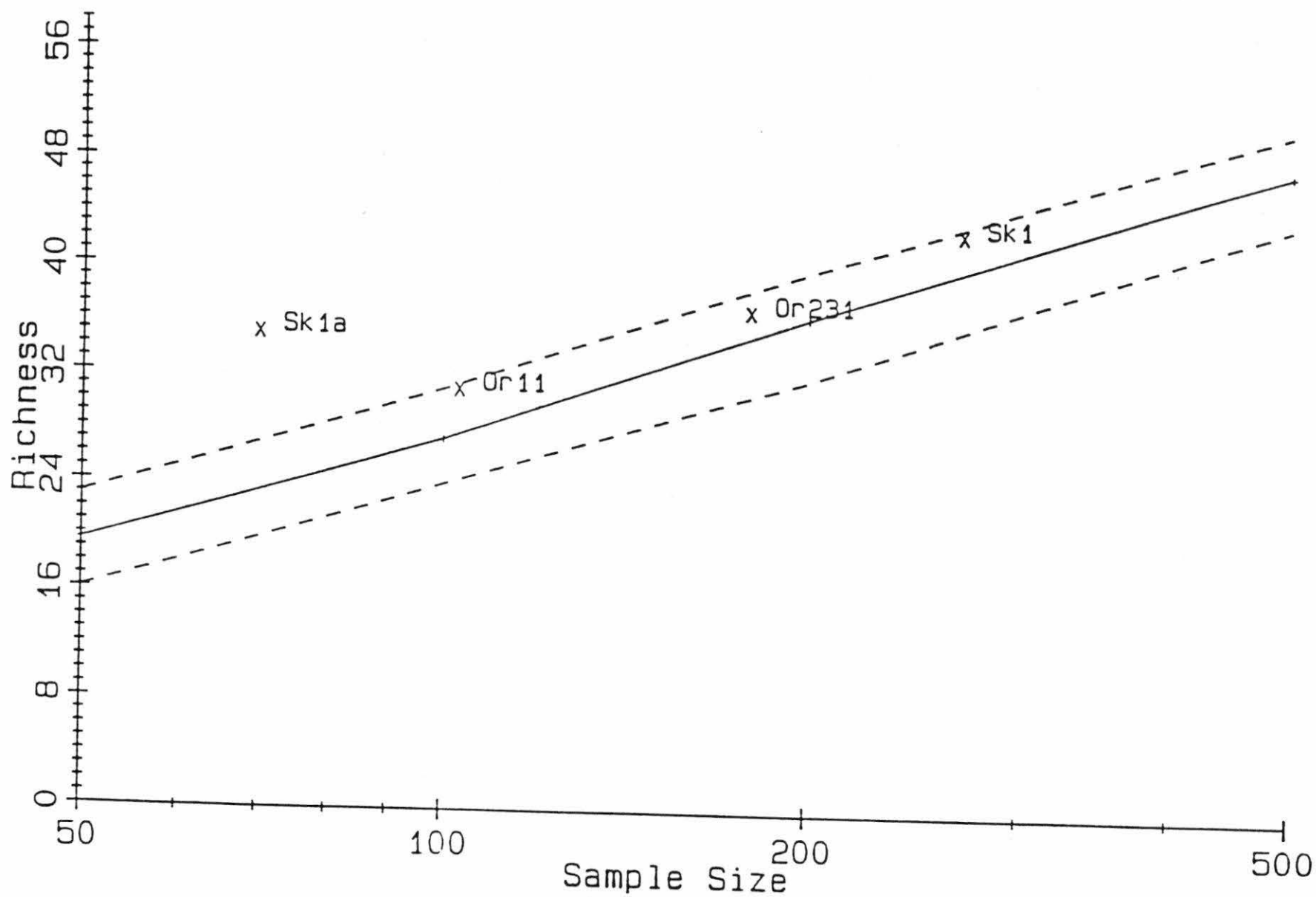
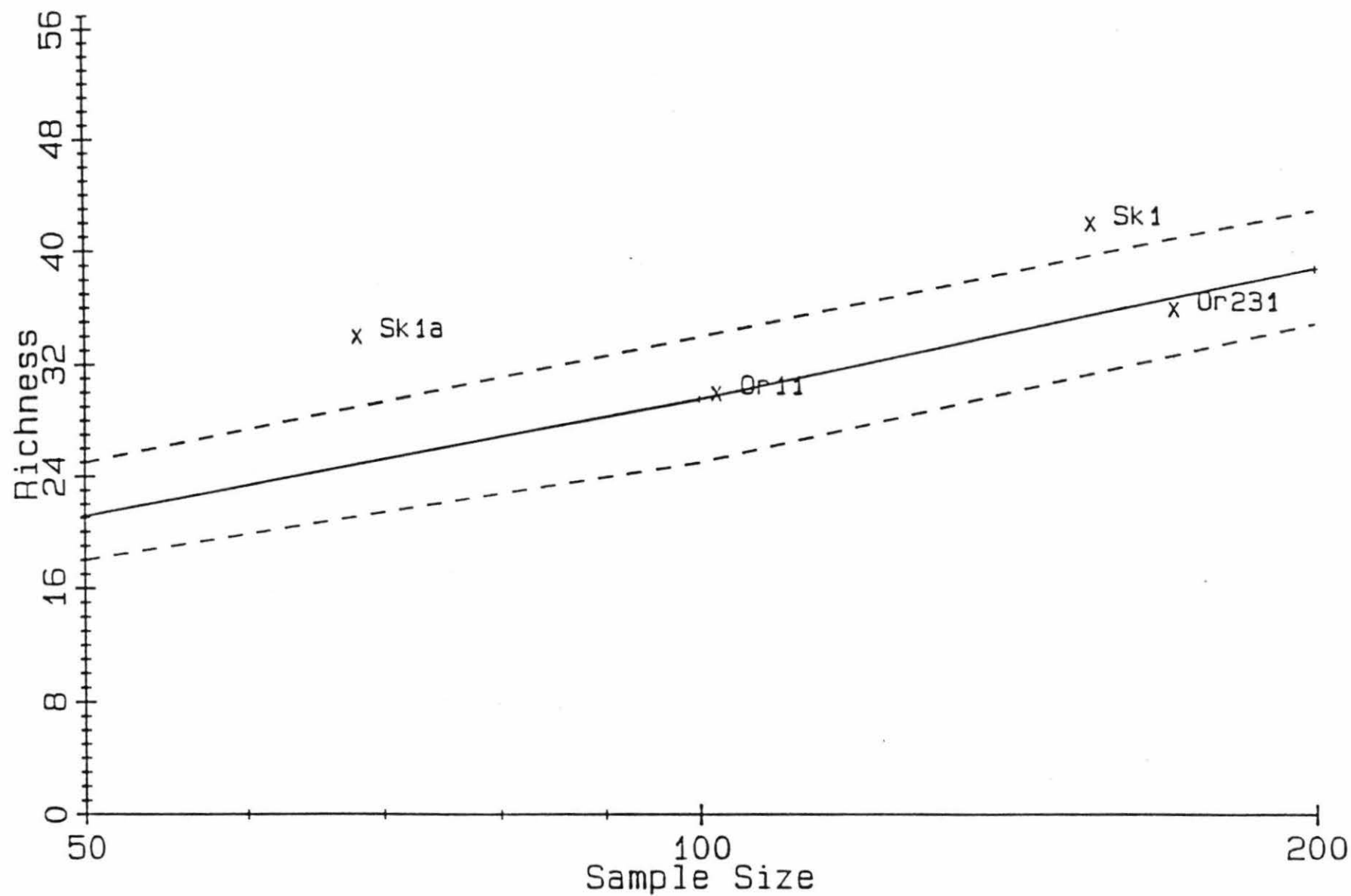


Figure 6.1 90% Interval Plotted  
Diversity Calculated with MNI

lives of the inhabitants of the village. For this reason, their overwhelming representation in terms of MNI may mask the similarities among the four sites. In order to test this hypothesis, Kintigh's method was utilized again, this time with passenger pigeon completely eliminated (Figure 6.2). The results of this procedure indicate that the Dan River sites (Early Upper Saratown and Upper Saratown) are more diverse than expected and both the Eno River sites (Wall and Fredricks) fall within the expected range of diversity.

An explanation for differences in diversity exhibited by the sites along the two river drainages can be found through an examination of the species present in each assemblage (Table 6.2). The most notable taxa present in the Dan River assemblages but absent from the Eno River assemblages are freshwater fish. While the Dan River assemblages exhibit every species of fish present in the Eno River assemblages, they also contain five fish taxa that were not identified in the Eno River assemblages. Thus, the sites along the Dan River exhibit a higher faunal diversity because of the presence of a greater variety of fish.

There are numerous possible explanations for the differences in the assemblages. At present, the Dan River is considerably larger than the Eno River and thus provides a wider variety of fish habitats to be exploited. For example, freshwater eels are dependent on permanent streams with continuous flow and shad are dependent on the open water of large rivers (Page and Burr 1991:32, 35). The Eno River, in the vicinity of the Wall and Fredricks sites, is considerably smaller than the Dan River and its size is



90% Interval Plotted

Figure 6.2 Diversity Based on MNI (pass. pigeon excluded)

Table 6.2. Comparison of Taxa from Dan River and Eno River Assemblages

=====		
General Category:	Eno River	Dan River
Taxon	Sites	Sites
-----		
Mammals		
opossum	x	x
short-tailed shrew	x	-
eastern mole	-	x
rabbit	x	x
chipmunk	x	-
woodchuck	-	x
gray squirrel	x	x
fox squirrel	x	x
beaver	x	x
white-footed mouse	x	x
Hispid cotton rat	x	x
meadow vole	x	x
muskrat	x	-
wolf, dog	x	x
red fox	x	x
gray fox	x	x
black bear	x	x
raccoon	x	x
long-tailed weasel	-	x
striped skunk	x	x
mountain lion	x	x
bobcat	-	x
pig	x	-
white-tailed deer	x	x
horse	x	-
Birds		
mallard	-	x
lesser scaup	x	-
turkey vulture	-	x
sharp-shinned hawk	-	x
ruffed grouse	-	x
bobwhite	x	x
turkey	x	x
great horned owl	x	-
plovers	x	-
sandpipers	x	-
yellow-shafted flicker	-	x
woodpeckers	x	x
blue jay	x	-
brown thrasher	-	x
sparrows	x	x
passenger pigeon	x	x
-----		



Table 6.2. (continued)

=====		
General Category:	Eno River	Dan River
Taxon	Sites	Sites
-----		
cooter	-	x
soft-shelled turtle	-	x
nonpoisonous snakes	x	x
poisonous snakes	x	x
Amphibians		
eastern spadefoot toad	x	x
frog	x	x
Fish		
bowfin	-	x
gar	x	x
white shad	-	x
minnows	x	x
suckers	x	x
catfish	x	x
American eel	-	x
sunfish	x	x
largemouth bass	-	x
flounder	-	x
=====		

affected by periods of low rainfall to a greater degree than the Dan. The fact that a greater variety of fish was recovered from the Dan River sites than from the Eno River sites indicates that this size discrepancy may have existed in the past. The Dan River would thus have been easier to navigate than the Eno and the inhabitants of the Dan River villages would have been able to travel more easily and over greater distances than those living along the Eno River. Thus, it may have been less difficult for the inhabitants of the Dan River sites to acquire a variety of fish than it was for the inhabitants of the Eno River sites. In a survey of faunal assemblages from Dan and Eno River sites, four of the five Dan River assemblages contained a greater proportion of fish (in terms of  $\%MNI$ ) than did the Eno River assemblages (Holm 1993).

Another explanation may lie in the fact that the Dan River drainage was more heavily populated than the Eno River was during the Late Prehistoric and Historic periods. This was likely due to the fact that the Dan River system is more mature than that of the Eno and has more extensive floodplains (Simpkins 1992:164). There is considerably more land suitable for agriculture and settlement along the Dan River than there is along the Eno (Ward and Davis 1991, 1993:8). Because of these larger populations, the inhabitants of the Dan River sites may have been forced to use resources that were considered less desirable or secondary in order to feed a greater number of people occupying a single area. Scott (1983:322) has noted that when there is an imbalance between resources and human populations two of the options for alleviating food shortages are (1) diversification of the resource base and (2) intensification

of previously existing strategies. In other words, when the populations living along the Dan River faced a possible food shortage their options included either the addition of a wider variety of resources to the diet or the intensification of the exploitation of the resources already in use (Winterhalder 1980). Diversification of the resource base is the lower-cost option (Scott 1983:322.)

Simpkins (1992) hypothesizes that Early Upper Saratown may represent an incipient chiefdom, heavily dependent on maize horticulture and that Upper Saratown represents a population that was starting to decline due to the deleterious effect of contact with European pathogens. It has already been noted that the assemblage from Early Upper Saratown appears to be more diverse than that from Upper Saratown. An examination of the species lists from these two sites reveals that there are 20 taxa present in the assemblage from Early Upper Saratown that are not found in the assemblage from Upper Saratown. On the other hand, there are only 8 taxa present at Upper Saratown but not at Early Upper Saratown. Although it seems possible that the inhabitants of Early Upper Saratown were utilizing a wider variety of taxa than those of Early Upper Saratown due to the higher population density at that site these discrepancies are more likely to be the result of the differences in sample size between the two sites.

Diversity measures indicate that the differences in the four faunal assemblages correlate to some degree with location of the sites on either the Dan or the Eno River. Differences between the two Dan River sites are likely to be the result of the fact that the

assemblage from Early Upper Saratown is considerably larger than the assemblage from Upper Saratown. It is clear that the degree to which the inhabitants of these sites were exposed to European contact is not the deciding factor in the differences in diversity exhibited by these assemblages.

CHAPTER VII  
ELEMENT DISTRIBUTION AND BONE MODIFICATION

Yellen (1977:277) has stated that there are three stages involved in the analysis of faunal remains: "first classification, then manipulation of the numerical results to determine either patterns or glaring irregularities, and finally that interpretive leap of faith, in which an attempt is made to explain observed results most often in cultural terms." Using the quantification techniques described above, it has been possible to enumerate the species utilized by the aboriginal inhabitants of the four piedmont sites, and determine the relative contribution each of these taxa made in terms of assemblage composition. Study of the differences in diversity exhibited by the four assemblages has yielded further information concerning the use of faunal resources by piedmont Indians. This information has made it possible to arrive at some conclusions about the effect of European contact on traditional subsistence systems. It is clear that the basic subsistence pattern did not differ dramatically from protohistoric to historic times. Although the inhabitants of the Dan River sites used a wider variety of animals than did those of the Eno River sites, the basic subsistence pattern at all four sites was the same. It is also evident that the desire to participate in the deerskin and fur trade did have an effect on the ways in which piedmont Indians

hunted, and the possession of firearms by the Occaneechi Indians made their hunting practices stand out from those of the inhabitants of Upper Saratown. Examination of element distributions and bone modification may now shed additional light on the cultural practices that produced these assemblages.

One can assume that any collection of archaeological bone will represent only a portion of the faunal remains originally associated with a site. Excavation techniques affect the number and kinds of bones eventually analyzed. The portion of the site excavated, sieving techniques utilized, and steps taken to protect the bone after excavation all affect the assemblage.

Numerous other factors, both pre- and postdepositional, influence how accurately the faunal assemblage analyzed reflects the fauna used at a site. Not all bones, for example, stand an equal chance of being represented in an archaeological assemblage. The survival of bone after it has been discarded is affected by two primary factors: its physical condition at the time of disposal, and the nature of the environment in which it was placed. The basic structure and density of the bone also plays an important part in determining how well it is preserved (Lyman 1984). Teeth and phalanges, for example, are inherently stronger than bones such as ribs and vertebrae, and are thus less likely to be destroyed. Cultural practices such as burning, boiling, and roasting bones effect their chemical and physical properties, and thus influence their preservation. The manner in which a particular bone is discarded also affects its survival. If the bone was deposited in a trash pit, for example, the rate of disintegration would depend

on factors such as the "acidity or alkalinity, degree of aeration, movement of water, bacterial population, as well as the seasonal and structural properties of the soil" (Chaplin 1971:16). If it remained on the surface of the ground, it would be more likely to be exposed to scavengers, damaged by weather, or stepped on and crushed. In addition to these factors that influence the preservation of bone once it has arrived in the aboriginal village, other factors such as field dressing and butchering practices determine whether a particular bone ever arrives in the village at all.

Although numerous physical and cultural factors interact to produce the faunal assemblage that is eventually available for study, it is sometimes possible to analyze characteristics of an assemblage in order to ascertain which cultural practices were in effect originally. In other words, it is often possible to recover evidence of patterned cultural behavior by studying such things as the context from which the bone was recovered, the condition of the bone (burned or unburned, rodent or dog gnawed or ungnawed), the presence and location, or absence of butchering marks, and element distribution. Ethnoarchaeological work by Binford (1978) and Yellen (1977) indicates that such things as cultural affiliation, degree of subsistence security, and site function are all reflected in the cultural practices that are elucidated through the detailed analysis of a faunal assemblage. Other writers, such as O'Connell and Hawkes (1988) and Bunn et al. (1988), express reservations about such assumptions.

## ELEMENT DISTRIBUTION: PREVIOUS RESEARCH

The importance and meaning of element distribution data is an issue which has received considerable attention over the last few decades. The differential representation of skeletal elements in different archaeological assemblages has been used most frequently in arguments concerning the transportation of carcasses, or portions of carcasses, from the kill site to the village site. Other authors have interpreted this differential representation as evidence of bone tool manufacture or as evidence of consumption of bone by domesticated dogs or carrion eaters (Dart 1957; Brain 1969). As early as 1953, White attempted to explain the relative proportions of the skeletal elements of a bison in terms of differential transport (White 1953b). In 1957, Raymond Dart interpreted variability in relative frequencies of anatomical parts at Makapansgat as resulting from australopithecine tool-using behavior.

Perkins and Daly introduced the concept of the "schlepp effect" in 1968 to explain one aspect of differential transportation. The term "schlepp" makes reference to the dragging of an animal carcass home from the kill site. If the carcass is large and/or must be dragged a long way, more of the heavy bones will be left behind than if the animal were small and easily transported as a single package. Thus, at the village site, the bones of the larger animal will be less well represented than the bones of the smaller animal (Wing and Brown 1979:150). In a series of articles written in the early 1950s, White (1952, 1953a, 1954)



also noted this inverse relationship between the size of a carcass and skeletal element representation. He also suggested that limb elements were more likely to be transported from the kill site to the village site than were elements of the axial skeleton because the limb bones carried a greater proportion of edible meat to bone weight than did axial elements.

These two propositions have become deeply entrenched in the archaeological literature and accepted by many in spite of information to the contrary. It has generally been assumed that, in the past, humans would have brought home the the elements that provided the highest nutritional yield while presenting the fewest problems in terms of processing and transport. Thus it has seemed logical to assume that the skeletal elements of small animals will be more completely represented at village sites than will the elements of larger animals, and that limb bones will be more frequently transported than will axial elements. Much work concerning transport of carcasses and butchering practices provides data in accordance with these principles in a very general sense (Binford 1978; Yellen 1977; O'Connell and Hawkes 1988; Bunn et al. 1988). However, all of these studies indicate that there is considerably more variance in the processing of carcasses than is often believed to exist.

Yellen (1977:277) notes the propensity of certain authors for attributing differential representation of skeletal elements to single causes. His ethnoarchaeological work with the !Kung (Yellen 1977), Binford's (1978) work with the Nunamiut, and the studies completed with material from the Hadza (O'Connell and Hawkes 1988;

Bunn et al. 1988) serve as vivid examples to destroy this myth. These authors all agree that numerous decisions are made and numerous actions are undertaken between the time an animal is killed and the time its remains are deposited in an archaeological context. Some of these decisions are predetermined by the basic anatomical structure of a carcass. Small animals may be transported in their entirety to a village site. Larger animals must be butchered into smaller portions for transport. Some bones, such as the long bones, may routinely be smashed in order to retrieve marrow while other bones, such as the scapula, cannot be broken for marrow. Binford (1978: 59-60) lists a number of factors that come into play when the Nunamiut make decisions regarding the way in which an animal will be butchered. These include: (1) whether the animal is to be transported immediately, (2) the means of transport available, (3) the status of the previously stored meat supplies, (4) the time available in which to butcher the animal, and (5) the intended use of the animal. Bunn et al. (1988:438) add to this list factors such as carcass size, distance from the kill site to the residential site, weather conditions and what they refer to as "other plans" (the decision of whether to share choice parts of the carcass, for example). Decisions such as these determine which (if any) anatomical parts of an animal will be transported from the kill site to the village site. The general results of all of these studies indicate that "body part transport patterns are highly variable but probably understandable in terms of the goal of maximizing net nutritional benefit relative to the costs of field processing and transport"

(O'Connell and Hawkes 1988:113).

Most faunal analysts recognize the problem of oversimplifying the considerations that influence the decisions and actions of people processing animal carcasses. Gifford-Gonzalez (1993:181) notes a bias in ethnoarchaeological research on bones, stating that this research "has given considerable attention to field processing and transport decisions and little attention to subsequent subdivision, processing, and discard." She also notes that "experimental research has concentrated on primary butchery activities and uncooked bones, seldom addressing culinary processing" (Gifford-Gonzalez 1993:181). Oliver (1993:200) has also studied carcass processing behavior by observing "butchery-, cooking-preparation-, and consumption-related bone breakage" and concludes that "carcass-processing by the Hazda is organized around considerations of (1) animal size and (2) later processing options, for example, nutrient extraction through bone smashing and bone boiling."

Studies such as these clearly indicate that explanations for patterning in faunal assemblages that rely primarily on carcass-size and transport decisions ignore a vast array of decisions and actions that occur after an animal is killed. Once at the village, a number of other factors come into play which will in turn determine the likelihood of these bones becoming a part of the archaeological assemblage. These factors include decisions about the way in which the bones themselves will be treated. For example, some bones will be cracked to obtain marrow and others may be broken in order to fit into a pot of a particular size and then

cooked in a stew. Others may be roasted with their meat in a fire. Some bones may be gnawed on or entirely consumed by humans and others fed to the dogs. Some bones may be curated for later processing. It is clear from this list that the differential representation of skeletal elements cannot be attributed to a single cause but must instead be seen as the end result of a long chain of decisions and a series of actions based upon those decisions.

Both Yellen (1977) and Binford (1978) agree that the relative proportions of skeletal elements in a faunal assemblage cannot be attributed to a single cause. However, their views are diametrically opposed on the issue of the presence or absence of cultural "blueprints" which determine the way in which animal carcasses are processed and consumed. Yellen (1977:327) states that the "!!Kung, and I very strongly suspect *all*, groups leave a cultural imprint on the faunal materials which are the final and incidental by-products of meat consumption." To take this opinion even further, he states "just as stone-tool forms and ceramic forms, both of which reflect cultural rules and patterns, are used to define and compare archaeologically known cultures, comparison in the patterning of faunal remains may be used in the same way" (Yellen 1977:329). Binford (1978:132) strongly opposes this view, stating that "there is not the slightest support for the proposition that variability in relative frequencies of similar things at different places is necessarily referable to variability in culture."

Binford (1978) proposes that variability in the archaeological

record reflects different manners of response to changing cultural and natural environmental conditions. As all cultures survive in situations of changing environmental conditions, they will all exhibit some flexibility in terms of procurement, processing, and consumption strategies. The degree of flexibility, he believes, will largely be determined by the degree of stability in the environment. In other words, "if the environment is stable ... we may expect greater redundancy and a greater role for unreasoned acceptance of traditional strategies for living" (Binford 1978:455).

The work done with the Hadza at first appears to support Binford's view on the issue of "cultural blueprints" determining the way in which an animal is processed and transported. Bunn et al. (1988:451) state that "there is no single Hadza way to butcher and transport a carcass; rather, depending on various factors, most of which are archaeologically invisible, the Hadza may transport essentially all carcass and skeletal units to base camps, or they may transport prodigious quantities of meat with few attached skeletal units." O'Connell and Hawkes (1988) also report considerable variability in the butchering and body part transport among the Hadza they studied. Although a "cultural blueprint" for butchering and transporting meat may exist, the complexity of decisions involved has, at least for now, prevented researchers from defining it. It has become increasingly clear over the years that one cannot predict precisely what an archaeological faunal assemblage should look like by simply knowing the cultural affiliation of the group producing it. Nor can one attribute the

final characteristics of an assemblage to a single cause. Instead, it is important to remember the complexity of human decisions and actions, combined with a wide variety of noncultural conditions that determine the characteristics of the assemblage brought to study.

#### ELEMENT DISTRIBUTION: RESULTS

Here an attempt is made to detect patterning in the ways in which deer carcasses were processed and discarded at the four piedmont sites included in this study. For a variety of reasons, deer is an especially appropriate taxon for this kind of inquiry. Deer was more abundantly represented in the assemblages from these sites than any other taxa. Also, because of the participation of the historic inhabitants of the Fredricks and Upper Saratown sites in the deerskin trade, it seems that the bones of white-tailed deer are more likely than those of any other animal to exhibit changes in treatment from Protohistoric to Historic times. For example, Bartram reported that, during the Historic period, some Southeastern Indians participating in the deerskin trade skinned deer in the field and left entire carcasses to rot (Swanton 1946:318). If such practices occurred in the Piedmont, inhabitants of the Fredricks and the Upper Saratown sites may have had access to an overabundance of deer, which in turn may have led them to transport and consume only the meatier and more desirable elements of the carcasses.

In an attempt to detect any such differential treatment of

deer carcasses, a technique was borrowed from a study designed to detect status from cattle bones recovered from historic sites in Charleston, South Carolina (Reitz and Zierden 1991). In the Charleston study, a table was constructed to record the distribution of cow bone fragments among the various portions of a carcass: head, axial skeleton, forequarter, hindquarter, etc. The proportion of elements that fell into each such category was then compared to the elements present in both an unmodified skeleton and one which reflected the number of elements that could realistically be expected to be identified from archaeological remains. Comparing the archaeological ratios to those which could be expected to be identified "realistically" mitigates the problem of differential preservation of elements.

In the present study, a similar exercise was conducted with the deer bones from Wall, Fredricks, Early Upper Saratown, and Upper Saratown. The percentage of bone fragments falling into each category was calculated for the deer bones in each assemblage (Table 7.1). Elements belonging to the category of "head" included cranial fragments, mandibular fragments, and teeth. The "axial" category included ribs, vertebrae, and sternum fragments. The "forequarters" consisted of fragments of the scapula, humerus, radius, and ulna; and the "hindquarters" consisted of the innominate, sacrum, femur, tibia, and patella. The "foot" category consisted of both metacarpals and metapodials in addition to phalanges, carpals, and tarsals. This division of the deer skeleton effectively separates the meatier portions of the carcass (fore- and hindquarters) from those which are less meaty (the

Table 7.1. Skeletal Distribution of Deer Elements

Site	Head		Axial		Forequarter		Hindquarter		Foot	
	NISP	%	NISP	%	NISP	%	NISP	%	NISP	%
Wall	2673	57.4	587	12.6	379	8.1	379	8.1	636	13.7
Fredricks	1363	24.7	884	16.0	876	15.9	809	14.7	1581	28.7
Early Upper Saratown	743	27.4	308	11.4	444	16.4	415	15.3	800	29.5
Upper Saratown	442	31.5	139	9.9	207	14.7	209	14.9	408	29.0
Standard Deer	63	23.9	73	27.7	8	3.0	16	6.1	104	39.4
Realistic Deer	51	32.1	28	17.6	8	5.0	13	8.2	59	37.1



skull, lower legs, and feet).

The "realistic" deer was derived from a calculation of the number of elements of an unmodified deer skeleton that can realistically be expected to be preserved and identified. For example, of the 63 cranial elements that are found with an unmodified deer skeleton, only 51 can be expected to be identified in an archaeological assemblage. Bones such as the nasal, lacrimal, presphenoid, and basisphenoid are not likely to be preserved. In a similar fashion, it was predicted that not all caudal vertebrae and ribs would be identifiable to the species level and this number was reduced also.

Table 7.1 lists the skeletal distribution of the deer elements from the four piedmont sites along with the distribution of elements from the "realistic deer." The %NISP for both the "realistic" deer skeleton and the deer elements from the faunal assemblages are first converted into common logarithms. The logs of the %NISP from the archaeological assemblages are then subtracted from the logs of the %NISP from the "realistic" deer. The results are plotted in Figures 7.1 and 7.2. In these figures, the archaeological data are superimposed over the "realistic" deer skeleton represented by the center, horizontal axis.

Figure 7.1 illustrates the similarity found among the four assemblages and indicates that the meatier fore- and hindquarters were overrepresented (compared to what one could "realistically" expect to identify) while the elements of the head, axial skeleton and feet were underrepresented. The only exception to this pattern is found in the overabundance of "head" elements identified in the

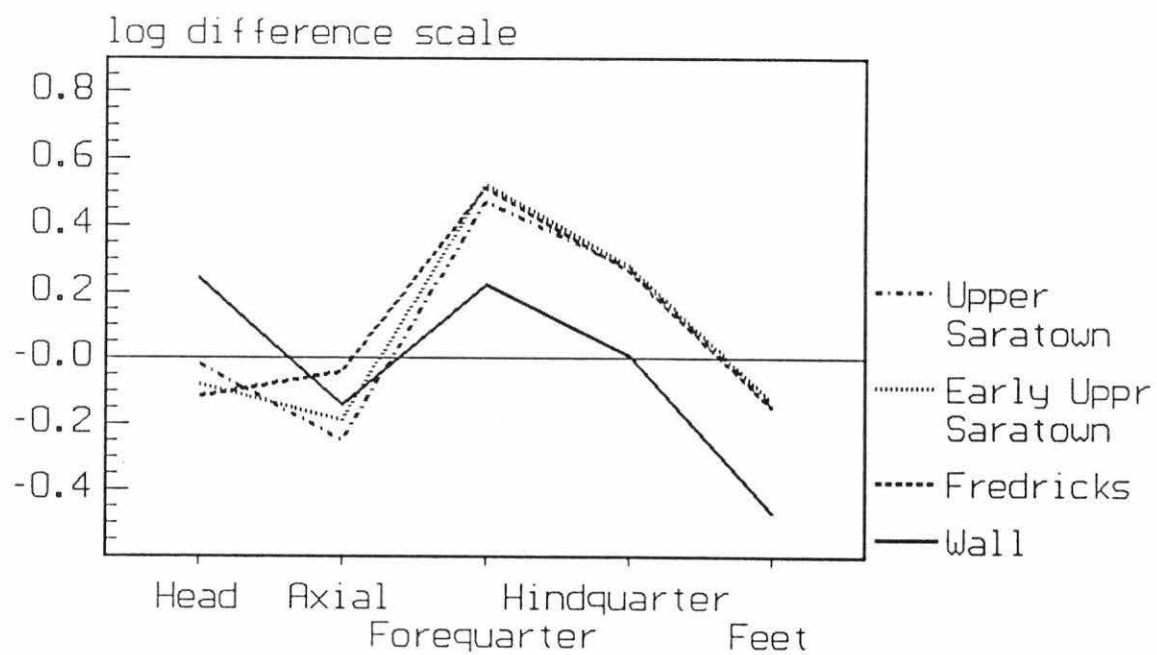


Figure 7.1. Skeletal Distribution of Deer Elements

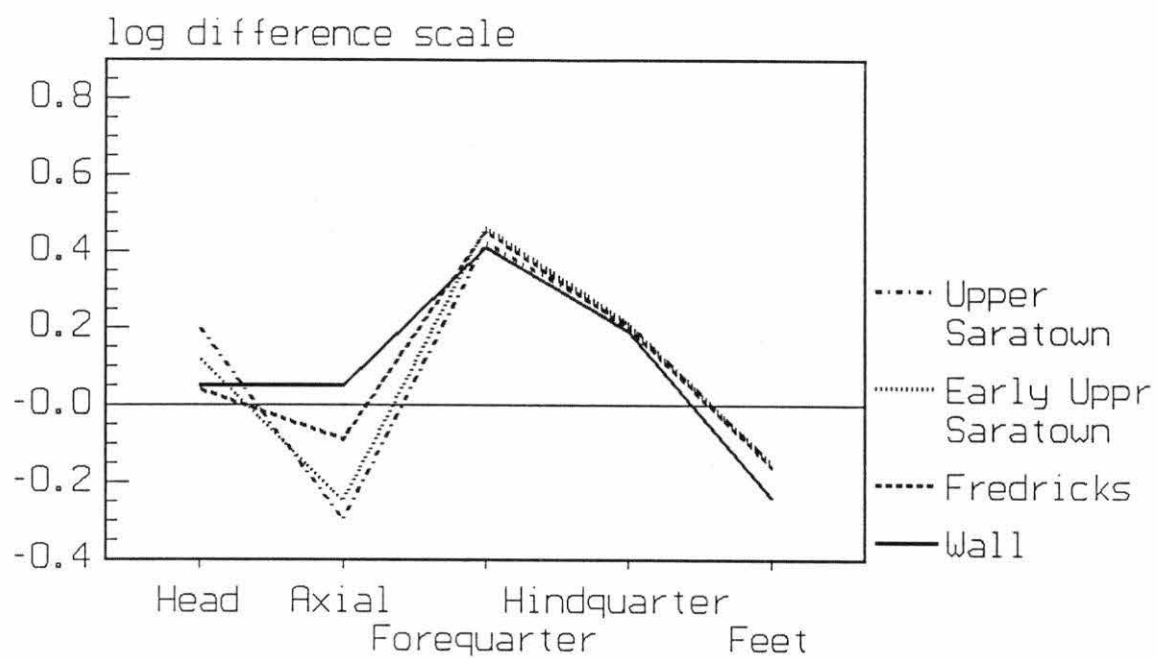


Figure 7.2. Skeletal Distribution of Deer Elements (Teeth Subtracted)

Wall site assemblage. An examination of the element list for deer indicates that 89% of the fragments classified as "head" were teeth and tooth fragments. Teeth are among the more durable elements and are more likely to survive in an archaeological context than are other bones. The bone assemblage from the Wall site was recovered from an extensive sheet midden while those from the other three sites were recovered from a number of pit features. Bones deposited on a sheet midden would have been more exposed to the effects of weathering, trampling, and scavenger behavior. The overabundance of deer teeth in the Wall site assemblage is likely to represent a large number of deer carcasses whose other elements have not been preserved in the more exposed context. The overabundance of deer teeth is thus believed to arise from a situation of differential preservation. For this reason, the ratio of deer elements in each assemblage was recalculated, omitting teeth from the "head" category. Figure 7.2 illustrates the results of this recalculation. When teeth are no longer included in the calculations, the pattern for the deer bones from the Wall site becomes very similar to that from the other three sites.

At the outset of this study, I hypothesized that in order to acquire deerskins for trade, the inhabitants of the Fredricks site and the Upper Saratown site may have been hunting more deer than they could consume. If this were the case, it is likely that they would only transport the more desirable, meaty portions of the carcass (along with the skins) back to the village rather than carry the sections that they were unlikely to utilize. Figures 7.1 and 7.2 appear to support this hypothesis. The elements of the

Table 7.2. Skeletal Distribution of Deer Elements With Teeth Subtracted

Site	Head		Axial		Forequarter		Hindquarter		Foot	
	NISP	%	NISP	%	NISP	%	NISP	%	NISP	%
Wall	405	17.0	587	24.6	379	15.9	379	15.9	636	26.7
Fredricks	821	16.5	884	17.8	876	17.6	809	16.3	1581	31.8
Early Upper Saratown	485	19.8	308	12.6	444	18.1	415	16.9	800	32.6
Upper Saratown	295	23.4	139	11.0	207	16.5	209	16.6	408	32.4
Standard Deer	31	13.4	73	31.5	8	3.4	16	6.9	104	44.8
Realistic Deer	19	15.0	28	22.0	8	6.3	13	10.2	59	46.5

fore- and hindquarters are clearly overrepresented when compared to the "realistic" deer and the foot and axial elements are underrepresented. Contrary to the hypothesis, however, head elements are overrepresented in all four assemblages. Lawson mentions that hunters often wore deer skull decoys when stalking deer and that deer brains were utilized for tanning skins and hides (Lefler 1967:29, 217). Both of these activities made deer skulls valuable in spite of their low meat to bone ratio and may account for the abundance of head elements in the assemblages. The same pattern of element representation can be observed in all four assemblages regardless of the dates during which the sites were occupied. Thus, these figures indicate that this "maximizing" strategy did not arise as a response to historic trading demands. Instead, it is a strategy that has its roots in the time before European contact. The longevity of this particular treatment of deer carcasses indicates that the residents of the Piedmont probably did not experience the shortage of deer reported for other areas (Van Doren 1928:181; Lefler 1967:65; White 1983:9, 86-87, 317) during the time that these sites were occupied. Because the Indians of the Piedmont were killed or forced to move out of the region so quickly after the arrival of the Europeans, the increased hunting for the deerskin and fur trade probably did not persist for long enough to cause widespread game depletion.

Ethnohistoric accounts indicate that Indians in the Southeast frequently left their villages in the winter in order to conduct extended hunts (Lefler 1967, Swanton 1946). Lawson states that "When these Savages go a hunting, they commonly go out in great

Numbers, and oftentimes a great many Days Journey from home, beginning at the coming of Winter... Here it is, that they get their Complement of Deer-Skins and Furs to trade with the English" (Lefler 1967:215-216). This passage indicates that activities associated with deerskin trade, in general, were carried out at hunting camps away from the village. Thus, the assemblages of bone recovered from all four sites may have represented primarily subsistence activities rather than behavior associated with trade. If this were the case, it is not surprising that there is little evidence for change when the element distributions of deer from protohistoric and historic sites are compared.

It is interesting to note that there does seem to be some kind of "Piedmont cultural blueprint" represented in the assemblages of deer bones. Noting this pattern, however, is far from identifying the specific behaviors responsible for producing it. The distribution of deer elements (Figure 7.2) shows that at each of the four sites, fore- and hind-limbs were overrepresented and foot bones were underrepresented. This pattern suggests that many of the deer were butchered in the field rather than carried back to the village. However, elements from all portions of the deer carcass were identified in all four assemblages, indicating that some deer probably did make it back to the village in their entirety.

#### BONE MODIFICATION: PREVIOUS RESEARCH

It was noted above that there tends to be a high degree of

variability in the way in which individuals process animal carcasses. Because of this variability, it would seem somewhat difficult to formulate hypotheses concerning, for example, where one would expect to find butchering marks on bones in an aboriginal collection. However, the basic anatomical structure of most of the animals hunted is very similar. Assuming the Indians were attempting to minimize both the time and the effort involved in butchering an animal, it is possible to formulate a rough outline of the procedures which they must have followed.

It is clear from ethnoarchaeological studies (Yellen 1977; Binford 1978; O'Connell and Hawkes 1988; and Bunn et al. 1988) that field butchering an animal usually entailed subdividing the carcass into a number of different anatomical units, usually corresponding to the skull, the axial skeleton (vertebrae, ribs, sacrum, and possibly the pelvis), the forelimbs, and the hindlimbs. Thus, in this study, it has been possible to note the presence or absence of entire anatomical units rather than individual bones and to determine that the distribution of deer anatomical units represented patterned behavior that continued from the Protohistoric period into the Historic.

Guilday and his colleagues (1962) have described the procedures for butchering deer utilized at several prehistoric sites in the East. In addition to the six basic anatomical units described above, they indicate that it was common practice to further subdivide the axial skeleton along the medial plane (into right and left halves). In the process of dismembering the carcass in this way, the pelvis would be split, leaving marks on the pubic



symphysis. In further subdividing the axial skeleton, the rib cage would be split into right and left halves and cut marks would possibly be left on the thoracic vertebrae. Parmalee (1965:26) notes that due to the difficulty of disarticulating the skull from the vertebral column, numerous cuts are likely to be found on the atlas, axis, and basioccipitals or occipital condyles. According to Guilday et al. (1962), the hind limbs were not dismembered at the "knee," although the forelimbs were disarticulated at the "shoulder" and the "elbow." Cut marks would thus be produced on the neck of the scapula, on the distal end of the humerus, and on the proximal ends of the radius and ulna. Parmalee (1965:26) observed that the inhabitants of Tick Creek Cave did disarticulate the hindlimbs of deer. In doing so, they apparently did not sever the femur from the acetabulum, but instead split the pelvis from the sacrum at the iliosacral joint. If this is the case, no cut marks would be observed on either the head of the femur nor around the acetabulum. Guilday and his colleagues (1962), on the other hand, did notice cut marks on the sacrum and the innominate that they attribute to the disarticulation of the hindlimb from the axial skeleton. Parmalee (1962) also observed cut marks on the distal end of the femur and on the proximal end of the tibia, indicating the separation of the lower limb from the upper. In disarticulating the lower hind limb at the hock, cut marks would possibly be left on the distal end of the tibia, on the proximal end of the metatarsal, and on the calcaneum and astragalus. Likewise, for the hindlimb, cut marks would be left on the distal radius and ulna and on the metacarpal and carpals.

The description of butchering practices derived from a combination of the observations made by Parmalee (1965) and Guilday (1962) is very similar to that described by Scott (1983) for assemblages from west-central Alabama and it is quite similar to procedures described by Yellen for the !Kung, by Binford for the Nunamiut, and by the several authors discussed previously for the Hadza. In all these cases, the majority of cuts are made at joints and muscle attachments. Thus, one can predict where butchering marks should be typically found. It is also clear that while decisions about the transport of various skeletal elements may vary tremendously and leave an ambiguous archaeological signature, butchering procedures are largely governed by the basic anatomy of the mammals being utilized and butchering marks, if they exist at all, exhibit a fair amount of redundancy in patterning.

#### BONE MODIFICATION: RESULTS

Considering the size of the assemblages examined, very few of the bone fragments exhibited any type of modification. Also, very few bone artifacts, such as awls, beamers, flakers, and fish hooks, were recovered from the four sites. Table 7.3 lists the modifications found on bones from each of the sites. Burning is the most common modification to bones from all four sites. At the Wall and Fredricks sites, cut marks are the next most frequently observed modifications. At Early Upper Saratown and Saratown, cut marks are the third most frequently observed modifications after burning and carnivore gnawing.

Table 7.3. Modified Bone

	310r11	310r231	31sk1	31sk1a
Butchering or Processing:				
cut marks	14	124	23	7
grooved and snapped	0	0	2	2
polished	4	4	15	3
longit. striations	0	0	4	0
drilled	0	1	4	0
burned	3,897	30,771	16,893	8,060
Artifact Manufacture:				
beamer	1	0	1	3
awl	4	3	8	3
antler flaker	0	1	4	0
needle	0	4	2	1
bead	1	4	0	0
fish hook	0	0	2	0
Nonhuman modification:				
rodent-gnawed	0	0	8	4
carnivore-gnawed	8	52	73	26

Because such a small sample of bones from each assemblage exhibit any cut marks at all, it is impossible to recreate the butchering patterns utilized by Piedmont Indians. However, the cut marks that are observed all appear in the area of joints and muscle attachments. The frequency of cut marks was well below 1% in all of the assemblages in this study. At the Fredricks site, however, the ratio of cut to uncut bones is more than three times higher than it is at any of the other sites. This finding lends confirmation to Waselkov's hypothesis that "butchering cuts occur more frequently at sites where metal tools were commonly used" because metal tools were more durable than stone tools and required less skill to use (Waselkov 1977:89-90). The Fredricks assemblage is the only one of the three in which metal tools are common. Guilday notes that it is possible to butcher an animal without leaving any marks on the bones at all, and that the probability that a bone will be cut in some way is greater if the person is careless, unskilled, or in a hurry (Guilday et al. 1962:64). Thus, the paucity of butchering marks on the bones from the four piedmont sites is actually not surprising.

Because such a small number of bone tools and beads was recovered, it is not possible to detect any change in the ways in which these artifacts may have been used after the arrival of Europeans in the Piedmont.

## CHAPTER VIII

### SUMMARY AND CONCLUSIONS

Two goals were defined at the outset of this study. The first was to define the pattern of faunal utilization practiced by the inhabitants of northern Piedmont sites prior to the arrival of Europeans. The second goal was to compare pre- and postcontact use of animal resources to examine the effect of European presence on the subsistence activities of the piedmont Indians. This study has provided a unique opportunity to study the effect of unprecedented social upheaval and culture change on a long-standing adaptation to conditions of the natural environment.

The four faunal assemblages analyzed in this study are derived from sites dating from approximately A.D. 1550 to A.D. 1710. During this century and a half, the indigenous populations of the North Carolina Piedmont were caught in a whirlwind of cultural change. At the time that people were occupying the protohistoric Wall and Early Upper Saratown sites, Europeans had yet to set foot in the Piedmont. During the time that Upper Saratown was occupied, European diseases and trade goods were becoming commonplace. Ethnohistoric accounts from this time document changes in virtually all aspects of aboriginal life. By the time the Occaneechi abandoned their

village on the Eno River in 1710, there were only a few isolated Indian populations remaining in the region. Analysis of the faunal remains from these four sites reveals that, in spite of this cultural upheaval, the interaction of native groups with their natural environment was not dramatically altered.

#### CONTINUITY AND CHANGE

The traditional subsistence system of most Southeastern Indian groups was one which mixed hunting and gathering with horticulture. This strategy was closely attuned to the opportunities and demands of the natural seasons and was effective in contending with prolonged or unpredictable periods of environmental change. Several attributes of this strategy made it exceptionally resilient. The seasonal variability of the Piedmont created yearly variation in the abundance and availability of both plants and animals. Prior to the arrival of Europeans, the Indians of the Piedmont coped by relying on a wide variety of both plant and animal resources. The faunal portion of their subsistence system was characterized by a heavy reliance on deer. Other staples of the diet include turkeys, box turtles, squirrels, raccoons, and mud turtles. Bear was also an important resource for some groups. In addition to a reliance on a few high yield and/or readily available species, the inhabitants of the Piedmont placed a high value on variety in the diet and supplemented their diet with fish, small mammals, and birds. A wide variety of plants was also utilized.

Corn was the staple, but nuts, small grains, and fleshy fruits were also valued. Studies have shown that the reliance on a wide variety of resources is a risk-avoidance strategy that helps to buffer the effects of periodic variations in food supply (Jochim 1976; Colson 1979; Hallstead and O'Shea 1989).

The native inhabitants of the Piedmont scheduled their hunting, gathering and planting activities to correspond to the seasonal availability of these resources (Swanton 1946:256-257). They were often seasonally mobile, moving from their villages to hunting camps in the fall and winter in order to increase the number of deer hunted (Lefler 1967). They also altered their environment by periodically burning the woods and fields in order to clear land and to facilitate hunting (Hammett 1986). Finally, piedmont groups also relied upon the storage of plant foods to provide during times of scarcity.

It is clear that native groups were not passively responding to environmental factors in their quest for subsistence security. Instead, they were engaged in a complex dynamic relationship with the natural environment. In many ways, they shaped the conditions of the environment in order to make it more productive. In a similar vein, Indian-White relations also involved the active participation of both parties. Indians were not simple, submissive victims of superior European power and goods. European plants and animals were not immediately and eagerly embraced by the Indians of the Piedmont. In fact, at least initially, explorers were forced to subsist on a diet more similar to that of the natives than of

their own cultures in order to survive in the New World. Few European subsistence items were embraced by piedmont groups--while peach and watermelon were utilized, domestic animals were not. Both plant species were "inexpensive to produce, productive, and easily incorporated into existing plant management systems (Gremillion 1989:iv). Domestic animals did not offer the same benefits. The Indians of the northern Piedmont were also discriminating in their tastes for trade goods and often dictated which goods they would accept from the Euro-American traders Merrell 1989).

Prior to the arrival of Europeans in the area, both trade and warfare were regular occurrences and intertribal struggles maintained on ongoing imbalance of power between various native groups. European- Indian trade represented an intensification of an interregional exchange network in existence long before the arrival of the first explorers. Although trade with Europeans introduced a wide array of novel goods, these goods were often incorporated into traditional functional categories and the effect of the new technology was not immediate and abrupt. Raiding, warfare, and the capture of slaves were also characteristic of native interaction prehistorically. Thus, except for the introduction of new diseases, many of the results of contact were not really innovations, but rather were intensifications of previously existing patterns. This fact, coupled with the resilience and flexibility of the subsistence strategy, allowed for the possibility of continuity rather than change in response to contact.



Given the disruption caused by the Europeans, however, it was predicted that the faunal assemblages from the historic sites would provide a reflection of a cultural system being altered beyond repair. It was predicted that the historic faunal assemblages would show an increase in the hunting of deer and fur-bearers for trade, and probably evidence that animals were being slaughtered for their hides rather than for meat. It was also expected that the possession of firearms may have led to an increase in the proportion of large (rather than small) animals hunted. Regular contact with Europeans also could have led to the use of domestic animals such as horses, pigs, and cattle. Finally, during the Late Contact period, the rapid decline in native populations was expected to have reduced the labor force and the amalgamation of small, previously unrelated groups was expected to have disrupted traditional food procurement and distribution activities.

Comparisons of the four assemblages examined in this study indicate a great deal of continuity in the use of faunal resources from protohistoric to historic times. The assemblages were not identical, however. One trend that is apparent in both the Dan and the Eno River assemblages is the decrease in the relative contribution of deer from protohistoric to historic times. Analysis indicates that this apparent decrease in deer is actually the result of an increase in the contribution of other taxa. At the Fredricks site, there is a dramatic increase in the representation of bear and turkey when this assemblage is compared to that from the Wall site. In the Dan River

assemblages, this historic increase is in fur-bearing animals other than bear and deer. In both cases, this decrease in the relative contribution of deer to the faunal assemblage may be attributed to participation in the deerskin and fur trade. The increase in small, fur-bearing animals observed at Upper Saratown may indicate that the inhabitants of this site participated in trade activities but, because of their relatively remote location, did not have ready access to guns. The presence of a large number of trade goods, coupled with the nearly complete absence of European armaments at this site supports this interpretation.

The Occaneechi are known to have maintained direct connections with the traders coming down the Virginia trading path and are also known to have controlled the types and quantities of goods reaching more remote tribes. A large number of arms-related artifacts and a high percentage of utilitarian trade goods were recovered from the Fredricks site. The dramatic increase in the representation of bear and turkey in the Fredricks assemblage may be the result of the ready access which the Occaneechi had to guns and ammunition.

The Occaneechi appear to have been the only group in the Piedmont to hold the position of middleman in the trade with Europeans. It is possible that because of their role as middlemen in the trade, this group did not actually hunt deer for the trade but, instead, only bartered the skins and goods brought to them by other participants in the trade. If this were the case, the faunal assemblage produced by the Occaneechi

may be representative of routine subsistence activities only. In their desire to acquire skins for trade, other Indian groups in the Southeast are reported to have been butchering deer carcasses in the field and transporting only the skins and the meatier portions of the body (Swanton 1946:318). Analysis of the faunal assemblage from the Wall and Fredricks sites, coupled with the analysis of the remains from sites along the Dan River, has made it possible to examine whether the role played by the Occaneechi made their interaction with the environment different from their less powerful contemporaries who were further removed from the Trading Path. An examination of the representation of the body elements of the deer from the four sites yielded surprising results. When the body part representation for deer was compared, the patterns found at all four sites were remarkably similar to one another. In each of the assemblages, the meatier parts of the carcass, such as the fore- and hindquarters, were overrepresented compared to the nonmeaty parts. This was true not only at the Contact period sites but at the precontact sites also. Thus, this "maximizing" strategy did not arise as a response to the demands of the deerskin trade and there is also no evidence that the Occaneechi differed from their contemporaries in the way in which they handled deer.

These findings are not necessarily contrary to the ethnohistoric accounts of hunting primarily to acquire skins and hides. The presence of a number of the less meaty portions of the deer carcass at each site is likely an indication that some animals were killed near enough to the village to make

transportation of the entire carcass feasible. The overabundance of meaty elements represented in these assemblages may simply indicate that deer were more often killed at some distance from the village, or by parties of only a few hunters, making transport of the entire carcass inefficient. The similarity in body part representation for deer at the four sites is not evidence that the inhabitants of the sites did not hunt to procure skins for the trade. If deer were being hunted primarily for their skins, it is likely that only the skins would be transported back to the village. There would be no evidence for the presence of these skins in the archaeological record.

Some of the differences found among the four assemblages seem to correlate more with the physical location of the sites rather than with their position in time. The assemblages recovered from sites along the Dan River appear to be more diverse than those from sites along the Eno River. When the species lists from the sites were compared it became apparent that the inhabitants of the Dan River sites were utilizing aquatic taxa to a greater extent than those of the Eno River sites. The Dan River is considerably larger than the Eno River and may have simply provided a wider variety and larger number of fish to be exploited.

In addition to the physical attributes of the two rivers, the greater diversity of fauna utilized by the inhabitants of the Dan River sites may also be explained in terms of population size and subsistence strategy. From late prehistoric to

historic times, the Dan River drainage was much more heavily populated than the Eno River drainage. It has been hypothesized that the more extensive floodplains of the larger river made it possible for greater numbers of people to settle in this region than along the smaller river. Because of the greater number of people residing along the Dan River at any one time, it may have been necessary for them to diversify their resource base and rely more heavily on aquatic resources in order to feed everyone. Archaeological evidence from the Upper Saratown site, though, indicates that the population of this village was experiencing a very high mortality rate and thus population size was declining. This decline in population and corresponding decrease in pressure on the region's natural resources may have occurred in so short a period of time as to not elicit any archaeologically observable adaptive responses in the subsistence strategy. However, differences in the abundance of fish available seems to be a more plausible explanation for the differences in the Dan and Eno assemblages than does dietary stress.

## CONCLUSIONS

For years, studies of culture contact in the New World concentrated on the obvious destruction and annihilation of native societies. Description and documentation of events was a primary goal. As our understanding of the details of contact increased, it became apparent that contact was a process rather

than an event and that it involved the interaction of different societies. Emphasis shifted to the concept of acculturation. "As commonly used, *acculturation* describes a process in which one group becomes more like another by borrowing discrete cultural traits. Acculturation proceeds under conditions in which a dominant group is largely able to dictate correct behavior to a subordinate group" (White 1991:x). In studies of contact in North America, the dominance of European culture and the subordination of native groups was, for the most part, taken for granted. Eventually, the view of native Americans as passive victims crushed by the power of European superiority gave way. Recent studies of the Contact period are inclined to view the native inhabitants of North America as active participants capable of adapting, to some degree, to their changing circumstances. Contact studies now stress the study of change, including changes in "economic and social organization, religious beliefs, settlement patterns, subsistence, land use, and other systems" (Fitzhugh 1985:5). This concentration on change and process has led to a heightened awareness of the diversity of interactions and responses encompassed within the general category of "culture contact."

Studies in the northern Piedmont of North Carolina make it clear that an examination of continuity is just as important to the understanding of the Contact period as is the examination of change. Analysis of the subsistence strategies of protohistoric and historic Piedmont groups sheds light on both the relationship of native groups to their environment and on yet

another variant of the potential responses to contact. Numerous characteristics of the contact situation in the Piedmont may be responsible for the continuity observed in native systems. The aboriginal subsistence strategy was both flexible and resilient and had survived the vicissitudes of hundreds of years prior to the arrival of Europeans. When contact was made in the Piedmont, it was limited to the activities of traders who had considerably less impact on the environment than did the settlers who arrived after the native groups departed. Also, many of the consequences of contact, such as increased warfare and trade, were similar to existing aboriginal activities. Finally, Piedmont groups maintained an active role in their encounters with both the physical and cultural components of their environment both before and after contact. It is possible, however, that the devastation wrought by contact moved with such a swift and relentless pace through the northern Piedmont that the native populations were given no time to adjust their long-standing practices to their new cultural environment. In any case, it appears that the resilient subsistence system of the northern Piedmont Indians existed until only remnant populations survived in the "Flower of the Carolinas."

# REFERENCES CITED

- Adams, Percy G.
  - 1980 Travelers and Travel Liars 1660-1800. Dover, New York.
- Alvord, Clarence W. and Lee Bidgood, editors
  - 1912 The First Explorations of the Trans-Allegheny Region by the Virginians, 1650-1674. Arthur H. Clark Co., Cleveland.
- Axtell, James
  - 1981 The European and the Indian. Oxford University Press, New York.
- Barber, Michael B. and Joseph A. Williams
  - 1978 Faunal Analysis. In 44Cpl, the Onion Field Site, Dan River Focus. Unpublished B.A. thesis by J.A. Williams, Department of Anthropology, College of William and Mary, Williamsburg.
- Barrett, John
  - 1993 Bone Weight, Meat Yield Estimates and Cod (Gadus morhua): a Preliminary Study of the Weight Method. International Journal of Osteoarchaeology 3: 1-18.
- Bassett, John Spencer
  - 1970 The Writings of Colonel William Byrd of Westover in Virginia. Esq. B. Franklin, New York.
- Beverly, Robert
  - 1947 The History and Present State of Virginia, edited with an introduction by Louis B. B. Wright. University of North Carolina Press, Chapel Hill.
- Binford, Lewis
  - 1959 Comments on the Siouan Problem. Ethnohistory 6:28-41.
  - 1978 Nunamiut Ethnoarchaeology. Academic Press, New York.
- Bishop, Charles
  - 1981 Northeastern Indian Concepts of Conservation and the Fur Trade: A Critique of Calvin Martin's Thesis. In Indians, Animals, and the Fur Trade, edited by Shepard Krech III, pp.39-58. University of Georgia Press, Athens.



- Blakely, Robert L. and Bettina Detweiler-Blakely  
1989 The Impact of European Diseases in the Sixteenth-Century Southeast: A Case Study. Midcontinental Journal of Archaeology 14:62-89.
- Bland, Edward  
1966 The Discovery of New Brittain (Orig. London 1651). Readex Microprint.
- Bobrowsky, Peter and Bruce Ball  
1989 The Theory and Mechanics of Ecological Diversity in Archaeology. In Quantifying Diversity in Archaeology, edited by Robert Leonard and George Jones, pp. 4-12. Cambridge University Press, Cambridge.
- Boyd, William K.  
1967 William Byrd's Histories of the Dividing Line Betwixt Virginia and North Carolina. Dover, New York.
- Bradley, James W.  
1987 Evolution of the Onondaga Iroquois: Accommodating Change, 1500-1655. Syracuse University Press, Syracuse, New York.
- Brain, C.K.  
1969 The Contribution of Namib Desert Hottentots to an Understanding of Australopithecine Bone Accumulations. Scientific Papers of the Namib Desert Research Station 39:13-22.
- Bull, John and John Farrand, Jr.  
1977 The Audubon Society Field Guide to North American Birds - Eastern Region. Alfred A. Knopf, New York.
- Bunn, Henry T., Laurence E. Bartram, and Ellen M. Kroll  
1988 Variability in Bone Assemblage Formation from Hadza Hunting, Scavenging, and Carcass Processing. Journal of Anthropological Archaeology 7:412-457.
- Calloway, Colin G.  
1991 Dawnland Encounters: Indians and Europeans in Northern New England. University Press of New England, Hanover, New Hampshire.
- Carson, James D.  
1961 Epiphyseal Cartilage as an Age Indicator in Fox and Gray Squirrels. Journal of Wildlife Management 25:90-93.
- Casteel, Richard W.  
1974 A Method for estimation of live weight of fish from the size of skeletal elements. American Antiquity 39(1):94-98.

- 1977 Characterization of Faunal Assemblages and the Minimum Number of Individuals Determined from Paired Elements: Continuing Problems in Archaeology. Journal of Archaeological Science 4:125-134.
- 1978 Faunal Assemblages and the "Weigemethode" or Weight Method. Journal of Field Archaeology 5:71-77.
- Chaplin, Raymond E.  
 1971 The Study of Animal Bones from Archaeological Sites. William Claus and Sons, London.
- Clay, James W., Douglas M. Orr Jr., and Alfred W. Stewart  
 1975 North Carolina Atlas. University of North Carolina Press, Chapel Hill.
- Cleland, Charles  
 1976 The Focal- Diffuse Model: An Evolutionary Perspective on the Prehistoric Cultural Adaptations of the Eastern United States. Midcontinental Journal of Archaeology 1(1):59-76.
- Coleman, Gary, Douglas Ubelaker, Michael Trinkley, and Wayne Clark  
 1982 The Reedy Creek Site, 44Ha22 South Boston, Virginia. Archaeology Society of Virginia, Quarterly Bulletin 37(2):150-188.
- Colson, Elizabeth  
 1979 In Good Years and in Bad: Food Strategies of Self-Reliant Societies. Journal of Anthropological Research 35:18-29.
- Crane, Verner W.  
 1981 The Southern Frontier: 1670-1732. W.W. Norton, New York. Craven, Wesley Frank  
 1970 The Southern Colonies in the Seventeenth Century, 1607-1689. Louisiana State University Press, Baton Rouge.
- Cronon, William  
 1983 Changes in the Land: Indians, Colonists, and the Ecology of New England. Hill and Wang, New York.
- Crosby, Alfred  
 1972 The Columbian Exchange. Greenwood Press, Westport, Connecticut.  
 1986 Ecological Imperialism: The Biological Expansion of Europe, 900-1900. Cambridge University Press, New York.

- Cruz-Urbe, Kathryn  
1988 The Use and Meaning of Species Diversity and Richness in Archaeological Faunas. Journal of Archaeological Science 15: 179-196.
- Cumming, William P.  
1958 The Discoveries of John Lederer. University of Virginia Press, Charlottesville.
- Daly, Patricia  
1969 Approaches to Faunal Analysis in Archaeology. American Antiquity 34(2):146-158.
- Dart, Raymond  
1957 The Osteodontokeratic Culture of *Australopithecus prometheus*. Transvaal Museum Memoir No. 10.
- Davis, R.P. Stephen, Jr. and H. Trawick Ward  
1989 The Evolution of Siouan Communities in Piedmont North Carolina. Paper presented at the 46th Annual Meeting of the Southeastern Archaeology Conference, Tampa, Florida.  
  
1991 The Occaneechi and Their Role as Middlemen in the Seventeenth-Century Virginia-North Carolina Trade Network. Paper presented at the Annual Meeting of the Society for Historical Archaeology. Richmond, Virginia.
- Dickens, Roy S. Jr., H. Trawick Ward, and R.P. Stephen Davis Jr.  
1987 Introduction. In The Siouan Project: Seasons I and II, edited by R.S. Dickens, Jr., H.T. Ward, and R.P.S. Davis, Jr., pp. 1-18. Research Laboratories of Anthropology, Monograph Series No. 1, University of North Carolina, Chapel Hill.
- Dobyns, Henry F.  
1983 Their Numbers Become Thinned: Native Population Dynamics in Eastern North America. The University of Tennessee Press, Knoxville.
- Dunnell, Robert C.  
1989 Diversity in Archaeology: a Group of Methods in Search of Application? In Quantifying Diversity in Archaeology, edited by Robert Leonard and George Jones, pp.142-149. Cambridge University Press, Cambridge.
- Eastman, Jane  
1992 Seventeenth-Century Lithic Technologies on the North Carolina Piedmont. In Indian Communities on the North Carolina Piedmont, A.D. 1000 to 1700, edited by H. Trawick Ward and R.P. Stephen Davis, Jr. Research

Laboratories of Anthropology, University of North  
Carolina, Monograph No. 2, Chapel Hill.

- Edwards, J.K., R.L. Marchinton, and G.F. Smith  
1982 Pelvic Girdle Criteria for Sex Determination of  
White-tailed Deer. Journal of Wildlife Management  
46:544-547.
- Egloff, Keith, Michael Barber, and Celia Reed  
1980 Leggett Site: a Dan River Agricultural/Riverine Hamlet.  
Ms. on file, Virginia Research Center for Archaeology,  
Williamsburg.
- Feduccia, Alan, ed.  
1985 Catesby's Birds of Colonial America. University of  
North Carolina Press, Chapel Hill.
- Fitzhugh, William, editor  
1985 Cultures in Contact. Smithsonian Institute Press,  
Washington.
- Fowler, H.W.  
1945 A Study of the Fishes of the Southern Piedmont and  
Coastal Plain. Philadelphia Academy of Natural  
Science, Monograph 7.
- Franklin, W. Neil  
1932 Virginia and the Cherokee Indian Trade, 1673-1754.  
The East Tennessee Historical Society's Publications  
4:3-21.
- Gifford-Gonzalez, Diane  
1993 Gaps in the Zooarchaeological Analysis of Butchery:  
Is Gender an Issue? In From Bones to Behavior:  
Ethnoarchaeological and Experimental Contributions  
to the Interpretation of Faunal Remains, edited by Jean  
Hudson, pp.181-199. Center for Archaeological  
Investigations, Occasional Paper No. 21. Southern  
Illinois University, Carbondale, Illinois.
- Grau, G.A., G.C. Sanderson, and J.P. Rogers  
1970 Age Determination of Raccoons. Journal of Wildlife  
Management 34:364-372.
- Grayson, D.K.  
1973 On the Methodology of Faunal Analysis. American  
Antiquity 38:432-439.
- 1984 Quantitative Zooarchaeology: Topics in the Analysis of  
Archaeological Faunas. Academic Press, Orlando.
- Gremillion, Kristen  
1984 Aboriginal Use of Plant Foods and European Contact

- in the North Carolina Piedmont. M.A. thesis, Department of Anthropology, University of North Carolina, Chapel Hill.
- 1989 Late Prehistoric and Historic Period Paleoethnobotany of the North Carolina Piedmont. Ph.D. dissertation, Department of Anthropology, University of North Carolina, Chapel Hill.
- Guilday, J.E., P.W. Parmalee, and D.P. Tanner  
 1962 Aboriginal Butchering Techniques at the Eschelman Site (36LA12), Lancaster County Pennsylvania. Pennsylvania Archaeologist 32(2):59-83.
- Hale, J.B.  
 1949 Aging Cottontail Rabbits by Bone Growth. Journal of Wildlife Management 13:216-225.
- Hallowell, A. Irving  
 1926 Bear Ceremonialism in the Northern Hemisphere. American Anthropologist 28:1-175.
- Halstead, Paul and John O'Shea  
 1989 Introduction: Cultural Responses to Risk and Uncertainty. In Bad Year Economics: Cultural Responses to Risk and Uncertainty, edited by Paul Halstead and John O'Shea, pp.1-7. Cambridge University Press, Cambridge.
- Hammett, Julia E.  
 1986 Ethnohistory of Aboriginal Landscapes and Land Use in the Southeastern United States. M.A. thesis, Department of Anthropology, University of North Carolina, Chapel Hill.
- Hardesty, Donald  
 1975 The Niche Concept: Suggestions for its Use in Human Ecology. Human Ecology 3(2):71-85.  
 1977 Ecological Anthropology. John Wiley and Sons, New York.
- Harrison, Fairfax  
 1922 Western Explorations in Virginia Between Lederer and Spotswood. The Virginia Magazine of History and Biography 30(4):323-340.
- Hazel, Forest  
 1992 Occaneechi-Saponi Descendants in the North Carolina Piedmont: The Texas Community. Southern Indian Studies 40:3-29.
- Hogue, S. Homes  
 1988 A Bioarcheological Study of Mortuary Practice and Change Among the Piedmont Siouan Indians. Ph.D.

dissertation, Department of Anthropology,  
University of North Carolina, Chapel Hill.

Holm, Mary Ann

- 1985 Faunal Remains From Two North Central  
Piedmont Sites. M.A. thesis, Department of  
Anthropology, University of North Carolina, Chapel Hill.
- 1993 Faunal Remains. In Indian Communities on the North  
Carolina Piedmont A.D. 1000 to 1700, by H. Trawick  
Ward and R.P. Stephen Davis, Jr. Monograph  
No. 2. Research Laboratories of Anthropology,  
University of North Carolina, Chapel Hill.

Hudson, Charles

- 1976 The Southeastern Indians. University of Tennessee  
Press, Knoxville.
- 1981 Why the Southeastern Indians Slaughtered Deer. In  
Indians, Animals and the Fur Trade: A Critique of  
Keepers of the Game, edited by Shepard Krech III,  
pp.155-176. University of Georgia Press, Athens.

Jackson, Edwin H.

- 1989 The Trouble with Transformations: Effects of Sample  
Size and Sample Composition on Meat Weight Estimates  
Based on Skeletal Mass Allometry. Journal of  
Archaeological Science 16: 601-610.

Jochim, Michael A.

- 1976 Hunter-Gatherer Subsistence and Settlement: a  
Predictive Model. Academic Press, New York.

Keene, A. S.

- 1979 Economic Optimization Models and the Study of  
Hunter- Gatherer Subsistence Settlement Systems. In  
Transformations: Mathematical Approaches to Culture  
Change, edited by C. Renfrew and K. Cooke, pp.369-404  
Academic Press, New York.

Kintigh, Keith W.

- 1984 Measuring Archaeological Diversity by Comparison with  
Simulated Assemblages. American Antiquity 49(1):44-54.
- 1989 Sample Size, Significance, and Measures of Diversity. In  
Quantifying Diversity in Archaeological Assemblages,  
edited by Robert Leonard and George Jones, pp.25-36.  
Cambridge University Press, Cambridge.

Klein, Richard G. and Kathryn Cruz-Urbe

- 1984 The Analysis of Animal Bones from Archaeological  
Sites. University of Chicago Press, Chicago.

- Lamb, H.H.  
1963 On the Nature of Certain Climatic Epochs which Differed from the Modern (1900-1939) Normal. In Changes in Climate: Proceedings of the Rome Symposium, pp.125-150. UNESCO, Paris.
- 1977 Climate: Present, Past and Future, vol. 2. Methuen, London.
- Lederer, John  
1672 The Discoveries of John Lederer. Samuel Heyrick, London.
- Lefler, Hugh T.  
1967 A New Voyage to Carolina by John Lawson. University of North Carolina Press, Chapel Hill.
- Leonard, Robert and George Jones, editors  
1989 Quantifying Diversity in Archaeological Assemblages. Cambridge University Press, Cambridge.
- Lewis, Ernest  
1951 The Sara Indians, 1540-1768: An Ethnoarchaeological Study. Master's Thesis, Department of Sociology and Anthropology, University of North Carolina, Chapel Hill.
- Lyman, R.L.  
1984 Differential Survivorship of Fossil Classes. Journal of Anthropological Archaeology 3:259-299.
- Manooch, Charles S., III  
1988 Fishes of the Southeastern United States. North Carolina State Museum of Natural History, Raleigh, North Carolina.
- Marks, G.A. and A.W. Erickson  
1966 Age Determination in the Black Bear. Journal of Wildlife Management 30(2):389-410.
- Martin, Calvin  
1978 Keepers of the Game: Indian-Animal Relationships and the Fur Trade. University of California Press, Berkley.
- Martoff Bernard, William Palmer, Joseph Baily and Julian Harrison  
1980 Amphibians and Reptiles of the Carolinas and Virginia. University of North Carolina Press, Chapel Hill.
- McManus, Jane  
1989 The Incorporation of Historic Trade Goods at Upper Saratown: A Study of Culture Contact. Ms. on File,

Research Laboratories of Anthropology, University of  
North Carolina, Chapel Hill.

Merchant, Carolyn

- 1989 Ecological Revolutions: Nature, Gender, and Science in New England. University of North Carolina Press, Chapel Hill.

Merrell, James

- 1984 The Indians' New World: The Catawba Experience. William and Mary Quarterly 41(4):537-565.
- 1987 "This Western World": The Evolution of the Piedmont, 1525-1725. In The Siouan Project: Seasons I and II, edited by Roy S. Dickens, Jr., H. Trawick Ward, and R.P. Stephen Davis, Jr., pp.19-27. Monograph Series No. 1, Research Laboratories of Anthropology, University of North Carolina, Chapel Hill.
- 1989 The Indians' New World: Catawbas and Their Neighbors from European Contact Through the Era of Removal. University of North Carolina Press, Chapel Hill.

Miller, Carl F.

- 1957 Reevaluation of the Eastern Siouan Problem with Particular Emphasis on the Virginia Branches - the Occaneechi, the Saponi, and the Tutelo. Bureau of American Ethnology, Bulletin 22.

Milner, George R.

- 1980 Epidemic Disease in the Postcontact Southeast: A Reappraisal. Mid-Continental Journal of Archaeology 5:39-56.

Minc, Leah D. and Kevin P. Smith

- 1989 The Spirit of Survival: Cultural Responses to Resource Variability. In Bad Year Economics: Cultural Responses to Risk and Uncertainty, edited by Paul Halstead and John O'Shea, pp.8-39. Cambridge University Press, Cambridge.

Mooney, James

- 1894 The Siouan Tribes of the East. Bureau of American Ethnology Bulletin 22. Washington D.C.

Moore, Julie H. and Emily W. Wood

- 1976 B. Everett Jordan Dam and Lake: Assessment of the Vegetation. Department of Environmental Sciences and Engineering, School of Public Health, University of North Carolina, Chapel Hill.

O'Connell, James F. and Kristen Hawkes

- 1988 Hadza Hunting, Butchering and Bone Transport and Their



Archaeological Implications. Journal of Anthropological Research 44(2):113-161.

Odum, E.P.

- 1959 Fundamentals of Ecology W.P. Saunders,  
Philadelphia.

Ogilvie, A.E.J.

- 1984 The Past Climate and Sea-Ice Record from Iceland,  
Part I: Data to A.D. 1780. Climatic Change 6:131-152.

Oliver, James S.

- 1993 Carcass Processing by the Hadza: Bone Breakage from  
Butchery to Consumption. In From Bones to Behavior:  
Ethnoarchaeological and Experimental Contributions  
to the Interpretation of Faunal Remains, edited by Jean  
Hudson, pp.200-227. Center for Archaeological  
Investigations, Occasional Paper No. 21. Southern  
Illinois University, Carbondale, Illinois.

Osborne, Scott

- 1992 Unpublished Report on Piedmont Deer Harvest Data. North  
Carolina Wildlife Resources Commission, Raleigh, North  
Carolina.

Page, Lawrence, M. and Brooks M. Burr

- 1991 A Field Guide to Freshwater Fishes. Houghton Mifflin,  
Boston.

Parmalee, Paul W.

- 1965 The Food Economy of Archaic and Woodland Peoples  
at the Tick Creek Cave Site, Missouri. Missouri  
Archaeologist 27:1-34.

Payne, Sebastian

- 1972 On the Interpretation of Bone Samples from  
Archaeological Sites. In Papers in Economic  
Prehistory, edited by E.S. Higgs, pp.65-81.  
Cambridge University Press, Cambridge.

Peet, Robert K.

- 1974 The Measurement of Species Diversity. Annual Review of  
Ecology and Systematics 5:285-307.

Perkins, D. Jr., and P. Daly

- 1968 A Hunter's Village in Neolithic Turkey. Scientific  
American 219(5):96-106.

Petherick, Gary R.

- 1987 Architecture and Features at the Fredricks, Wall and  
Mitchum Sites. In The Siouan Project: Seasons I and  
II, edited by Roy S. Dickens Jr., H.Trawick Ward,  
and R. P. Stephen Davis Jr., pp.29-80. Research

Laboratories of Anthropology, University of North  
Carolina, Chapel Hill, Monograph Series No. 1.

- Phillips, Paul C.  
1961 The Fur Trade, vol. 1. University of Oklahoma Press,  
Norman.
- Pielou, E. C.  
1966 The Measurement of Diversity in Different Types of  
Biological Collections. Journal of Theoretical Biology  
13:131-144.
- Potter, Eloise, James Parnell, and Robert Teulings  
1980 Birds of the Carolinas. The University of North  
Carolina Press, Chapel Hill.
- Ramenofsky, Ann F.  
1987 Vectors of Death. University of New Mexico Press,  
Albuquerque.
- Ray, Arthur J.  
1974 Indians in the Fur Trade. University of Toronto Press,  
Toronto.
- 1978 History and Archaeology of the Northern Fur Trade.  
American Antiquity 43:26-34.
- Ray, Arthur J. and Donald Freeman  
1978 Give us Good Measure: An Economic Analysis of  
Relations Between Indians and the Hudson's Bay Company  
Before 1763. University of Toronto Press, Toronto.
- Reed, Charles A.  
1963 Osteoarchaeology. In Science in Archaeology, edited  
by D. Brothwell and E. Higgs, pp.204-216. Basic Books,  
New York.
- Reidhead, V.A.  
1980 The Economics of Subsistence Change: A Test of an  
Optimization Model. In Modeling Change in Prehistoric  
Subsistence Economies, edited by T. K. Earle and A. L.  
Christensen. Academic Press, New York.
- Reitz, Elizabeth and Stephen L. Cumbaa  
1983 Diet and Foodways of Eighteenth-Century Spanish St.  
Augustine. In Spanish St. Augustine: the Archaeology  
of a Colonial Creole Community, by Kathleen A. Deagan,  
pp. 152-185. Academic Press, New York.
- Reitz, Elizabeth J. and Dan Cordier  
1983 Use of Allometry in Zooarcheological Anlysis. In  
Animals and Archaeology Volume Two: Shell Middens,  
Fishes and Birds, edited by Caroline Grigson and Juliet  
Clutton-Brock, pp. 237-252. BAR

International Series 183. BAR, Oxford, England.

Reitz, Elizabeth J., Irvy R. Quitmyer, H. Stephen Hale, Sylvia J. Scudder, and Elizabeth S. Wing

1987 Application of Allometry to Zooarchaeology. American Antiquity 52(2): 304-317.

Reitz, Elizabeth J. and Martha Zierden

1991 Cattle Bones and Status from Charleston, South Carolina. In Beamers, Bobwhites, and Blue-Points: Tributes to the Career of Paul W. Parmalee, edited by James Purdue, Walter Klippel, and Bonnie Styles, pp.395-407. Illinois State Museum Scientific Papers, Vol. 23, Springfield, Illinois.

Rhode, David

1988 Measurement of Archaeological Diversity and the Sample- Size Effect. American Antiquity 53(4):708-716.

Ricklefs, Robert E.

1990 Ecology, 3rd edition. W.H. Freeman, New York.

Rogers, J. Daniel

1990 Objects of Change: The Archaeology and History of Arikara Contact with Europeans. Smithsonian Institution Press, Washington.

Rountree, Helen

1989 The Powhatan Indians of Virginia. University of Oklahoma Press, Norman.

Rowley-Conwy, Peter and Mark Zvelebil

1989 Saving it for Later: Storage by Prehistoric Hunter-Gatherers. In Bad Year Economics: Cultural Responses to Risk and Uncertainty, edited by Paul Halstead and John O'Shea, pp.40-56. Cambridge University Press, Cambridge.

Runquist, Jeannette

1979 Analysis of the Flora and Faunal Remains from Protohistoric North Carolina Cherokee Indian Sites. Ph.D. Dissertation, Department of Zoology, North Carolina State University, Raleigh.

Schorger, Arlie W.

1955 The Passenger Pigeon: Its Natural History and Extinction. University of Wisconsin Press, Madison.

Scott, Susan L.

1983 Analysis, Synthesis, and Interpretation of Fauna from the Lubbub Creek Archaeological Locality. In Agricultural Communities in West Central Alabama:

Excavations in the Lubdub Creek Archaeological Locality, edited by C.S. Peebles, Springfield, Virginia; U.S. Army Corps of Engineers, Mobile District, National Technical Information Services.

Severinghaus, C.W.

- 1949 Tooth Development and Wear as Criteria of Age in White-tailed Deer. Journal of Wildlife Management 13: 195-216.

Shannon, C. E. and W. Weaver

- 1949 The Mathematical Theory of Communication. University of Illinois Press, Urbana.

Sheldon, A.L.

- 1969 Equitability Indices: Dependence on the Species Count. Ecology 50:466-467.

Shott, Michael J.

- 1989 Diversity, Organization, and Behavior in the Material Record. Current Anthropology 30(3):283-315.

Silver, Timothy

- 1990 A New Face on the Countryside: Indians, Colonists, and Slaves in South Atlantic Forests, 1500-1800. Cambridge University Press, Cambridge.

Simpkins, Daniel L.

- 1985 First Phase Investigations of Late Aboriginal Settlement Systems in the Eno, Haw, and Dan River Drainages, North Carolina. Ms. on file, Research Laboratories of Anthropology, University of North Carolina, Chapel Hill.

- 1992 Aboriginal Intersite Settlement System Change in the Northeastern North Carolina Piedmont During the Contact Period. Ph.D. dissertation, Department of Anthropology, University of North Carolina, Chapel Hill.

Smith, Bruce D.

- 1974 Middle Mississippi Exploitation of Animal Populations: A Predictive Model. American Antiquity 39(2):274-291

- 1975a Middle Mississippi Exploitation of Animal Populations. Anthropological Papers, 57. Museum of Anthropology, University of Michigan, Ann Arbor.

- 1975b Toward a More Accurate Estimation of Meat Yield of Animal Species at Archaeological Sites. In Archaeozoological Studies, edited by A. T. Clason, pp.99-106. North Holland, Amsterdam.

Smith, Marvin T.

- 1987 Archaeology of Aboriginal Culture Change: Depopulation During the Early Historic Period. Ripley P. Bullen Monographs in Anthropology and History No. 6. University of Florida Press, Gainesville.

Snow, Dean R.

- 1981 Keepers of the Game and the Nature of Explanation. In Indians, Animals and the Fur Trade: A Critique of Keepers of the Game, edited by Shepard Krech III, pp.59-71. University of Georgia Press, Athens.

Snow, Dean R. and Kim M. Lanphear

- 1989 More Methodological Perspectives: A Rejoinder to Dobyns. Ethnohistory 36:299-304.

Styles, Bonnie Whatley

- 1981 Faunal Exploitation and Resource Selection: Early Late Woodland Subsistence in the Lower Illinois Valley. Northwestern University Archaeological Program, Evanston, Illinois.

Swanton, John R.

- 1924 Early History of the Eastern Siouan Tribes. American Anthropologist 26:371-381.

- 1946 Indians of the Southeastern United States. Bulletin 137, Bureau of American Ethnology, Smithsonian Institution, Washington, D.C.

Usner, Daniel

- 1992 Indians, Settlers and Slaves in a Frontier Exchange Economy: the Lower Mississippi Valley Before 1783. University of North Carolina Press, Chapel Hill.

Van Doren, Mark, editor

- 1928 Travels of William Bartram. Dover, New York.

Walden, Howard Talbot

- 1964 Familiar Freshwater Fishes of America. Harper and Rowe, New York.

Warburton, Gordon S.

- 1993 Unpublished Information Report on North Carolina Black Bears. North Carolina Wildlife Resources Commission, Raleigh, North Carolina.

Ward, H. Trawick

- 1980 The Spatial Analysis of the Plowzone Artifact Distributions from Two Village Sites in North Carolina. Ph.D. Dissertation, Department of Anthropology, University of North Carolina, Chapel Hill.

- 1987 Mortuary Patterns at the Fredricks, Wall and Mitchum Sites. In The Siouan Project: Seasons I and II, edited by Roy S. Dickens, Jr., H. Trawick Ward, and R.P. Stephen Davis, Jr., pp.81-110. Research Laboratories of Anthropology, University of North Carolina Press, Chapel Hill.
- Ward, H. Trawick and R.P. Stephen Davis, Jr.
- 1991 The Impact of Old World Diseases on the Native Inhabitants of the North Carolina Piedmont. Archaeology of Eastern North America 19:171-181 .
- 1993 Indian Communities on the North Carolina Piedmont A.D. 1000 to 1700. Monograph No. 2, Research Laboratories of Anthropology, The University of North Carolina, Chapel Hill, North Carolina.  
Ward, H. Trawick and R.P. Stephen Davis, Jr., editors
- 1988 Archaeology of the Historic Occaneechi Indians. Southern Indian Studies 36-37.
- Waselkov, Gregory
- 1977 Prehistoric Dan River Hunting Strategies. M.A. thesis, Department of Anthropology, University of North Carolina, Chapel Hill.
- 1989 Seventeenth-Century Trade in the Colonial Southeast. Southeastern Archaeology 8(2):117-133.
- Webster, W. David, James F. Parnell, and Walter C. Biggs, Jr.
- 1985 Mammals of the Carolinas, Virginia, and Maryland. University of North Carolina Press, Chapel Hill.
- White, Richard
- 1983 The Roots of Dependency: Subsistence, Environment, and Social Change Among the Choctaws, Pawnees, and Navajos. University of Nebraska Press, Lincoln.
- 1991 The Middle Ground: Indians, Empires and Republics in the Great Lakes Region, 1650-1815. Cambridge University Press, Cambridge.
- White, T.E.
- 1952 Observations on the Butchering Technique of Some Aboriginal Peoples:I. American Antiquity 4:337-338.
- 1953a A Method for Calculating the Dietary Percentage of Various Food Animals Utilized by Aboriginal Peoples. American Antiquity 18(4):396-398.
- 1953b Observations on the Butchering Techniques of Some Aboriginal Peoples No.2. American Antiquity 19(2);160-164.

- 1954 Observations on the Butchering Technique of Some Aboriginal Peoples Nos. 3,4,5, and 6. American Antiquity 3:254-264.
- Wiens, John A.  
 1976 Population Responses to Patchy Environments. Annual Review of Ecology and Systematics 8:81-120.
- Wilson, Jack H.  
 1983 A Study of Late Prehistoric, Protohistoric and Historic Indians of the Carolina and Virginia Piedmont: Structure, Process and Ecology. Ph.D. Dissertation, Department of Anthropology, University of North Carolina, Chapel Hill.
- Wing, Elizabeth  
 1977 Subsistence Systems in the Southeast. The Florida Anthropologist 30(2):81-87.
- Wing, Elizabeth and Antoinette Brown  
 1979 Paleonutrition: Method and Theory in Prehistoric Foodways. Academic Press, New York.
- Winterhalder, Bruce  
 1980 Environmental Analysis in Human Evolution and Adaptation Research. Human Ecology 8(2):135-170.
- Wright, J. Leitch, Jr.  
 1986 Creeks and Seminoles: The Destruction and Regeneration of the Muscogulge People. University of Nebraska Press, Lincoln.
- Yellen, J.E.  
 1977 Cultural Patterning in Faunal Remains: Evidence from the !Kung Bushmen. In Experimental Archaeology, edited by D. Ingersoll, J.E. Yellen, and W. MacDonald. pp.271-331, Columbia University Press, New York.
- Ziegler, Alan C.  
 1973 Inference from Prehistoric Faunal Remains. Addison-Wesley Module in Anthropology 43. Reading Massachusetts.

- 1954 Observations on the Butchering Technique of Some  
Aboriginal Peoples Nos. 3,4,5, and 6. American  
Antiquity 3:254-264.
- Wiens, John A.  
1976 Population Responses to Patchy Environments. Annual  
Review of Ecology and Systematics 8:81-120.
- Wilson, Jack H.  
1983 A Study of Late Prehistoric, Protohistoric and  
Historic Indians of the Carolina and Virginia  
Piedmont: Structure, Process and Ecology. Ph.D.  
Dissertation, Department of Anthropology, University  
of North Carolina, Chapel Hill.
- Wing, Elizabeth  
1977 Subsistence Systems in the Southeast. The Florida  
Anthropologist 30(2):81-87.
- Wing, Elizabeth and Antoinette Brown  
1979 Paleonutrition: Method and Theory in Prehistoric  
Foodways. Academic Press, New York.
- Winterhalder, Bruce  
1980 Environmental Analysis in Human Evolution and  
Adaptation Research. Human Ecology 8(2):135-170.
- Wright, J. Leitch, Jr.  
1986 Creeks and Seminoles: The Destruction and  
Regeneration of the Muscogulge People. University of  
Nebraska Press, Lincoln.
- Yellen, J.E.  
1977 Cultural Patterning in Faunal Remains: Evidence from  
the !Kung Bushmen. In Experimental Archaeology, edited  
by D. Ingersoll, J.E. Yellen, and W. MacDonald.  
pp.271-331, Columbia University Press, New York.
- Ziegler, Alan C.  
1973 Inference from Prehistoric Faunal Remains.  
Addison-Wesley Module in Anthropology 43. Reading  
Massachusetts.