AN ETHNOBOTANICAL STUDY OF PLANT FOOD REMAINS FROM THE WARREN WILSON SITE (31Bn29), NORTH CAROLINA: A BIOCULTURAL APPROACH

by

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ABSTRACT

DANIEL L. SIMPKINS. An Ethnobotanical Study of Plant Food Remains from the Warren Wilson Site (31Bn29), North Carolina: A Biocultural Approach (Under the direction of ROY S. DICKENS, JR.)

Plant food data from the Southern Appalachians are utilized in an attempt to determine if genetic mediation may have influenced the development of plant food inventories in the New World. In developing a genetic mediation model, possible co-evolutionary tendencies between primates and angiosperms are explored and an argument is presented that culturally derived plant food knowledge became attenuated during the migration across the Beringian isthmus. The genetic mediation model is then tested against archaeological and historic data pertaining to the Cherokee Indians and their ancestors.

Carbonized plant food remains from the Warren Wilson site (31Bn29) in Buncombe County, North Carolina are analyzed in order to determine dietary changes through the Late Archaic (Savannah River), Early Woodland (Swannanoa), and Mississippian (Pisgah) phases. The analysis of 1420.13 grams of charred plant remains from 120 features indicates that nut remains predominated in the first two phases with an expansion of resources, including several cultigens, in the Pisgah phase. Comparison between comtemporaneous feature categories reveal that shallow depressions (ditches or moats) along the Pisgah phase palisade lines contain the richest deposits of plant food remains. A discussion of the various

sampling techniques utilized at the site concludes with the suggestion that standard volumes of soil from known volumes of feature fill should be processes in future paleoethnobotanic studies. It is also suggested that plant remains alone usually provide only weak indications of primary feature function, although ultimate feature function can sometimes be inferred from feature content. The Warren Wilson plant remains are compared with those from other Southern Appalachian sites.

In addition to the archaeological analysis, an examination was conducted of historic and ethnographic data pertinent to Cherokee plant foods in order to provide a rough measure of the kinds of plant foods that might be underrepresented in the archaeological samples. Such data indicates that greens and roots are underrepresented.

Although the impact of genetic mediation cannot be assessed for the New World as a whole, evidence for such an impact is negligible in the presently analyzed ethnobotanic record.

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INTRODUCTION

One perspective in contemporary anthropology is the biocultural approach, wherein an inseparable relationship is assumed between biological and cultural processes. Greenwood and Stini (1977: viii) insist that:

> human biology and culture are locked in a continual causal interaction throughout human history; further, we argue that only through combining information about human biology and culture can we gain any understanding of human nature. These are essential correctives to the current tendency to either wholeheartedly accept or reject sociobiological and other biologistic arguments. We accept what is useful in these arguments but reject any approach that trivializes the importance of cultural phenomena in human behavior.

It is tempting to assume that cultural variables have predominated over genetic variables to such an extent throughout the history of human occupation of the New World that the influence of the latter variables can be ignored in paleoethnobotanic studies. However, unless this assumption is empirically demonstrated it will remain difficult to determine the anthropological significance of similarities and differences in the cultural histories of the Old and New Worlds in regard to questions such as the origins of agriculture. For instance, co-evolution was probably involved in the symbiotic relationship seen between some fruit-bearing plants and the animals which disperse their seeds. If chemoperception helped humans recognize such plants as edible, they may been incorporated into human diets at an early date. Thereafter, these plants would have been likely to remain dietary elements and may have expanded their range as humans migrated to new areas. Once agricultural processes began, these plants may have been particularly suited to become domesticated. Human exploitation of such plants would have begun in the behavioral realm but would have become increasingly cultural in character as knowledge of and beliefs about the plants were shared within a society.

Durham (1982) proposed five principal modes of interaction which are theoretically possible between genes and culture in human microevolution:

> Culture may direct the course of biological evolution within a given set of alternatives (cultural mediation), genetic properties may similarly direct the course of cultural evolution amid existing variability (genetic mediation), and cultural evolution may well proceed under its own control and subject to its own constraints. The latter results in enhancement when cultural fitness reinforces genetic fitness, in neutrality when cultural fitness has virtually no impact on genetic fitness, and opposition when cultural fitness runs counter to genetic fitness (Durham 1982: 312-313, emphasis in original).

Among these interaction modes, genetic mediation has undoubtedly been subject to the most serious disagreement between culturologists and sociobiologists. Under genetic mediation, genetically inherited features of the human organism influence the probability of acceptance of cultural traits, and the ease with which such cultural traits are transmitted. Consequently, some general degree of genetic influence on human behavior (and by extension culture) as reflected in ecology and evolution is suggested by some proponents of genetic mediation. However, examples of genetic mediation that have been proposed thus far remain controversial. Durham (1982) suggested that the best example of genetic mediation presently available involves cross-cultural semantic commonalities in basic color terminology. Research into other aspects of human sensory perception would appear to offer one of the most direct avenues to search for additional examples of genetic mediation, in that genetically derived sensory perception can be precisely measured while ethnoscience studies can provide comparative measurements of cultural response. Paleoethnobotanical studies of food plants may provide the only means of examining the interplay of genetically derived sensory perception and cultural variables through archaeological techniques.

Genetically, our chemoperceptive and digestive systems, and perhaps our color vision as well, suggest that plant food usage was intimately related to the development and differentiation of our order, family, genus, and species. The toxicity of many plant species, or particular parts of edible species, had to be confronted genetically and/or through learned behavior or culture throughout our history, and in various environments, in order that plants could be utilized as foods. An eventual understanding of the dual roles of nature and nurture in the development of human use of plant foods is also critical to refining our understanding of the relationships between steady state (ecological) and transformational (evolutionary) adaptation. Moreover, if systemic models including both biological and cultural processes are employed in ethnobotanical studies, some of the relationships between the contexts of adaptational phenomena may be elucidated.

In Chapter I, an attempt is made to suggest a biocultural model which could be employed in a study of human/food plant interaction. The model, based largely upon a literature review, attempts to incorporate both genetic and cultural processes in a comprehensive adaptational perspective, while simultaneously distinguishing between the distinct structures and mechanisms of the two types of processes. The primary focus of the model, therefore, is to delineate those aspects of the human genotype which could conceivably play a mediating role in the selection of food plants. The model suggests that certain plants should have been more readily acceptable for human consumption when genetic factors alone are considered. The model is then examined in light of empirical archaeological data in an attempt to determine whether genetic mediation may have played a role in the acquisition of plant food knowledge in one area of the New World. It should be mentioned that much of this analysis was undertaken with a spirit of exploration. It was realized that firm conclusions would be most unlikely, but I was interested in pursuing certain ideas as far as I could. Consequently, although many questions pertaining to genetic mediation remain unanswered, the types of questions which would require examination under such a model are brought into the discussion wherever possible.

The primary focus of Chapter II is an analysis of food plant remains from the Warren Wilson site (31Bn29). A substantial inventory of plant food remains through time at a single locus was needed to provide a data set through which the genetic mediation model could be addressed. The Warren Wilson site consists of stratified deposits of charcoal-bearing features from the Savannah River, Swannanoa, and Pisgah phases of the Southern Appalachian physiographic-cultural region. As such, plant food use from the Late Archaic, Early Woodland, and Mississippian periods (from about 2000 B.C. to about 1450 A.D.) could be examined. Two subsidiary problems -- 1) investigation of the homogeneity of plant food remains within functionally and chronologically similar features, and 2) comparison of plant food recovery techniques at the Warren Wilson site -- are also discussed in the second chapter.

Supplementary paleoethnobotanic data from nearby sites with associated archaeological phases was examined in Chapter III to provide greater time depth to the study. In addition, since the Warren Wilson site lies within the general area of the historic Cherokee Indians, historic and ethnographic records provided a diachronic inventory of plant food use within a particular environment.

Chapter IV examines the diachronic food plant inventory compiled in Chapters II and III in terms of the biocultural model presented in Chapter I. A short concluding chapter summarizes the findings of the thesis.

CHAPTER I

SOME ECOLOGICAL AND EVOLUTIONARY FACTORS RELEVANT TO PLANT FOOD UTILIZATION

The Relationship Between Synchronic and Diachronic Adaptation in Anthropological Studies

Cultural ecological studies are most often synchronically oriented. It is expedient to close the systems under consideration in the temporal dimension in order to control for the numerous theoretical and methodological problems introduced by the passage of time. An ecologically oriented ethnographer must therefore select the parameters that will temporally bound the culture under investigation in such a manner as to be able to ask operational questions relevant to subsistence. Adjustments of the cultural system to frequently occurring periodic environmental fluctuations such as seasonality are normally considered by ecologists, but adjustments to rarer, but nevertheless periodic, aberrations such as severe droughts which may occur once in a generation or two begin to strain the fabric of steady state models. The optimal duration of an ecological study seems to be a time span long enough to detect the full range of environmental vicissitudes to which a biological population or an anthropological culture is normally exposed, yet not so long a time that the population is replaced, the culture no longer fits its original definition, or a non-reversable environmental perturbation occurs.

The ethnologist is sometimes able to document the approximate ecological niche of a culture in a year or two of investigation. In recent years, however, it has become increasingly difficult for ethnographers to define cultural niches of groups such as hunter-gatherers and swidden agriculturalists before environmental changes, particularly in the sociocultural realm of the environment, alter the group under investigation in such a way that either the culture and/or its niche is no longer the same entity as it was at the beginning of the study (cf. Lee 1979).

Nevertheless, control for time is less a problem for the ethnologist as it is for the ecologically oriented archaeologist. Although the contemporary ethnologist may observe cultural change proceeding at an ever increasing rate, and the archaeologist is often dealing with relatively stable cultures, the archaeologist's problems in defining the cultural niche of the group under investigation are more severe. In addition to the inherent interpretation problems brought about through the unequal preservation of subsistence remains, the archaeologist often encounters difficulties in correlating such remains from separate contexts in order to formulate a precise understanding of a particular cultural adaptational network bounded both spatially and temporally. Even within the most precise archaeological unit achievable by the archaeologist, such as a zone within a feature, it is difficult to determine, for instance, how many meals for how many people are represented. Whether the overlying zone represents an accumulation of cultural debris from the next day, the next month, or the next year is usually difficult to determine (cf. Wilson 1977). In the southeastern United States, the minimum unit of time represented by a presumably related archaeologically assemblage is often relatively large or even unknown. A single component represented by a single level at a single site may represent the remains of several generations. As a consequence, the cultural ecologist as archaeologist is necessarily working at a much more general level of interpretation than is the ethnological ecologist.

The difficulty in conducting finely-tuned synchronic cultural ecological studies in archaeology has not prevented archaeologists from determining broad regional and temporal subsistence patterns for some of the more recently extinct cultures. This perhaps would have been more difficult if rates of cultural change were not relatively slow for much of prehistory thereby providing many similar archaeological sites to excavate, analyze, and compare. Nevertheless, the forte of the environmentally oriented archaeologist as opposed to the contemporary ethnologist is in the sphere of diachronically occurring adaptational phenomena. Although the precision of the ethnologist is impossible, the time depth and areal range available to the archaeologist cannot be equalled through studies limited to the historic period. Archaeology and ethnology stand counterpoised in this respect: the former poor in detail yet rich in depth and the latter rich in detail but shallow in terms of ability to observe cultural change that is not dominated by the effects of European influences. Each anthropological sub-discipline attempts to draw inferences from the record of the other with varying success.

An understanding of the relationship between synchronic and diachronic adaptation can be useful in archaeological research when gaps appear in archaeological sequences. Tentative inferences as to the content of such cultural lacunae can be drawn by prediction from the preceeding phase and postdiction from the subsequent phase. Of course, such methods are useful only in the formulation of such hypothetical phases rather than in the demonstration of their existence. For instance, many types of information regarding aboriginal plant use will never be revealed through analysis of charred plant remains from archaeological sites alone. Preservation of plant remains is surely biased in any archaeological context, and improved methods of archaeological recovery will never, by themselves, answer many of the questions we would like to answer. We can safely assume that some types of plant remains will be preserved far more often than others. Nut remains, for instance, will probably always be more detectable at archaeological sites than will the remains gathered for their roots or greens. Also, it is logical that older sites will normally provide fewer plant remains for analysis than will comparatively younger sites. There are fewer older sites, and these are generally more inaccessable. Also, their increased age often can be directly correlated with decreased preservation of floral remains.

Many of the more interesting problems in North American archaeology are difficult to address because of our ignorance of early plant use. For example, our understanding of Paleo-Indian subsistence, the extinction of numerous Pleistocene animal species, and the processes by which the Archaic stage developed from the Paleo-Indian stage are limited. Our understanding of later processes, such as the development of agriculture, are also hampered by our lack of information concerning whether the presumed increase in plant food utilization occurred rapidly or gradually through time. In general, our understanding of cultural evolution is severely restricted by limited information on the ecological adaptations and histories of the particular peoples represented in various archaeological phases.

The most reasonable archaeological unit for ecological studies in archaeology would appear to be the site component. Unfortunately, most archaeological components probably do not represent the full subsistence range of their respective cultures. Moreover, the time depth of a particular component may be quite lengthy. The correlation of components into phases (cf. Willey and Phillips 1958) probably constitutes the closest approximation to an ethnographic cultural unit that an archaeologist can achieve. As such, phases may be the most appropriate unit for ecological studies available archaeologically. The chronological separation of phases within a region presents a problem since phases are more often defined according to tool assemblages rather than to demonstrated shifts in subsistence techniques. In the absence of data pertaining to subsistence, such a procedure is necessary and proper. Ideally, however, it seems that archaeologists might attempt to define phase changes in accordance with subsistence as well as technological systemic changes. The boundaries between phases might then be viewed as thresholds in the sense that they separate systems with different dynamic equilibria (cf. Butzer 1982) or, different sets of homeostatic negative feedback loops.

Rappaport (1978) suggested that adaptation refers to two separate processes. The first aspect of adaptation refers to the means by which living systems maintain homeostasis as they confront short-term environmental fluctuations. The second aspect of adaptation refers to transformations in living systems in response to long-term nonreversing changes in the composition and structure of their environments.

> I take living systems to include (1) organisms, (2) single species assemblages such as populations, troops, tribes and states, and (3) the multispecies associations of ecosystemic communities (Rappaport 1978: 49).

In archaeological situations, it is particularly difficult to determine whether a succession of phases represents extinctions and replacements or the accumulation of adaptive changes from one system into a descendant cultural system. In the present study, the simplifying assumption is made that phase changes at a particular archaeological site represent at least a general continuity of indigenous historical development.

The Relationship Between Genetic and Cultural Ecology and Evolution

Despite methodological and conceptual difficulties, archaeology presents a useful method of addressing diachronic changes in cultural subsistence patterns. The precise meaning of the phrase "cultural evolution" is therefore of interest to archaeologists. "Cultural evolution" signifies more than "culture change" yet many anthropologists are reluctant to use the former term perhaps because changes in cultural phenomena cannot be directly correlated with evolutionary theory as it has developed in such fields as biology and population genetics. In anthropological parlance, specific cultural evolution, as opposed to general cultural evolution, probably means something akin to the process of cultural adaptation in both a functional and structural sense; especially where equilibrium thresholds are crossed. Yet in a biological sense, evolution usually implies genetic structural changes such as those responsible for speciation.

Slobodkin and Rapoport make several important observations regarding terminology:

> When we refer to an evolutionary change, in the broadest sense, we refer to an alteration in the genetic constitution of a population together with the associated changes in the biological properties of the organisms. This is to be distinguished from behavioral, physiological, or numerical changes... There is not now any word for the whole set of non-genetic changes... We will speak here of tactical adjustments. Tactical adjustments, as we will show, may or may not be accompanied by genetic change, but genetic changes are always accompanied by tactical adjustments (Slobodkin and Rapoport 1974: 183).

The types of tactical adjustments that a particular genotype can make in order to adjust to less than optimal environmental conditions are a function of the genotype itself.

> If organisms were infinitely adaptable..., then all genotypes would be equivalent. Conversely, if all environments were constant there would be no need for the flexible adaptive machinery to intervene between the genotype and the environment (Ibid.: 196).

The particular adaptive response that an organism makes to an environmental perturbation can not be predicted, but it is assumed that the response should be as parsimonious as possible in terms of the time it takes to accomplish the response and the degree to which resources are committed. Consequently, responses should range (in order of increasing time to accomplish and commitment of resources) through (1) changes in behavior; (2) short-term physiological change; (3) physiological acclimitization; (4) death rate change; (5) selective mortality and fecundity; and (6) deep genetic changes in things such as anatomy and innate behavior. The first three of these responses take place within an individual and are reversible (albeit with different rates and degrees of difficulty), and the last three occur within a population.

Within this context, a significant aspect of human biological evolution appears to be that genetic changes have accumulated in such a manner that the overwhelming majority of perturbations can be met by the least costly and fastest responding of mechanisms available, i.e.

behavioral changes. If this is the case, many cultural changes should correlate with adaptations of individuals to perturbations in the environment. The particular exigency or perturbation could last different lengths of time and arise out of abiotic, biotic, or cultural systems themselves. If we can assume that individuals have some foresight in terms of being able to predict future environmental perturbations, we might even be able to postulate a measure of hypothetical general evolution based upon an increase in the capacity to respond to future perturbations with progressively fewer somatic and progressively more extrasomatic or behavioral changes.

The radical differences between human and non-human behavior have sometimes been interpreted as proof that cultural change does not occur under the influence of natural selection. However, it may be possible to demonstrate a functional similarity between genetic and symbolic change; which is essentially change in behavior manifested through cultural variables of technology, social structure, and ideology.

Alexander Alland, Jr. noted that:

> Evolution is a process through which systems develop and are modified in relation to specific environmental backgrounds. All the theory requires is that there be mechanisms of variation (producing new variables) and mechanisms of continuity (preserving maximization) present in these systems and that these systems be subject to environmental selection. There is no requirement that these mechanisms be specifically biological in nature. If the theory is seen as a theory about process, the distinctions between so-called biological and cultural evolution disappear (Alland 1973: 273).

Of course, the specific structural mechanisms and results of cultural evolution differ from those of biological evolution. For instance, symbolic adaptations can be transmitted to both related and unrelated individuals and across generation boundaries. Moreover, cultural adaptation can occur more rapidly than can somatic adaptations based upon Darwinian inheritance.

Investigators have laid different amounts of stress upon culture as primarily self-generating or as being at least partially derived from underlying genetic factors. The former view, or culturology, has been most stoutly espoused by Leslie White:

> ...although culture is produced and perpetuated only by the human species and therefore has its origin and basis in the biological make-up of man, in its relation to human beings after it has come into existence and become established as a tradition, culture exists and behaves and is related to man as if it were *nonbiological in character* (White 1959: 12. Italics in original).

The latter view, associated with the sociobiological school, is often associated with the work of E. O. Wilson:

> Although the genes have given away most of their sovereignty, they maintain a certain amount of influence in at least the behavioral qualities that underlie variations between cultures (Wilson 1975: 550).

Alexander Alland has outlined the general focus to be addressed here:

> There is no evidence that any aspect of culture is inherited, although one must not overlook the fact that certain behavioral systems are more compatible with the total physiological and psychological structure of the human organism. It is probably for this reason, among others, that similarities between rather complex systems of behavior appear in widely scattered areas of the world where there is little possibility that these similarities arose as a result of borrowing. The cultural traits which develop develop against the background of biologically determined human nature (Alland 1973: 236).

Clearly, many of the more interesting questions concerning cultural ecology and cultural evolution depend upon sorting out which aspects of behavior are derived primarily through genetic or "Darwinian" variables as opposed to cultural or "Lamarckian" variables even while recognizing that the two types of variables are constantly interacting (cf. Durham 1982).

Anthropological subsistence studies should be able to yield valuable information in this regard concerning the middle ground between strict culturology and sociobiology. Not only is the need for non-toxic food a biological constant among all species, but our species specific senses of smell, taste, and perhaps color vision are probably closely linked to diet composition. Although actual food choices in a familiar environment might depend primarily upon cultural ecological factors such as those induced by the strictures of seasonality and scheduling; the initial act of distinguishing between edible, inedible, and poisonous foods (and particularly plant foods) within a newly encountered environment would seemingly rely heavily upon genetic characteristics of chemoperception and perhaps color vision, as well as the physiological capacities and limitations of the gastro-intestinal system. It seems reasonable that food plants which were initially selected for genetic compatability would thereafter persist in cultural inventories. Therefore, we might expect that a paleoethnobotanical record of food plants through time would include a higher proportion of genetically compatible plants in the earliest stages and progressively more culturally modified plant foods through time. Of course, ecological and energetic factors would complicate such a simple relationship.

One of the factors which may have been important in the rate at which new plant foods were added to human diets in relatively unfamiliar areas might be the lowering of palatability requirements as hunger levels increased. In light of the probability that experimentation with new potential food plants may have increased dramatically in new habitats during lean times, and further due to the probability that knowledge of edibility would quickly be transmitted to other members of the social group; the rate at which food plants were added to the cultural inventory may have been very rapid thereby largely overriding genetically perceived information. On the other hand, reluctance to expand dietary niches or to enter new environments hay have contributed to a rather static inventory of food plants over long spans of time.

The present study has concentrated upon chemoperception as it applies to plant utilization on a very general level. It should be recognized, however, that "specific hungers" or "nutritional wisdom" (cf. Zahorik and Houpt 1981) might develop differentially in various environments according to available resources, including animal resources. A large body of literature pertaining to human taste and smell preferences has been left unexamined in the present study, and contemporary cross-cultural comparisons would seem to be feasible. Finally, it should be noted that possible cultural mediation upon chemoperception has not been addressed although it seems clear that children are quite capable of bypassing chemoperceptive warnings and poisoning themselves without supervision.

Genetic Control Versus Influence in Primate Food Selection

The difficulty in distinguishing between those aspects of human food selection which are primarily influenced by genetic, as opposed to cultural factors, can be illustrated by several examples drawn from primatological studies. Although non-human primate species have not yet been demonstrated to possess culture in the sense of the imposition of arbitrary form or meaning, they clearly do exhibit behavioral flexibility of food choices and the sharing of dietary knowledge among social units. Several related issues in this area are the methods by which food resources are learned; the means by which knowledge of such food resources is transmitted to other members of the social group and to progeny; and the degree to which different assemblages of food resources are utilized by various social groups of the same species occupying identical and/or different habitats.

Kenneth Glander described a behavior he called "sampling" among mantled howling monkeys (*Alouatta palliata* Gray):

> Group members are conservative in their feeding, but one adult animal at a time ingests a very small amount of plant material from a new source. If this sampling produces a negative effect such as gastrointestinal distress, the sampler does not return to that tree. If no stress results, the sampler builds up feeding time in that tree and gradually other group members join the sampler and a new tree becomes part of the group's resource base (Glander 1981: 254).

Glander is concerned primarily with the behavior relevant to species already included within the dietary repertoire of the monkeys. He noted that sampling may allow tracking of seasonal changes in secondary compound content within tree species, or prepare gut fauna and flora for new chemicals, or aid in nutrient balancing. It seems quite likely that sampling behavior is also useful in adding new food species to a dietary repertoire.

Studies of Japanese macaques (*Macaca fuscuta*) indicated that an innovative food behavior (sweet potato washing) invented by an individual was imitated by its group. Juveniles adopted the new behavior more than adults and adult females more than adult males. Moreover, close social ties facilitated transmission of the innovation from one individual to another (Kummer 1971).

A brief experiment with wild chimpanzees indicates that the rate of learning new foods might be quite conservative. Although the experimental controls were not stringent, Reynolds and Reynolds (1965) placed bananas, mangoes, maize, avocado pears, and paw-paws in the forest where chimpanzees could have access to them. None of the foods were naturally available in the forest although the chimpanzees may have been familiar with cultivated bananas and paw-paws. Some of the bananas had been eaten the next day, one of the two paw-paws was eaten after it ripened, and one of the two avocado pears was moved but not eaten by the chimpanzees. The mangoes and maize were not utilized. Thus, none of the unfamiliar foods was eaten.

The proportion of animal food as well as the specific fruits and vegetables eaten varies among chimpanzees living in different environments (Hladik 1975). George Schaller (1965) observed no overlap in gorillas' plant foods between troops in lowland rain forest and Hagenaria woodland although seventeen food plants were collected in the former habitat and twenty-nine in the latter. Such studies suggest that intraspecific differences in food behavior probably developed very early in hominoid/hominid evolution. The essential point made by these examples is that even in those cases where cultural influences upon plant food selection can be largely, if not totally, discounted; genetically controlled behavioral responses still exhibit a high degree of flexibility. As such, we can safely discount any rigid genetic control over food choices in a biocultural model of plant food use by humans. Nevertheless, the degree to which genetic factors influence food choices remains to be established.

Genetic Influences on Plant Food Selection Possibly Related to Co-Evolutionary Developments Among Angiosperms and Primates

Attention to plant food use by hominids and their ancestors should prove useful in eventually sorting out the aspects of subsistence which are linked to genetic predispositions of our species from those aspects which are culturally derived. Plant food use may have been more discriminating than animal food use through all stages of hominid evolution due to the noxious or toxic qualities of many plant species. An understanding of possible co-evolutionary relationships between primates and flowering plants is therefore essential to the development of a genetic mediation model.

The angiosperms, or flowering plants, became well established in the Cretaceous period of the Mesozoic era, and all modern families had evolved by the time of the Miocene epoch of the Cenozoic era (Stokes 1973). The Cretaceous period, which ended about 68 million years ago, also witnessed the appearance of modern insects and perhaps the earliest divergence of prosimians from insectivores (Starr 1971) as witnesses by the Montana fossil Purgatorius ceratops. Szalay (1972) inferred from molar adaptations that a herbivorous-frugivorous shift in primate diet away from a primarily insectivorous diet may also have occurred in the Cretaceous period. The Paleocene epoch immediately followed the Cretaceous period, and the fossil record indicates that 60 genera of prosimians, in about eight families, inhabited the Northern hemisphere during the Paleocene and subsequent Eocene epochs (Simons 1964). It was not until the Oligocene epoch, as represented by fossil deposits in the Fayum depression of Egypt, that fossil forms thought to be ancestral to Old World monkeys, apes, and hominids are first encountered in deposits dating approximately 32 million years B.P. (Poirier 1977).

During the course of their evolution, flowering plants developed two primary means of discouraging predation. One of these was mechanical and involved the development of spines, thorns, hairs, barbed hooks, and other mechanical repellants (Alcock 1975). The other defense was chemical:

> ...we can surmise that the great success of the angiosperm plants (plants with enclosed seeds), which now dominate the plant world since most of the primitive gymnosperm lines have disappeared, is probably due in large measure to the angiosperms' early acquisition of chemical defenses. One important group of protective secondary plant substances, the alkaloids, is found almost exclusively in this class of plants and is well represented in those groups of angiosperms that are considered most primitive. Whereas other plants were poorly equipped for chemical warfare, the angiosperms were able to diversify behind a chemical shield that gave them considerable protection from herbivores (Ehrlich and Raven 1967: 110-111).

In general, secondary compounds can be described as those present in tissues but which are not required for basic metabolism. Richard Schultes (1972) noted that 4,350 plant alkaloids were known in 1969. Of this number, only 256 had been isolated from non-angiospermous plants. Important secondary compounds other than alkaloids include glycosides, genins, terpenoids, coumarins, anthraquinones, and phenolic compounds such as tannins and essential oils.

Although there is some dissent as to the defensive role of any plant secondary compounds (cf. Robinson 1974), Glander (1982) maintains that many plant secondary compounds developed as a defense against insect predation and the fact that some secondary chemicals also deter vertebrate herbivory is largely accidental. However, some insects incorporate plant secondary compounds in their own tissues for defensive purposes, and the first primates, which were probably insectivores, may have evolved detoxification mechanisms for dealing with their insect prey:

> The insects obtained these secondary compounds from the local plants. Therefore, the insectivorous primates, with their specialized detoxification systems, may have been pre-adapted to eventually evolve as

herbivores and feed on the same plants for which they already had the means of detoxifying the contained secondary compounds (Glander 1982: 12).

Alcock (1975) suggested that during the course of human evolution, selection may have favored individuals who had an innate tendency to avoid tainted or toxic foods and who were attracted to foods with high nutritional content. Chemoperceptive senses, such as taste and smell, appear to reflect such tendencies in that sweet substances often contain carbohydrates; mildly acid foods often contain vitamins; and mildly salty foods contain sodium, potassium, magnesium, calcium and other ions necessary for cellular functions. Conversely, bitter foods are consistently rejected by humans. This isn't surprising since bitter substances usually contain toxic compounds and, perhaps especially, plant secondary compounds such as alkaloids. Alcock also suggested that the placement of chemical receptors on the tongue is adaptive:

> The forward location of the sweet receptors reflects the importance of testing for palatability (carbohydrate concentration) without placing the food deep in the mouth. If the material passes the primary test it is subjected to secondary analysis for salt and acid content. If considered acceptable at this level, it must still pass a final test for toxicity. If a food is highly bitter, the other types of receptors will detect it. However, a mildly bitter food might escape detection or be thrust hastily into the mouth, in which case the sensitive bitter receptors at the back of the tongue in conjunction with the gag reflex will see to it that the substance is not swallowed (Alcock 1975: 459).

Gaulin and Konner also argue for an evolutionary explanation of the development of chemoperceptive sensory phenomena:

> ... the gustatory system has evolved to presample foods for both beneficial and harmful constituents (Gaulin and Konner 1977: 2).

In humans, chemoperception is primarily comprised of distant chemoreception, or smell, and contact chemoreception, or taste (Frings 1979). The gustatory chemoreceptors are dependent upon direct contact, primarily with water soluble materials, while olfactory chemoreceptors detect vaporous, generally water insoluble, materials. Thresholds for distance chemoreceptors are usually very much lower than are those for contact chemoreceptors. Chemical senses are primitive and probably developed in conjunction with tactile senses. Humans' eyes, anus, and reproductive openings still retain a common sensitivity to certain chemical irritants which has been lost over those portions of the epidermis which has become horny (Moncrieff 1967).

Alcock (1975) suggested that even our color vision may have developed partially in relation to the food quest in that our sensitivity to yellows, reds, and oranges may have aided in the detection of ripe fruits. Some support for this suggestion may be provided by cross-cultural studies of color terminology which indicate that, aside from white and black, the color red is the most prevalent focus identified by a color term and may include yellows, oranges, and browns within its spectrum (Berlin and Kay 1969). It could be argued that reds, oranges, and yellows are merely the most intense colors of the visible spectrum; but this in turn may be related to the reason why many fruits adopt such colors. The subject of the evolution of fruits is complicated and not as well studied as the co-evolution of floral structures and insect pollinators. It would seem that symbiotic co-evolutionary processes must have been at least partially involved in the development of edible fruits although the role of primates in such trends remains largely uninvestigated:

> Fleshiness of fruits is at least ordinarily an adaptation to dissemination by animals (including birds). In most cases the seeds are swallowed along with the pulpy pericarp and pass through the digestive tract unharmed. Obviously this method of seed dispersal entails the development of a protective covering of the seed that is resistant to digestion (Cronquist 1968: 117-118).

Alison Jolly suggested that primates have a great deal of influence on forest vegetation by distributing seeds through their digestive tracts and depositing them in a pat of fertilizer far from the parent tree:

> Many of the forest trees are adapted to this mode of distribution, with tough, heavy seeds (Jolly 1972: 58).

Similarly, Glander (1975) retrieved viable seeds of four tree species from howler monkey feces in Costa Rica.

It is, of course, very difficult to assess the role of the various factors discussed above in relation to the existence of a "natural" human diet. However, many of the phenomena are suggestive of quite ancient patterns of primate/angiosperm interaction. At least some such biological patterns certainly have persisted in *Homo sapiens* or perhaps were even elaborated through them.

Very generally, according to a genetic mediation model, I would expect that sweet and brightly colored fruits incorporating seed equipped with the capacity to withstand animal digestion would be most easily incorporated into human diets. Conversely, plant parts containing bitter secondary compounds would be avoided whenever edibility was determined primarily through genetic means.

Direct archaeological evidence of plant foods at early hominid sites is extremely rare:

> Even where traces of plant foods do survive, such as hackberries at Choukoutien, and *Syzigium fruits* and *Borassus* palm nuts on Acheulian floors at Kalambo, it is very hard at present to gauge the dietary importance of these foodstuffs (Isaac 1971: 281).

Consequently, a holistic biocultural approach attempting to determine diets of our most recent primate ancestor which did not rely upon cultural means would allow a more precise formulation of the genetic background underlying plant food utilization. For instance, Walker suggested eight analytic methods that might contribute to the reconstruction of extinct hominid diets. These methods, several of which could be or or have been employed in reconstructing more recent hominid diets, include:

(1) interspecific comparisons of tooth morphology;
(2) biochemical reconstruction;
(3) inspection of tooth microwear;
(4) carbon isotope analysis;
(5) trace element analysis;
(6) application of ecological "rules";
(7) analysis of "food refuse" from archaeological sites;
(8) diagnosis of cases of metabolic diseases caused by diet (Walker 1981: 58).

Based upon tooth microwear and features of the masticatory system; Walker was able to suggest, for example, that robust australopithecines were predominantly frugivorous. The specific fruits eaten were probably encased in hard shells or pods or were small seeds in hard, protective cases.

Cultural and Ecological Factors Pertinent to Plant Food Utilization by Early Inhabitants of the New World

It would seem that cultural factors would have long ago masked any human genetic factors influencing the use of plant foods. Consequently, an understanding of ethnobotanical questions pertaining to diet could be derived primarily through the study of cultural and ecological variables. Such a viewpoint would be especially convincing if human utilization of plant foods had progressed in a steady or uninterrupted fashion throughout prehistory and history.

However, anthropologists have been blessed with a particularly useful test case for biocultural studies in that the settling of the western hemisphere took place in comparatively recent times. Most anthropologists would agree that the Old and New Worlds developed largely independently between the time that the Beringian land bridge last closed and European contact occurred along the Atlantic coast. Consequently, studies pertaining to such large scale issues as the extinction of Pleistocene megafauna, the origins of agriculture, and the development of urban centers have at least two independent cases to examine in each instance.

The settling of the New World is particularly informative in terms of ethnobotanic studies since it can be argued that knowledge of food plants may have reached a low ebb during the Beringian crossing. Therefore, ethnobotanic comparisons between the culture histories of the Old and New Worlds may be able to control (to a degree) for cultural variables. However, such partial control for the cultural aspect of ethnobotanic relationships underscores the necessity of understanding whatever role genetic factors had in influencing plant food selection. The argument that plant food use reached a low point during the Beringian crossing can be supported by ecological, comparative ethnological, and paleoclimatic evidence.

Charles Cleland (1976) made a useful distinction between focal and diffuse adaptations. Diffuse adaptations are more likely in forested low and mid-latitude situations where resources are varied and scattered and where few resources are abundant enough or reliable enough to form an economic base. Early hominid foragers almost certainly had a diffuse form of adaptation. Focal adaptations are specialized and conservative and must be based upon high quality, abundant, and consistently available resources. High latitude environments are characterized by relatively few species occurring in large numbers and it is in such environments that focal adaptations are most likely to develop:

> This pattern includes those cultures that were adapted to the hunting of big game. Archaeologically, Early Focal adaptations would include those of the original immigrants to the Western Hemisphere,

> as well as the late Pleistocene and early post-Pleistocene descendents of these people (Cleland 1976: 68).

Additional support for Cleland's contention that the Beringians were focally adapted can be derived through an examination of recent ethnographic studies of peoples living near the Bering Straits.

The Eskimo inhabit the most arctic areas and vegetable foods include:

> ... the black crowberry, marsh whortleberry, cloudberry and other Arctic fruits, the roots of certain plants, the stalk of the aromatic angelica, various algae, etc. (Birket-Smith 1936: 96-97).

Fermented floral contents from caribou paunches and chewing gum made from solidified seal oil and willow catkins complete the inventory of floral resources noted by Birket-Smith.

The Aleuts supplemented their predominantly meat diet with berries; the Eskimo potato (_Fritillaria camschatcensis_); a type of lily bulb which was gathered in quantities and stored for winter use; greens of the cow-parsnip (_Heracleum lanatum_); cowslip (_Caltha palustris_), anemone (_Anemone narcissiflora_); and roots of the lupine (_Lupinus nootkatensis_) and the anemone. Certain marine algae were also used for food. Other edible plants were available on the Aleutians, and although they were not recorded as used by the natives, the ethnographers (Collins _et. al_. 1945) noted that they were used elsewhere in the Arctic and may have been used either as staples or emergency foods. Such plants included fern fiddle-heads, mountain sorrel (_Oxyria digyna_), cresses (species of _Barbaria_, _Nasturtium_ and _Cardamine_), scurvyweed (_Cochlearia officinalis_), Labrador tea (_Ledum palustra_), northern fireweeds (_Epilobium latifolium_), and dandelions (_Taraxacum_ sp.). Lichens and bulbs and roots of onion (_Allium_ sp.) and bistort (_Polygonum viviparum_) respectively, complete the list. Many of these plants are ubiquitous weeds and would not have been available to the pre-contact Aleut. However, the ethnographers identified 480 species of seed plants and ferns on the Aleutians and some of these might have been important food resources.

On the Siberian side of the Bering Straits, the Chukchee in 1890-1901 were studied by Bogoras (1909). Roots appear to have been the most relished of Chukchee plant foods and included Hedisarum obscurum, Polygonum viviparum, Pedicularis sudetica, Potentilla fragiformis, Oxytropis sp., and various species of Carex. Both roots and leaves of willow, Polygonum polymorphum, and Claytonia acutifolia were eaten as were the leaves of Oxyria digina and several other plants. Roots and leaves were often combined with animal blood, meat, fat, or internal organs (and occasionally reindeer paunch contents), and stored for winter use. Berries were not common on the tundra although Empetrum nigrum and Rubus chamoemorus were were eaten on the spot. Several kinds of seaweed were eaten by children, larch tree pitch was chewed as gum, and various leaves were used as tea substitutes.

Jochelson (1908) worked among the Koryak of the central Kamchatka Peninsula in 1900 and 1901. Root foods included martagon, Claytonia acutifolia, wild sorrell (Polygonum polymorphum) and sedge roots. As with the Chukchee, many of these were robbed from mice burrows. Greens and a type of flour were obtained from Epilobium angustifolium and Heraclium spandilium. Berries and fruits included Empetrum nigrum, Vaccinium vitis idaea, Rubus chamaemorus, Lonicera sp., Prunus padus, Rosa alpina, mountain ash, sea-colewort (Alaria esculenta), and cedarnuts. The cambium or willow bark and reindeer rumen contents completed the inventory. As with the Chukchee, many of the vegetable resources were mixed in various ways with animal products and such "puddings" were sometimes frozen for winter use although supplies did not last through the season.

The ethnographic information suggests an opportunistic utilization of plant food resources commensurate with availability. As such, the more southern groups relied more heavily on floral resources than did their northern neighbors (cf. Lee 1968: 42). In the four cases cited, it seems clear that the peoples were focally oriented toward animal resources.

Paleoclimatic data based upon pollen cores appear to support the contention that cultural inventories of food plant knowledge must have reached an extremely low diversity among the generations of humans who inhabited Beringia. Colinvaux (1964) noted that the Beringian land bridge supported treeless arctic tundra during both of the last two glacial episodes. As such:

> A cold-adapted culture based on the mammalian fauna of the land bridge is implied. Social groups must have been mobile, equipped with good hunting equipment, and possessed of good, tailored clothing, that would protect against intense cold. Men would have had to be able to keep warm without either the blubber of sea animals or wood fuel other than willow twigs (Colinvaux 1964: 327).

Eventually, of course, as climate moderated and/or peoples moved further south, adaptive modes became increasingly diffuse in respect to plant food additions to diets.

The Complicating Variable of Angiosperm Phytogeography

A question which can not be totally side-stepped at this stage of the discussion concerns the degree to which genetically derived somatic and behavioral capacities articulated with the flowering plants of the temperate New World. We can assume that some limited knowledge of plant foods accompanied the Paleo-Indians south from Beringia, but a potentially important variable must now be considered. This variable is that the genetic traits of our species relevant to plant food utilization had primarily evolved in relation to Old World plants; and perhaps African plants especially. How well did such genetic traits articulate with the temperate New World plants? This is an exceedingly difficult question, yet one which is of interest since it could bear upon the rate at which plant foods were learned in the New World. A few very general points can be made about angiosperm diversity in relation to phytogeography. Other plant groups are not considered since they are less important, overall, in human diets.

Baker (1973) noted that angiosperm diversity increased in the middle Cretaceous Period and then expanded rapidly in the Upper Cretaceous and the early part of the Tertiary Period. Axelrod (1960) suggested that the first angiosperms may have evolved as early as the Permian Period, and Takhtajan (1969) noted that the absence of pre-Cretaceous angiosperm fossils is probably due to the montane origin of the group. It is probable, therefore, that all continents were populated by angiosperms before the separation of Pangaea into Laurasia and Gondwanaland at the Triassic/Jurassic boundary. The separation of Laurasia from western Gondwanaland by the Tethys sea was never complete, but some physical barriers to angiosperm migrations must have accompanied the climatic barriers inherent in the latitudinal differences. South America and Africa began to separate at the Jurassic/Cretaceous boundary, and by the end of the Cretaceous, the South Atlantic had widened into a major ocean (Dietz and Holden 1970). The Cretaceous was the period of major radiation of the angiosperms so South America and Africa probably shared a similar flora until the close of the period (Axelrod 1979). Meanwhile, the North Atlantic was opening thereby separating North America from Eurasia although the two land areas remained connected via Greenland, and perhaps Beringia (cf. Smiley 1979), well into the Tertiary Period. From the Eocene epoch to the present, North and South America have exchanged floral elements via intervening islands and the eventual Middle America isthmus. Axelrod (1979) suggested that most of the successful movement of flora was from North America southward rather than from South America northward.

Cracraft (1974) noted that some authorities believe that insectivores and primates, as well as rodents and carnivores, had their source in Laurasia. However, there are some indications that primitive African primates of the early Tertiary Period may have been closely related to both catarrhines and platyrrhines. As previously noted, the primates are thought to have evolved sometime near the end of the Mesozoic era or the beginning of the Cenozoic era.

Clearly, much angiosperm diversification, as well as primate diversification, must have occurred after the dispersal of the continents. Conversely, much sharing of flora across ocean barriers certainly took place. Although many factors other than continental drift are responsible for current phytogeographical trends, it would appear that the North American and African continents were perhaps the most isolated from each other of all the major land masses whereas North America and Eurasia shared a long coterminous history. If humans have relied upon genetic capabilities to aid them in determining the edibility of plants (and if such capabilities arose primarily in Africa), the entry into temperate North America might have been challenging in terms of becoming familiar with plant foods through sensory perception alone. If, however, Homo erectus and early Homo sapiens populations were still acquiring chemoperceptive capabilities in Eurasia; the adaptation to the New World may have been biologically facilitated. Moreover, it is probable than many chemoperceptive traits had been retained from much earlier primates; and some such traits could have been associated with essentially pan-global angiosperm families and characteristics.

The next two chapters of this thesis develop a partial archaeological and historic inventory of plant foods in the Cherokee homeland of the Southern Appalachians. The following chapter will attempt to examine aspects of the diachronic food plant inventory in light of the discussion presented above.

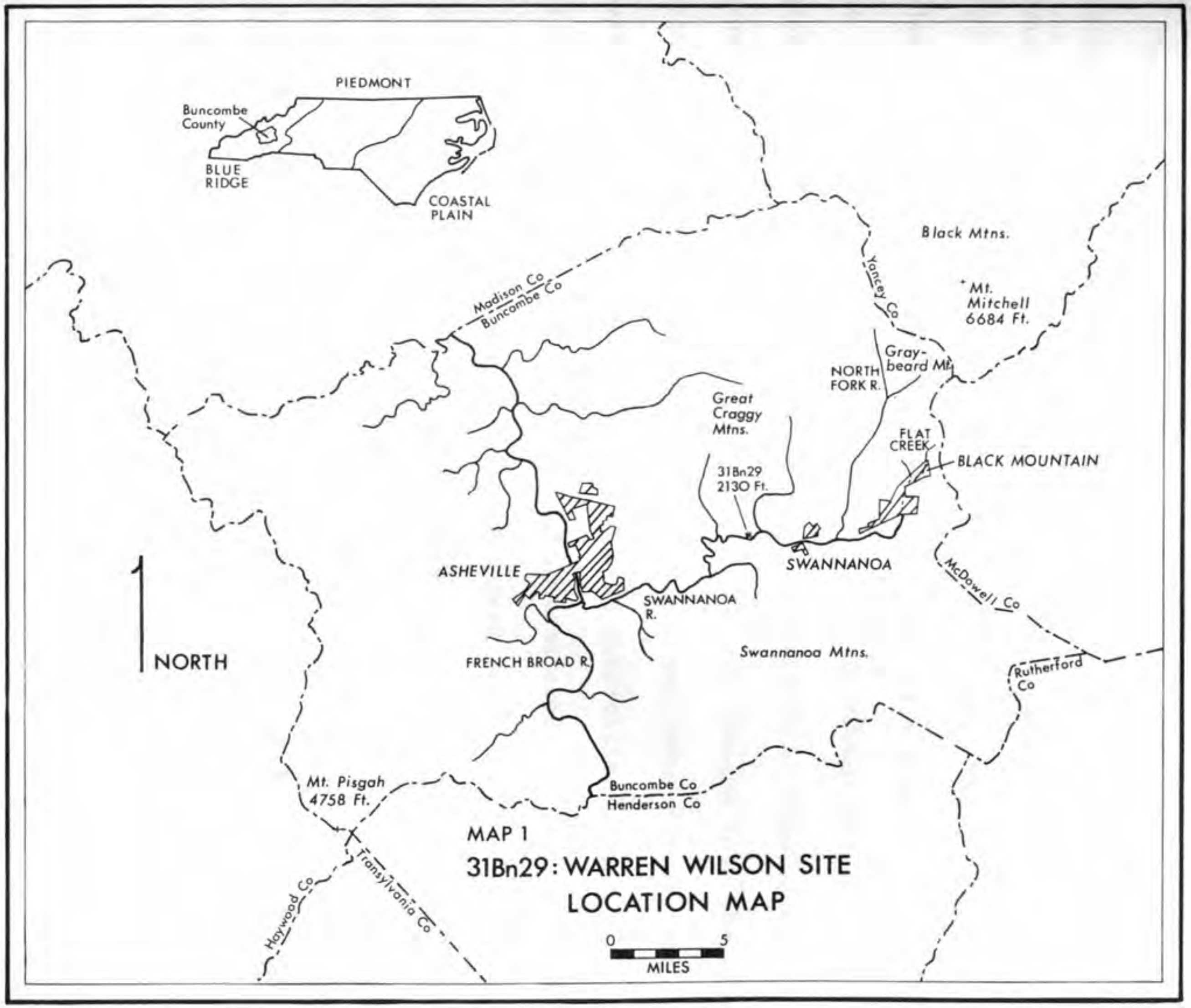
CHAPTER II

ANALYSIS OF PLANT REMAINS FROM 31Bn29

Site Environment

The Warren Wilson site (31Bn29), in Buncombe County, North Carolina, contains the remains of a stratified, multi-component Indian village that was situated on the northern floodplain of the Swannanoa River at the eastern edge of the Blue Ridge physiographic province. The site lies at an elevation of approximately 2130 feet above sea level at a bend of the Swannannoa River. The property is presently owned by Warren Wilson College, from which the site name is derived (Map I). The Swannanoa River's main tributaries are Flat Creek and the North Fork River which originate in the Craggy, Black, and Greybeard mountains to the north. The Swannanoa mountains to the south also drain into the Swannanoa basin. The Swannanoa valley is eighteen miles long and varies from less than one mile to six miles in width. The entire Swannanoa River lies within Buncombe County (Penford n.d.). The site lies about ten miles, on a straight line, from its confluence with the French Broad River at Asheville, North Carolina. The French Broad eventually joins with the Holston River to form the Tennessee River.

The physical and biotic setting of the Warren Wilson site within the Blue Ridge Province of the Appalachian Summit has been described in



MAP 1
31Bn29: WARREN WILSON SITE
LOCATION MAP

some detail by Keel (1976) and Dickens (1976). Discussion here focuses upon those factors that are most relevant to the prehistoric ethnobotany of the various Indian groups who lived or camped at the site through time.

The Warren Wilson site lies near the transition zone between the northern and upland deciduous forests and the southern and lowland deciduous forests as reconstructed by Shelford (1974) for the period A.D. 1500 to 1600 (or prior to European settlement). The northern and upland forests and the southern and lowland forests constitute two of the three large subdivisions of the Temperate Deciduous Forest Biome recognized by Shelford. The third large subdivision is comprised of the stream-skirting forests extending westward along streams into the Great Plains. Within the larger subdivisions of the deciduous forest, the Oak-chestnut region of the Northern and Uplands subdivision grades into the Oak-hickory region of the Southern and Lowland subdivision.

Strictly speaking, the Oak-chestnut forest is primarily associated with the Appalachians and the Oak-hickory forest is primarily associated with the Piedmont and, to some extent, the Coastal Plain. The Warren Wilson site lies only about nine miles west of Swannanoa Gap, where the boundary between the Piedmont and Blue Ridge physiographic provinces lies.

Küchler (1964) mapped the potential natural vegetation of the site area as "Appalachian Oak Forest" with white oak (Quercus alba) and Northern red oak (Quercus rubra) as the dominant canopy species. Chestnut (Castanea dentata) was formerly a co-dominant, but is now insignificant due to chestnut blight. Other components of the potential natural vegetation would include other oaks, maples (Acer spp.), beech

(Fagus grandifolia), hickories (Carya spp.), and tulip tree (Liriodendron tulipfera). White pine (Pinus strobus) and Eastern hemlock (Tsuga canadensis) would occur in the northern parts of the region or, presumably, at higher elevations in the southern part of the region. Higher elevations in the Southern Appalachians would be dominated by Northern Hardwood forests (Acer, Betula, Fagus, and Tsuga), and the highest elevations would be dominated by the Southeastern Spruce-Fir forest (Picea and Abies). Disjunct "islands" of the Piedmong Oak-hickory-pine forest (Quercus, Carya, and Pinus) could also be expected in some areas of the Appalachian Oak Forest.

Braun (1974) attempted to reconstruct the original forest patterns of eastern North America prior to European colonization. The Oak-chestnut Forest region included most of the Ridge and Valley and Blue Ridge Provinces as well as portions of the Piedmont and Coastal Plain north of central Virginia. The climax forest included chestnut, red oak, chestnut oak, and tulip tree as frequent dominants with white oak as the physiographic climax. Mixed mesophytic cove forests were well developed, and altitudinal variations were frequent. The low elevation of the Asheville Basin and the Swannanoa Valley at the Warren Wilson site may have resulted in a higher frequency of shortleaf and pitch pine in the area. Also, an increase of white oak over chestnut with a well developed Vaccinium understory may have characterized the area. Braun noted that:

> This vegetation, so unlike that of the surrounding mountains, resembles that of the Great Valley to the west (Braun 1974: 206).

Penford discussed the contemporary vegetation of the Swannanoa Valley specifically (Penford n.d.: 15-17). At least four forest types exist in the middle elevations of the valley (from 2000-4500 feet). Variation in forest type is influenced by elevation, slope orientation, and the alternation of coves and ridges on major slopes. Moist sites, such as north-facing slopes, coves, and valley flats include elements of northern hardwood forests. Included species are beech, birch, buckeye (*Aesculus* sp.) and the sugar maple along with mesic species such as basswood (*Tilia* sp.), hemlock, silver bell (*Halesia* sp.), and tulip tree. Moderately moist sites presently include the major components of the Appalachian oak forest minus chestnut. Drier ridges and rock outcrop canopies are predominated by pitch pine (*Pinus rigida*), scrub or Virginia pine (*Pinus virginiana*), and scarlet oak (*Quercus coccinea*) while the river is fringed with river birch (*Betula nigra*) and an understory of tag alder (*Alnus serrulata*). Tulip poplar (*Liriodendron tulipfera*) is the most abundant tree in the valley except where native white pine (*Pinus strobus*) has been planted. Black walnut (*Juglans nigra*) is present in rich woods of the valley (Penford n.d.) and butternut (*Juglans cinerea*) is reported by Radford *et*. *al*. (1968) for Buncombe county.

Max White (1980) noted that the area occupied by the Cherokee Indians in the historic period included parts of three physiographic provinces (the Piedmont Plateau, the Ridge and Valley, and the Blue Ridge) in which seven forest types were represented. In general terms the seven forest types are associated with elevation differences as follows: Oak-Hickory (below 500 feet), Poplar-Oak (500-1000 feet), Oak-Chestnut (1500-2000 feet), Maple-Beech-Basswood (2500-3500 feet), Birch-Hemlock-Spruce (3500-4200 feet), Spruce-Fir (4500-6000 feet), and Heath Bald (above 6000 feet). White observed that nut and fruit-bearing trees were most abundant in the first three forest types at elevations below about 2500 feet; and that herbaceous plants are most abundant in and near river bottoms.

The Warren Wilson site, at about 2130 feet would therefore appear to have been well situated both in terms of edible plant resources and animals which would have fed upon them. Elevations within Buncombe county range from 1740 feet where the French Broad River leaves the county to 6419 feet at the summit of Potato Knob on the Buncombe-Yancey county line (Goldston et. al. 1954). Floral resources of many altitudinal zones would therefore have been available to the inhabitants of the Warren Wilson site although not without some effort. Sanford (1970) examined the Atlas of the Vascular Flora of the Carolinas by Radford et. al. (1965) and compiled a list of wild plants present in Buncombe County. The list indicates that at least 913 species in 121 families are present in the county. Since only a limited amount of field work had taken place, the list is undoubtedly a very conservative estimate of floral species aboriginally present in the county even though some of the listed plants are introduced species.

Average annual precipitation and temperatures are difficult to determine and vary widely within Buncombe county due to the great differences in elevation (Penford n.d.; Goldston et. al. 1954) and local topography. The frost-free season at Asheville, at an elevation of 2203 feet, averages 191 days (from April 9 to October 17) although killing frosts have occurred as early as October 3 and as late as May 10 for a frost-free interval of only 144 days. Maize requires at least 120 frost-free days of growth. At Black Mountain, at an elevation of 2395 feet, the average number of frost-free days is only 159 days (National Oceanic and Atmospheric Administration 1980). Ashevelle is only about eight miles west of the Warren Wilson site and Black Mountain is only about six miles east of the site. Average annual precipitation also appears to vary considerably with elevation and local topography. The Black Mountain and Asheville stations reported annual average precipitation of 38.77 and 38.28 inches respectively whereas the Swannanoa station, at an elevation of 2240 feet, reported 42.84 inches of precipitation based upon 35 years of record. No average annual temperature or frost-free interval were reported for the Swannanoa station (National Oceanic and Atmospheric Administration 1980).

This brief climatic summary indicates that projection of climatic trends any distance into the historic or prehistoric past are likely to be problematic. Reconstruction of floral associations, which are partially dependent upon climatic conditions, are even more likely to be imprecise or inaccurate when speaking of aboriginal situations along the Swannanoa River valley over the last 6000 years. Nevertheless, the Delcourts (1979) noted that oak, pine, hickory, and spruce were represented at Shady Valley at an elevation of 2700 feet in east Tennessee between 16,500 and 12,500 B.P. during late glacial times. Pigeon Marsh, at 2066 feet on Lookout Mountain in Georgia:

> contains a peak in Fagus grandifolia pollen of nearly 20% of the tree pollen at 10,000 BP...along with 50% Quercus, 10% Carya, over 5% Ostrya-Carya type, and several percent each of Liquidambar styraciflua, Fraxinus, Ulmus, Acer saccharum, Castanea, Tsuga, Betula, and Picea (Delcourt and Delcourt 1979: 98).

Such information suggests that the floral communities present in the Swannanoa Valley during the Archaic period occupation of the Warren Wilson site may not have been significantly different than the late prehistoric communities discussed by Shelford, Küchler, and Braun. Of course, such a suggestion is quite tentative and does not consider anthropogenic influences such as the intentional setting of fires in particular locales. Perhaps the greatest differences, if any existed, between Archaic period and late prehistoric plant communities of the Swannanoa Valley were represented more in elevational differences in plant communite placement rather than in absolute differences in ecosystemic structure.

Yarnell analyzed samples of wood charcoal from Pisgah features at the site and suggested that pine and oak were predominant in the site vicinity.

> Both the red and white oak groups are well represented. Beyond this, only hickory and chestnut were identified more than tentatively but surprisingly, only once each. Questionable identifications include locust and (or) honey locust, cherry, poplar, and birch, An unidentified diffuse porous wood is relatively abundant... (Yarnell 1976: 220).

Wood charcoal analysis therefore substantially agrees with the inferred vegetation of the late prehistoric period as discussed above.

Site Stratigraphy

One primary goal of the present study included the comparison of plant remains recovered from different functional categories of features within specific phases represented at the Warren Wilson site. Another goal was an overall comparison between the food plant remains recovered from the different phases represented at the site. A subsidiary goal was a comparison of the effectiveness of various methods of recovery of paleoethnobotanical remains.

Previously conducted artifactual analyses of lithics and ceramics recovered from Warren Wilson indicated a large number of archaeological phases were represented although many of these were poorly represented and unlikely to be indicated by features. Keel (1976: 171) indicated that the following projectile point types were represented at the site: Lecroy Bifurcated, Morrow Mountain I, Guilford Lanceolate, Savannah River

Stemmed, Otarre Stemmed, Swannanoa Stemmed, Plott Short-Stemmed, Pigeon Side-Notched, Haywood Triangular, Garden Creek Triangular, Pisgah Triangular, and Unclassified. The range of projectile point types therefore indicated that prehistoric occupation or visitation at 31Bn29 ranges from relatively early in the Archaic period to the Mississippian period if one can assume that all the lithic types represent primary deposition. In regard to ceramics, Keel (1976: 170) listed Swannanoa, Pigeon, Connestee, and Pisgah series as having been recovered from the site as well as several miscellaneous types. These miscellaneous types included wares from the Catawba, Dan River, PeeDee, Etowah, and Woodstock series. As such, it appeared that Indians had been present at the site from the early Woodland to the Mississippian periods based upon the ceramic evidence. The miscellaneous types were interpreted as representing "trade wares".

The stratigraphy of the Warren Wilson site has been discussed by both Keel (1976) and Dickens (1976). Zone A consists of the plow zone, which contains primarily Pisgah remains (circa 1000-1450 A.D.), but also some Connestee (circa 500 A.D.); Pigeon (circa 0 A.D.); and Swannanoa (circa 500 B.C.) ceramics. In addition, lithics from all phases present at the site have been recovered from the plow zone. The plow zone is generally dark in color and ranges from a little over a foot thick near the center of the site to only about a tenth of a foot deep along parts of the southern fringes of the site. Zone B is a yellowish-brown to tan-colored sandy loam, usually a little over one half foot thick which contains _in situ_ remains from the Swannanoa phase occupation of the site. Post holes, other features, and burials intrude into the Swannanoa phase soils from a once-intact Pisgah phase surface. No Connestee or Pigeon features have been identified as penetrating into the Swannanoa soil which directly underlies the plow zone (except in a few isolated areas where Pisgah midden has been preserved). Apparently, either no features were constructed by Middle Woodland peoples at the site or such features were very shallow and have been completely destroyed by modern plowing and erosion.

> Zone C, about 1 foot thick, was composed of brown sandy loam with some organic content. Within this stratum were the remains of the Savannah River phase, which included a number of irregular rock clusters and rock-lined pits. Intrusive features from the Pisgah phase occupation usually extend no deeper than Zone C. Zone D, a 1-foot-thick deposit of yellowish-brown clay loam, contained the cultural remains on the site. These consisted of scattered chipped stone artifacts of the Morrow Mountain phase. Below this, the soil graded from clay loam to clay films with an increase in weathered rock, presumably ancient river gravel. These clays and gravels, labeled Zones E, F, and G, were culturally sterile (Dickens 1976: 25).

In summary, the features from the Warren Wilson site that were analyzed in the present study all came from either Zones A, B, or C although individual features sometimes could not be assigned with certainty to one zone. Pisgah features intruded into both Zones B and C. Although intact Pisgah midden was present in scattered patches between Zones A and B at the site, midden *per se* was not analyzed for ethnobotanical remains. Swannanoa features, although primarily confined to Zone B, were occasionally observed within the plow zone when such features consisted of rock clusters presumably representing hearth remains. Occasionally, Swannanoa hearths intruded into Zone C and such features were usually presumed to be "pit hearths". Savannah River features (circa 2000 B.C.) were usually confined to the C horizon although pit hearths often intruded into Zone D. Lithic artifacts from Archaic archaeological phases not represented by features were encountered throughout Zones A-C with a weak tendency for the older materials to be encountered at deeper levels. All ceramic artifacts were primarily restricted to the plow zone with fewer occurrences in Zone B except for Swannanoa sherds which strongly predominated in Zone B, and which were the only ceramics to occur in Zone C outside of features.

In 1968, Keel (1976) collected two soil columns which were submitted to the Soils Department at North Carolina State University for analysis. Keel noted that the soil horizons and archaeological zones represent actual soil horizons rather than cultural middens. Whether the boundaries separating such soil horizons represent discontinuities as might be expected from episodes of erosion followed by deposition, or rather differential eluviation and deposition of organic and mineral inclusions, is unclear. The former possibility would indicate very good stratigraphic separation of Savannah River and Swannanoa features. If the different soil horizons are primarily due to leaching, however, the separation of Savannah River and Swannanoa features upon the basis of stratigraphic criteria alone may not be accurate. Most probably, the relatively dark color of the Savannah River Zone C is the consequence of some degree of organic enrichment by the Savannah River peoples.

Feature Typology Within Phases

At the outset of the present study, it was hoped that statistical comparisons of plant food uses during the various phases, as well as between different types of features within phases, could eventually be presented. Additionally, comparisons between the various plant recovery techniques utilized at the site were hoped for. All in all, these studies were inconclusive although some suggestions as to how such studies might be improved in the future are suggested. Two types of information were needed in order to conduct these analyses:

1) A compilation of formal and/or functional categories of features present at the site through time.

2) An inventory of the types of samples that were obtained from the features and which were suitable for paleoethnobotanical analysis.

The first step in an attempt to separate the Warren Wilson features into meaningful chronological and functional categories consisted of an examination of existing records including site catalogues, feature forms, yearly summaries, and published reports. Several difficulties were encountered. Primary among these was the wide variety of terms which had been applied to the various feature categories through the course of excavation and analysis. For example, three feature categories were assigned to the Morrow Mountain features, seven to the Savannah River features, fourteen to the Swannanoa features, and twenty-seven to the Pisgah features. Moreover, there were eight categories of "Archaic" features and thirty-five categories of features which were apparently either non-cultural in origin or were of ambiguous chronological provenience.

Many such terminological categories were quite similar as, for instance; "borrow pit", "small pit", "midden filled depression", "pit", and "small trash pit" all of the Pisgah phase. It became clear that reanalysis of feature designations used for particular pahses was needed in order to refine the proposed analysis of paleoethnobotanical remains between functional categories of features within phases. Similarly, it appeared prudent to make certain that "Archaic" features belonged to the Savannah River phase and that "Early ceramic" features referred to Swannanoa as opposed to Connestee or Pigeon features.

It should be stressed that the designation of feature function categories presented here is by no means definitive. Additional investigations will probably result in alternative categories especially since not all the attributes of features could be included in the present classification. Relevant factors which were not examined in the present study included re-analysis of artifact inclusions, spatial relationships between many of the features, and faunal content of the various features. The purpose here is not so much to definitively type the features according to function as to develop a provisional classification which can be examined in light of ethnobotanical remains. A few modifications of feature categories will be suggested in terms of observations made of such ethnobotanical remains. In general, more care was taken to ensure that chronological proveniences assigned to features were accurate than to determine the presumed emic function of such features. In some cases, features have been assigned to functional categories other than those originally proposed on feature forms, but in the great majority of cases the field supervisors' designations have been accepted or standardized. It would not be prudent to second guess the original designations or most features since first-hand examination of the feature itself, during excavation, certainly provided more information than could be derived through examination of records alone.

Several reasons why feature form or function designations varied can be suggested. First, the excavator often categorized the feature at the time of its excavation when information such as geographical placement in relation to other features was unknown. Many such interpretations are more easily made in the laboratory at a later date, as the site map expands and reveals overall relationships and details. Second, during excavation many features were designated by their form rather than their presumed function. This is generally preferrable to the false designation of feature function, but the proliferation of such designations in the site records led to difficulties in reducing feature form categories to a reasonably concise set of types at the outset of this study. With hindsight, it is clear that various designations of feature form were inevitable as different field supervisors worked at the site, and especially since different areas of the site vary in structure.

Several previous investigations had been partially concerned with assigning more consistent functional designations to the Warren Wilson features. Dickens (1976) had summarized the data on Pisgah features through number 154, and Ward (1980) re-examined the Pisgah features through number 246. Ward's Table 2 (1980: 107) summarized the Pisgah feature type frequencies within six functional categories. Ward also provided descriptions of such categories. Dickens (n.d.) examined 22 garbage-filled features from seven late prehistoric and historic aboriginal sites in the Southeast and assigned six Warren Wilson features to one of eight feature types.

The only previous report attempting to summarize feature function designations of Swannanoa and Savannah River features is Keel (1976: 174). Although I use Keel's categories, we often disagree about the cultural phase represented by individual features.

Pisgah Features

In the present study, the Pisgah features have been consolidated from twenty-seven to fifteen tentative categories. For a summary of the Pisgah features and their respective categories see Appendix I. Nine of the fifteen categories were excluded from the present analysis. These categories were:

1) House floor midden or structural posthole patterns,
2) House entry trenches,
3) Sweat houses,
4) Palisades,
5) Bell-shaped storage pits,
6) Midden,
7) Clay or ochre concentrations,
8) Burials without human bone, and
9) Spoil from burial pits.

Several of these categories could be expected to produce charred plant remains. House floor midden and general Pisgah midden are good examples. However, I wished to avoid analysis of plant remains incidental to architectural remains and to concentrate upon feature categories representing aboriginal excavation and refilling. This was because it was reasoned that vertical and horizontal controls pertaining to midden deposits would be less precise than those pertaining to features intentionally excavated by aboriginal inhabitants of the site. Samples from two of the bell-shaped storage pits had previously been analyzed by Yarnell (1976) and the third did not have an adequate sample for analysis. The single feature that is generally agreed to be a sweat house, feature 54, had no curated samples. The decision had been made to limit analyses to features rather than burials so categories eight and nine were also excluded from further examination. The clay or ochre concentrations were deemed to be very unlikely to produce good charcoal samples.

Six Pisgah feature categories were considered amenable to paleoethnobotanical analyses. These feature categories and their correspondence with the categories employed by Ward (1980) and Dickens (n.d.) are given below:

Ward (1980)	Dickens (n.d.)	Present Categories
Borrow Pit	Borrow Pit	Borrow Pit
Storage Pit	Storage Pit	Clay-Lined Storage Pit
Clay Hearth	Hearth and/or Cooking Pit	Clay Hearth
Pit Hearth	Cooking Pit	Pit Hearth
Roasting Pit	Ditch/Moat	Ditch/Moat
		Posthole Cluster

I agree with Ward that both clay-lined and bell-shaped storage pits are present at the site. Dickens worked at the site prior to the excavation of the four features proposed to be clay-lined storage pits. Dickens therefore noted only the bell-shaped storage pits. A formal category for Ward's "roasting pit" or the "ditch/moat" category used by Dickens and in this classification would be "Refuse accumulations in shallow depressions along the palisade lines".

Borrow pits (Figure Ia) are among the most common Pisgah features at the Warren Wilson site. Eighteen features were classified in this category. Of these, eleven were examined for charred plant remains content; four had no samples taken in the field or the samples could not be located; and three features had samples which were deemed unsuitable for analysis because they weighed less than half an ounce. The majority of borrow pits were located within houses. Most of the remaining examples were located along palisade lines. Borrow pits had circular to ovoid mouths of variable diameters and were rarely over a foot deep. They were unlined and usually contained few artifacts. Dickens (n.d.) proposed that clay excavated from such pits was used for construction and building repair. Ward (1980) suggested that excavated clay was used in the construction of hearths and feature linings. One problem with this functional interpretation for borrow pits is that clays are not particularly prevalent at the site above about three feet in depth, in the

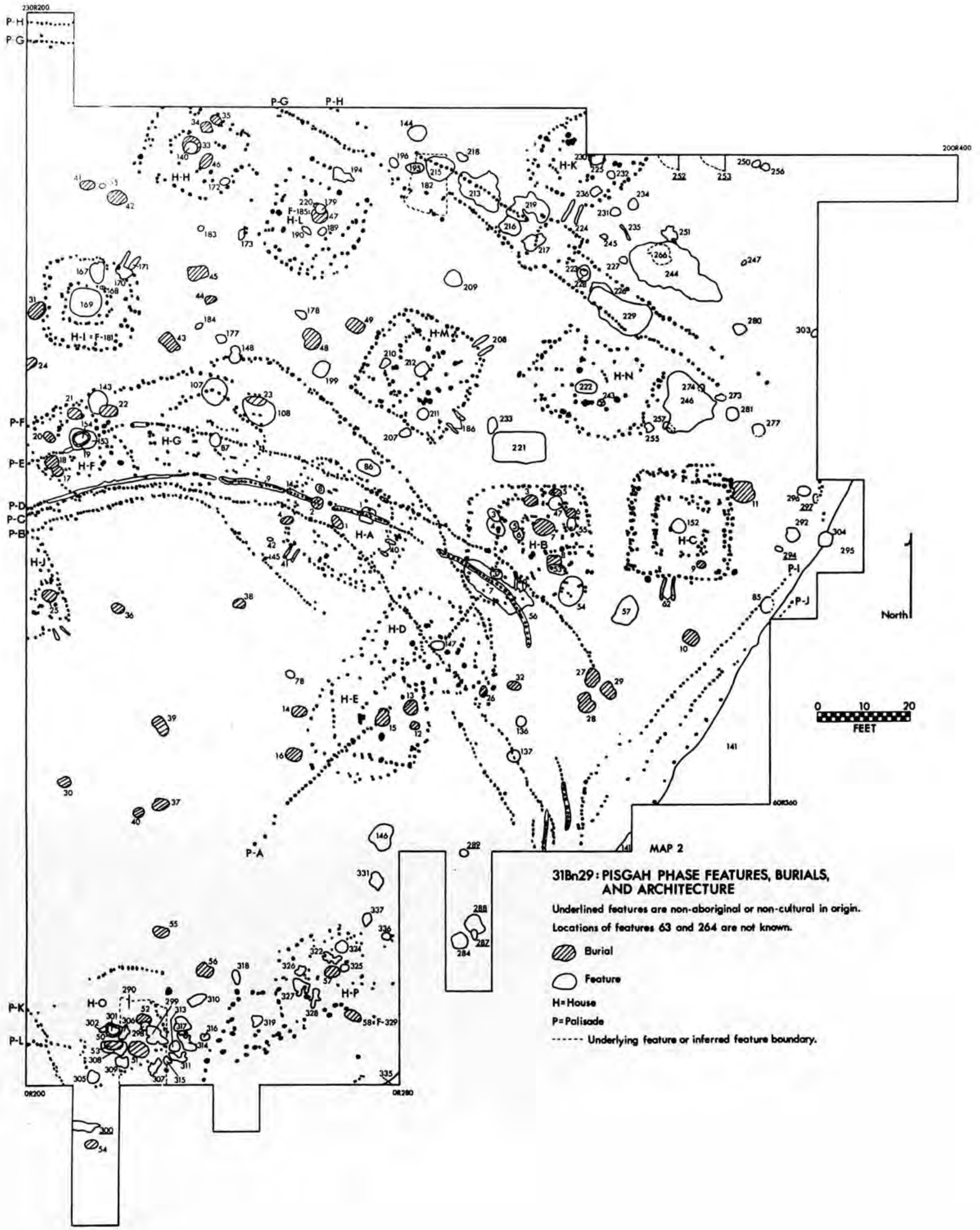
Figure Ia. Feature 78. Example of a Pisgah Borrow Pit.

Figure Ib. Feature 231. Example of a Pisgah Clay-Lined Storage Pit.

B2t horizon and below (cf. Keel 1976: 163). Nevertheless, the excavation of such features in order to obtain soil for construction purposes appears quite plausible, and the interpretation of such features as borrow pits is retained in this study.

Storage pits are rare at the Warren Wilson site. The seven features which are interpreted to have been storage pits can be divided into bell-shaped and clay-lined storage pits. Ward (n.d.) suggested that food storage was above ground on racks and further proposed that such storage techniques are characteristic of chiefdom as opposed to tribal social structure. Dickens (n.d.) suggested that nuts and hard seeds may have been stored in such pits and that above-ground cribs were used for the storage of maize and other vegetables. Moist soil may have provided an incentive for above-ground storage. Samples from two of the three bell-shaped pits were analyzed by Yarnell (1976) and the third did not have a large enough sample to warrant analysis. The two pits analyzed by Yarnell (Features 136 and 137) lay within five feet of each other in the vicinity of Palisade C (Map II). Feature 137 was intruded by the palisade. Both features were almost circular at the orifice with diameters of about three feet and a depth of about two feet. Sherds recovered from the two features articulated.

The four features interpreted as clay-lined storage pits (Figure Ib) were all located in the vicinity of House K. Features 232 and 236 were within the house and features 231 and 234 were just southeast of the house. House K itself was unique was unique in its location outside the double palisade G and H; and just northeast of an outward protrusion in the double palisade which might represent a bastion. All four features were shallow and less than one and a half foot in diameter with



MAP 2

31Bn29: PISGAH PHASE FEATURES, BURIALS, AND ARCHITECTURE

Underlined features are non-aboriginal or non-cultural in origin.

Locations of features 63 and 264 are not known.

Burial

Feature

H=House

P=Palisade

----- Underlying feature or inferred feature boundary.

generally circular orifices. An exception was feature 236 which had a rectangular orifice. Each feature was entirely lined with a thin layer or clay (Ward 1980). Ward described the fill as homogeneous with few included artifacts.

Eighteen features were classified as Pisgah clay hearths (Figure IIa). Seven of these were examined in the present study. No samples were taken in the field from six features. Four of the features were unsuitable for analysis due to small sample size or because such samples were taken from fired clay collars which were deemed unsuitable for flotation. One clay hearth, feature 140, had been analyzed by Yarnell at an earlier date (Yarnell 1976). Clay hearths appear to represent the central hearths of houses. Ward (1980) suggested that the few examples of such features which were not associated with house floors may indicate the locations of houses which could not otherwise be detected archaeologically. These features were usually less than one half foot deep and less than three feet in diameter with circular orifices. The basins were often deepened through the construction of a clay collar around the perimeter. Such clay collars were indurated by the fires within the hearths. In several cases, where burials were located in the center of houses, clay hearths intruded into the burial pit fill. Artifact densities in clay hearths were very low. Ward (1980) suggested that the hearths were periodically cleaned and their contents were deposited in secondary context. Dickens (n.d.) called such features "hearths and/or cooking pits", and noted that some were lined with rocks rather than burned clay.

Pit hearths (Figure IIb) were represented by twenty-three features. Nineteen of these were examined in the present study. In addition, Yarnell (1976) analyzed one of these features and Sanford (1970) analyzed

Figure IIa. Feature 179. Example of a Pisgah Clay Hearth.

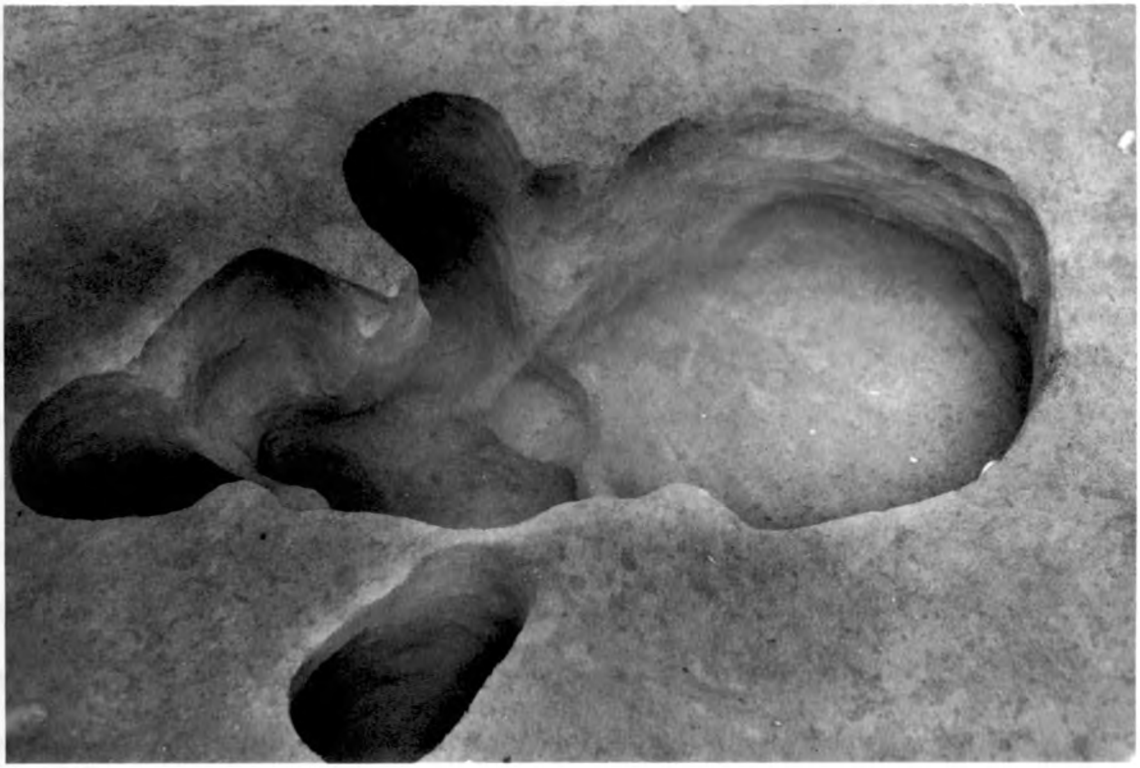
Figure IIb. Feature 167. Example of a Pisgah Pit Hearth.

two. One pit hearth, feature 144, was not represented by a large enough sample to warrant analysis. Pit hearths comprise one of the most variable feature categories at the Warren Wilson site. Pit hearths were referred to by Dickens (n.d.) as cooking pits. He described them as being from about three to six feet in diameter and less than two feet in depth with straight sides and basin-shaped profiles. Burned areas and/or concentrations of fire-cracked rock were usually present. Ward (1980) also noted that indications of postholes were often associated with the perimeter of such features. Although several pit hearths were located near structures, others were associated with palisade lines. In general, however, pit hearths were more randomly distributed over the site than other Pisgah feature category examined in this study. Artifact densities in the features was variable. It would appear, from an examination of feature forms, that the term "pit hearth" was often associated with features having the general morphology of the category even when indications of fire were not readily apparent. Several pit hearths were described as possibly representing the remains of sweat houses (especially 167) although only feature 54 at the site was definitely placed in the category by the field supervisor.

The feature category referred to as a "ditch/moat" (Figure IIIa) was termed a "roasting pit" by Ward (1980) although that functional interpretation is no longer accepted by the author (Ward, Personal Communication 1983). A good description of such features might be "refuse accumulations in large, shallow depressions along palisade lines". Dickens (n.d.) suggested that the depressions resulted from the excavation of clay to be used in the daubing of the palisade. Several examined samples in this study contained particles of what appeared to be

Figure IIIa. Feature 246. Example of a Pisgah Ditch/Moat.

Figure IIIb. Feature 243. Example of a Pisgah Posthole Cluster.



unfired "daubed clay" which might support such an interpretation. The presence of moats at some large Mississippian ceremonial centers might be related to the connection of such depressions along segments of a palisade line. Ward (1980) found that ceramic and bone concentrations in these features was very high and suggested that they were used as secondary refuse deposits. Paleoethnobotanical remains also seem to be most concentrated in the depressions along the palisade lines thereby lending support to Ward's (1980) suggestion. Several of the refuse accumulations measured over fifteen feet long and nearly as wide. Depth was less than three feet at the center of these large, basin-shaped depressions. Fill ranged from relatively homogeneous in features 316, 217, and 219 to highly stratified and lensed in feature 229. Similarly, artifact and garbage concentrations appear to have ranged from low to very high. Nine features at Warren Wilson can be classified as ditches/moats. Samples from six of these features were analyzed in the present study. One feature (226) did not have samples available for study, and one feature (219) did not have a sufficiently large sample. Feature 7 had previously been analyzed by Yarnell (1976).

Eleven features were classified as posthole clusters (Figure IIIb). Five of these were analyzed in the present study, two had no samples, and four had samples that were too small for analysis. Posthole clusters are not an especially well-defined feature category although in their most apparent form they can be described as probably representing the locations of interior support posts of houses which were replaced or reinforced over a period of time (cf. Moore 1979). In several cases, excavators initially described features as pits and upon excavation it was noted that numerous posts had apparently penetrated the bottoms of the features. Rocks, perhaps used as chinking, were often present in these features. Neither Ward (1980) or Dickens (n.d.) included such features in their feature categories, but rather, they placed them in the category of postholes. However, there appears to be a similarity between some features classified as borrow pits and some of the features described as posthole clusters. The majority of the features designated as posthole clusters were located on the southern portion of the site where house floor patterns were not as easy to discern as in the central portion of the site. Any houses present in this area would have been on the opposite side of the plaza area from the primary cluster of houses indicated on Map II. The indistinct nature of house patterns in the southern portion of the site could be due to several factors including greater plow disturbance or greater age. Posthole clusters were included in the present analysis in an attempt to clarify the feature category and perhaps to compare it with the borrow pit category. It was also considered possible that an analysis of plant remains from such features might provide clues as to the formation processes responsible for the feature form. Although posthole clusters might best be considered as architectural remains, and such remains were previously stated to be outside the scope of the present study; their actual function is considered sufficiently ambiguous to warrant consideration here.

In summary, fifty-two Pisgah features from six tentative functional classes were examined in the present study (see Appendix I).

Swannanoa Features

Four functional classes of Swannanoa features appear to occur in the excavated sample from Warren Wilson. There were two possible Swannanoa phase postholes (Features 18 and 19); a single cache of chipped stone tools and a sharpening stone (Feature 214); thirty-five Swannanos rock clusters assumed to represent hearth remnants; and eight "pit hearths" of Swannanoa provenience. The possible postholes and cache were excluded from analysis. Thirteen rock cluster hearths and six pit hearths were included in the present study. The portion of the Swannanoa level which was preserved at the site was relatively undisturbed except for Pisgah period intrusions and bioturbation by roots, insects, and rodents. It is not possible to say how much of the Swannanoa phase soils was removed through plowing, but once the plow zone and plow scars were removed, the remaining Swannanoa soils (Zone B) contained numerous *in situ* artifacts and features. The majority of artifacts were ceramic and steatite sherds, projectile points, fire-cracked rock, stone gorgets, grooved axes, celts, metates, manos, bell-shaped pestles, tubular smoking pipes, and flake scrapers (Keel 1976). In addition, the Swannanoa level displayed large areas of very mottled soils which might indicate cultural activity although these mottled soils were usually impossible to define in any precise manner.

The Swannanoa rock clusters (Figure IVa) usually consisted of large areas of fire-cracked and fire clouded river cobbles as well as intact cobbles. Such features were often scattered over wide areas as though the rocks had been disturbed. However, a central core of rock was necessary in order to assign a feature number to these presumed hearth remains. Diameters of rock cluster hearths, although difficult to determine due to scattering, ranged from a few feet to about eight feet. Rocks were usually piled several deep, and the number of rocks and fragments

Figure IVa. Feature 129. Example of a Swannanoa Rock Cluster Hearth.

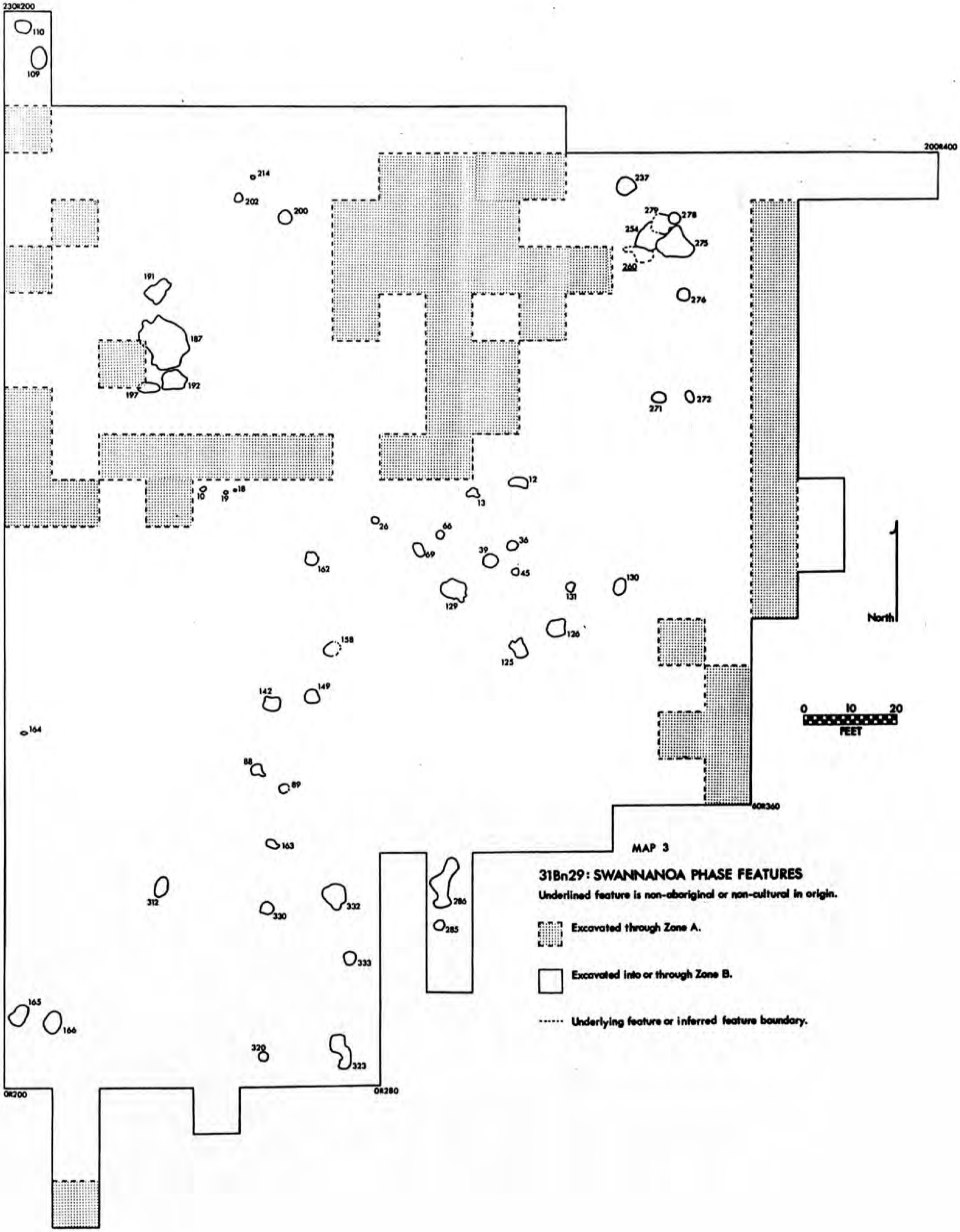
Figure IVb. Feature 285. Example of a Swannanoa Pit Hearth.

present varied from less than twenty to several hundred. Since these features were not concentrated in depressions it was often difficult to obtain soil samples that could be positively identified as being associated with the hearths. As a consequence, twenty-one such features either had no samples suitable for plant content analysis or such samples were too small to be considered eligible for analysis.

> In the cases where no pit was present as in the Swannanoa hearths the sample was taken from among the rocks in as centrally located a position as possible. Charcoal samples were taken directly from the hearths or pits whenever possible. In some cases, again primarily the Swannanoa hearths, there were no charcoal concentrations. In this situation as mush was gathered directly from the hearth as possible. The remainder was often, however, taken from the washing (Loftfield n.d.; unnumbered, but 13).

Swannanoa phase artifacts were relatively common among the rocks comprising the features.

Swannanoa pit hearths (Figure IVb) were usually rather small and shallow, and roughly circular to ovoid at the orifice. Orifice diameter was usually about two feet, and depth was usually about one-half foot. Some rocks were usually present in the fill although this was not always the case. The presence of a pit was determined by the darker color of the soil in relation to the orange-tan soil of the Swannanoa level. Pit outlines and profiles were not clearly defined and digging tool marks were not observed. Swannanoa period artifacts were occasionally associated with the fill. The artifacts as well as the level in which the features were encountered suggested their association with the Swannanoa phase occupation of the site. Charcoal was abundant in a few of the features and nearly absent in others. The presence of charcoal and fire-cracked rock in many of these features suggest they were hearths. The defining character of pits associated with these features provide good context for the analyzed samples.



MAP 3

31Bn29: SWANNANOA PHASE FEATURES

The Swannanoa occupation at the Warren Wilson site appears to have been intensive and periodic. No definite architectural remains have been located at the site although mottled soils and high artifact concentrations give the appearance of "living floors". Map III indicates the distribution of Swannanoa features.

Savannah River Features

Six classes of Savannah River phase features are apparently present in the Warren Wilson sample. Two of these categories, charcoal concentrations (Features 90 and 91) and a single "large rock" (Feature 270), can not be given functional designations although the large rock would seem to be a manuport. The four proposed functional categories of features are rock clusters (presumed to be hearth remains), pit hearths, and a single projectile point cache (Feature 15), and two possible burial pits (Features 102 and 282) which contained no preserved bone. Rock cluster hearths were represented by 64 features of which eleven were deemed suitable for analysis. Pit hearths were represented by 53 features of which 34 were considered suitable for analysis.

The rock cluster hearths (Figure Va) and pit hearths (Figure Vb) varied little from each other in size and shape. The primary distinction between the two was that pits were indicated in the latter category by either soil stains or rock alignments. As with the Swannanoa features, samples amenable to analysis were more easily and with more certainty of context from the pit hearths than from the rock clusters. It can probably be expected that the two feature categories overlap to some extent. That is; pits were often not very distinctive and some may not have been

Figure Va. Feature 48. Example of a Savannah River Rock Cluster Hearth.

Figure Vb. Feature 44. Example of a Savannah River Pit Hearth.
Note the zone designations in the profile.


A
B
C

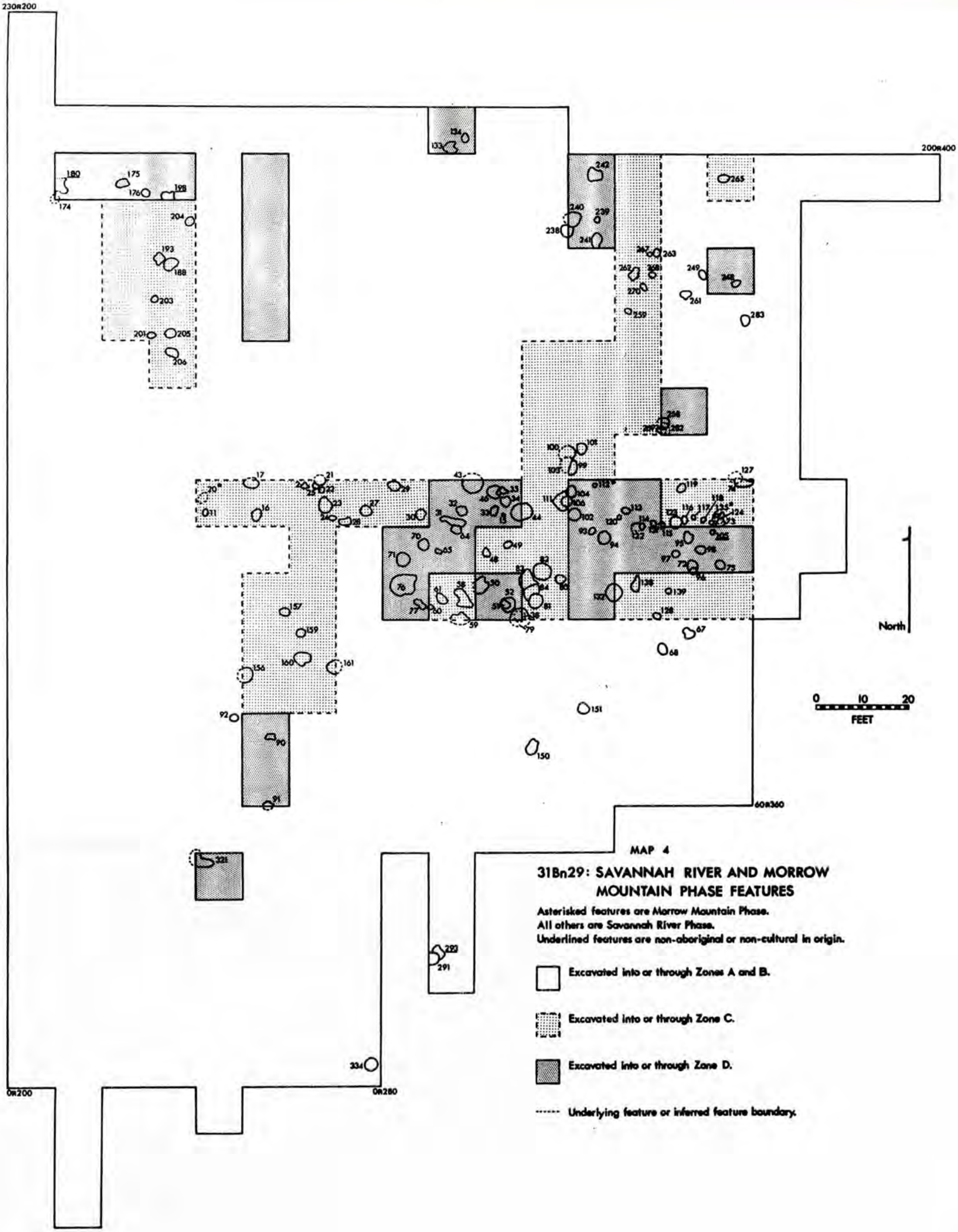
noticed at all. Conversely, rock clusters often contained several tiers of rock piled on top of each other. If any organic inclusions were retained in the feature, the excavator could have interpreted the darker soil around the rocks as pit fill. It could be questioned whether any of the Savannah River hearths were actually constructed on top of the living surface and not placed in some sort of pit. The primary observation supporting such an argument is the compact and nearly intact appearance of most Savannah River phase hearths and the general similarity in their size, although some rock cluster hearths consist of only a few rocks. Hearths constructed directly on a living floor would be expected to be more scattered than appears to be the case for most of the features designated as rock cluster hearths. Keel (1976) apparently did not recognize non-pit hearth categories in either the Swannanoa or Savannah River levels. In fact, Keel seemed to feel that there is little distinction between the hearths of the two periods other than stratigraphy and artifact content:

> Both groups of hearths were the rock-filled pits. Features 12 and 160 are illustrated (Plates 30, 31) to show the general appearance of this hearth type. As a class the hearths ranged in size from 5.7 X 3.7 X 1.1 feet to 1.5 X 1.4 X 0.4 feet. The mean size was about 3.0 X 2.2 X 0.4 feet, which also closely approximated the median of 3.0 X 2.2 X 0.4 feet. The rocks used to fill the pits were local river cobbles of schists and quartzite. Many were fire-cracked and heat-spalled. The sparse amount of bone recovered from these features was either calcined or very poorly preserved. Charcoal was abundant in some hearths but virtually absent in others (Keel 1976: 175).

Keel provided two radiocarbon dates for Savannah River phase hearths. Feature 31, containing a Savannah River Stemmed projectile point, was dated at 4865+/- 280 years, or 2915 B.C. Feature 34, containing two hammerstones and a pestle, was dated at 3515+/- 140 years or 1565 B.C. Oliver (1981) gave recalibrated dates of 3560 B.C. and 1820 B.C. respectively. Oliver further suggested a probable separation of the Savannah River occupation into an early and late phase. The early phase is characterized by "classic" Savannah River Stemmed points, full-grooved ground stone axes, and a general absence of steatite vessels. The late Savannah River phase is marked by the presence of Small Savannah River Stemmed points and the use of steatite vessels (Oliver 1981).

The Savannah River period occupation at the Warren Wilson site seems to have been sporadic over a long span of time. It is very difficult to surmise how many hearths may have been in use at any one time. Therefore, it is virtually impossible to suggest what sorts of social groups may have occupied the site. The intact structure of most of the Savannah River features does suggest that they were used for short spans of time and were subsequently abandoned without re-use. However, there was some overlap of the features suggesting re-use of the same locus. Map IV shows the distribution of Savannah River features at the site.

Three features (20, 112, and 135) appear to represent the Morrow Mountain phase (circa 5000 B.C.) in that they were located in Zone D. The rock clusters contained four, four, and three rocks respectively and perhaps represent hearth remains. The rocks in both features 112 and 135 were a coarse red sandstone described as "brick-like" on the feature forms. In addition, feature 112 contained chips described as brick red and heavily patinated although it is unclear whether the material was the same as that of the stones comprising the clusters. The rocks comprising feature 20 were scattered over an area about six feet in diameter while those in feature 112 were concentrated in an area less than one foot in diameter. The rocks comprising feature 135 were concentrated in an area about one and a half foot in diameter. Feature 112 was partially surrounded by dark soil to a depth of about one half foot which may have indi-



MAP 4

31Bn29: SAVANNAH RIVER AND MORROW MOUNTAIN PHASE FEATURES cated the presence of a small pit. None of these features provided material suitable for charcoal analysis.

The remaining features, from among the first three hundred excavated at the site, included one for which no information could be located (Feature 63); fifteen which were apparently non-cultural in origin; and two features (141 and 295) which represent overbank midden. This last category consisted of features with reversed stratigraphy resulting from plowed soil pushed over the edge of the site onto the banks of the Swannanoa River. Feature 141 was analyzed for plant remains by Sanford (1970) and a small sample from feature 295 was examined in this study. Appendix I provides a summary of all features excavated at 31Bn29 by the end of the 1982 field season.

Sample Categories

In addition to the difficulties encountered in attempting to classify features in formal and functional categories, there was an additional problem in determining the types of samples available from these features.

During most of the period that materials recovered from the site were catalogued, no volumes or weights were used to describe quantities of non-artifactual remains. The great majority of soil samples, washings samples, ethnobotanical samples, and flotation samples from the site were quantified merely by numbers of bags. Examination of actual samples quickly revealed that "one bag" might refer to a miniscule sample or one of many pounds in weight. A further difficulty lay in the fact that individual cataloguers often designated soil samples, washings, flotation samples , and individually recovered charred botanical specimens all under the general category of ethnobotanical (eb) remains. It was impossible to determine what type of sample was actually curated without actual inspection. As a consequence of these uncertainties, an attempt to select a sample of features prior to examination of the actual curated materials was abandoned. Instead, the decision was made to examine all possible samples from the first three hundred features excated at the site, and to refine chronological and functional categories during the sample examination period. The choice of the first three hundred features was made for several reasons. First, excavation was continuing each summer at the site and it was clear that numerous features would be added to the site inventory before analysis could be completed. Second, three hundred features appeared to be an adequate, if not overly adequate, sample of the features at the site. Third, my own field supervision at the site began with the unexcavated portion of feature number 299. David Moore had assigned this feature number the preceeding season. Feature numbers 300 through 309 had also been assigned by Moore in 1979, and the first number I actually assigned was number 310. However, I was familiar with the 1979 excavation, and David Moore had helped me assign feature designations to most of the features excavated in 1980. Therefore, it seemed that feature number 300 constituted a fairly good separation between those features with which I was relatively familiar in the field and those which I knew only through excavation records. It therefore seemed adviseable to limit my analysis to those features for which I had little pre-conceived (or perhaps biased) notion of function or chronological designation. It also seemed adviseable to leave some features wholly unanalyzed in order to provide future ethnobotanical researchers with unmodified samples.

Many of the first three hundred features from the site were deleted from further consideration because they either had no ethnobotanically analyzeable samples recovered, or such samples were so small as to render analysis inefficient. In general, any feature with less than one-half ounce of soil sample or washings was excluded from analysis except when flotation samples and individually recovered charcoal concentrations were present. The latter two categories were often analyzed when they weighed less than one-half ounce. Other features were deleted from further analysis because they were non-cultural in origin even though some such features had associated midden concentrations.

A total of 120 of the first 300 features excavated at the Warren Wilson site were partially analyzed in terms of their carbonized plant food remains. A summary of the chronological placement and hypothetical function of all features at the site is presented in Appendix I.

The primary consideration in choosing a sample for analysis from a particular feature was maximization of plant diversity. Clean charcoal samples which appeared to have been processed by flotation techniques were given first precedence. Soil samples were chosen in preference to washings except when the soil samples were very small or clayey. In most cases only a portion of a soil sample was floated so that later investigators interested in pursuing other studies related to soils would have available samples. In cases where a feature had multiple soil or washings samples, the sample which appeared richest in organic content and/or charcoal was selected over those which appeared high in clay content or otherwise poor in charcoal content. As with soil samples, washings samples which appeared rich in charcoal were chosen over those which appeared poor in charcoal content. Many samples designated as washings were so rich in charcoal content that they probably consisted primarily of charcoal skimmed from the surface of the water used to wash away the dirt medium. The distinction between washings and flotation samples was often not clear from the catalogue information, bag labels, or excavation records. The primary processing distinction between flotation and water screening was that the flotation samples consisted of charcoal skimmed from the surface of the water immersion bath with an implement such as a tea strainer whereas washings consisted of the remainder of soil samples left in a window screen size (1/16th inch) mesh after being dipped and swirled in a water bath. Washings were consequently richer in small pebbles and sand than were flotation samples. It should be noted that very little, if any, of the water screening conducted at the Warren Wilson site appeared to be of the forced water variety as when water is pumped onto a sluice table containing soil samples. Nevertheless, the friction and mechanical shock resulting from hand swirling the soil samples in window screen is undoubtedly much more destructive of carbonized plant remains, and particularly seeds, than is flotation. In the laboratory it was not always possible to reconstruct whether water-screening of charcoal-rich, loamy soil samples or flotation had been employed. Such samples, when analyzed, were considered to be flotation samples. A distinction was made in the laboratory between clean and dirty charcoal samples. Both were assumed to be field flotation samples, but the latter category required an additional flotation in order to obtain a sample clean enough for microscopic analysis. Both clean and dirty charcoal samples often may have been derived from individually excavated charcoal concentrations rather than through the processing of a general soil matrix.

The choices of samples may not have been the best in terms of maximization of the number of plant categories identified. As can be seen in Appendix II, the majority of plant identifications were made from refloated washings samples. Further attempts to recover ethnobotanic samples from the site's curated materials would probably be best rewarded by a concentration upon washing samples. This is not to say that water-screening is the optimal technique for recovering plant remains; but rather that, overall, water-screening appears to have been more effectively employed at the site than was flotation. Moreover, the soil samples recovered from the site are generally too small to reward flotation and may be more useful for other types of analyses.

It should be stressed that only a minute fraction of the potentially analyzeable materials from the site have thus far been examined for ethnobotanic remains. Only portions of many samples were examined in the present study. Moreover, many features have multiple samples, and only one was examined in the present study. An extreme example is feature 229 which has approximately 200 samples of washings, soil samples, and individually recovered ethnobotanic remains.

Flotation Methodology

Laboratory flotation was conducted on all samples except clean charcoal samples derived through field flotation. The laboratory flotation technique utilized in the present study was very similar to the simple hand system described by Helbaek:

> This process... is carried out by drying the soil or ash sample and then pouring it into a basin with water. Under cautious stirring, the

> water is slowly poured through a fine mesh sieve, the plant matter floating on the surface and being retained in the sieve. When the mineral matter approaches the lip of the basin, the process is stopped and the sediment, as circumstances indicate, either thrown away, or dried again and subjected to other kinds of examination. After drying in shade, the plant material is ready for the microscope (Helbaek 1969: in Watson 1976: 80).

The samples used in the present study were considered sufficiently dry to preclude the necessity of additional drying. Volumes and weights of samples were recorded prior to the addition of water to the samples within a five gallon bucket. The sieve used was a standard geological screen with a mesh size of .7 millimeters. The plant matter referred to by Helbaek in his description consisted of charred plant remains or recent organic contaminants in the present study, and was referred to as the "light fraction". The swirling and pouring process was repeated as necessary until the charcoal content of the sample was nearly depleted. The light fraction was removed from the .7 millimeter screen by smartly tapping the edge of the screen against a block of wood and allowing the screen contents to fall on several sheets of paper towel overlying newspaper. Any material remaining in the screen was removed onto the paper towels by directing a light spray of water, from a bottle equipped with an atomizer, onto the back of the screen as it was held over the paper towels. The light fraction was then wrapped in the paper towels and newspaper, taped, and labeled. A similar process was completed with the remaining mineral-rich sample or heavy fraction. In most cases the heavy fraction was reduced in volume by water screening away the majority of the soil as it lay in the screen so as to facilitate drying. In some cases, when the heavy fraction consisted almost entirely of soil which was washed away in the screen, or of sterile gravel or sand, the heavy fraction was simply discarded. Otherwise, it was wrapped in paper towels and newspapers as was the light fraction.

The samples were next placed upon a drying rack through which air was gently circulated by a fan. After several days they were dry enough to remove from the drying rack but were allowed to thoroughly dry over a period of several weeks before analysis of charcoal content began. Only the light fractions were utilized in the analysis. Heavy fractions were returned to storage in their paper towel and newspaper wrappings.

Analysis Techniques

The analysis techniques used were those developed by Richard A. Yarnell and his students over a period of years. These techniques, as described by Yarnell (1974b), were only slightly modified in the present study. The analysis process was standard for each feature.

The light fraction was weighed in its wrapper. It was then unwrapped and its contents were poured into a stacked set of two screens with a pan beneath. The wrapping paper was then weighed and that weight was subtracted from the total weight to compute the sample weight prior to screening and examination. The upper screen mesh size was 2.00 millimeters (200 microns) and the lower screen mesh size was .707 millimeters (707 microns). Additional screens are sometimes used by Yarnell and his students in order to facilitate microscope work. That is, refocusing can be reduced if the sub-samples are all about the same diameter. However, the light fraction samples examined in the present study were mostly rather small and the slight inconvenience of examining charred remains of unequal diameter was compensated for by having fewer sub-sample containers to label and manipulate. Once the sample had been poured into the stacked screens, the sides and bottom of the top screen were gently tapped with a pen in order to facilitate the sifting process. When the material in the 2.00 mm. screen was sufficiently sorted it was removed from the screen, weighed, and placed in a container of appropriate volume. The process was then duplicated with the .707 mm. screen. The pan contents were gently brushed into a container after being weighed in a tared receptacle. The primary purpose for separating samples into fractions of roughly equal size is so that identified individual components from the larger diameter fraction can be extrapolated to the entire sample through a calculation process discussed below.

Once the sample had been separated into weighed fractions; examination, sorting, and identification began. All materials were examined under a dissecting microscope at magnifications ranging from 7X to 30X. The entire sample fraction recovered in the 2.00 millimeter screen were sorted into one of several categories.

All uncarbonized plant material, and animal remains such as insect fragments, was considered to be modern contamination and was placed in a category of "modern organic". This category therefore included all non-carbonized seeds. Although a tabulation of such seeds may have been useful in identifying possible misidentifications of seeds thought to be carbonized, no such tabulation was kept. For instance, in a few of the Savannah River phase features at the site, carbonized *Chenopodium* sp. seeds are reported. Although care was taken to ensure that any *Chenopodium* seeds recovered were actually carbonized (by breaking them and examining the interiors); it was often difficult to be certain in regard to carbonization. If a record of the number of uncarbonized *Chenopodium* seeds present in the sample had been retained, a stronger case for either accepting or rejecting a claim of chenopodium at the site during the Savannah River phase could be made. Unfortunately, this was not considered until after the modern organic components of the features had been weighed and discarded. At any rate, one is left skeptical about the presence of chenopodium at the site during the Late Archaic period since so few seeds were recovered. Since the weight of uncarbonized plant material present in a sample provides hints as to depth below surface that a feature was encountered and possible contamination from aboveground sources, this quantity is reported for all features.

The wood category includes bark and occasional galls, buds, and sap as well as xylem and phloem. Pine bark and cane (presumably Arundinaria sp.) were sufficiently distinct to be reported separately. In his analysis of charred plant remains from the Warren Wilson site Yarnell reported that:

> The bulk of the unidentified material from Feature 7, approximately 3 grams, has somewhat the appearance of thick, fleshy leaf. It is composed of a multitude of long cylindrical cells between thin epidermal layers. This material occurs also in the other features, especially in Features 57 and 140 (Yarnell 1976: 223).

The majority of specimens reported here as "pine bark" resemble Yarnell's description. The material referred to as "sycamore bark" made up virtually the entire sample in Feature 148, a Pisgah pit hearth. The identification of this material as sycamore is based upon its general appearance even though sycamore is not particularly common in the North Carolina mountains.

The rock and soil category is essentially self-explanatory except for a few cases where the soil may be indicative of unfired clay or caulking as, for instance, in some of the shallow depressions along the palisade line.

Artifacts such as sherds and flakes were reported separately. In some cases it was not possible to distinguish between sherds, daub, fired clay from hearths, and unfired dirt or clay caulking.

The animal bone category includes teeth and tooth enamel as well as occasional fish scales. Although no definite human bone or tooth fragments were observed, some long bone fragments could conceivably have been of human origin.

A tentative category of "fungus" was created to incorporate carbonized materials that resemble fungus although it may not actually be such. The material described as fungus had one face consisting of an epidermal-like structure. The opposite face consisted of bared cell-like structure. The individual "cells" were too large to be such in an anatomical sense. The short and squat cells somewhat resembled honeycomb although not actually hexagonal in outline. A single example of another type of material which was placed in the fungus category was recovered from feature 199. This specimen resembled a very small puffbal such as Lycoperdon sp.

All reported nut remains, including acorns, consisted of shell fragments. No nut meat was observed in any of the samples.

Maize (Zea mays) was always separated into cupules and kernel fragments. The two categories of maize remains are somewhat different in that only kernels represent actual plant food remains. Cob fragments are included in the cupule category.

The unidentified category refers strictly to non-seed unidentified charcoal. Unidentified charred seeds are listed as such (Appendix III). All other categories reported in the sample fractions larger than 2.00 millimeters are self-explanatory.

Once the 2.00 millimeter and larger materials had been completely sorted into components, the sample fraction with sizes ranging between .707 and 2.00 millimeters was examined under the microscope. In this case, however, only unidentified plant remains, carbonized seeds, and identifiable components not present in the larger sample fraction were separated from the sample. For computation and recording purposes, newly identified (non-seed) sample components from the fraction less than 2.00 mm. were treated as though they had been recovered from the sample fraction larger than 2.00 millimeters. The remainder of the original sample, which had passed through the .707 millimeter screen and was caught in the underlying pan, was also examined. Only carbonized seeds were removed from the matrix of material comprising the pan sample.

No attempt was made to identify the types of wood present in the analyzed sample beyond noting the presence of what appeared to be pine and sycamore bark. Seeds were identified using two standard texts (Martin and Barkley, 1961; and Montgomery, 1977) and a heavy reliance upon the expertise of Richard A. Yarnell. Yarnell also confirmed the identification of many of the nut remains although most of the nut remains identifications, as well as the provisional seed categories, are my own. I never felt completely secure about my ability to distinguish between black walnut (Juglans nigra) and butternut (Juglans cinerea). Yarnell was not asked to check all the Juglans spp. identifications. Yarnell also made the identifications of Lagenaria sp. and Cucurbita sp. rind from among my unidentified sample components.

The location of the Warren Wilson samples analyzed by Yarnell (1976) was not determined until after all other analyses had been completed. Appendix VIII contains information pertaining to a re-examination of

Yarnell's unidentified seeds.

Extrapolation Calculations

Once the microscopic examination of the light fraction from a sampled feature had been completed, a standardized procedure was followed in order to derive the weights reported in Appendix II. All categories of remains recovered in the fraction larger than 2.00 millimeters, except seeds and unidentified plant remains, were weighed to the nearest hundredth gram. Next, all seeds from the entire sample were weighed and then separated into biological classes or provisional categories. Counts of individual seed categories were recorded although weights were not. The seed counts reflected, where possible, numbers of intact and/or partial remains from each category as well as an estimate of minimum number of seeds actually represented by the combination of intact and fragmentary seeds. The unidentified remains from the entire sample larger than .707 millimeters were pooled and weighed together.

The weights of the remainder of the sample fraction between .707 and and 2.00 millimeters and the remaining fraction smaller than .707 millimeters were recorded. At this stage, a total of all recorded weights was computed and checked against the weight of the entire light fraction prior to screening. If the two totals were reasonably close in value, the remaining pan sample was discarded and did not enter into any further computations. Usually, the sample weights before and after screening and examination did not correspond exactly. Any of a number of factors such as loss during examination, differential humidities, and normal variance of the scale could have contributed to the recorded weight differences. If the weights agreed within a percentage point everything was assumed to be in order. If not, the samples were re-weighed. A few truly aberrant weight differences were resolved by allowing the electronic scale to warm up a bit longer. For all further computation purposes, the sample weight after, as opposed to before screening and examination, was used. The weight categories comprising the total sample weight before extrapolation therefore consisted of:

1) All the individual components of the sub-sample larger than 2.00 millimeters.

2) Combined seed weights from the entire sample.

3) Unidentified (non-seed) charred plant remains larger than .707 millimeters.

4) The weight of the sample between .707 and 2.00 millimeters after seeds and unidentified charred plant remains had been removed.

The next step in the computation process involved the derivation of extrapolated component weights for the entire examined sample larger than .707 millimeters from the weights of the sorted components larger than 2.00 millimeters. Since seeds and unidentified charred plant material had already been removed from all the sample, the value given for them in Appendix II is their actual as opposed to extrapolated value. The following ratio illustrates the basis of the computation procedure:

$$\frac{a}{(b-c)} = \frac{d}{(e-f)}$$

where "a" is the weight of component "x" in the fraction larger than 2.00 millimeters; "b" is the weight of the entire fraction larger than 2.00 millimeters; "c" is the weight of seeds and unidentified materials larger than 2.00 millimeters; "d" is the weight of component "x" larger than .707 millimeters; "e" is the weight of the entire fraction larger than .707 millimeters; and "f" is the weight of seeds and unidentified materials larger than .707 millimeters. Therefore:

$$d = \frac{(a)(e-f)}{(b-c)} .$$

The weight of each component "x" was calculated according to the second equation. Total sample weight could then be checked against the pre-extrapolation total by noting that:

Total Sample Weight before Extrapolation = g + h + i

where "g" is the sum of extrapolated component weights; "h" is the weight of seeds from the entire sample; and "i" is the weight of all unidentified materials larger than .707 millimeters.

Although the computations are not difficult, neither are they obvious. It is not always clear from paleoethnobotanical reports exactly how the reported figures were derived. Unfortunately, it is quite possible that different investigators are using slightly different calculation methods leading to somewhat different results. This would be unfortunate in light of the desideratum of comparable data. Clearly, in a field filled with as many uncertainties as paleoethnobotany; standardization, or at least explicit definition, of calculation and reporting techniques are desirable.

Problems Encountered in Comparing Data Categories

There were four types of comparisons that were desired from the feature analysis data. These were:

1) a comparison of the degree and variety of plant food use through time;
2) a comparison of the similarity of plant food remains within comtemporaneous feature function categories;

3) a comparison of plant food remains between synchronic feature function categories; and

4) a comparison of the effectiveness of different techniques in recovering plant food remains.

Unfortunately, convincing and satisfactory comparisons were not obtained in any of these areas except, perhaps, between contemporaneous feature function categories. The disappointing results were primarily the consequence of failing to realize the limitations of the samples from 31Bn29. The primary problem encountered was the inability to make direct comparisons between samples recovered by different techniques. It had been hoped, at the outset of the study, that a means could be found to determine the volumes of soil which had been processed in order to obtain the washings and flotations as well as the clean and dirty charcoal samples. This proved to be much more difficult than anticipated although investigators with more patience or mathematical expertise than myself may eventually succeed in standardizing such data from the Warren Wilson site. In the present study, various linear regression models using weights and volumes of various components and entire samples were attempted in order to determine the volumes of soils prior to processing. None were successful.

Initially, it had been assumed that since sufficient data were available to compute feature and zone volumes in an approximate manner; it would be a relatively simple matter to determine processed soil volumes assuming that all feature soil had been processed. This assumption seemed less assured as the feature and excavation data were examined more closely. An additional very serious problem was not realized until late in the investigation. This was the fact that although total feature, and probably zone, volumes could be computed; a proportion of such volumes was comprised of rocks, sherds, and animal bone. The volumes of such inclusions was often large and could not be adequately determined for the majority of features given the time available to complete such a task. As such, even in those cases where it could be ascertained with certainty that all soil from a particular zone or feature had been processed; it was nevertheless difficult or impossible to determine what that soil volume was. Such difficulties may have been overcome if a sufficient number of samples of different types had been examined from within particular features during the analysis stage. However, the emphasis had been placed primarily upon examining as many different features as possible during analysis. As a consequence, comparative data from within particular features or zones was not adequate to compute, for instance, how much soil was processed to obtain the washings from within a particular feature. It was also impossible, in the end, to make meaningful comparisons based solely upon the laboratory flotation of soil samples. The reason was that the volumes of soil floated in the lab were much too small to provide consistent data. As previously noted, soil samples were preferred for analysis in the present study over field-processed washings in that it was assumed that flotations would be more likely to yield intact seeds than were washings. Although this assumption is probably true in a general sense, the available soil samples were often quite small. Moreover, it was not considered prudent to float the entire volume of such soil samples in light of their potential for other types of research. As can be seen from Appendix II, the overwhelming majority of soil samples floated were under one liter in volume. This proved to be an inadequate sample size in the majority of cases.

It was also difficult to make comparisons between laboratory and field processed flotation samples. Records were often unclear as to whether field flotation samples had been obtained from large soil samples or whether they were the result of an intentional gathering of charcoal concentrations from selected areas within features.

Although the present analysis is therefore very limited, I do feel that I can make a few suggestions which, if followed, will allow more meaningful comparisons to be made in the future. My primary recommendation is that feature and zone samples upon which paleoethnobotanical studies are to be made are collected in terms of standard volumes or aliquots of sufficient size to later yield adequate samples. Standard volumes are preferrable to standard weights since weights since weights can be expected to vary proportional to charcoal content. Approximate volume measurements could be made with devices as simple as calibrated buckets or wheelbarrows. It is probably desireable to have a relatively small volume (e.g. ten to twenty-five liters) as the initial standard unit so that zones with small volumes can be compared with those having larger volumes. In the case of larger zones there would be no reason why several aliquots could not be examined and compared with each other or with aliquots from different zones.

One of the more interesting things that might be attempted if standard volumes of features or zones were analyzed would be a comparison of diversity indices between feature categories or through time. An important first step toward such analyses was taken by Gardner (n.d.) in an attempt to determine how focal or diffuse the food plant exploitation was at the Beaverdam Creek Mound and Village site in Elbert County, Georgia. Gardner measured niche width at the site through a ubiquity index based upon the number of samples which contained specific plant foods. Gardner's method has been applied in this study in a comparison between niche breadths for the Savannah River, Swannanoa, and Pisgah phases at the Warren Wilson site and is discussed below. However, an obvious difficulty in using the number of samples containing a food item is that samples can be extremely variable in terms of the amount of soil processed to produce them. It would seem that if samples were derived from standard soil volumes it would be possible to utilize more precise ecological diversity measurements such as Simpson's Index or the Shannon-Weaver Index (Peet 1974) which either require, or are facilitated by, equal sample sizes when comparisons are to be made between samples. Although such indices are normally computed in terms of the relative frequencies of species per unit area it would seem that volumes could easily be substituted for areas. Standard volume measurements would also certainly facilitate comparisons between different processing techniques especially since it will probably always be too time consuming to machine float the entire volumes of features. It would, of course, also be desireable if excavators at different sites all adopted the same standard volumes as their units of analysis.

All soil from within feature zones, other than the standard volumes used for flotation, could be water screened. Although it might be desireable to water screen soil in the same standard volume units as the flotation samples, such a practice would be impractical in large features except for a sample of each zone's content. Zone volumes can be calculted from data normally recorded during excavation, but in order to extrapolate plant remains content to entire zones and features it is necessary that volume measurements of non-soil inclusions are recorded so that actual soil volumes within zones can be calculated. Volumes of feature inclusions such as animal bone and ceramics could be recorded during laboratory cataloguing or during analysis. It is crucial, however, that approximate volumes of materials discarded in the field (such as large quantities of fire-cracked rock) be recorded.

Plant Remains Variation Through Time at 31Bn29

A comparison between the plant food remains from the three analyzed phases at 31Bn29 is facilitated by reducing the plant food remains data from each phase to a single value. Niche breadth for each phase was therefore calculated according to the formula:

$$B = (\sum_{i}^{n} p_i^{\,2})^{-1}$$

> where "n" is the number of items in the diet and "p_i" is the proportion of the diet contributed by resource "i". A highly selective feeder will have a niche width which approaches zero, while a feeder which exploits all items in its diet equally will have a niche width of "n" (Gardner n.d.: 13).

Values of p_i were calculated in terms of the number of samples which contained the item. For instance, from the total of sixty Pisgah feature samples, 147 identifications, presumably representing plant foods were made based upon the counts of the number of times a separate item appeared in each individual feature. Thirty-eight samples contained hickory nut remains so p_i for hickory was .259 (or 38/147). Although B is not directly comparable between the three phases, a general idea of how diffuse or focal plant use was in the various phases can be obtained by comparing the individual values of B with the respective values of n (see Appendix IV). Of course, such comparisons can be made only while keeping in mind differential preservation potentials due to varying antiquity of the individual phases, as well as the differences between the sizes of samples and different processing techniques employed. Moreover, the absolute quantities of remains from each plant group are not considered. With these caveats in mind, the following values were obtained:

	n	B
Pisgah features	27	7.76
Swannanoa features	4	3.00
Savannah River features	11	4.39

The B value for the Pisgah phase was computed while including several tentative categories of unidentified seeds. If the tentative identifications are correct, the plants from these categories fall within groups noted in the literature pertaining to the Cherokee as either medicinal or food plants. They have therefore been included, with reservations, in the computation of B as it pertains to possible plant use categories.

The values of B appear to indicate a fairly focal resource base in the Swannanoa phase and more diffuse resource utilization in both the Pisgah and Savannah River phases. Unfortunately, the B values are far from convincing especially since n is so low for the Swannanoa phase.

The values of B might also reflect differential seasonal habitation of the Warren Wilson site. Both the Savannah River and Swannanoa phase occupations may have been seasonal. Therefore, the B values may reflect plant use during only part of the year (probably autumn). In contrast, the Pisgah phase occupation was probably continuous throughout the year and the B value probably reflects the plant spectrum for all seasons.

Yarnell (Personal Communication 1983) noted that B could be expected to correlate with the number of samples examined. The same would be true if the number of features rather than samples were used as the basis of calculating p_i. As a consequence, Yarnell suggested that a more useful comparison of niche breadth could be obtained by dividing B by either the square root of the number of samples or the number of samples. When B is divided by the square root of the number of samples the resulting values are (1.00, .69, and .62) for the Pisgah, Swannanoa, and Savannah River features respectively, and correspond to an increasingly diffuse resource base through time as might be expected. If B is divided by the number of samples, the resulting values (.13, .16, and .09) for the Pisgah, Swannanoa, and Savannah River features respectively, show yet another scaling configuration. In light of current re-evaluations of niche width measurements (cf. Feinsinger et. al., 1981) it is probably prudent to avoid experimentation with the definition of B unless a firm mathematical basis for doing so can be established.

An examination of the particular plant categories present in each of the three phases might provide a somewhat clearer idea of plant use through time. It is perhaps not surprising that the Swannanoa phase is represented by fewer types of plants than the Savannah River phase given the small number of features. Only 216.50 grams of total plant remains were recovered from the Swannanoa features as opposed to 543.17 grams and 660.46 grams from the Pisgah and Savannah River features respectively. Additionally, the preservation potential for the Swannanoa features may have been less than the Savannah River features due to the smaller number of aboriginally excavated features in the Swannanoa phase. The Swannanoa phase contained no potential food plants which were not included in the other two phases. Somewhat surprisingly however, the Savannah River phase contained three types of potential plant foods not recovered from Pisgah contexts. These were butternut, beech, and Polygonum sp. Yarnell (1976) recovered butternut from his samples of Pisgah features from the site, so its absence in this analysis could be due to either feature variation or occasional misidentifications of butternut as black walnut. Both beech and Polygonum sp. were represented by only one identification from the Savannah River features, so their presence may be purely incidental. An interesting note, however, is that the Polygonum seed was obtained from a Late Savannah River phase feature (Number 34) as determined through radiocarbon dating and artifact inclusions.

Another indication of plant use change through time can be seen in the proportion of potential plant food remains to total plant remains in the three phases. In this case, the trend reflects what one might intuitively suspect in that the percentages are two, five, and twenty-four percent for the three phases respectively through time. The lesser percentages of plant food remains in the earlier features can not be taken to represent lesser amounts of plant food utilization. Rather, it seems probable that many plant foods might be less well preserved through than wood charcoal. Moreover, the larger proportion of plant food remains in the Pisgah phase is partially due to the inclusion of corn cupules in the plant food category. When corn cupules are not considered as plant food remains per se, the proportion of food to non-food plant remains falls to only twelve percent.

Another difference in plant food use through time at the site appears to have been a greater reliance upon walnut (Juglans nigra) in the Swannanoa and Savannah River phases as compared to the Pisgah phase. In fact, walnut use appears to have declined steadily through time. Butternut was found only in the Savannah River phase contexts in the present study.

Although some of the variation between the phases might be due to differential utilization of the site by season, such an interpretation would be very difficult to either support or refute from the data at hand.

Variation in Recovery Techniques

The primary difficulty in determining the differences between recovery techniques in the present study is that too few samples from within the same feature context, but which were processed differently, were analyzed. As previously noted, it had been anticipated at the outset of the present study that flotation samples would provide more representive samples of carbonized seeds than would washings samples. All of the Warren Wilson flotations were manually recovered as opposed to being recovered by a machine equipped with frothing or bubbling devices. Keeley (1978) recommended against manual flotation in comparison to machine flotation since he felt that manual recovery of plant remains was incomplete. Nonetheless, in the absence of more sophisticated flotation devices, it was anticipated that seed recovery would be more complete from manual flotation samples than from water-screened samples.

The most direct comparison between flotation and water screening can be made with Features 244 and 246 from which both types of samples were analyzed. Both features were Pisgah refuse accumulations in shallow depressions (or "ditch/moats") along the outer palisade line. More types of food plant remains were recovered from washings in both cases. In fact, all plant remains recovered from the soil samples were recovered in greater abundance from the washings. However, only 500 milliliters of soil were floated whereas 1000 milliliters of washings were refloated from both features. Since the washings undoubtedly represented the content of much more than a single liter of processed soil, the only inference which can be made is that not enough soil was floated in any instance. An examination of the types of seeds recovered through different techniques through all samples reveals that, aside from unidentified or tentative categories, only the persimmon seed fragments from Pisgah feature 229 and the individual *Polygonum* sp. seed from Savannah River feature 34 were recovered from flotation samples only. However, no washings were analyzed from either feature. On the other hand, no heavy fractions from flotation samples were analyzed. Comparisons between washings samples and either the clean or dirty charcoal samples from the field are difficult due to factors previously discussed. Consequently, it can only be concluded that greater volumes of soil should be processed when flotation techniques are utilized.

Plant Remains Variation Within Synchronic Feature Function Categories

A great deal of ethnobotanic variation within feature function categories of the same phase could indicate either or both of two things, first that the feature function interpretations are incorrect, and/or second that there was actually a great deal of ethnobotanic variation within such categories. The latter possibility is quite likely in that feature function and fill are only related in a very indirect manner (c.f. Dickens n.d.). Some idea of how much variation exists within functional categories must be obtained before an analysis of variation between such categories can be attempted.

A simplifying assumption made in the comparison of plant remains within synchronic feature function categories is that the analyzed samples accurately reflect the entire feature content. Since apparently rich samples from each feature were analyzed, this assumption is considered generally true. Such an assumption is also considered reasonably because most features at the site did not contain numerous zones. More sophisticated comparisons of feature function based upon plant remains content would do well to ensure that sampling within zones was effectively conducted. In most cases it can probably be assumed that carbonized plant remains are homogeneously distributed throughout a zone. Homogeneous fill would indicate that seed counts of particular species represented in the fill would be Poisson distributed. Rare species would, of course, be less likely encountered within standard volumes than would abundant species. Attenuation problems regarding the presence or absence of rare elements, as discussed by Cowgill (1970), could perhaps be addressed by analyzing numerous standard volumes from a particular feature zone and determining how likely it would be for particular rare elements to be missed in individual standard volumes. When charcoal concentrations are encountered within a zone a decision must be made as to whether a new zone should be designated. Flotation samples taken by standard volumes would be useful in such a situation in that an additional flotation sample could be obtained without designating an additional zone within an over-all homogeneous matrix. Without standard volume samples, comparisons of plant remain content within zones would be rendered more problematic.

Quantitatively, the data pertaining to comparisons of plant remains within synchronic feature function categories did not allow a great deal of manipulation due to factors already discussed. The best means of analysis I could devise was a simple examination of ratios of sample volume to total plant remains; sample volume to total plant food remains; and total plant remains to total plant food remains. The means and standard deviations (n-1 weighting) of such ratios were calculated for all features within particular sample types and within each feature category (Appendix V). It was anticipated that standard deviations would be large in relation to the means in highly variable feature or sample categories. Unfortunately, this analysis is not very revealing in that virtually all categories showed relatively high standard deviations compared to means and very few samples within any particular category were present. Even the five soil samples taken from different zones within feature 229 showed considerable variation. Perhaps such large variations of ratios are not surprising when one considers the numerous factors that could have affected deposition within features; and the uncertainties created by differential sampling within features. Therefore, although particular functional categories cannot be demonstrated through the examination of the ratios provided; the large variations also cannot be taken as an indication that the feature function categories are incorrect. However, the large variations may suggest that caution is necessary when attempting to categorize feature classes or zones from individual samples. In general, it is well to keep in mind that the formation processes pertaining to the ultimate function of a feature are often quite different from those formation processes pertaining to the original function of the feature (c.f. Dickens n.d.).

A more qualitative examination of the contents of the features within functional categories is useful in isolating possible aberrations.

For example, features 8 (Pisgah Borrow Pit) and 247 (Pisgah Pit Hearth) both contained extremely high proportions of corn cupules with few associated kernels. Both may therefore represent hid smoking or "smudge pits" (cf. Binford 1967), especially since the form of the features closely resembles Binford's descriptions. A related function may have been associated with feature 148 (Pisgah Pit Hearth) which contained large amounts of what appeared to be sycamore bark and no other wood charcoal. Other than these three features, it would seem a risky venture to attempt an assignment of feature function bases solely upon included plant remains. Even among the cob filled pits, caution is warranted in assigning feature function. Rather than representing primary feature function, the corn cobs could represent ultimate function of a category such as a borrow pit when filled with refuse at a time of the year when corn cobs stripped of their kernels were prevalent.

Among Swannanoa features, number 191 had a much greater acorn content than any of the other rock cluster hearths. Feature 237 had more nut remains than any of the other Swannanoa pit hearths. Amounts of wood charcoal within both Swannanoa and Savannah River phase feature categories varied somewhat although most features from both phases were generally rich in wood charcoal.

Plant Remains Variation Between Synchronic Feature Function Categories

Several quotations from Trawick Ward's dissertation provide suggestions as to possible variation of plant remains from different types of Pisgah features at 31Bn29:

> In general, all classes of refuse appeared to have been cleaned up and disposed in a similar fashion... (Ward 1980: 158).

> ... the Warren Wilson data indicate that the overwhelming bulk of the refuse was dumped along the palisade either on the surface or in shallow depressions (Ibid.: 240).

> ... roughly ninety percent of the feature bone from Warren Wilson came from the fortuitous filling of large roasting pits along the palisades (Ibid.: 243).

> ... at Bn^{v}29 the pottery was concentrated in areas along the palisades (Ibid.: 242).

Judging from the present analysis, plant remains were also most prevalent in the shallow depressions (ditches/moats) along the palisades (see Appendices II and III). Furthermore, the concentration of floral remains along the palisades is matched by a general paucity of such remains within other feature categories, especially clay hearths and clay-lined storage pits. Primary deposits from clay hearths were probably redeposited, perhaps along the palisades. The clay-lined storage pits were apparently never refilled with refuse after their original purposes had been fulfiled. Pit hearths contained the greatest amount of plant remains after the refuse accumulations along the palisades. Dicken's (n.d.) interpretation of such features as cooking facilities is very attractive. In contrast, clay hearths may have been used primarily for heating and lighting within houses. Perhaps the pit hearths were occasionally cleaned, at least perfunctorally. Pisgah borrow pits contained relatively large amounts of plant remains as one might expect from unintentional midden accumulation in unfilled depressions. Pisgah posthole clusters contained modest amounts of plant remains which probably resulted from midden accumulation around loose posts within houses. Paleoethnobotanical means of distinguishing between posthole clusters and borrow pits would not seem to be especially productive in ambiguous cases.

The differences between the Swannanoa pit hearths and surface hearths are slight. Those that exist are primarily quantitative and are probably due to the lack of large washings samples from the pit hearths. Types of plant remains represented in the two feature categories are nearly identical.

A relationship similar to that of the Swannanoa features can be observed between the Savannah River pit hearths and surface hearths. The types of material recovered from each are similar. However, the pit hearths were represented by washings samples which appear to have been somewhat richer in plant remains than were the washings samples from the surface hearths. Alternatively, plant remains may have been better protected in pits.

One of the two Savannah River phase charcoal concentrations (Feature 90) contained a larger proportion of hickory nut to wood charcoal than any other Savannah River phase feature category. The other such feature (Feature 91) contained much less hickory. No functional interpretation for such features can be made at this time.

Feature 282, a possible Savannah River phase burial pit, apparently contained virtually no plant remains. Feature 295 (overbank midden of mixed chronological context) appeared to contain wood charcoal only.

Perhaps more than anything else, the present analysis of plant remains indicates that paleoethnobotanical materials recovered from an archaeological site may be extremely variable from one area of a site to another. As a consequence, paleoethnobotanical interpretations based upon a small number of features should only be undertaken with extreme caution where comprehensive site structure and function are concerned.

CHAPTER III

ARCHAEOLOGICAL, HISTORIC, AND ETHNOGRAPHIC DATA RELEVANT TO CHEROKEE PLANT USE

Archaeological Data

The primary purpose of this chapter is to develop a body of plant food data which can then be analyzed in the next chapter. Archaeological, historic, and ethnographic data have all been utilized as they pertain either to the Cherokee Indians or prehistoric groups who occupied the geographical area associated with the Cherokee. The link between the late prehistoric and historic Indians of the study area has been established:

> I suggest, therefore, that the Pisgah, Etowah-Wilbands, and Dallas phases formed vital strains in the development and ultimate synthesis of Cherokee Indian culture (Dickens 1976: 214).

A direct historic link between earlier phases and Cherokee Indian culture becomes tenuous as phases increase in age. In a very general sense, the geographical boundaries, or horizons, of the earlier phases within the Cherokee area increase with age. Therefore, the development of younger Indian cultures would seem to be a focusing of more widespread cultural complexes within restricted areas. For example, the Savannah River phase was represented over a large area of the Southeastern United States. It is assumed here that those Savannah River phase sites within the boundaries of historic Cherokee territory were more closely allied to the Cherokee historical development than were those Savannah River phase sites outside Cherokee territory. Similar assumptions are made for all other phases represented in the area although direct historic links could have been more pronounced during some phases than others. Moreover, it is not necessarily true that the historic link between various archaeological phases and Cherokee culture grew closer as a direct function of proximity in time since migrations or diffusions into or out of the study area could have strongly affected the development of Cherokee culture. With such disclaimers announced, I would generally agree with the following interpretation:

> I favor an in situ development hypothesis for Cherokee Culture because the phases I have defined in this study have great numbers of elements in common, although many of them may have appeared first elsewhere. The persistence of culture traits almost obscures distinctive elements to the point where phase separations sometimes seem arbitrary. The continuity of traits through time and the similarity between one unit and another reinforce the interpretation of an evolutionary continuum in the area (Keel 1976: 214).

The archaeological data presented in Table I have been compiled from the present analysis and several other sources (Chapman and Shea 1981; Yarnell n.d.; Asch et. al. 1972; Wilson 1980; Sanford 1970; and Yarnell 1976). Two of the references (Yarnell n.d.; and Asch et. al. 1972), pertain to Archaic period sites in Ontario and Illinois respectively. They have been included in Table I to provide contrasting data although they are not included in the Chapter IV analyses.

Historic and Ethnographic Data

Ethnohistoric research concerning protohistoric Indians usually con-

TABLE I

Comparison of 31Bn29 Plant Food Remains
with Selected Sites

Pre - Morrow Mountain Phases
(Includes Plant Remains from Lower and Upper Kirk, St. Albans, LeCroy, Kirk-Stemmed and Stanly Associations)

Lower Little Tennessee Valley circa 7500-5500 B.C. (Chapman and Shea 1981)	Warren Wilson Site No Stratified Representation

Total Plant Remains = 2195.10 grams
Numbers of Seeds and Fruits[a]

Acalypha sp.	1
Amaranthus sp.	1
Ampelopsis sp.	1
Asteraceae	7
Chenopodium sp.	9
Fabaceae	1
Galium sp.	26
Gleditsia triacanthos	1
Ipomea sp.	1
Passiflora lutea	1
Phalaris caroliniana	1
Phytolacca americana	22
Poaceae	2
Polygonum sp.	1
Portulaca oleracea	3
Rhus sp.	3
Rubus sp.	1
Vitis sp.	1

Plant Food Remains = 982.80 grams[b]

Approximate % of Weight

Carya sp.	86.34
Quercus sp.	11.92
Juglans sp.	.69
Castanea sp.	.99
Corylus sp.	-
Fagus sp.	-
	99.98

TABLE I (Continued)

Morrow Mountain Period

Lower Little Tennessee Valley circa 5500-4500 B.C. (Chapman and Shea 1981)	Warren Wilson Site circa 5000 B.C. (Dickens 1976)
Total Plant Remains = 857.71 grams	0.00 grams

Numbers of Seeds and Fruits[a]

Asteraceae	4
Fabaceae	1
Gleditsia triacanthos	1
Liriodendron tulipfera	1
Phytolacca americana	3
Polymnia uvedalia	3
Portulaca oleracea	1
Rubus sp.	1
Vitis sp.	11

Plant Food Remains = 312.36 grams[b]

Approximate % of Weight

Carya sp.	81.33
Quercus sp.	3.50
Juglans sp.	14.77
Castanea sp.	.10
	99.70

TABLE I (Continued)

Savannah River Period

	Lower Little Tennessee Valley circa 2500-1800 B.C. (Chapman and Shea 1981)	McIntyre Site 1750 B.C. (Yarnell n.d.)	Koster Site 5000-2000 B.C. (Asch et. al. 1972)	Warren Wilson circa 3560-1820 B.C. Present Study
Total Plant Remains=611.88 g.[c]		1001 g.[d]	not given[e]	660.46 g.
Numbers of Seeds and Fruits[a]				
Asteracea	1			
Chenopodium sp.	1	3381	16	2
Diospyros virginiana	3			
Galium sp.	8	2682	7	2
Phalaris caroliniana	128			
Phytolacca americana	1		1	
Poaceae	87	12	2	
Rhus sp.	1	9	3	
Vitis sp.	2	340	12	2
Zizania aquatica	3	1(?)		
Crataegus sp.		259	1	
Prunus sp. (Plum)		14	2	1[f]
Prunus sp. (Cherry)		6		
Vaccinium sp.		2		
Rubus sp.		231		
Polygonum sp.		85(?)	7	1
Ambrosia sp.		1	3	
Amaranthus sp. (?)		1		
Unidentified		448		8
Plant Food Remains=254.34 g.[b]		251.81 g.	317.1 g.	15.32 g.
Approximate % of Weight				
Pecan			.8	
Carya sp.	66.9	.10	96.4	52.81
Quercus sp.	4.0	4.26	1.5	.85
Juglans nigra	29.1[g]		1.2	45.43
Juglans cinerea		88.15		.46
Corylus sp.		.17		
Fagus grandifolia		.01		-
Tuber		-		
Fruit Pulp		.02		
Seeds		7.28		.46
	100.00	100.00	99.9	100.01

TABLE I (Continued)

Early Woodland Phases

Lower Little Tennessee Valley Long Branch Phase circa 300 B.C.-200 A.D. (Chapman and Shea 1981)		Warren Wilson Site Swannanoa Phase circa 500 B.C. Present Study
Total Plant Remains=3128.12 g.		216.50 g.
Number of Seeds and Fruits[a]		
Amaranthus sp.	1	
Asteraceae	15	
Chenopodium sp.	565	
Diospyros virginiana	1	
Fabaceae	1	
Galium sp.	1	1
Gleditsia triacanthos	3	
Helianthus annuus	7	
Ipomea sp.	3	
Iva annua	20	
Phytolacca americana	2	
Poaceae	6	
Polymnia uvedalia	4	
Prunus sp.	1	
Rhus sp.	1	
Rubus sp.	1	
Scirpus sp.	1	
Vaccinium sp.	1	
Vitis sp.	15	
Plant Food Remains=1644.04 g.[b]		9.28 g.
Approximate % of Weight		
Carya sp.	82.82	29.85
Quercus sp.	11.65	46.55
Juglans nigra *Juglans cinerea*	5.54[g]	23.60
Unidentified Nut		-
Seeds		-[h]
	100.00	100.00

TABLE I (Continued)

Mississippian Period

	Lower Little Tennessee Valley Early Mississippian Martin/Hiwassee Island Phase 900-1300 A.D. (Chapman and Shea 1981)	Lower Little Tennessee Valley Late Mississippian Dallas Phase 1300-1600 A.D. (Chapman and Shea 1981)	Plum Grove Site Pisgah Phase (Wilson n.d.)
Total Plant Remains=	1853.01 g.	1956.78 g.	742.32 g.
Number of Seeds and Fruits[a]			
Acalypha sp.		5	
Ambrosia sp.	6	1	
Asteraceae	1	4	
Carex sp.		1	
Chenopodium sp.	192	25	
Cornus sp.	2		
Crataegus sp.		2	
Diospyros virginiana	1	2219	
Fabaceae	27	22	
Galium sp.	12	9	1
Gleditsia triacanthos	4	40[i]	
Helianthus annuus	4	2	
Ipomea sp.	58	35	
Iva annua	13	445	
Malus sp.		20	
Passiflora incarnata	1	6	
Phalaris caroliniana	39		
Phaseolus sp.		80	
Phytolacca americana	2	5	
Poaceae	8	4	
Polygonum sp.	366	13	
Polymnia uvedalia	2	1	
Prunus sp.	4	3	
Rhus sp.		8	
Rubus sp.	5	1	
Vitis sp.	18	15	1
Xanthium sp.		7	
Tubers		1	
Amphicarpa bracteata			1
Unidentified			50
"Kamp Mound"			
Solanum sp.(?)			
Unidentified fruit			
Provisionals			

TABLE I (Continued)

Mississippian Period (Continued)

	Warren Wilson Site Pisgah Phase 1000-1450 A.D. (Sanford 1970)	Warren Wilson Site Pisgah Phase 1000-1450 A.D. (Yarnell 1976)	Warren Wilson Site Pisgah Phase 1000-1450 A.D. Present Study
Total Plant Remains=	Not given	378.65 g.[j]	543.17 g.
Number of Seeds and Fruits[a]			
Acalypha sp.			4
Ambrosia sp.		7	
Asteraceae			
Carex sp.			
Chenopodium sp.		2	10
Cornus sp.			
Crataegus sp.			
Diospyros virginiana		2	8
Fabaceae			1
Galium sp.		2	2
Gleditsia triacanthos			
Helianthus annuus			
Ipomea sp.			
Iva annua		7	1
Malus sp.			
Passiflora incarnata	3	17	38
Phalaris caroliniana			
Phaseolus sp.		2	1
Phytolacca americana		1	
Poaceae		2	2
Polygonum sp.		2	
Polymnia uvedalia			1
Prunus sp.			1
Rhus sp.		1(?)	
Rubus sp.			2
Vitis sp.		25	14
Xanthium sp.			
Tubers			
Amphicarpa bracteata			
Unidentified		78	26
"Kamp Mound"		5	
Solanum sp.(?)		1	
Unidentified fruit			2
Provisionals			19

TABLE I (Continued)

Mississippian Period (Continued)

	Lower Little Tennessee Valley Martin/Hiwassee Island Phase	Lower Little Tennessee Valley Dallas Phase	Plum Grove Pisgah Phase
Plant Food Remains	399.88 g.[b]	293.36 g.[b]	79.22 g.
% of Weight			
Carya sp.	90.9	87.0	69.92
Carya cordiformis			
Juglans nigra / *Juglans cinerea*	4.2[g]	10.1[g]	6.39[g]
Quercus sp.	4.9	2.9	4.50
Corylus sp.			2.45
Unidentified nut			
Corn cupules	present[k]	present[k]	7.70
Corn kernels	present[k]	present[k]	8.53
Cucurbita pepo	present[k]	present[k]	
Lagenaria siceraria			
Seeds			.16
Phaseolus vulgaris		present[k]	.35
Iva annua			
Unidentified fruit			
	100.00	100.00	100.00

TABLE I (Continued)

Mississippian Period (Continued)

Plant Food Remains	Warren Wilson Pisgah Phase (Sanford 1970)	Warren Wilson Pisgah Phase (Yarnell 1976)	Warren Wilson Pisgah Phase Present Study
	Not given	53.98 g.	130.69 g.
% of Weight			
Carya sp.		67.62	30.66
Carya cordiformis			.54
Juglans nigra		2.69	2.24
Juglans cinerea		.63	
Quercus sp.		5.58	9.36
Corylus sp.			.02
Unidentified nut	22 fragments		.03
Corn cupules	118 + cob fragment	21.32[L]	50.94
Corn kernels	present		5.88
Cucurbita pepo		.13	.05
Lagenaria siceria			.05
Seeds			.24
Phaseolus vulgaris		.65	present
Iva annua		.07	present
Unidentified fruit		1.32	
		100.01	100.00

[a] Whole seeds or fragments when number of whole seeds unavailable except for 31Bn29 where estimates of whole seeds are given.

[b] Nut remains only for Lower Little Tennessee River Valley phases.

[c] Plus 18 fragments of squash rind.

[d] All weights and counts extrapolated to total volume of 35 features below plow zone.

[e] Includes also: 1 Asimina triloba, 1 Polygonatum sp., 1 Smilax sp., 23 Iva annua, 3 Strophostyles sp., 2 Celtis sp., 2 Gleditsia sp., 2(?) Desmodium sp., 1 Cyperaceae, and 1 Viburnum sp.

[f] Not necessarily plum.

[g] Combined Juglans.

[h] Includes one corn cupule assumed to be intrusive.

[i] Plus 112 seed pod fragments.

[j] Plus squash rind and seeds.

TABLE I (Continued)

[k] Presence noted but weights not given.

[L] Cupules and kernels combined.

centrates upon accounts by conquistadores, explorers, missionaries, traders, military personnel, and European captives of the Indians.

Unfortunately, European documentation of protohistoric Cherokee plant use appears to be sparse, or at least I have not succeeded very well in locating such sources. Among the conquistadores, only the chronicles of the De Soto expedition of 1539 bear much relevance; yet De Soto's route remains problematic, and his contact with the Cherokee was marginal (Varner and Varner 1962). The Cherokee were in a remote and rugged area and most direct European contact came relatively late. Many secondary sources suggest that Spaniards were in Cherokee territory in the seventeenth century, ostensibly engaged in silver mining, but I have seen no references to primary documents. Information relating to Indian plant food in the De Soto chronicles, as well as the Juan Pardo explorations (Charles Hudson Personal Communication, 1983), is primarily concerned with the European desire to be provisioned maize although some information pertinent to nuts and their processing can be found in the De Soto chronicles.

Later European exploration and trading in Cherokee country were virtually synonymous:

> In 1673,... James Needham and Gabriel Arthur, the first white men of record to have entered the Overhill Cherokee Country, found that already the Indians had been trading with the Spanish in Florida, apparently for a long time, since they had no fewer than sixty Spanish muskets. They also learned that the Overhills made a practice of obtaining the white men's goods from Virginia traders through the Occoneechee Indians, who conducted a profitable business as middlemen from their island home in the Roanoke River in the southern part of Virginia, not far above the North Carolina line (Rothrock 1929: 4-5).

That the traders did not leave a wealth of documentary evidence in regard to Cherokee plant use may be partially understood by examining the type of individual who found himself engaged in the fur trade:

> The courier de bois from the Illinois country, the voyageur captured from a pirogue on the Mississippi and the deserter from the garrison at Mobile were likely material for the Carolina traders' employment, and such men as these constituted in part the tempestuous, brave, and lawless class of packhorsemen (Rothrock 1929: 9).

Acculturation, in some aspects of Cherokee culture, probably occurred rapidly after the onset of the fur trade in the area:

> Remote and small indeed was the Cherokee village which by the second quarter of the eighteenth century could not boast of traders, white men of English, Spanish or French, or even all three, nationalities. Negroes, too, were not unknown, though one of the earlier acts for regulating the trade forbade taking black slaves into the Indian country (Rothrock 1929: 8).

A more thorough search of ethnohistoric literature would probably reveal more data relevant to Cherokee plant use than is presented here. Detailed historic research, especially in terms of trying to locate primary seventeenth century documents, was considered beyond the scope of this study. Consequently, only a few references are discussed below, and these are most relevant to the late eighteenth century and later.

Unfortunately, John Lawson did not enter Cherokee territory in his travels through the Carolinas beginning in December of 1700 (Lawson 1966). Although many of the plants noted by Lawson as used by Piedmont and Coastal Plain Indians of the Carolinas were probably also used by the Cherokee; it seems unwise to assign them as Cherokee plants from Lawson's account alone.

William Bartram attempted to reach the Overhill Cherokee in 1775. However, it is unclear whether any of Bartram's Indian plant food data refers specifically to the Cherokee. Bartram's assignation of a small grove of "Casine yapon" to Cherokee territory rests upon the location of the Indian village of "Jore", which was abandoned at the time of Bartram's visit (Harper 1958: 227). Merrill (1979), placed Jore in western North Carolina, near the Georgia border. Merrill also noted that W. V. Turner collected Ilex vomitoria in "Cherokee countrey" in 1769 and suggested that the specimen came from one of the Lower Cherokee towns.

A thorough search of Andre Michaux's journals might also provide information on Cherokee plant use since he entered Cherokee territory in 1787. Michaux used Indian guides who apparently pointed out native plants to him. One such plant, which remains unidentified, was a serrate-leafed plant the leaves of which the Indians said tasted good when chewed, and had an agreeable scent when crushed (Rembert 1979).

The most useful account of the Cherokee territory by a military man is that of Lieutenant Henry Timberlake who entered Cherokee territory around Christmas-time in 1761. Timberlake (Williams 1927) provided some of the best information available on Overhill Cherokee culture along the Little Tennessee River. Agricultural plants included many introduced crops by the time of Timberlake's visit. Although the time of year of his sojourn among the Cherokee makes it unclear whether he actually saw some of the crops he mentions, these included:

> ... vast quantities of pease, beans, potatoes, cabbages, Indian corn, pumpions, melons, and tobacco, not mention a number of other vegetables imported from Europe...(Williams 1927: 68).

Edible fruits included several sorts of grapes, plums, cherries, several kinds of berries and cultivated peaches and pears. Edible roots were gathered in the woods. Ginseng and "physic" (apparently Ilex sp.) were among the native medicinal plants or teas.

James Adair, writing in 1775, mentioned bean plots, corn, and calabash rattles as well as several medicinal plants. The latter group included white nettle root (thought by Williams to be cranesbill or Geranium maculatum) for cleaning ulcers as well as several cures for snake bite:

> ... such as the Seneeka, or fern-snake-root, or the wild hore-hound, wild plantain, St. Andrew's cross, and a variety of other herbs and roots, which are plenty, and well known to those who range the American woods...(Williams 1930: 247-248).

The list of Cherokee plants provided by Adair reflects a general problem in assessing ethnobotanical literature pertaining to the Cherokee. That is, the greatest interest of most early writers centered upon medicinal as opposed to food plants. Contemporary ethnographic work focused upon food plants to a greater extent, but even that literature is often largely concerned with medicinal plants. A thorough examination of Cherokee medicinal plants is far beyond the scope of this study, but mention must be made of some of the sources since they occasionally provide information on food plants. Table II indicates cases where medicinal properties of food plants are noted; but no plants used solely for their medicinal properties are listed. A study of European herbals, pharmocopia, and Materia Medica might indicate some of the background noise from Europe which has surely crept into alleged lore related to Indian uses of plants for medicinal purposes.

Records of medicine mens' formulae were collected by James Mooney:

> On first visiting the reservation in the summer of 1887, I devoted considerable time to collecting plants used by the Cherokees for food or medicinal purposes, learning at the same time their Indian names and the particular uses to which each was applied and the mode of preparation. It soon became evident that the application of the medicine was not the whole, and in fact was rather the subordinate, part of the treatment, which was always accompanied by certain ceremonies and "words" (Mooney 1889: 310).

The numerous cases in which sympathetic magic appears to be involved in these formulae (cf. Mooney 1890) reminds one of the medieval "doctrine of signatures" of Europe and perhaps homeopathic practices as well. Further analysis might reveal whether this similarity is due to acculturation of the Cherokee through contact with Europeans or whether the two cultures developed similar concepts independently. Many families of plants were known from Europe to be "medicinal". Often, members of the same family or genus were native to the New World and were experimented with by settlers. These plants may have often been given the descriptive term "Indian" to indicate "false" or nongenuine European plants (Witthoft 1953). There was a tendency on the part of Europeans to exaggerate the value of Indian cures. Manufacturers of patent medicines appear to have taken advantage of this by advertising their products as being derived from Indian usage. Two major American Materia Medica (or materials of medicine) are Mahoney (1849) and Barton (1798). Both men were physicians who were interested in attempting to discover which North American plants were useful in medical practice. Both men were relatively scientific in their research and dealt with Cherokee sources. However, neither was specifically interested in identifying their sources and each was heavily plagiarized by later authors thereby rendering associations with specific Indian groups difficult.

Witthoft noted that:

> ... in the late nineteenth century, herb gathering was practically the only source of cash-income on the reservation, and was a very important local industry. ...The herb traffic, no longer in existence here, has had some interesting effects on Cherokee botany. The average herbalist not only knows the Cherokee and local white names for plants, but he also generally knows the names used in the herb business. Many of these are extremely peculiar, with no relationship to New Latin names or to any folk-terms of any area with which I am familiar; they represent fragments of a rather eccentric jargon of the old wholesale drug industry (Witthoft 1953: 20).

The herb trade had become a supplement to the fur trade as early as the mid-eighteenth century. Hatley (1977) provided figures on the amounts of pink root (Spigelia marilandica, L.) and snakeroot (Aristlochia serpentaria) shipped from Charleston in 1760-1774. Appalachia remains the principal American source of medicinal plants and large quantities are harvested each year in the area. At least eight wholesalers had their headquarters in the Appalachian region in 1969 (Krochmal et. al. 1969). In 1828, Constantine Samuel Rafinesque addressed a letter to the readers of the "Cherokee Phoenix", then printed in Oklahoma, asking for pressed specimens of medicinal and other plants (Kilpatrick and Kilpatrick 1968). In the 1850's the Office of Indian Affairs sent out a circular to its agents requesting information on Indian medicinal plants, their properties, their quantities, and their distance to navigable streams. A response from the Cherokee agent was received and published (Evans 1859).

The reasons why an eventual evaluation of the literature related to Cherokee medicinal plants is important are several. First, many of the plants recorded to have medicinal qualities are not duplicated in the food plant data and are also unlikely to be found in archaeological context. Archaeological preservation would appear to be unlikely since it is probable that few individuals would have used the plants and those individuals could only be expected to do so on relatively rare occasions. Any comprehensive assessment of aboriginal plant knowledge in the Cherokee area is impossible without recognizing the specific knowledge inherent in the ingestion of medicinal plants. The apparent toxicity of many medicinals is evidenced by the body's tendency to excrete them in a variety of ways. Barton (1798), for instance, divided native medicinal plants into categories including astringents, tonics, stimulants, errhines (which cause sneezing and tearing), sialagogas (which increase salivation), emetics, cathartics, diuretics, and anthelmintics. Whether such categories are wholly European in origin is unclear although Mahoney

(1849) appeared to indicate that the categories at least partially reflected aboriginal ones. Experimentation with such plants, perhaps initially in response to hunger or curiosity, must have taken place in order to learn their affect on the human physiological system. Therefore, a knowledge of medicinals used by a particular culture may suggest an indirect measure of the extent to which the environment had been explored for floral food resources as well suggest processes by which such knowledge is gained. Comparisons between human physiological responses to both medicines and foods could also serve to clarify the distinctions between these two classes of ingested plants. The distinction is not always clear, especially when such things as "teas" are considered. In the present study teas have been considered medicinal, and the plants from which they were made have not been included in Table II.

In reconstructing prehistoric aboriginal subsistence through use of the direct historical approach, data from the early contact stage is most useful. However, much information about prehistoric usage should be decipherable through very late and perhaps even contemporary data in the case of the Cherokee:

> ... the available field data on Cherokee ethnobotany, in Mooney's notes and my own, differs in quantity and quality from herbal data available from any other southeastern Indian community. The Cherokee botany is nearly a complete tribal herbal, whereas only scraps have been made available elsewhere (Witthoft 1953: 5).

Witthoft's 1953 manuscript can be sifted to obtain a thumbnail sketch of Cherokee life on the Qualla Reservation of the Eastern Cherokee in the 1950's. He noted that only a small portion of the land on the reservation is in floodplain and that virtually all of this land had been usurped by white and near-white lineages of the Cherokee. Witthoft also noted that Cherokee ethnobotany includes plants from numerous ecological zones, both naturalized and native plants, and both cultivated and wild plants. Furthermore:

> It is the folk botany of a resourceful people who inhabit the richest and most diverse botanical region of the North American continent, and it seems at the present time to present an almost endless field for ethnological research (Witthoft 1953: 23).

Many articles concerning contemporary Cherokee plant use are difficult to assess because they utilize references related to Southeastern Indians in general (e.g. Chamberlain 1901 and Core 1967) and ascribe such usage to the Cherokee in particular. Such sources have not been included in Table II which summarizes the analyzed historical and ethnographic literature pertaining to Cherokee plant use. Table II is limited to vascular flora and therefore excludes fungi. Intensive exploitation of particular fungal species which occur in large numbers is practiced by the contemporary Cherokee (Witthoft 1953). Puffballs (Lycoperdon pyriforme) and beefsteak mushroom (Fistula hepatica) were listed by Banks (1953), and the latter species was listed by Witthoft as well. Meadow mushroom (Psalliota campestris), orange-milk mushroom (Lactarius deliciosus), and species of both Boletus and Morchella were reported by Witthoft (1953). Perry (1974) noted the specific use of Boletus purpureus and Morchella esculenta as well as honey mushroom (Armillaria mellea) and Polyporus frondosa. Several authors noted that an execrescence or fungus growing on Rhododendron sp. was consumed (Banks 1953; Witthoft 1953; Hamel and Chiltoskey 1975). No attempt was made to determine if any of these species were represented in the "fungus" category of archaeological remains from 31Bn29.

Table II indicates whether the listed plants are considered edible or poisonous by Fernald and Kinsey (1958) and Peterson (1978). Such information may be useful in assessing the reliability of the records or indicating whether processing may have been necessary in order to render a particular plant edible. A separate column indicates whether a particular species or genus has been recovered from archaeological contexts as noted on Table I. A distinction is made between mature "leaves" and apparently immature leaves and stems or "greens" in Table II.

A separate column was considered for seasonality of usage, but most such information largely agreed with the following statement:

> Early spring was found to be the season of availability for most greens; summer, for berries and fruits; spring and fall for fungi; autumn, for nuts and seeds; and historically, winter, for roots (Perry 1974: 63).

Yarnell (Personal Communication 1983) noted that tubers and roots would more accurately be described as available from autumn to spring. If Perry's assessment is essentially correct it would appear that spring and winter occupations would be difficult to detect archaeologically.

A summary of the references consulted and their primary sources of information is given below:

Source	Code Letter	Historic Account	Literature Review	Cherokee Informants	Ethnography
Bartram 1789	A	*			
Barton 1798	B	*	*		
Gambold 1818	C	*			
Mahoney 1849	D	*		*	
Mooney 1891	E				*
Mooney 1900	F				*
Ulmer and Beck 1951	G			*	
Banks 1953	H				*
Witthoft 1953	I				*
Perry 1974	J				*
Chiltoskey 1975	K			*	
Grant 1975	L			*	
Hamel and Chiltoskey	M		*	*	
White 1975	N				*
Witthoft 1977	O				*
Ethridge 1978	P		*		

Table II has been ordered primarily in terms of plant families since an eventual understanding of secondary compounds is most likely to be derived through an examination of plants on the family level of organization. A listing arranged in order of plant parts eaten was considered and rejected since many species would require multiple listings. However, Appendix VI contains a listing of genera according to the plant part utilized for the various archaeological phases considered and the historic period Cherokee.

TABLE II

Cherokee Food Plants of the Historic Period

Families and Species[a]	Common Name[b]	Sources	Part Eaten	Edibility and Archaeological Notes F.[c]	P.[d]	A.[e]	Medicinal References	Comments
Osmundaceae								
Osmunda cinnamomea	Cinnamon Fern	M*	Fronds	X			H,M,P	
Aspidiaceae								
Polysticum acrostichoides	Christmas Fern	M	Fiddle-heads				A,H,M	
Poaceae								
Zea mays	Corn	Numer-ous	Kernels			X	H,M	Native Cultigen
Araceae								
Acorus calamus	Calamus, Sweet Flag	I	Roots, Stem	X	X		D,H,M	
Commelinaceae								
Tradescantia virginiana	Spider-wort	C,H, I,J, M,O(10)[f]	Greens	X	X		H,M	
Liliaceae								
Asparagus officinalis	Asparagus	M	Shoots	X	X			Intro-duced
Smilax tamnifolia	Carrion-Flower	A,B,M	Roots				M	
S. herbacea	Carrion-Flower	M	Roots	X			H,M	
S. glauca	Green-brier, Catbrier	M	Roots	X			H,M,P	
S. rotundi-folia	Green-brier, Catbrier	M	Roots	X	X		H,M	
Medeola virginiana	Indian Cucumber Root	I	Roots	X	X		B	

TABLE II (Continued)

Families and Species	Common Name	Sources	Part Eaten	Edibility and Archaeological Notes F.	P.	A.	Medical References	Comments
Polygonatum biflorum	Solomon's Seal	H,I,J, K,L,M, O(6)	Greens Roots	G.[g]	X		E,H,M	
Lilium philadelphicum	Wood Lily	I	Bulb	G.				
L. canadense	Canada Lily, Wild Yellow Lily	M	Bulb	G.	X		H,M	
Uvularia sessifolia	Bellwort	M	Greens	X	X		H,M	
U. perfoliata	Bellwort Wild Oats	O(7)	Greens	G.	G.			
Allium cernuum	Nodding Onion	C,M	Bulb	X	X		M	C is genus only.
A. tricoccum	Ramps, Wild Leek	G,I,J, K,L,M, N,O(3)	Bulb Greens	X	X		M	
A. canadense	Wild Garlic	J	Bulb	X	X			
Streptopus roseus	Twisted Stalk	H,J, O(4)	Greens	G.	X		H	
Diasporum lanuginosum	Bean Salad	L,N	Greens					
Yucca filamentosa	Bear-Grass	N	Flow-ers(?)	G.	X			
Iridaceae								
Sysyrinchium angustifolium	Blue-Eyed Grass	M,O(11f)	Greens				H,M	
Juglandaceae								
Juglans nigra	Black Walnut	A,G,I, J,K,L, M,N	Nuts	X	X	X		G,K is genus only.
J. cinerea	Butter-nut, White Walnut	A,I,J, M,N	Nuts	X	X	X	C,D,H,M	
Carya ovata	Shag-bark Hickory	G,I,J,K	Nuts	G.	X	G.	E	J,K all genus

TABLE II (Continued)

Families and Species	Common Name	Sources	Part Eaten	Edibility and Archaeological Notes F.	P.	A.	Medicinal References	Comments
C. laciniosa	Big Shell-bark Hickory	M	Nuts	G.		G.	D,H,M	
C. pallida	Pale Hickory	M	Nuts	G.		G.	M	
C. tomentosa	Mocker-nut, White-heart, or White Hickory	M,N	Nuts	G.	X	G.	D,M,P	
C. ovalis	Sweet Pignut	I	Nuts	G.		G.		
C. glabra	Pignut Hickory	N						
Betulaceae								
Corylus americana	Hazel-nut	I,M,N	Nuts	X	X	G.	H,M,P	
Betula lutea	Yellow Birch	I	Bark	X	X			
B. lenta	Cherry Birch	I	Bark	X	X		H,M,P	
Fagaceae								
Fagus grandifolia	Beech	I	Nuts	X	X	X	D,H,M	
Castanea dentata	American chestnut	E,G,H,I, J,K,M,N	Nuts	X	X	G.	H,M	
C. pumila	Chinqua-pin	I,N	Nuts	X	X	G.	H,M,P	
Quercus alba	White Oak	A,I	Nuts	G.	X	G.	C,H,M	A is all species of genus.
Ulmaceae								
Celtis occidentalis	Hackberry Sugarberry	I	Berr-ies	X	X			
Moraceae								
Morus alba	White Mulberry	M	Fruit	X	X		D,M	Intro-duced

TABLE II (Continued)

Families and Species	Common Name	Sources	Part Eaten	Edibility and Archaeological Notes F.	P.	A.	Medicinal References	Comments
Morus rubra	Red Mulberry	A,I,J, M,N	Fruit				B,M	
Polygonaceae								
Polygonum hydropiper	Common Smartweed	O(25)	Greens		G.	G.	M	Intro- duced
P. cuspidatum	Japanese knotweed	J	Greens					Intro- duced
Rumex acetosella	Sheep- sorrel Sour- grass	J,M	Greens	X	X		D,H,M	Intro- duced(?)
R. crispus	Yellow Dock, Hag Tongue, Narrow Dock, Curled Dock, Yellow Roots	D,J, O(19)	Greens		X		D,H,M	Intro- duced
Chenopodiaceae								
Chenopodium album	Lamb's Quarters Pigweed	I,J,M, O(12)[h]	Greens	X	X	G.		Intro- duced
Amaranthaceae								
Amaranthus hybridus	Pigweed	I	Greens	G.	X	G.		
A. retroflexus	Pigweed	I	Greens	G.	X	G.	H,M	
Phytolaccaceae								
Phytolacca americana	Poke, Pokeweed, Pigeonberry, Inkberry	G,H,I,J, K,L,M, N, O(2)	Greens	X	X	X	D,H,I,M	
Ranunculaceae								
Ranunculus abortivus	Buttercup	M	Greens	G	GT[i]		M	

TABLE II (Continued)

Families and Species	Common Name	Sources	Part Eaten	Edibility and Archaeological Notes F.	P.	A.	Medicinal References	Comments
R. recurvatus	Butter-cup	M	Greens	G	GT		M	
R. acris	Butter-cup	M	Greens	G	Gt		M	Intro-duced(?)
Berberidaceae								
Podophyllum peltatum	May-apple, Mandrake	F,I(?), J,M	Fruit	X	X		B,C,D,H,M,P	
Magnoliaceae								
Liriodendron tulipfera	Tulip-tree	M	Sap			G.	C,D,H,M	Repro-ductive struct-ure only archaeol-ogically.
Annonaceae								
Asimina triloba	Pawpaw	I,M	Fruit	X	X			
Calycanthaceae								
Calycanthus floridus var. laevigatus	Sweet-Shrub, Spice-bush, Allspice, Bully, Coconut	I	Seeds				C,H,I,M	Star-vation food.
Lauraceae								
Sassafras albidum	Sassa-fras	G,J,M	Roots, Bark	X	X		D,E,H,M,P	
Lindera benzoin	Spice-bush	J,K,M	Twigs, Bark	X			D,H,I,M	
Brassicaceae								
Lepidium virginicum	Poor-man's pepper	J,M	Seeds, Capsules	G.	X		M	Intro-duced(?)

TABLE II (Continued)

Families and Species	Common Name	Sources	Part Eaten	Edibility and Archaeological Notes F.	P.	A.	Medicinal References	Comments
L. campestre	Cow Cress	O(11a)	Greens	G.	X			Introduced
Capsella bursa-pastoris	Shepherd's Purse	H,M, O(11g)	Greens	X	X			Introduced
Brassica campestris	Naturalized "Mustard"	O(20)	Greens					Introduced
Brassica napa	Turnip	O(21)	Greens	G.	X			Introduced
Sisymbrium officinale	Hedge Mustard	H,J,M	Greens	X			M	Introduced
Nasturtium officinale[j]	Watercress	G,H,M	Greens	X	X			Introduced(?)
Barbarea vulgaris	Winter Cress, Creaseys, Early Cress, Upland Creases, Yellow Rocket	G,I,J,K, L,M,N, O(11b)	Greens	X	X			Introduced: Late Winter Green.
Cardamine diphylla	Dentaria, Toothwort	M	Greens	G.			M	
C. pennsylvanica	Bitter Cress	O(11e)	Greens	X	X			
Dentaria diphylla	Crow's Foot, Toothwort	J,K,O(?) (11c)	Greens	G.	X			
Thlaspi arvense	Penny Cress	J	Leaves	X	X			
Crassulaceae								
Penthorum sedioides	Wild Turnip	J	Greens					
Saxifragaceae								
Saxifraga pensylvanica	Saxifrage	H,M	Greens	X	X		H,M	
S. micranthidifolia	Saxifrage, Mountain or Branch Lettuce	J,K,N, O(8)	Greens	X	X			

TABLE II (Continued)

Families and Species	Common Name	Sources	Part Eaten	Edibility and Archaeological Notes F.	P.	A.	Medicinal References	Comments
Hydrangea arborescens	Seven-bark	J,O(23)	Greens, Branches, Twigs					
Ribes rotundifolium	Goose-berry	J,N	Berries		G.			
R. cynosbati	Goose-berry	J	Berries	X	G.			
Hamamelidaceae								
Liquidambar styraciflua	Sweet gum	H	Sap	X	X		C,H	
Rosaceae								
Fragaria virginiana	Straw-berry	F,I,J, K,L,M, N	Fruit	X	X		D,M	
Rubus odoratus	Flower-ing Raspberry	I,J,L,M	Fruit	G.	X	G.	M	New shoots as greens: O(24)
R. idaeus	Red Raspberry	I,M	Fruit	G.		G.	H,M	Intro-duced(?) D gives entire genus as med-icinal.
R. procumbens(?)		I	Fruit	G.		G.		
R. occidentalis	Black-Cap Raspberry	I,J,M,N	Fruit	G.		G.	H,M	
R. allegheniensis	Black-berry	I,M,N	Fruit, Shoots	G.		G.		J,K,L,N give "Black-berry" as food.
R. argutus	Black-berry	M	Fruit, Shoots	G.		G.	H,M	J gives "black-berry shoots" as food.

TABLE II (Continued)

Families and Species	Common Name	Sources	Part Eaten	Edibility and Archaeological Notes F.	P.	A.	Medicinal References	Comments
R. canadensis	Blackberry	I	Fruit, Shoots	G.		G.		
R. flagellaris	Dewberry	I,M	Fruit	G.		G.	M	J gives "dewberry" as food.
R. trivialis	Dewberry	I,K,M	Fruit				H,M	
Pyrus communis	Pear	M	Fruit	G.	X			Introduced.
Malus pumila	Common Apple	H,K,M	Fruit	G.		G.	H,M	Introduced.
M. coronaria	Crabapple	M	Fruit	G.		G.	M	
M. angustifolia	Southern Crabapple	J	Fruit	G.		G.		
Amelanchier arborea	Juneberry, Shadbush, Serviceberry	H,I,J, M,N	Berries	G.	G.		E,H,M,P	
Prunus persica	Peach	K,M	Fruit				D,H,M	Introduced.
P. americana	Wild Plum	A,I,K,M	Fruit	X		G.	M	
P. cerasus	Sour Cherry	M	Fruit			G.	A,D,E,M	
P. pennsylvanica	Fire Cherry, Pin Cherry	J,M	Fruit	X	X	G.	H,M	
P. virginiana	Choke Cherry	M	Fruit	X	X	G.	B,C,H,M	
P. serotina	Black Cherry	K,M	Fruit	X	X	G.	H,M,P	
Crataegus macrosperma	Hawthorn	J	Fruit	G.	G.	G.		
Fabaceae								
Phaseolus vulgaris	Bean	numerous				X		Native cultigen.

TABLE II (Continued)

Families and Species	Common Name	Sources	Part Eaten	Edibility and Archaeological Notes F.	P.	A.	Medicinal References	Comments
Gleditsia triacanthos	Honey Locust	A,G,I, J,K,L,M	Seed Pulp	X	X	X	H,M	
Pisum sativum	Field Pea	M	"Fruit"					Introduced.
Apios americana	Wild Bean, Groundnut	H,I,J, L,M	Tubers	X	X		I	
Amphicarpa bracteata	Hog Peanut	H,I,J,M	Underground seeds	X	X	X	H,M	
Oxalidaceae								
Oxalis violacea	Violet Wood Sorrel	M	Greens	X	X		M	H gives genus as medicinal.
O. corniculata	Creeping Lady's Sorrel	M	Greens				M	Introduced(?)
O. stricta	Sour Sorrel	J	Leaves	X				
Anacardiaceae								
Rhus typhina	Staghorn Sumac	A,I,K,M	Berries	X	X	G.	B,M,P	B gives genus as medicinal.
R. copallina	Dwarf sumac, Winged Sumac, Shining Sumac	M	Berries	X	X	G.	H,M,P	
R. glabra	Smooth and Common Sumac	I,M	Berries	X	X	G.	D,H,M,P	
Aceraceae								
Acer saccharum	Sugar Maple	J,M	Sap	X	X		H	

TABLE II (Continued)

Families and Species	Common Name	Sources	Part Eaten	Edibility and Archaeological Notes F.	P.	A.	Medicinal References	Comments
Vitaceae								
Vitis rotundifolia	Muscadine	L	Fruit	G.	G.	G.	H,M	A,G,K give genus as food.
V. baileyana	Possum Grape	J	Fruit	G.	G.	G.		
V. labrusca	Fox Grape	A,G,H, K,M,N	Fruit	G.	G.	G.	H,M	
V. vulpina	Frost Grape	I,M,N	Fruit	G.	G.	G.	M	
V. aestivalis	Summer Grape	H,I,M	Fruit	G.	G.	G.	H,M,P	
Violaceae								
Viola blanda	White Violet	J	Greens	G.	G.			Genus available most of the year (Perry 1974).
V. pennsylvanica	Yellow Violet	J	Greens	G.	G.			
Viola sp.	Blue Violet	J	Greens	G.	G.			
Passifloraceae								
Passiflora incarnata	Maypops	G,H,I, J,K,M,N, O(16)	Greens, Seed Pulp	X	X	X	H,M	G is for genus.
P. lutea	Maypops	I	Seed Pulp			X		
Onagraceae								
Oenothera biennis	Evening Primrose	H,J,M, O(17)	Greens	X	X			H,J,O for genus. J gives roots & leaves.

TABLE II (Continued)

Families and Species	Common Name	Sources	Part Eaten	Edibility and Archaeological Notes F.	P.	A.	Medicinal References	Comments
Epilobium angustifolium	Fire-weed	I	Greens	X	X			
Apiaceae								
Osmorhiza claytonii	Sweet Cicely, Anise-Root	I	Greens	X	X			
Ligusticum canadense	Lovage, Angelico, Angelica	C,I,J, K,L,M, O(9)	Greens					Often confused with Angelica atropurpurea.
Oxypolis rigidor		M	Root	XT				I notes this as a poisonous plant.
Ericaceae								
Rhododendron calendulaceum	Flame Azalea	H,M	Fungus on plant.				H,M	
R. nudiflorum	Wild Azalea, Pinxter-Flower	I	Fungus on plant.					
Oxydendron arboreum	Sourwood	M	Sap? Leaves?	X			H,M	
Gaultheria procumbens	Winter-green, Checker-berry, Wild Rats Bane	I,J,M	Leaves	X	X		D,H,M	
Vaccinium stamineum	Squaw Huckle-berry, Gooseberry	H,I	Berry	X	G.	G.		

TABLE II (Continued)

Families and Species	Common Name	Sources	Part Eaten	Edibility and Archaeological Notes F.	P.	A.	Medicinal References	Comments
Vaccinium erythrocarpum (?)	Bearberry	M	Berry		G.	G.	D(?),M	
Gaylussacia baccata	Huckleberry	I,J,L,M	Berry	X	G.		M	
Ebenaceae								
Diospyros virginiana	Persimmon	A,I,J,L, M,N	Fruit	X	X	X	D,H,M,P	
Convolvulaceae								
Ipomea batatas	Sweet Potato	K,M	Tuber			G.		Introduced.
I. pandurata	Man-Root	M	Root	X	X	G.	H,M	
Hydrophyllaceae								
Phacelia dubia		K,M,O(5)	Greens					
Lamiaceae								
Prunella vulgaris	Heal-all, Terrapin Paw	J,M,O(18)	Greens				H,M	Introduced.
Monarda didyma	Bee-Balm, Wild Bergamot	K,M	Leaves	G.	X		H,M	
M. fistulosa		M	Leaves	G.	X		H,M	
Pycanthemum flexuosum		M	Leaves	G.			H,M	H is for genus.
P. incanum		M	Leaves	G.	X		M	
Mentha arvensis	Mint	M	Leaves	G.	X		M	Introduced(?)
M. spicata	Spearmint	M	Leaves	G.	X		D,H,M	Introduced(?)
M. piperita	Peppermint	G,M	Leaves	G.	X		D,M	Introduced.

TABLE II (Continued)

Families and Species	Common Name	Sources	Part Eaten	Edibility and Archaeological Notes F.	P.	A.	Medicinal References	Comments
Solanaceae								
Physalis heterophylla	Ground Cherry	H,I,J,M	Berry	G.	X			
Solanum tuberosum	Irish Potato	K,M	Tuber				M	Introduced.
S. nigrum		C,M	Greens	X	XT	G.	M	Not in range.
Scrophulariaceae								
Chelone glabra	Turtlehead, Snakehead	J,O(15)	Greens				D,M	
Pedicularis canadensis	Lousewort	J	Greens					
Plantaginaceae								
Plantago major	Plantain, Green Plantain	J,M	Greens	X	X		D,H,M,P	Introduced. H,P for genus.
P. lanceolata	English Plantain	M	Greens				M	Introduced.
P. aristata		M	Greens				M	
Rubiaceae								
Mitchella repens	Partridge Berry, Winter Clover, One Berry	M	Berries	X	X		D,H,M	
Caprifoliaceae								
Sambucus canadensis	Elderberry	H,I,J,M,N	Berries	X	X		A,H,M	
S. pubens	Elderberry	N	Berries(?)	XT				

TABLE II (Continued)

Families and Species	Common Name	Sources	Part Eaten	Edibility and Archaeological Notes F.	P.	A.	Medicinal References	Comments
Valerianaceae								
Valerianella locusta	Corn Salad, Lamb's Lettuce	J,M, O(11d)	Greens	G.	G.			Introduced.
Cucurbitaceae								
Cucurbita pepo	Pumpkin	numerous	Pulp, Seeds			X	D,H,M	Native Cultigen.
Lagenaria vulgaris	Bottle Gourd	M	Seeds			X	M	Native Cultigen.
Citrullus vulgaris	Watermelon, Citron	M	Pulp				M	Introduced.
Asteraceae								
Prenanthes trifoliata	Rattlesnake Root, Gall-of-the-Earth	M	Greens				H,M	
P. serpentaria	Gall-of-the-Earth, Lion's Foot, Rattlesnake Root	M	Greens				M	
Lactuca canadense	Wild Lettuce	H,I,M	Greens, Leaves	G.	X		H,M	
Cacalia atriplicifolia	Pale Indian-Plantain	M	Leaves				M	
Rudbeckia laciniata	Coneflower	H,I,J, K,L,M, N,O(1)	Greens				H	H is for genus as medicine.

TABLE II (Continued)

Families and Species	Common Name	Sources	Part Eaten	Edibility and Archaeological Notes F.	P.	A.	Medicinal References	Comments
Helianthus tuberosus	Jerusalem Artichoke	G,I,J	Tubers	X	X		D(?),M(?)	Introduced(?)
Eupatorium[k] purpureum	Queen-of-the-Meadow	J	Root				E,P	Root processed for salt.
Taraxacum officinale	Dandelion	J,K	Greens	X	X			Introduced.

[*] For explanation of sources see text immediately preceeding Table II.

[a] All specific names are as listed in Radford, Ahles, and Bell (1968). Species not listed by Radford et. al. are given as in original citation. Outmoded names have been changed to modern ones as listed by Radford et. al. (1968) when available.

[b] Cherokee plant names are given only occasionally and only when original authors have translated such names into English.

[c] Listed as edible in Fernald and Kinsey (1958).

[d] Listed as edible in Peterson (1978).

[e] Archaeological identifications within study area and researched reports.

[f] Numbers in parentheses refer to Witthoft as follows:

> "In the following listings, I have arranged potherbs under the Cherokee names in approximate order of decreasing importance in Cherokee diet. Those that are listed first are still in widespread use; those listed last are either used by few or are added in small quantities to mixtures (Witthoft 1977:251)."

Letters following numbers indicate members of equally important groups of potherbs.

[g] Genus as a whole listed.

[h] "The same Cherokee name is also used for Amaranthus spp. (Witthoft 1977:253)."

TABLE II (Continued)

[i] Listed as toxic rather than edible.

[j] Radford, Ahles, and Bell (1968) note that this plant occurs with and is often confused with Cardamine pensylvanica.

[k] Root for salt.

CHAPTER IV

DISCUSSION

A Genetic Mediation Model of Plant Food Use Proposed for the Cherokee Culture Area

In Chapter I, it was suggested that an examination of plant foods could provide a test case for genetic mediation upon behavioral developments. Chemoperceptive and digestive characteristics of our species are measurable variables as are the secondary compound constituents of various plant groups. Moreover, tests designed to measure the degree of articulation between human perception of nutritious and toxic compounds contained in plant foods could be conducted. Chemoperception and digestion are primarily genetically controlled variables although cultural mediation upon chemoperception must also be evident to anyone who has tried to protect children from poisons. Apparently, both genetics and learning must play some role in the development of diet.

It was also argued in Chapter I that cultural inventories of knowledge pertaining to food plants should have been relatively attenuated at the time that the initial New World populations encountered temperate environments with diverse plant communities. Consequently, paleoethnobotanical inventories of food plants should exhibit high proportions of chemoperceptively compatible plant food remains at early horizons if genetic mediation was a significant factor in the development of plant food inventories. The focus of this chapter, therefore, will be to examine the ethnobotanic literature pertaining to plant foods in the study area in an attempt to determine whether genetic mediation in the plant component of human diets is evident. Under a genetic mediation model one would expect that such plants might appear in the archaeological record earlier than those plants which would require cultural processing techniques in order to enhance detection and digestion.

It could be expected that any such tendencies perceived in the ethnohistoric literature would be weak and difficult to measure in precise terms. The archaeological stage at which we would expect genetic mediation to be most evident (the Paleo-Indian) is not even represented in the ethnobotanic record. It must therefore be assumed that the earliest archaeological horizons from which plant food remains occur will still bear evidence of preceeding genetic mediation. Since a major cultural-ecological transition may have taken place between the Paleo-Indian and Archaic stages, such an assumption may be entirely unwarranted. Differential preservation of plant parts also introduces difficulties. Additionally, the model encounters difficulties in attempting to dichotomize those aspects of food plant utilization which were primarily derived through genetic as opposed to cultural adaptation. This is especially the case since plant foods seldom protect their tissues from herbivory by chemical defenses alone. Mechanical or ecological defenses such as unapparency or small seed size often accompany chemical defensive tactics. Also, energetic factors probably overrode genetic factors in many instances. Finally, in a theoretical vein, some damage to a biocultural perspective is unavoidable in attempting to dichotomize genetic and cultural variables especially when feedback loops between the two types of variables are not considered.

Despite these very real difficulties, the ensuing analysis attempts to examine the ethnobotanic record of the Cherokee culture area in light of seven categories of food plants each of which consists of a particular subset of human genetic or cultural, and plant chemical or mechanical attributes. Ecological complicating factors are noted in each category.

Under a strict genetic mediation model, it would be expected that those categories of nutrient containing plants or plant parts which were not chemically protected would have entered inventories of plant foods earliest. Among such plants, those which exhibit seed dispersal mechanisms whose effectiveness is enhanced through animal consumption would be the initial plants to appear in plant food inventories. Through time those plants which were poorly protected by chemical defenses would be added to plant food inventories. Other things being equal, those plants with the more easily counteracted mechanical defenses would appear before those with more stubborn mechanical defenses. Finally, those plants which required extensive cultural preparation in order to counteract chemical defenses would appear in food plant inventories. At any stage, ecological or energetic variables may have overridden genetic and cultural variables. Such variables are noted where appropriate. In sequence, the very general order by which plants of equal nutritional value would be expected to appear in food plant inventories according to a genetic mediation model would be:

1) Those which have symbiotic relations with animals in terms of seed dispersal;
2) Those which have developed neither mechanical nor chemical defenses;

3) Those which rely upon mechanical defenses which could be counteracted by simple cultural techniques;

4) Those which rely upon chemical defenses which could be counteracted by simple cultural techniques and;

5) Those which rely upon chemical defenses which could only be counteracted by more sophisticated cultural techniques.

Plant Categories Examined

Seven categories of food plants are proposed for examination under the genetic mediation model. These include 1) fruits whose seeds are not destroyed, for the most part, through animal consumption; 2) greens; 3) nuts; 4) fruits in which the majority of seeds are destroyed through animal consumption; 5) roots, tubers, bulbs, and underground stems; 6) flowers; and 7) various plant parts utilized primarily as flavorings and condiments. The categories are listed in the general order they might be expected to appear under a genetic mediation model as discussed above except for the last two categories which apparently played a small role in subsistence. Overlap between the categories in terms of their order of introduction into diets could be expected, and certain genera within each category do not fit particularly well in terms of their particular characteristics. Table III indicates the number of genera in each class which were apparently utilized historically and prehistorically. Appendix VI lists the genera employed in each category as indicated by the historic and archaeological records. Appendix VII provides a summary of plant usage in each category in terms of plant families represented in the prehistoric and historic records.

TABLE III

Numbers of Food Plant Genera by Period and Category

PERIOD	"Fruits": Seeds Not Destroyed	Greens	Nuts	"Fruits": Seeds Destroyed	Underground Plant Parts	Flowers	Flavorings
Historic	23	35	6	5	12	2	14
Prehistoric Periods Combined	12	10	6	16	1	0	1
Mississippian Period	12	7	4	12	1	0	0
Early Woodland Phases	7	6	3	6	1	0	0
Savannah River Phase	5	4	4	4	0	0	0
Morrow Mountain Phase	3	3	4	1	0	0	1
Pre-Morrow Mountain Phase	5	8	6	5	1	0	0
Archaic Period: All Phases Combined	7	8	6	6	1	0	1

The criteria used to place a particular genus within a particular category are subjective to some extent, particularly in regard to the prehistoric as opposed to the historic period. No claim is made that the category designations of particular genera are the best or only designations which could be made. Underground plant parts and greens assigned to archaeological categories are particularly suspect since their actual usage can usually only be inferred from the presence of their seeds. Inferences of prehistoric usage have been partially based upon contemporary references pertaining to wild plant food consumption as given by Fernald and Kinsey (1958) and Peterson (1978). Direct archaeological evidence of prehistoric consumption as based upon seed caches and paleofeces have been utilized where available. References to historic period usage by the Cherokee are assumed to have applied in the prehistoric period although the validity of such an assumption may be questionable. Certain genera (such as Acalypha), which have been identified archaeologically, have not been placed in any subsystem if the historic or contemporary wild plant food literature does not provide supporting information for their usage as foods. All historically recorded genera have been placed in as many subsystem categories as literature pertaining to the Cherokee suggests were used. Genera recorded from archaeological contexts alone have been placed in as many categories as either archaeological or contemporary wild plant food references suggest are applicable. The co-occurence of several archaeological genera within both the greens and "fruits with seeds destroyed" subsystems is particularly problematic in those cases where actual consumption of seeds by prehistoric peoples has not been adequately demonstrated.

Category # 1, which is the consumption of fruits without the destruction of seeds, is characterized by a truly symbiotic relationship between plants and animals. Genetic factors predominate in the category which consists of the consumption of plant reproductive parts by animals with the consequent dispersal of seeds by the animals.

In contrast th floral structures which are often linked to particular animal pollinators, seed dispersal mechanisms through animals would appear to be most effective when a wide range of animals could consume fruits. Although numerous seeds might be destroyed through particular animal consumers, there would still seem to be an advantage to attracting a variety of such animal consumers. For example, it would seem that blueberries (Vaccinium spp.) and huckleberries (Gaylussacia spp.) as well as several genera, would be more effectively dispersed by birds than by mammals. Birds might carry the seeds further and subject them to digestive processes for a shorter period of time. Nevertheless, dispersal might also be affected by mammals. The critical point is not so much whether a particular species' fruit evolved to be dispersed by a particular animal group, but rather whether the fruit thus evolved was edible to other animals including humans. The degree to which humans effectively dispersed viable seeds after consuming fruits is a secondary question which could be investigated experimentally.

At least 23 genera of plants appear to fit this category historically and twelve genera of archaeologically recovered plants also appear to fit the category. Seventeen families of plants are recorded in either or both contexts. Since seed containing structures are the plant parts being consumed, and such structures carbonize reasonably well, they can be expected to occur on archaeological sites although not as frequently as grains. Plants meeting the criteria of the category could probably be expected to be among the first, if not the first, utilized in a newly encountered environment. Their recognition by humans would be facilitated by chemoperception, and perhaps by color vision as well, since one could expect plants to "advertise" their fruits to animals. Of course not all brightly colored fruits are edible to humans and many are surely even poisonous. However, sampling of fruits would probably reveal unpleasant tastes or digestive tract discomfort or rejection and would almost certainly be remembered. The individual sampling such fruits would probably reject them in the future and transmit his knowledge of such plants to other individuals. The most dangerous fruits would be those which tasted good, but which nevertheless contained toxic compounds. However, it seems likely that most harmful substances would be recognized by unusual or unpleasant tastes or odors. Moncrieff noted that:

> It is a source of wonder that the nose can cope so efficiently with the hundreds of thousands of new synthetic substances that are now made and that have never occurred in nature. ...Tasteless toxic substances could not have existed widespread in nature in readily available forms at any time in evolutionary history, since in the absence of a taste warning every animal or man that ingested them would have perished. It is more likely that they belong to a group of compounds to which in evolutionary history, man and animals have never been extensively exposed... (Moncrieff 1967: 4-5).

Moncrieff probably overstated his case somewhat since sickness rather than death could be the result of consuming tasteless toxins. Sickness might then be followed by a rejection of any or all foods that were consumed a short time prior to the onset of illness.

It would seem plausible that any plant which provided edible fruits containing seeds which could be dispersed by a particular species of animal would thrive as that animal's population and consequent predation upon the plant increased. Through time, positive feedback loops between Indians and certain fruit-bearing species may have contributed to increased populations of both humans and plants. Human selection of the most desirable fruits within a species might also have led to improvements of such plants from the human standpoint. This would have been especially true as human impact on the overall environment increased. It is important to note that such "improvements" in the plants could have occurred without any deliberately purposive effort on the part of human consumers to "domesticate" such plants.

The second category relevant to human/plant food interaction concerns immature leaves and stems. These plant parts, or greens, most often were collected from leafy annuals although pokeweed, for instance, is a perennial. Witthoft noted that:

> The Cherokee eat a greater quantity and variety of greens than the people of any other community in which I have visited (Witthoft 1953: 24).

Indeed, the historic and ethnographic literature pertaining to the Cherokee indicates the use of at least 35 genera of plants in 26 families as greens. Although no greens are recorded as such from the archaeological record, seeds from at least ten genera that may have been used for greens were indicated in the archaeobotanic literature reviewed. The importance of the greens category in Cherokee diet is further reflected in the several genera and at least two families (Plantaginaceae and Valerianaceae) of weedy plants which have been introduced from Europe and accepted as traditional components of the Cherokee diet. Altogether, at least 29 plant families are represented in the literature pertaining to greens usage among the Cherokee or in the Southern Appalachians archaeological area.

The apparent complexity of the category as reflected in the diversity of components masks, however, what I believe to be the underlying simplicity of the greens subsystem. The key to the greens complex may lie predominantly in the fact that the great majority of consumed greens appear to be immature annuals or parts of such plants. Weakley, in an unpublished paper (1981), examined the literature pertaining to anti-herbivory mechanisms in seedlings and made several observations relevant to the topic of greens consumption.

Most seedlings are selected for rapid growth above and below ground as a consequence of competition for light, water, and nutrients. The development of anti-herbivorous chemical defences at an early stage of growth may therefore be excessively costly in terms of the plant's resources especially since the need to avoid autotoxicity requires further expenditure of resources. However, seedlings are unapparent from an herbivore's standpoint in that they are ephemeral, often difficult to locate, and constitute a minor proportion of available biomass. As such, it may be generally adaptive to allocate the majority of resources to quick growth while delaying development of mechanical or chemical defenses despite the "window of vulnerability" in the seedling stage of growth. This is despite the desirability of seedlings to herbivores since they are easily masticated and digested, and are generally high in nutrients as well.

In a cultural context, utilization of greens is further facilited and generalized through boiling which, especially if the pot liquor is discarded, would remove most of any toxic compounds (as well as some nutrients) present while simultaneously counteracting such mechanical defences as hairs or spines by softening. Moreover, the ability to mix several species of greens in one preparation (cf. Witthoft 1953, 1977 and Perry 1974) would increase the value of the complex as a whole in the likely event that a sufficient quantity of a single species could not be readily obtained. The greens category therefore appears to reflect, as a whole, a cultural adaptation to the general biological tendency of new plant growth, especially among annuals to be chemically unprotected. Taste and smell would, of course, provide initial tests of edibility prior to the introduction of a new species to the greens complex. The rarity of perennials in the greens category might be due, in part, to the ability of established plants to protect new growth with generalized protective chemicals such as tannins which slow growth of nearly all herbivores. Generalized protective chemicals are usually more expensive to produce than are specialized toxins such as those found among the alkaloids. Moreover, the latter protective compounds may be effective against only a few species.

One aspect of the greens complex which is somewhat problematic archaeologically is that extensive utilization of greens would appear to be greatly facilitated by efficient cooking, and particularly boiling, containers. Although stone boiling in vessels such as skin bags may have been practiced in pre-ceramic or stone bowl horizons it seems somewhat doubtful that such preparation techniques could have been as efficient as preparation in ceramic or stone vessels. The variety of greens utilized prior to the Late Archaic period could therefore have been more circumscribed due to both the lack of proper facilities for preparation of large quantities of greens as well as the increased risks of eating more mature greens raw as in salad preparations. It might be that more efficient boiling containers may have allowed the use of larger quantities and a greater variety of increasingly more mature greens which could be expected to contain an ever increasing proportion of undigestible or toxic components. More mature greens would also be more likely to have associated seeds which could be broadcast unintentially through harvesting of the plants for greens. The observations made here pertaining to cooking facilities are, of course, speculative.

Category # 3 is the human consumption of nuts. This is an extremely important category both archaeologically and historically with the same six genera and three closely related plant families represented in both records. The primary characteristic of the complex is the overcoming of the plants' mechanical protection of nut meats. In that some of the nuts are also protected by protein binding tannins, a chemical protection is counteracted by cultural detoxification. Although the destruction of nut meats links nut utilization to Category # 4, there are sufficient differences in the operation of the two categories to distinguish between them. Nut collection and processing is probably easily learned and provides additional advantages in terms of major nutritional benefits and ease of storage. Nut remains probably dominate the plant spectrum in most archaeological assemblages in the Eastern United States, but actual importance in the diet compared to other plant species is difficult to assess in consideration of the great resistance of carbonized nut shell to biological and mechanical degradation. Since nut shell probably accumulated in rather large quantities, it was probably also used as fuel thereby adding to its preservation potential and dominant profile in the paleoethnobotanical record. Parching in order to kill insects which had bored through nut husks and/or shells, to kill the seeds, and to reduce seed moisture may have been common prior to storage. Such parching could have introduced additional nut remains into archaeological contexts. Nevertheless, historic records give a strong indication that nuts were indeed major dietary components. There is no reason to believe that nuts were not among the earliest plant foods used aboriginally although it is less clear whether their importance was primarily in the fall and winter or whether they were stored for use in the spring and summer as well. On its surface, nut consumption would appear to carry no benefit to the trees involved since large numbers of embryos were certainly destroyed. However, the massive quantities of nuts produced by such trees (cf. Munson et. al. 1971) in peak years, in conjunction with their widespread habitat, certainly ensured the propagation of the species. It is also possible that human impact on the environment such as intentional setting of fires, differential clearing of live trees, and loss of nuts around organically enriched and ecologically simplified campsites, may have been beneficial to some nut-bearing species. It is also difficult to assess how the harvesting of other nut consuming species, such as deer and turkeys, may have affected the distribution of mast bearing trees of the Fagaceae. The processing techniques developed to leach tannins from certain nuts may have developed in conjunction with, or been a prelude to, the development and/or expansion of the "root" consumption category.

The nut complex probably did not consist of a single set of homogeneous techniques for all genera exploited. Harvesting techniques probably varied, and historic/ethnographic data indicates that processing techniques varied considerably according to the type of nut utilized. Among the Juglandaceae the extreme invagination of the nut within the shell could have made exploitation of these species cumbersome until processing techniques were perfected. Juglans spp. were probably cracked and eaten raw or roasted, but oil was also obtained by boiling crushed meats and shells. The oil was skinned from the top of the boiling vessel once it had cooled and was stored as an ingredient in soups and cooked greens. The "milk" left in solution after skimming off the oil was used as a soup base after pouring it off the settled nut fragments (Witthoft 1953). Presumably such processing was preceeded by operations to cleanse the nut shells of the inky husk interiors. Carya spp. was processed in a fashion similar to Juglans spp. The method has been described by many authors including Battle (1922), Ulmer and Beck (1951), and Witthoft:

> The nuts are crushed between stones in a cloth-lined basket, and then about a quart of the crushed meats and shells are placed in the wooden mortar (the ordinary corn "pounding block") and beaten with the pestle until the meats and shells are completely pulverized. When beaten finely enough, the paste can be molded into dough-like balls between the hands, and it is made into solid balls about six inches in diameter. These may be use immediately, but may be stored for some days. One of these balls is boiled in about two quarts of water, to the consistency of thick cream, and is usually eaten without any other materials being added. The shells are not removed at any stage in the preparation, and are hardly conspicuous in the final soup (Witthoft 1953: 52).

Among the Betulaceae, hazel nuts (Corylus americana) were cracked and eaten raw, especially by children (Witthoft 1953). It would seem that hazel nuts were not abundant enough to provide a large constituent of the diet.

The Fagaceae are protected by a less dense shell than are members of the Juglandaceae. Beech nuts (Fagus grandifolia) were processed in a manner similar to walnuts, butternuts, and hickories except the shell fragments were more often winnowed and picked from among the crushed nuts before boiling (Witthoft 1953). However, beech nuts do not appear to have been important either historically or archaeologically perhaps because the nuts are seldom well developed within their shells and are mildly toxic as well.

Only the white oak (Quercus alba) is reported to have been exploited for acorns in the historic period. Species identifications of archaeological remains have not been attempted in the examined paleoethnobotanical studies. It is perhaps significant that white oak has a low tannin content. Shells were removed by breaking the acorns in a mortar and winnowing in a basket. The partially cleaned meats were then beaten into a fine flour in a mortar and used as a corn substitute in breadstuffs.

Chestnuts (Castanea dentata) was important historically before the chestnut blight although chinquapin (C. pumila) does not seem to have been important except as a field food. Chestnuts were apparently not ground to a flour; but were rather shelled, cut into pieces, and boiled. The nuts and stock were then used in corn or bean breads which comprised a Cherokee staple in the last century (Witthoft 1953). The relative scarcity of Castanea remains in archaeological contexts is poorly understood.

The fourth category considered is that concerning the consumption of fruits or seeds (other than nuts) in such a manner that seeds are primarily destroyed rather than disseminated. Quite remarkably, archaeological plants outnumber historic plants within this complex at a count of sixteen genera to five. The significance of these figures is further highlighted through an examination of the historic genera involved: Zea, Phaseolus, Cucurbita, Lagenaria, and Amphicarpa. Amphicarpa bracteata, the hog peanut, produces a fruit which is commonly found beneath the ground. In some respects, therefore, hog peanut utilization resembles the root procurement subsystem. Amphicarpa, like Phaseolus, is a member of the Fabaceae. The four genera other than Amphicarpa are readily recognized as the corn, beans, squash (and gourd) complex so familiar in the historic literature. The "seeds destroyed" complex can be viewed as cultural predation upon plants in that increased efficiency of the subsystem could have led to the eventual decline of the plants involved. However, the planting of a reservoir of seeds withheld from consumption would have assured the survival and even the spread of the plants involved thereby changing the subsystem into a symbiotic one. This was fortunate since fruit and seed collection and selection had apparently progressed to a stage where self-propagation of some of the plants had become very difficult, if not impossible. The five genera involved (except Amphicarpa) had become cultigens in the full sense of the word in that they had become dependent upon people for their survival at least within the range of the Cherokee. The processes by which maize, beans, squashes, and bottle gourds became domesticated and/or introduced into new habitats are well beyond the scope of discussion. More at issue here is why archaeological representatives of the complex outnumber those recorded historically and ethnographically.

Five of the archaeological plants are identical to those recorded for historic times. As with all members of the archaeological complex, inferences must occasionally be made that seeds were actually consumed prehistorically. Such is especially true for squashes and the bottle gourd in the present instance.

Several of the archaeological plants fall into a category which Yarnell (1978) has called "plants of intermediate status". Such plants can survive independently of human influence yet occur most abundantly where human activity is most obvious. Chenopodium, Amaranthus, Polygonum, and Portulaca comprise a possibly related sub-complex within the "seeds destroyed" category in that they all provide edible greens and therefore crosscut categories. The genera belong to four closely related families; Chenopodiaceae, Amaranthaceae, Polygonaceae, and Portulacaceae respectively. Two storage pits filled with cleaned and carbonized Chenopodium and Polygonum seeds were located at the Late Woodland Newbridge site of Illinois (Asch and Asch 1977), and seeds of all four genera have been recovered from Salts Cave paleofeces (Yarnell 1974). Yarnell noted that numerous ethnographic records indicate the use of wild amaranth seeds and greens throughout temperate North America (Yarnell 1978). Purslane seeds (Portulaca sp.) were present in human feces at Salts Cave (Yarnell 1978) and may have been extensively utilized by the Aztec (cf. Chapman et. al. 1974).

It would not be surprising if seed consumption of the above complex had its inception in the greens complex. The terminal inflorescences of these plants are quite leafy, and collection of greens in the later stages of maturation could easily have resulted in the ancillary collection of large numbers of seeds which may well have been consumed along with the herbaceous parts of the plants. Such collection techniques could have resulted in the dispersal of seeds at camps or village sites where many of the small seeds would have been lost in habitats suitable for their germination and growth. The plants of this greens sub-complex may thus have been pre-adapted to take advantage of gathering and consumption by humans in terms of increasing their range and density. Intentional exploitation of the seeds themselves from such plants would seemingly require more specialized collection techniques in environments already enriched with the species involved. Seed production among these plants is prodigious, and intentional planting was probably never necessary when the loss of numerous seeds in suitable habitats is considered.

Another sub-complex of the "seeds destroyed" category apparently took advantage of grasses and sedges. Poaceae is represented archaeologically by Zizania aquatica, Phalaris caroliniana and, of course, Zea mays; while Cyperaceae is represented by small quantities of Scirpus sp. seeds. Scirpus (bulrush) can be utilized as a green and might be allied to the greens sub-complex. Its representation is so slight, however, that its presence in archaeological deposits may be entirely fortuitous. Phalaris caroliniana, or maygrass, appears to have been a major food plant archaeologically. The natural range of the species had been expanded northward under human influence from the south into Ohio and Illinois. Maygrass seeds were the dominant component of 20 of 165 paleofeces specimens analyzed from Salts and Mammoth Caves and were second only to sumpweed in feces from Newt Kash Hollow where masses of seed heads were also recovered (Yarnell 1978). Phalaris has dense panicles of seeds which may have aided collectors. It is also a weedy, although presently uncommon, colonizer of disturbed ground. Small quantities of wild rice (Zizania aquatica) were recovered from Late Archaic period contexts in the Lower Little Tennessee Valley and thirteen specimens were present in samples from the historic Cherokee town of Chota (Chapman and Shea 1981). It is difficult to say much else about these small samples.

The last sub-complex within the "seeds destroyed" complex consists of members of the Asteraceae family. Two definite cultigens: Iva annua and Helianthus annuus are well represented in archaeological collections. The cultigen status of these two plants has been well documented (cf. Yarnell 1972, 1978). It would be interesting to know if any of the processes involved in the exploitation and eventual domestication of the cultigen composites may have also been operating (presumably unsuccessfully) on Ambrosia and Polymnia, both of which also belong to the Asteraceae. It is interesting that Asteraceae seedheads, along with Galium sp.

and Phytolacca americana occurred in all components from the Lower Little Tennessee Valley except those of the Lower Kirk (Chapman and Shea 1981).

Yarnell recovered seven Iva annua seeds lacking achene coats from 31Bn29 samples:

> Average measurements of the seven seeds are 4.6 X 3.5 mm. Adding approximately 0.7 X 0.4 mm. for the achene coat and 10 percent for shrinkage as a result of carbonization of each dimension, these figures become approximately 5.9 X 4.3 mm. ... Modern Iva annua achenes are only half as large as the Warren Wilson reconstructed average size... (Yarnell 1976: 223).

Yarnell further noted that the sumpweed seeds recovered from the Warren Wilson site were the most easterly and youngest specimens discovered at the time. A single sumpweed seed was recovered from feature 244 in the present analysis of 31Bn29 materials. The seed measured 4.9 X 3.8 mm. Reconstruction of original achene size following the same criteria as used by Yarnell indicates that the achene measured approximately 5.6 X 4.2 mm. after carbonization and 6.2 X 4.6 mm. prior to carbonization. The achene length, as well as the seed length, could actually be measured on the feature 244 specimen and was 5.6 mm. which agrees agrees exactly with the addition of 0.7 mm. to carbonized seed lengths in order to obtain carbonized achene lengths.

The apparent reduction in genera within the last category from prehistoric to historic times may have been due to either an increased reliance upon Mississippian cultigens or European disruption. Clarification would ensue from a detailed examination of Qualla phase components. The historic Cherokee site analyses of Chota, Tomotley, Tanasee, Citico, and Wear Bend (Chapman and Shea 1981) indicate substantial quantities of Ambrosia, Chenopodium, Phalaris, Polygonum, Polymnia, and Helianthus annuus (sunflower); but virtually no Iva annua (sumpweed). As a consequence, there are strong indications that European disruption played an important role in the loss of several plants from the "seeds destroyed" complex. Iva annua may have been replaced by sunflower prior to European contact (Yarnell 1972).

Category # 5 is the human utilization of roots, tubers, bulbs, and underground stems. Twelve genera in seven families are indicated in the historic literature pertaining to Cherokee utilization of such plant parts. Only one genus (Ipomea) is indicated in the archaeological literature (and that one indirectly through seeds) although unidentified tubers are occasionally reported archaeologically. Underground plant parts often often are used to store food resources for the plant itself. Their consumption by animals is therefore harmful to the plant both in terms of the loss of nutrients to the plant as well as the uprooting necessary to harvest them. This would seem to be the reason why a large proportion of such potential plant foods are protected by toxic substances. For example, of the twelve genera listed, five require fairly extensive processing prior to consumption, one is listed as poisonous (Fernald and Kinsey 1958), and one was utilized for salt extraction rather than for food per se. The human use of "root" foods therefore often requires fairly sophisticated knowledge of the environment and of processing techniques. The variety of families utilized would seem to suggest that different plant toxins may have been encountered. Underground plant parts are, by definition, hidden from direct observation and their use therefore requires knowledge of associated above-ground parts. For these reasons, it would seem that "root" foods would be some of the last plant resources learned in a new environment. Once learned, however, root foods would have been dietarilly significant. Moreover, some species may have been intentionally propagated at an early stage of exploitation through replanting vegetatively reproductive portions of the plant immediately after harvesting. An alternative view is provided by Hatley and Kappelman (1980) who suggested that the preponderance of belowground nutritional plant material in semiarid and subhumid ecosystems provided a critically important and stable food resource for developing hominids. However, no consideration was given to the possibility that secondary compounds might discourage the utilization of such underground plant parts.

Category # 6 is characterized by the consumption of flowers. Only two species within two families are represented historically in this category, and no evidence of archaeological use is available. Consumption of flowers probably provided little nutritional benefit to the human consumer and could not be anything but harmful to the consumed plant. However, the apparently minor role of such plant foods in human subsistence probably did not constitute any major threat to the survival of individual plants or the propagation of the plant species. Flowers appear to constitute a food source unutilized, for the most part, by humans and other animals. Available biomass, particularly among tree species, appears to be large in the spring. Although chemical defences may protect some trees' flowers, it seems more likely that nutrient values are low. Protection against insects may be partially provided by the temporal means of flowering in early spring. Among humans it may be that the logistics involved in gathering flowers from tall trees may be too complicated for the benefits derived. Moreover, it may be energetically more efficient to wait until fruits develop from the flowers.

Category # 7 is characterized by the utilization of a wide variety of plant parts primarily for flavorings, condiments, or teas. Only those teas which seem to have had possible nutritional as opposed to medicinal value are included in the present analysis. Mature leaves, bark, twigs, sap, and occasionally roots constitute the plant parts primarily utilized within the complex. Indigenous aromatic flavorings or "spices" are included in this category as are sugary substances primarily derived from tree sap. Nutritional benefits to humans would appear to be minor within the system except, perhaps, for vitamin and mineral content. Individual plants may have been debilitated somewhat (though rarely killed) within the category, and reproduction and propagation would probably not have been greatly affected. Like the use of flowers, the importance of the flavorings category was probably of minor caloric importance. Nevertheless, at least fourteen genera of plants in ten families were utilized historically while only an extremely weak inference (to Liriodendron tulipfera) can be made to the use of such plants archaeologically. Historically, tulip tree may have been utilized for its sap and archaeologically the plant is represented by one seed or fruit (Chapman and Shea 1981) from a Morrow Mountain component. As such, the actual evidence for archaeological plants in the flavorings complex is effectively non-existent.

Comparison of the Genetic Mediation Model and Empirical Data

An examination of the food plant categories through the various phases (Table III) provides few clear-cut patterns that could not be attributed to sample size or differential preservation.

The fruits category in which seeds are apparently not destroyed does appear to have developed early, but preservation potential in the group is relatively high. Moreover, several other categories are represented by comparable numbers of genera.

The "greens" category is very difficult to judge in terms of antiquity since no direct indications of greens have been recovered archaeologically. The genera inferred to have been part of the complex have been determined through the presence of their seeds. Seeds would have been present in "greens" plants only at the time when their utility as greens was probably on the decline. Therefore, the seeds may indicate other uses of the plants so indicated in some cases.

The "nuts" category of plant foods came into use early and never disappeared. The same six genera present in pre-Morrow Mountain contexts are also observed in the literature pertaining to the historic and, to a lesser extent, contemporary Cherokee.

Among the "fruits with seeds destroyed" category, maize first appeared in Middle Woodland contexts and beans (Phaseolus vulgaris) in early Mississippian contexts. Otherwise, the most striking pattern is the overall persistence (although in varying quantities) of several wild plant genera through the entire stratigraphic column, especially as reflected in the work of Chapman and Shea (1981). One would feel more comfortable in dismissing the presence of plants such as Phalaris, Polygonum, Chemopodium, Amaranthus, and Portulaca in pre-Morrow Mountain archaeological contexts as merely accidental inclusions if several of these genera had not eventually become quite important food plants. If the early indications of these plants suggest operation of the "fruits with seeds destroyed" category, the initial stirrings of agricultural development in the Cherokee homeland may have been very ancient indeed. The interpretation of Chenopodium remains is rendered more difficult by the fact that intact seeds were recovered from Salts Cave paleofeces (Yarnell 1978). If Chenopodium seeds remained viable after digestion the plant might more properly belong to the category of plants whose embryos are not destroyed through animal consumption. Whether such seeds cooked long enough to kill embryos prior to consumption would be a complicating factor.

Underground plant parts other than seeds are not present in the archaeological record except for the possible presence of Ipomea as evidenced by seeds and possible tubers. Preservation potential is low, however, and it is not possible to judge how important the category was to the prehistoric Cherokee. Certainly Apios, Smilax, Allium, and Polygonatum seem to have been of some importance historically. At present, it is impossible to determine if the "roots" category may have been later in development than some of the other plant food categories proposed. Of course, it is also impossible to tell whether those genera of the "roots" complex which could have been easily detected chemoperceptively (e.g. Allium) or through the development of other complexes such as greens (again e.g. Allium) might have been used earlier than genera such as Smilax.

Flowers and flavorings are essentially absent from all phases of the archaeological record. However, neither category is considered important in terms of subsistence and neither category could be expected to be preserved very often especially in open-air archaeological contexts.

Unfortunately, it appears that the archaeological record is ambiguous regarding the plant food types proposed early in this chapter. Plant remains from Paleo-Indian sites might clarify some of the relationships, but the Lower Kirk horizon examined by Chapman and Shea (1981) is already abutting the beginnings of the Archaic period. A close examination of plant processing tools would be useful in helping to determine the earliest uses of plant foods in the Cherokee area and the rates at which new plant foods were added to the diet. However, such plant processing tools do not seem to appear before the Middle Archaic period, such as in the Stanly horizon (circa 5000 B.C.) at the Doershuk site where a single stone mortar was found (Coe 1964).

The environment encountered by the first inhabitants of the Cherokee culture area must have been very diverse in botanical resources. "Rejuvenation" of the environment probably began immediately perhaps especially through the use of fire. Chopping tools capable of cutting down trees first appear in the Guilford horizon (circa 4000 B.C.) as evidenced by chipped stone axes (Coe 1964).

Wood charcoal analyses from the Lower Little Tennessee Valley indicate that:

> The impact of man on the mixed mesophytic vegetation of the alluvial terraces is reflected in the wood charcoal spectra as successional plants increase in frequency over time (Chapman and Shea 1981: 79).

Perhaps a correlation study of the relationship between the food plant subsystems proposed in this study and habitats of archaeologically recovered food plants would be useful in suggesting which food plants indigenous to the Cherokee area first entered the diets of the area's earliest inhabitants. That is, it would be useful to know whether the earliest utilized plants came primarily from mature ecosystems or those types of ecosystems which would have expanded under human "rejuvenation" influences upon the pristine environment. In addition, it would need to be determined whether the earliest plant foods encountered in any particular area had been derived primarily through familiarity with previously encountered habitats and, if so, whether such foods had been learned through chemoperceptive or cultural means.

Overall, the evidence available at the present time neither confirms nor disproves the genetic mediation model as it was proposed. This is not to say that genetic characteristics of humans did not play a role in the selection of plant foods in the New World but, rather, that cultural and environmental factors probably masked any apparent genetic mediation tendencies of the sort proposed here at a very early stage. For instance, plant specialists (shamans for instance?) might have played an important role in testing plants in many areas where unfamiliar species were encountered. Similarly, it may well be that although plant foods are learned somewhat slowly, the time available to do so was so long as to render peoples all over the world fully cognizant of wild plant food potentials long before the earliest development of the processes which eventually led to intensive agriculture. One topic of research that would be useful in the future would be an attempt to determine whether food plant use increased evenly and steadily over time until agriculture began to appear, or whether wild food plant utilization was fully developed and static over a long period of time to be replaced in a "spurt" of cultural/biological evolution by the development of agriculture and introduction of cultigens.

If we can assume that the present archaeological record is not deceptive as to plant food use in the Early Archaic period, then we may be able to address the cultural history of plant food utilization in the New World since that time largely in ecological and cultural terms. Still, one could wish that if genetic mediation was not a particularly important variable in plant food utilization in the New World, that we could at least demonstrate such to be the case in a more convincing fashion. For we are still left with a fascinating instance of certain "independent invention" in the development of agriculture in the Eastern and Western hemispheres. Certainly it would be useful in attempting to explain this anthropological phenomenon of we could more confidently control for a possible genetic mediation variable as we surely can for the diffusion variable.

CHAPTER V

CONCLUSUSIONS

The research reported in this thesis falls into two rather distinct categories. The first of these is the examination of various aspects of the paleoethnobotanic record at the Warren Wilson site (31Bn29) in North Carolina. The second is the utilization of the plant remains of the site and the associated cultural-geographical area to examine whether genetic mediation influences upon plant food selection might be evident.

Three general topics received attention during the course of examining plant remains from the Warren Wilson site. These included an examination of plant food utilization through time, an examination of variation in plant remains within and between contemporaneous feature function categories, and a comparison of plant remains recovery techniques utilized during the course of excavation.

Forty percent (120) of the first 300 features excavated at the Warren Wilson site were chosen for plant remains analysis after all of the first 300 features were screened in terms of their suitability for such analysis. Those features which were not examined more closely were generally excluded because they were of ambiguous chronological provenience, or the samples were too small (generally less than .5 grams of charcoal), or they had previously been analyzed, or they were not contained within aboriginally excavated depressions. Altogether, 130 samples were examined. These samples consisted of soil samples which were floated in the laboratory, field flotations, or field washings which were floated in the laboratory. The field flotations were further subdivided into samples which either required further laboratory flotation or were ready for microscopic examination without further processing. The analyzed features consisted of 52 Pisgah phase features, 19 Swannanoa phase features, and 48 Savannah River features.

Plant remains examined from the three phases totalled 1420.13 grams. Of this total, 543.17 grams were from Pisgah features, 216.50 grams were from Swannanoa features, and 660.46 grams were from Savannah River features.

The examined Pisgah phase features consisted of eleven borrow pits, four clay-lined storage pits, seven clay hearths, nineteen pit hearths, six ditches/moats, and five posthole clusters. Plant remains were most concentrated in the ditches or moats. The placement of these shallow depressions along the palisade lines, in conjunction with the fact that ceramic and faunal remains are also most concentrated in these features, suggests that they served as secondary refuse deposits. The general paucity of plant remains in other types of Pisgah features supports this suggestion. Feature 8 (Pisgah Borrow Pit) and 247 (Pisgah Pit Hearth) contained large amounts of corn cupules and cob fragments, and few kernels, which suggests that they represent hide smoking or "smudge" pits.

Two types of Swannanoa features were examined -- rock cluster hearths (thirteen) and pit hearths (six). Food plant remains from both types of features were very scarce, with nuts predominant. Acorn remains were more prevalent in feature 191 than any other rock cluster hearth, and feature 237 had more nut remains than any other Swannanoa pit hearth.

Among the Savannah River features, eleven rock cluster hearths, thirty-four pit hearths, two charcoal concentrations, and one possible burial pit were examined. Nuts comprised nearly all of the food plant remains in the Savannah River features.

A comparison of the niche breadth (B) of the three phases was conducted in terms of the number of samples from each phase which contained a particular food item. Although the values of B are not directly comparable, they indicate a fairly focal resource base in the Swannanoa phase (B = 3.00) with the Savannah River phase (B = 4.39) and Pisgah phases (B = 7.76) being somewhat more diffuse. Among the nineteen Swannanoa feature samples, seven contained hickory, nine contained walnut, four contained acorn, and one feature contained a single bedstraw seed. Among the fifty Savannah River samples, twenty contained hickory; eighteen contained walnut; three contained butternut; six contained acorn; two contained bedstraw, pigweed, and/or grape; and one feature each contained either beech, <u>Prunus</u> sp., or <u>Polygonum</u> sp. The sixty Pisgah features contained a greater variety of plant remains as can be seen in Appendix IV. In addition to all of the items mentioned for the preceeding two phases, the Pisgah features also included bitternut, hazelnut, maize, bean, sumpweed, squash, gourd, maypops, persimmon, <u>Rubus</u> sp., and bearsfoot, as well as several unidentified and tentatively identified categories of plant remains. Although the present samples from Pisgah features contained no observed butternut, the samples analyzed by Yarnell (1976) did.

Comparisons between the feature function categories within the same phase and comparison between the different phases were difficult to conduct due to the variety of charcoal recovery techniques used at 31Bn29 through time. It is suggested that more useful comparisons can be made in the future if standard volumes of soil are processed and if greater attention is payed to the volume of the feature and/or zone from which the sample is obtained. Attention to soil volumes would also allow more useful comparisons between flotation and washings samples whenever both techniques are employed on a site. One liter of soil was determined to be much too small sample to provide useful data through flotation procedures. Flotation samples of ten or twenty liters would undoubtedly provide better results than were obtained in the present study although attenuation of rare elements (cf. Cowgill 1970) would still need to be accounted for. Specifically, this means that comparisons between rare elements from different archaeological contexts must be conducted with caution.

Comparisons between the plant remain contents of synchronic feature function categories indicated that such contents are poor indicators, by themselves, of feature function except, perhaps, in exceptional situations such as the Pisgah phase ditches or moats along palisade lines. Charcoal remains are not always distributed evenly through feature fill, thereby creating sampling difficulties; and also, the ultimate function of a feature is often better represented by archaeological remains than is its original function.

Although the present study was beset by sampling problems, the quantity of plant remains examined appears to support the contention that wood charcoal strongly predominates over plant food remains in both the Savannah River and Swannanoa phases as represented at the Warren Wilson site. Plant food remains are best represented in the ditches or moats along the palisade lines at the site, and future paleoethnobotanical studies concerned with Pisgah phase subsistence at the site would probably be most productive if concentrated upon those features.

Comparisons with related archaeological phases as represented by components from other sites in the south Appalachians, and especially those studied by Chapman and Shea (1981) is rendered difficult due to the predominance of flotation in the Lower Tennessee River Valley and the small amount of flotation conducted at the Warren Wilson site. Possible taphonomic variability, due especially to edaphic factors, also remains to be assessed. The two data sets are most alike in the Mississippian period. In earlier times, the Tennessee components are consistently richer in quantities and diversity of plant remains than are related components at the Warren Wilson site. If this relationship is not due primarily to sampling differences, it is tempting to suggest that the Ridge-and-Valley physiographic province may have been more favorable to humans in terms of plant resources at an earlier date. Although the Swannanoa River Valley and Warren Wilson site are at lower elevations than most of the surrounding Blue Ridge physiographic province, and may therefore have phytogeographically resembled the Great Valley, the overall mountainous terrain of the Warren Wilson environs could have restricted population size during the Archaic and, to a lesser extent, Woodland periods. Unpredictable climatic variations in the vicinity of the Warren Wilson site could have also constrained population size and concommitant ecological rejuvenation of the Warren Wilson environs resulting from higher population densities. If so, mature forests containing a higher proportion of nuts and fewer forbs may have persisted longer in the Swannanoa River Valley thereby resulting in a longer dependence upon the former category of plants in the Swannanos Valley. All speculation about the differences between the two data sets is, however, highly speculative.

An examination of historic and ethnographic data pertinent to Cherokee plant foods was conducted in order to provide a rough measure of what sorts of plant foods might be underrepresented in archaeological samples. Historic documents provide more data on medicinal than food plants and thus provide an indirect measure of the extent to which the Cherokee were familiar with the plant resources of their habitat. Ethnographic data are richer in terms of food plant data although it is undoubtedly more difficult to draw inferences as to aboriginal diets from such sources than it would be from detailed historic accounts. Nevertheless, the ethnographic data indicate that greens and roots may have been more important in prehistoric diets than is evident in the archaeological data (see Tables II and III).

The data compiled during the course of the archaeological, historic, and ethnographic research have been utilized in an attempt to address a major theoretical question in contemporary anthropology. That question concerns the degree to which human genetic characteristics influence cultural characteristics and development. First, an argument was made that human chemoperception probably evolved at least partially in response to the evolution of chemical defensive mechanisms among flowering plants and, conversely, in response to the development of flowering plant fruits containing seeds that could be dispersed by animals following ingestion. Next, an argument was presented that cultural adaptations to plant foods were probably reduced during the migration across the Beringian isthmus. Consequently, the development of plant food inventories in the New World should exhibit correlations with genetically derived perceptions of plant nutrients and toxins if genetic mediation of cultural choices had played a detectable role in learning which temperate New World plants were edible. All in all, the results of the analysis did not reveal that genetic mediation was a significant factor among the archaeological phases examined although such a study might be more interesting in the event that archaeological plant remains from a set of Paleo-Indian sites are eventually recovered.

APPENDIX I

Feature Summary

Pisgah Analyzed Feature Categories

Borrow Pits		Clay-Lined Storage Pits		Clay Hearths	
Analyzed	Accession #	Analyzed	Accession #	Analyzed	Accession #
3	2094eb1057	231	2241m2485	179	2225m659
6	2094eb1074	232	2241m2487	212	2241m611*
8	2094eb1096	234	2241m2497	225	2241m1945
55	2094eb1226*	236	2241m2508	227	2241m1966
78	2094m3075*			228	2241m1987*
170	2225m633			230	2241m2472
172	2225m639			292	2310m2691
189	2225m1832				
190	2225m1856				
199	2225m1891				
245	2310m1259				

Borrow Pits: No samples or Missing Samples	Clay Hearths: No samples or Missing Samples
4	1
5	87
173	152
218	153
	154
	222

Borrow Pits: Unsuitable or Previously Analyzed Samples	Clay Hearths: Unsuitable or Previously Analyzed Samples
47	140(Y)[a]
183	147
194	177
	211
	223[b]

APPENDIX I

Feature Summary (Continued)

Pisgah Analyzed Feature Categories

Pit Hearths: Analyzed	Accession #	Ditches/ Moats: Analyzed	Accession #	Posthole Clusters: Analyzed	Accession #
37	2094eb1156	213	2241m673*	178	2225eb1711*
85	2094eb3105*	216	2241m722*	243	2310m1173
86	2094eb5272*	217	2241m738*	255	2310m2243
107	2094m5934	229		256	2310m2247*
108	2094eb5941	Zone I	2241m2295	257	2310m2249
148	2094eb9467	Zone II	2241m2351		
167[c]	2225m612	Zone III	2241m2384		
209	2241eb567	Zone IV	2241m2410		
215	2241m711*	Zone VI	2241m2420		
220	2310m2203	244	2310m1218		
247	2310eb2210*		2310m1219		
	2310m2212	246	2310m1268		
	2310eb2211*		2310m1269		
250	2310m2216				
266	2310m2277*				
274	2310m2083				
277	2310eb2116				
280	2310m2151				
281	2310m2184*				
284	2310m2603				
296	2310m2721				

	Ditches/ Moats: No samples or Missing Samples	Posthole Clusters: No samples or Missing Samples
	226	168
		299

Pit Hearths: Unsuitable or Previously Analyzed Samples	Ditches/ Moats: Unsuitable or Previously Analyzed Samples	Posthole Clusters: Unsuitable or Previously Analyzed Samples
57(Y)	7(Y)	184
143(S)[d]	219	251
144		273
146(S)		298

Pisgah Unanalyzed Feature Categories

	House Floor Midden or Structural Post-hole Pattern	House Entry Trenches	Sweat House	Palisades
Unsuitable Samples	181, 185	62,171,186,208	54	9
Potentially Analyzable	169	40,41,224,235		14,56(Y)

APPENDIX I

Feature Summary (Continued)

Pisgah Unanalyzed Feature Categories

Bell-shaped Storage Pit	Midden	Clay or Ochre Concentrations	Burials without Human Bone	Spoil from Burial Pits
Missing, Unsuitable, or Non-existing Samples				
155		42	196 210	195
Previously Analyzed or Potentially Analyzable				
136(Y) 137(Y)	182 221 290	145	53 207	

Swannanoa Analyzed Feature Categories

Hearth (Rock Cluster)

Analyzed	Accession #
12	2094m3109
13	2094eb1109
36	2094eb1149*
89	2094m5278
109	2094eb5957
129	2094eb6007*
149	2094eb9485*
164	2094eb9513*
187	2225m1817
191	2225eb1850/1*
192	2225eb1865
275	2310m2093
279	2310m2137*

No Samples or Missing Samples

10,26,45,66,69,88,110,
125,,26,142,163,165,
166,254

Unsuitable Samples

39,158,162,197,200,
202,286

Pit Hearths

Analyzed	Accession #
130	2094eb6014*
237	2241m2523*
272	2310m2072
276	2310eb2108
278	2310m2128
285	2310m2607

No Samples of Missing Samples

131

Unsuitable Samples

271

APPENDIX I

Feature Summary (Continued)

Swannanoa Unalyzed Feature Categories

Post Mold

No Samples
19

Potentially Analyzable
18

Lithic Tool Cache

No Samples
214

Savannah River Analyzed Feature Categories

Hearth (Rock Cluster)

Analyzed	Accession #
21	2094eb1120
33	2094eb1137
35	2094eb1145*
48	2094eb1198
77	2094eb3072
156	2094eb9488*
161	2094eb9502*
176	2225eb650
188	2225m1823
	2225eb1824*
239	2241m2556*
242	2310eb1160

No Samples of Missing Samples

2,11,16,27,28,49,50,
59,60,61,65,67,68,72,
73,74,75,76,95,96,97,
113,114,115,116,117,
118,120,128,133,134,
138,139,150,151,159,
248,249,265,267,268

Unsuitable Samples

17,22,24,25,29,30,
31,51,175,193,201,
206

Pit Hearth

Analyzed	Accession #
32	2094eb1136*
34	2094eb1142
43	2094eb1248
44	2094eb1183
46	2094eb1185
52	2094eb1204
71	2094eb3062*
81	2094eb3087*
82	2094m3092
83	2094eb3096*
84	2094eb3098*
92	2094m5892*
94	2094m6028
98	2094m5899
99	2094eb5902
100	2094eb5908
103	2094eb5921*
119	2094eb5973*
121	2094m5976
122	2094eb5977*
123	2094eb5982
124	2094eb5986*
132	2094eb6022*
157	2094eb9490*
174	2225eb643
203	2225m1909*
205	2225m1925*
238	2241m2546*
240	2310m1145

Pit Hearth (Continued)

Analyzed	Accession #
241	2310m1118
261	2310eb2259
262	2310m2261*
	2310eb2263
283	2310m2202
291	2310m2673

No Samples or Missing Samples

38,58,64,70,93,101,
106,127,160,269

Unsuitable Samples

23,79,80,104,111,
204,258,259,263

APPENDIX I

Feature Summary (Continued)

Savannah River Charcoal Concentration

Analyzed	Accession #
90	2094m5284
91	2094m5887

Savannah River Burial Pit(?)

Analyzed	Accession #
282	2310m2695

Unalyzed

102

Savannah River Projectile Point Cache

No samples

15

Savannah River Large Rock

No samples

270

Morrow Mountain Hearth (Rock Cluster)

No samples

20
135

Unsuitable Samples

112

No Information

63

Overbank Midden

Analyzed	Acc. #
295	2310eb 2716

Previously Analyzed

141(S)

Non-Aboriginal or Non-Cultural Features: 105,180,198,233,252,253,260, 264,287,288,289,293,294,297, 300

APPENDIX I

Feature Summary (Continued)

ANALYSIS SUMMARY

Sampling Universe (N)=300 features
Features Analyzed (n)=120 features (40%)
Total Number of Samples=130

			Analyzed
Pisgah Features:	N=111	n=52	%=47
Borrow Pits	18	11	61
Clay-Lined Storage Pits	4	4	100
Clay Hearths	18	7	39
Pit Hearths	23	19	83
Ditches/Moats	9	6	67
Posthole Clusters	11	5	45
House Floor Midden	3	0	0
House Entry Trenches	1	0	0
Sweat House	1	0	0
Palisades	3	0	0
Bell-shaped Storage Pits	3	0	0
Midden	3	0	0
Clay or Ochre Concentrations	2	0	0
Burials Without Human Bone	4	0	0
Spoil from Burial Pit	1	0	0
Swannanoa Features:	N=45	n=19	%=42
Hearth (Rock Cluster)	34	13	38
Pit Hearth	8	6	75
Post Mold	2	0	0
Lithic Tool Cache	1	0	0
Savannah River Features:	N=123	n=48	%=39
Hearth (Rock Cluster)	64	11	17
Pit Hearth	53	34	64
Charcoal Concentration	2	2	100
Burial Pits(?)	2	1	50
Projectile Point Cache	1	0	0
Large Rock	1	0	0
Morrow Mountain Features:	N=3	n=0	%=0
Hearth (Rock Cluster)	3	0	0
Indeterminate Features:	N=3	n=0	%=0
Overbank Midden	2	1	50
No information	1	0	0
Non-cultural features:	N=15	n=0	%=0

APPENDIX I

Feature Summary (Continued)

ADDENDUM

Features Beyond Number 300 Excavated by the End of the 1982 Field Season

Feature #	Phase	Interpretation
301	Pisgah	Fill in Burial Slump
302	Pisgah	Borrow Pit
303	Pisgah	Pit Hearth
304	Pisgah	Clay Hearth
305	Pisgah	Posthole Cluster?
306	Pisgah	Posthole Cluster
307	Pisgah	Posthole Cluster
308	Pisgah	Fill in Burial Slump
309	Pisgah	Posthole Cluster
310	Pisgah	Midden in Tree Stump Slump
311	Pisgah	Posthole Cluster
312	Swannanoa	Burial Without Human Bone?
313	Pisgah	Borrow Pit
314	Pisgah	Borrow Pit
315	Pisgah	Borrow Pit
316	Pisgah	Borrow Pit
317	Pisgah	Posthole Cluster
318	Non-cultural origin	
319	Pisgah	Clay Hearth
320	Swannanoa	Hearth (Rock Cluster)
321	Savannah River	Hearth (Rock Cluster)
322	Pisgah	Borrow Pit
323	Swannanoa	Hearth (Rock Cluster)
324	Pisgah	Borrow Pit
325	Pisgah	Borrow Pit
326	Pisgah	Posthole Cluster
327	Pisgah	Borrow Pit
328	Pisgah	Borrow Pit
329	Pisgah	Burial 58
330	Swannanoa	Bottom of Hearth (Rock Cluster)?
331	Pisgah	Borrow Pit?
332	Swannanoa	Hearth (Rock Cluster)
333	Swannanoa	Hearth (Rock Cluster)
334	Savannah River?	Pit Hearth
335	Non-cultural origin	
336	Pisgah?	Clay Hearth
337	Pisgah?	Clay Hearth

APPENDIX I

Feature Summary (Continued)

[*] Entire sample pulled from main collections and stored with Simpkins' M.A. thesis analyzed specimens. Other samples constitute only a portion of the curated material under a given specimen number. There may, however, be some discrepancies.

[a] Analyzed by Yarnell (1976).

[b] Included within Feature 228.

[c] Possibly a sweat house.

[d] Analyzed by Sanford (1970).

APPENDIX II

Sample Measurements and Components

Pisgah Borrow Pits

Feature Number	3	6	8	172	55	170	189
Type of Sample	CC[d]	CC	CC	CC	DC[g]	SS[h]	SS
Pre-Processing Weight[a]	1.96	.40	.91	5.63	7	1021	369
Pre-Processing Volume[b]	10	4	6	10	10	1000	500
Pre-Processing Density[c]	.20	.10	.15	.56	.70	1.02	.74
Modern Organic				-[e]		.05	.03
Rock and Soil	.01		.01	3.12[f]	.38	.45	.06
Feces							
Sherds	.06			1.20			
Daubed Clay							
Flakes				.04			
Animal Bone				.95			
Shell				-			
Pine Bark						-	
Cane							
Fungus and/or Gall							
Wood	1.78	.39		.11	2.31	.35	.60
Hickory				-	.02	-	
Bitternut							
Walnut							
Acorn							
Unidentified Nut							
Corn Cupules			.88			-	
Corn Kernels							
Unidentified Seeds							
Total Processed Weight	1.85	.39	.89	5.42	2.71	.85	.69
Artifact/Ecofact Weight	1.84	.39	.88	2.30	2.33	.35	.60
Total Plant Remains	1.78	.39	.88	.11	2.33	.35	.60
Plant Food Remains	.00	.00	.88	-	-	-	.00
Categories of Plant Foods	0	0	1	1	1	2	0

APPENDIX II (Continued)

Sample Measurements and Components

Pisgah Borrow Pits

Feature Number	245	78	190	199	CC Totals
Type of Sample	SS	W[1]	W	W	
Pre-Processing Weight	595	184	397	623	9[j]
Pre-Processing Volume	500	200	400	500	30
Pre-Processing Density	1.19	.92	.99	1.25	.30
Modern Organic	-	.27	.18	.82	-
Rock and Soil		.17	.18	.84	3.14
Feces				.01	
Sherds					1.26
Daubed Clay				.81	
Flakes					.04
Animal Bone		.04	.01	.15	.95
Shell					-
Pine Bark		.10		.06	
Cane				.22	
Fungus and/or Gall		.04		.06	
Wood	.10	17.66	35.16	23.83	2.28
Hickory	.10	1.30	.31	2.56	-
Bitternut				.61	
Walnut				.70	
Acorn		.48	.03	.86	
Unidentified Nut				.04	
Corn Cupules		.56	.06	.96	.88
Corn Kernels		.46	.16	.26	
Unidentified		.08	.07	.52	
Seeds		.01	.01	.03	
Total Processed Weight	.20	21.17	36.17	33.34	8.55
Artifact/Ecofact Weight	.20	20.73	35.81	31.68	5.41
Total Plant Remains	.20	20.69	35.80	30.71	3.16
Plant Food Remains	.10	2.81	.57	6.02	.88
Categories of Plant Foods	1	7	5	11	2

APPENDIX II (Continued)

Sample Measurements and Components

Pisgah Borrow Pits

Feature Number	DC Totals	SS Totals	W Totals
Type of Sample			
Pre-Processing Weight	7	1985	1204
Pre-Processing Volume	10	2000	1100
Pre-Processing Density	.70	.99	1.09
Modern Organic		.08	1.27
Rock and Soil	.38	.51	1.19
Feces			.01
Sherds			
Daubed Clay			.81
Flakes			
Animal Bone			.20
Shell			
Pine Bark		-	.16
Cane			.22
Fungus and/or Gall			.10
Wood	2.31	1.05	76.65
Hickory	.02	.10	4.17
Bitternut			.61
Walnut			.70
Acorn			1.37
Unidentified Nut			.04
Corn Cupules		-	1.58
Corn Kernels			.88
Unidentified			.67
Seeds			.05
Total Processed Weight	2.71	1.74	90.68
Artifact/Ecofact Weight	2.33	1.15	88.22
Total Plant Remains	2.33	1.15	87.20
Food Plant Remains	.02	.10	9.40
Categories of Food Plants	1	2	14

APPENDIX II (Continued)

Sample Measurements and Components

	Pisgah Borrow Pits Feature Class Totals	% in Total	% of Plant Remains	% of Plant Food Remains
Pre-Processing Weight	3205			
Pre-Processing Volume	3140			
Pre-Processing Density	1.02			
Modern Organic	1.35	1.30		
Rock and Soil	5.22	5.03		
Feces	.01	.01		
Sherds	1.26	1.22		
Daubed Clay	.81	.78		
Flakes	.04	.04		
Animal Bone	1.15	1.11		
Shell	-	-		
Pine Bark	.16	.15	.17	
Cane	.22	.21	.23	
Fungus and/or Gall	.10	.10	.11	
Wood	82.29	79.37	87.69	
Hickory	4.29	4.14	4.57	41.25
Bitternut	.61	.59	.65	5.87
Walnut	.70	.68	.75	6.73
Acorn	1.37	1.32	1.46	13.17
Unidentified Nut	.04	.04	.04	.38
Corn Cupules	2.46	2.37	2.62	23.65
Corn Kernels	.88	.85	.94	8.46
Unidentified	.67	.65	.71	
Seeds	.05	.05	.05	.48
		100.00	100.00	100.00
Total Processed Weight	103.68			
Artifact/Ecofact Weight	97.11			
Total Plant Remains	93.84			
Food Plant Remains	10.40			
Categories of Plant Foods	14			

APPENDIX II (Continued)

Sample Measurements and Components

Pisgah Clay-Lined Storage Pits

Feature Number	231	232	234[k]	236	Feature Class Totals
Type of Sample	SS	SS	SS	SS	
Pre-Processing Weight	522	567	624	567	2280
Pre-Processing Volume	500	550	500	550	2100
Pre-Processing Density	1.04	1.03	1.25	1.03	1.09
Modern Organic	.48	.03	.05	-	.56
Wood	.03	.16	-	.09	.28
Hickory	.03	.03	.02	.04	.12
Total Processed Weight	.54	.22	.07	.13	.96
Artifact/Ecofact Weight	.06	.19	.02	.13	.40
Total Plant Remains	.06	.19	.02	.13	.40
Food Plant Remains	.03	.03	.02	.04	.12
Categories of Food Plants	1	1	1	1	1

	% in Total Sample	% of Plant Remains	% of Plant Food Remains
Modern Organic	58.33		
Wood	29.17	70.00	
Hickory	12.50	30.00	100.00
	100.00	100.00	100.00

APPENDIX II (Continued)

Sample Measurements and Components

Pisgah Clay Hearths

Feature Number	212	225	227	228	230
Type of Sample	SS	SS	SS	SS	SS
Pre-Processing Weight	142	595	453	510	567
Pre-Processing Volume	200	500	500	500	525
Pre-Processing Density	.71	1.19	.91	1.02	1.08
Modern Organic		.08			.24[1]
Rock and Soil	14.32	1.21	1.40	1.45	
Flakes	.04				
Animal Bone					
Wood	-	.31	.23	.19	.81
Hickory			.05	.01	
Acorn					-
Corn Cupules					
Corn Kernels					
Unidentified					
Seeds					
Total Processed Weight	14.36	1.60	1.68	1.65	1.05
Artifact/Ecofact Weight	.04	.31	.28	.20	.81
Total Plant Remains	-	.31	.28	.20	.81
Plant Food Remains	.00	.00	.05	.01	-
Categories of Plant Foods	0	0	1	1	1

Feature Number	292	179
Type of Sample	SS	W^m
Pre-Processing Weight	326	255
Pre-Processing Volume	250	200
Pre-Processing Density	1.30	1.28
Modern Organic	.32[1]	1.15
Rock and Soil		.29
Flakes		
Animal Bone		.02
Wood	.05	5.02
Hickory	.01	.38
Acorn		.02
Corn Cupules		.09
Corn Kernels		.23
Unidentified	-	
Seeds		-
Total Processed Weight	.38	8.40
Artifact/Ecofact Weight	.06	5.76
Total Plant Remains	.06	5.74
Plant Food Remains	.01	.72
Categories of Plant Foods	1	4

APPENDIX II (Continued)

Sample Measurements and Components

Pisgah Clay Hearths

Feature Number	SS Totals	Feature Class Totals	% in Total Sample	% of Plant Remains	% of Plant Food Remains
Type of Sample					
Pre-Processing Weight	2593	2848			
Pre-Processing Volume	2475	2675			
Pre-Processing Density	1.05	1.06			
Modern Organic	.64	1.79	6.41		
Rock and Soil	18.38	18.67	66.87		
Flakes	.04	.04	.14		
Animal Bone		.02	.07		
Wood	1.59	6.61	23.67	89.32	
Hickory	.07	.45	1.61	6.08	56.96
Acorn	-	.02	.07	.27	2.53
Corn Cupules		.09	.32	1.22	11.39
Corn Kernels		.23	.82	3.11	29.11
Unidentified	-	-	-	-	
Seeds		-	-	-	-
			100.00	100.00	100.00
Total Processed Weight	20.72	27.92			
Artifact/Ecofact Weight	1.70	7.46			
Total Plant Remains	1.66	7.40			
Food Plant Remains	.07	.79			
Categories of Plant Foods	2	4			

APPENDIX II (Continued)

Sample Measurements and Components

Pisgah Pit Hearths

Feature Number	37	108	274	85	86	148	209
Type of Sample	CC	CC	CC	DC	DC	DC	DC
Pre-Processing Weight	2.87	1.90	12.16	28	312	85	17
Pre-Processing Volume	13	10	10	50	450	150	60
Pre-Processing Density	.22	.19	1.22	.56	.69	.57	.28
Modern Organic	.01	.01	.08				
Rock and Soil	.12		11.53	.03	.01		
Animal Bone	.03	.11					
Shell	.02						
Sycamore(?) Bark						9.41	
Pine Bark					.12		
Fungus and/or Gall							
Wood	2.32	1.69	.23	1.50	37.86		16.57
Hickory	.29		.02				
Walnut			-				
Acorn							-
Hazel Nut							
Corn Cupules			.08				
Corn Kernels							
Unidentified			-			-	
Seeds		-				-	
Total Processed Weight	2.79	1.81	11.94	1.53	37.99	9.41	16.57
Artifact/Ecofact Weight	2.66	1.80	.33	1.50	37.98	9.41	16.57
Total Plant Remains	2.61	1.69	.33	1.50	37.98	9.41	16.57
Food Plant Remains	.29	-	.10	.00	.00	-	-
Categories of Food Plants	1	2	3	0	0	1	1

APPENDIX II (Continued)

Sample Measurements and Components

Pisgah Pit Hearths

Feature Number	247 (2310eb2210)	247 (2310eb2211)	277	107
Type of Sample	DC	DC	DC	SS
Pre-Processing Weight	85	57	7	510
Pre-Processing Volume	200	150	10	500
Pre-Processing Density	.43	.38	.70	1.02
Modern Organic	.08	.11	-	-
Rock and Soil	1.48	.04	.03	
Animal Bone				
Shell				
Sycamore(?) Bark				
Pine Bark				
Fungus and/or Gall				
Wood	1.19	2.34	.69	9.66
Hickory		-		
Walnut				
Acorn				
Hazel Nut				
Corn Cupules	17.38[n]	23.39		
Corn Kernels		.12		
Unidentified				.01
Seeds		.01		
Total Processed Weight	20.13	26.01	.72	9.67
Artifact/Ecofact Weight	18.57	25.86	.69	9.67
Total Plant Remains	18.57	25.86	.69	9.67
Food Plant Remains	17.38	23.52	.00	.00
Categories of Food Plants	1	4	0	0

APPENDIX II (Continued)

Sample Measurements and Components

Pisgah Pit Hearths

Feature Number	215	247 (2310m2212)	250	280	281
Type of Sample	SS	SS	SS	SS	SS
Pre-Processing Weight	624	482	595	567	907
Pre-Processing Volume	700	500	500	525	800
Pre-Processing Density	.89	.96	1.19	1.08	1.13
Modern Organic		-	.06	.16	.03
Rock and Soil			-		
Animal Bone					
Shell					
Sycamore(?) Bark					
Pine Bark					
Fungus and/or Gall					
Wood	.31	.94	.91	.05	2.26
Hickory	.04			.05	
Walnut					
Acorn	-				
Hazel Nut					
Corn Cupules		12.25			
Corn Kernels		.06			
Unidentified Seeds		.02			
Total Processed Weight	.35	13.27	.97	.26	2.29
Artifact/Ecofact Weight	.35	13.27	.91	.10	2.26
Total Plant Remains	.35	13.27	.91	.10	2.26
Food Plant Remains	.04	12.31	.00	.05	.00
Categories of Food Plants	1	1	0	1	0

APPENDIX II (Continued)

Sample Measurements and Components

Pisgah Pit Hearths

Feature Number	284	296	167	220	266	CC Totals
Type of Sample	SS	SS	W	W	W	
Pre-Processing Weight	623	354	198	340	964	17
Pre-Processing Volume	500	300	200	350	700	33
Pre-Processing Density	1.25	1.18	.99	.97	1.38	.52
Modern Organic	.55[1]	.46[1]	.89	.84	3.51	.10
Rock and Soil			2.63	.03	1.57	11.65
Animal Bone				.05	.04	.14
Shell						.02
Sycamore(?) Bark						
Pine Bark						
Fungus and/or Gall				-	-	
Wood	.11	.10	29.31	6.93	4.53	4.24
Hickory			.08	.86	4.67	.31
Walnut			.10		.80	-
Acorn			-	.08	-	
Hazel Nut			.02			
Corn Cupules			-	.03	.04	.08
Corn Kernels				.03	.07	
Unidentified				.01	-	-
Seeds			.03		-	-
Total Processed Weight	.66	.56	33.06	8.86	15.23	16.54
Artifact/Ecofact Weight	.11	.10	29.54	7.99	10.15	4.79
Total Plant Remains	.11	.10	29.54	7.94	10.11	4.63
Food Plant Remains	.00	.00	.23	1.00	5.58	.39
Categories of Food Plants	0	0	9	3	7	4

APPENDIX II (Continued)

Sample Measurements and Components

Pisgah Pit Hearths

Feature Number	DC Totals	SS Totals	W Totals	Feature Class Totals
Type of Sample				
Pre-Processing Weight	591	4662	1502	6772
Pre-Processing Volume	1070	4325	1250	6678
Pre-Processing Density	.55	1.08	1.20	1.01
Modern Organic	.19	1.26	5.24	6.79
Rock and Soil	1.59	-	4.23	17.47
Animal Bone			.09	.23
Shell				.02
Sycamore(?) Bark	9.41			9.41
Pine Bark	.12			.12
Fungus and/or Gall			-	-
Wood	60.15	14.34	40.77	119.50
Hickory	-	.09	5.61	6.01
Walnut			.90	.90
Acorn	-	-	.08	.08
Hazel Nut			.02	.02
Corn Cupules	40.77	12.25	.07	53.17
Corn Kernels	.12	.06	.10	.28
Unidentified	-	.03	.01	.04
Seeds	.01		.03	.04
Total Processed Weight	112.36	28.03	57.15	214.08
Artifact/Ecofact Weight	110.58	26.77	47.68	189.82
Total Plant Remains	110.58	26.77	47.59	189.57
Food Plant Remains	40.90	12.40	6.81	60.50
Categories of Food Plants	6	3	11	13

APPENDIX II (Continued)

Sample Measurements and Components

Pisgah Pit Hearths

	% in Total Sample	% of Plant Remains	% of Plant Food Remains	% of Plant Food Remains Without Feature 247
Modern Organic	3.17			
Rock and Soil	8.16			
Animal Bone	.11			
Shell	.01			
Sycamore(?) Bark	4.40	4.96		
Pine Bark	.06	.06		
Fungus and/or Gall	-	-		
Wood	55.82	63.04		
Hickory	2.81	3.17	9.93	82.44
Walnut	.42	.47	1.49	12.35
Acorn	.04	.04	.13	1.10
Hazel Nut	.01	.01	.03	.27
Corn Cupules	24.84	28.05	87.88	2.06
Corn Kernels	.13	.15	.46	1.37
Unidentified	.02	.02		
Seeds	.02	.02	.07	.41
	100.00	100.00	100.00	100.00

APPENDIX II (Continued)

Sample Measurements and Components

Pisgah Ditch/Moats

Feature Number	213	216	217	229 Zone I	229 Zone II	229 Zone III
Type of Sample	SS	SS	SS	SS	SS	SS
Pre-Processing Weight	1134	652	765	496	567	510
Pre-Processing Volume	1200	600	900	525	525	500
Pre-Processing Density	.95	1.09	.85	.94	1.08	1.02
Modern Organic		.11	.02	.02	-	.05
Rock and Soil	.21			.47	.09	-
Feces						
Sherds						
Daubed Clay						
Flakes						
Animal Bone			.06	.15	-	.16
Shell						
Pine Bark						
Sap						
Grass Stem						
Fungus and/or Gall					-	
Wood	3.16	.86	4.56	3.78	.91	2.21
Hickory	.25	.25		.19	.03	.16
Bitternut						
Walnut	.04	.04	.13			
Acorn	-	-		.04	.06	.05
Corn Cupules	-	-		.02		
Corn Kernels				.06		
Cucurbita						
Lagenaria						
Unidentified			-	.06		.02
Seeds	.02	.02				
Total Processed Weight	3.68	3.68	4.77	4.79	1.09	2.65
Artifact/Ecofact Weight	3.47	3.47	4.75	4.30	1.00	2.60
Total Plant Remains	3.47	3.47	4.69	4.15	1.00	2.44
Food Plant Remains	.31	.31	.13	.31	.09	.21
Categories of Food Plants	6	2	1	3	2	2

APPENDIX II (Continued)

Sample Measurements and Components

Pisgah Ditch/Moats

Feature Number	229 Zone IV	229 Zone VI	244 (2310ml218)	246 (2310ml268)
Type of Sample	SS	SS	SS	SS
Pre-Processing Weight	397	595	624	624
Pre-Processing Volume	400	525	500	500
Pre-Processing Density	.99	1.13	1.25	1.25
Modern Organic	-	-	.05	-
Rock and Soil	.05	.24	.81	
Feces				
Sherds				
Daubed Clay				
Flakes				
Animal Bone		.04	.12	
Shell				
Pine Bark				
Sap				
Grass Stem		-		
Fungus and/or Gall				
Wood	1.33	.50	1.61	.73
Hickory	.29	.60	.03	.03
Bitternut		.10		
Walnut				
Acorn	-	-	.02	.03
Corn Cupules			.03	
Corn Kernels	.05	.06	.02	
Cucurbita				
Lagenaria				
Unidentified	.01	.08		
Seeds	-	-		-
Total Processed Weight	1.73	1.62	2.69	.79
Artifact/Ecofact Weight	1.68	1.38	1.83	.79
Total Plant Remains	1.68	1.34	1.71	.79
Food Plant Remains	.34	.76	.10	.06
Categories of Food Plants	4	5	3	3

APPENDIX II (Continued)

Sample Measurements and Components

Pisgah Ditch/Moats

Feature Number	244 (2310ml219)	246 (2310ml269)	SS Totals	W Totals
Type of Sample	W	W		
Pre-Processing Weight	794	936	6364	1730
Pre-Processing Volume	1000	1000	6175	2000
Pre-Processing Density	.79	.94	1.03	.87
Modern Organic	5.39	3.11	.25	8.50
Rock and Soil	.69	.33	1.87	1.02
Feces	-			-
Sherds	.03	.03		.06
Daubed Clay		3.17		3.17
Flakes		.02		.02
Animal Bone	3.57^{o}	.69	.53	4.26
Shell	.17			.17
Pine Bark	2.52			2.52
Sap		.21		.21
Grass Stem	.03		-	.03
Fungus and/or Gall	-		-	-
Wood	88.28	57.86	19.65	146.14
Hickory	8.10	16.16	1.58	24.26
Bitternut			.10	
Walnut	.03		.17	.03
Acorn	6.53	3.02	.20	9.55
Corn Cupules	9.82	.68	.05	10.50
Corn Kernels	4.84	1.14	.19	5.98
Cucurbita	.06			.06
Lagenaria	.06			.06
Unidentified	.68		.17	.68
Seeds	.15	.04	.02	.19
Total Processed Weight	130.95	86.46	24.78	217.39
Artifact/Ecofact Weight	124.87	83.02	22.66	207.89
Total Plant Remains	121.10	79.11	22.13	200.21
Food Plant Remains	29.59	21.04	2.31	50.63
Categories of Food Plants	14	8	8	16

APPENDIX II (Continued)

Sample Measurements and Components

Pisgah Ditch/Moats

Feature Number	Feature Class Totals	% in Total Sample	% of Plant Remains	% of Plant Food Remains
Type of Sample				
Pre-Processing Weight	8094			
Pre-Processing Volume	8175			
Pre-Processing Density	.99			
Modern Organic	8.75	3.61		
Rock and Soil	2.89	1.19		
Feces	-	-		
Sherds	.06	.02		
Daubed Clay	3.17	1.31		
Flakes	.02	.01		
Animal Bone	4.79	1.98		
Shell	.17	.07		
Pine Bark	2.52	1.04	1.13	
Sap	.21	.09	.09	
Grass Stem	.03	.01	.01	
Fungus and/or Gall	-	-	-	
Wood	165.79	68.45	74.57	
Hickory	25.84	10.67	11.62	48.81
Bitternut	.10	.04	.04	.19
Walnut	.20	.08	.09	.38
Acorn	9.75	4.03	4.39	18.42
Corn Cupules	10.55	4.36	4.74	19.93
Corn Kernels	6.17	2.55	2.78	11.65
Cucurbita	.06	.02	.03	.11
Lagenaria	.06	.02	.03	.11
Unidentified	.85	.35	.38	
Seeds	.21	.09	.09	.40
		100.00	100.00	100.00
Total Processed Weight	242.19			
Artifact/Ecofact Weight	230.55			
Total Plant Remains	222.34			
Food Plant Remains	52.94			
Categories of Food Plants	18			

APPENDIX II (Continued)

Sample Measurements and Components

Pisgah Posthole Clusters

Feature Number	243	178	255	256	257	W Totals
Type of Sample	SSP	W	W	W	W	
Pre-Processing Weight	510	298	255	369	85	1007
Pre-Processing Volume	500	300	150	275	50	775
Pre-Processing Density	1.02	.99	1.70	1.34	1.70	1.30
Modern Organic	-	1.01	.86	.82	.89	3.58
Rock and Soil		.02	.45	.61	.24	1.32
Flakes			.14			.14
Pine Bark	.10	.19				.19
Wood	2.67	18.76	.32	1.09	.51	20.68
Hickory	.07	2.13	.27	.21	.68	3.29
Walnut		.24		.70	.19	1.13
Acorn	.02	.99				.99
Corn Cupules		.30				.30
Corn Kernels		.13				.13
Unidentified		.04			-	.04
Seeds		.01		-		.01
Total Processed Weight	2.86	23.82	2.04	3.43	2.51	31.80
Artifact/Ecofact Weight	2.86	22.79	.73	2.00	1.38	26.90
Total Plant Remains	2.86	22.79	.59	2.00	1.38	26.76
Plant Food Remains	.09	3.80	.27	.91	.87	5.85
Categories of Food Plants	2	8	1	3	2	8

APPENDIX II (Continued)

Sample Measurements and Components

Pisgah Posthole Clusters

Feature Number	Feature Class Totals	% in Total Sample	% of Plant Remains	% of Plant Food Remains
Type of Sample				
Pre-Processing Weight	1517			
Pre-Processing Volume	1275			
Pre-Processing Density	1.19			
Modern Organic	3.58	10.33		
Rock and Soil	1.32	3.81		
Flakes	.14	.40		
Pine Bark	.19	.84	.98	
Wood	20.68	67.37	78.83	
Hickory	3.29	9.69	11.34	56.57
Walnut	1.13	3.26	3.81	19.02
Acorn	.99	2.91	3.41	17.00
Corn Cupules	.30	.87	1.01	5.05
Corn Kernels	.13	.38	.44	2.19
Unidentified	.04	.12	.14	
Seeds	.01	.03	.03	.17
		100.00	100.00	100.00
Total Processed Weight	34.66			
Artifact/Ecofact Weight	29.76			
Total Plant Remains	29.62			
Food Plant Remains	5.94			
Categories of Food Plants	8			

APPENDIX II (Continued)

Sample Measurements and Components

Swannanoa Hearths (Rock Clusters)

Feature Number	192	109	129	149	164	89	191
Type of Sample	CC[q]	DC	DC	DC	DC	SS	SS
Pre-Processing Weight	.67	113	397	878	99	85	907
Pre-Processing Volume	4	150	500	1200	100	125	800
Pre-Processing Density	.17	.75	.79	.73	.99	.68	1.01
Modern Organic		.02			.01		
Rock and Soil	.02	4.21	2.11		.29		
Flakes			.23				
Wood	.60	15.41	52.19	73.54	2.38	1.73	18.50
Hickory			.50				1.87
Walnut		.06	.41				
Acorn							4.23
Corn Cupules							
Unidentified Seeds							
Total Processed Weight	.62	19.70	55.44	73.54	2.68	1.73	24.60
Artifact/Ecofact Weight	.60	15.47	53.33	73.54	2.38	1.73	24.60
Total Plant Remains	.60	15.47	53.10	73.54	2.38	1.73	24.60
Food Plant Remains	.00	.06	.91	.00	.00	.00	6.10
Categories of Food Plants	0	1	2	0	0	0	2

APPENDIX II (Continued)

Sample Measurements and Components

Swannanoa Hearths (Rock Clusters)

Feature Number	275	279	12	13	36	187	DC Totals
Type of Sample	SS	SS	W	W	W	W	
Pre-Processing Weight	624	907	340	751	85	1219	1488
Pre-Processing Volume	500	800	225	550	50	1000	1950
Pre-Processing Density	1.25	1.13	1.51	1.37	1.70	1.22	.76
Modern Organic	.07	.07	.17	2.28	.17	5.59	.03
Rock and Soil	.37		1.64	1.18	1.52	1.91	6.61
Flakes							.23
Wood	-	1.20	3.28	7.29	3.10	10.42	143.52
Hickory			.05	.17	.06	.03	.50
Walnut		.14	.25	.57	.17	.30	.47
Acorn					-	-	
Corn Cupules						tr	
Unidentified Seeds			.01	-	-	.04	
Total Processed Weight	.44	1.41	5.40	11.49	5.02	18.29	151.36
Artifact/Ecofact Weight	-	1.34	3.59	8.03	3.33	10.79	144.72
Total Plant Remains	-	1.34	3.59	8.03	3.33	10.79	144.49
Food Plant Remains	.00	.14	.30	.74	.23	.33	.97
Categories of Food Plants	0	1	2	3	3	3	2

APPENDIX II (Continued)

Sample Measurements and Components

Swannanoa Hearths (Rock Clusters)

Feature Number	SS Totals	W Totals	Feature Class Totals	% in Total Sample	% of Plant Remains	% of Plant Food Remains
Type of Sample						
Pre-Processing Weight	2523	2395	6407			
Pre-Processing Volume	2325	1825	6104			
Pre-Processing Density	1.09	1.31	1.05			
Modern Organic	.14	8.21	8.38	3.80		
Rock and Soil	.37	6.25	13.25	6.01		
Flakes			.23	.10		
Wood	21.43	24.09	189.64	86.06	95.54	
Hickory	1.87	.31	2.68	1.22	1.35	30.42
Walnut	.14	1.29	1.90	.86	.96	21.57
Acorn	4.23	-	4.23	1.92	2.13	48.01
Corn Cupules		-	-	-	-	-
Unidentified		.05	.05	.02	.03	
Seeds			-	-	-	-
				100.00	100.00	100.00
Total Processed Weight	28.18	40.20	220.36			
Artifact/Ecofact Weight	27.67	25.74	198.73			
Total Plant Remains	27.67	25.74	198.50			
Food Plant Remains	6.24	1.60	8.81			
Categories of Food Plants	3	4	4			

APPENDIX II (Continued)

Sample Measurements and Components

Swannanoa Pit Hearths

Feature Number	130	276	237	272	278	285	DC Totals
Type of Sample	DC	DC	SS	SS	SS	SS	
Pre-Processing Weight	113	1	978	1247	1021	566	114
Pre-Processing Volume	125	9	800	1000	1000	500	134
Pre-Processing Density	.90	.11	1.22	1.25	1.02	1.13	.85
Modern Organic		-	.09	-	.03	.22	-
Rock and Soil	1.00		24.67	.59			1.00
Cane		.03					.03
Wood	8.98	.32	.09		8.06	.05	9.30
Hickory			.09				
Walnut			.28			.01	
Acorn			.09				
Unidentified Nut				-			
Unidentified						-	
Total Processed Weight	9.98	.35	25.31	.59	8.09	.28	10.33
Artifact/Ecofact Weight	8.98	.35	.55	-	8.06	.06	9.33
Total Plant Remains	8.98	.35	.55	-	8.06	.06	9.33
Food Plant Remains	.00	.00	.46	-	.00	.01	.00
Categories of Food Plants	0	0	3	1	0	1	0

APPENDIX II (Continued)

Sample Measurements and Components

Swannanoa Pit Hearths

Feature Number	SS Totals	Feature Class Totals	% in Total Sample Weight	% of Plant Remains	% of Plant Food Remains
Type of Sample					
Pre-Processing Weight	3812	3926			
Pre-Processing Volume	3300	3434			
Pre-Processing Density	1.16	1.14			
Modern Organic	.34	.34	.76		
Rock and Soil	25.26	26.26	58.88		
Cane		.03	.07	.17	
Wood	8.20	17.50	39.24	97.22	
Hickory	.09	.09	.20	.50	19.15
Walnut	.29	.29	.65	1.61	61.70
Acorn	.09	.09	.20	.50	19.15
Unidentified Nut	-	-	-	-	-
Unidentified	-	-	-	-	
			100.00	100.00	100.00
Total Processed Weight	34.27	44.60			
Artifact/Ecofact Weight	8.67	18.00			
Total Plant Remains	8.67	18.00			
Food Plant Remains	.47	.47			
Categories of Food Plants	3	3			

APPENDIX II (Continued)

Sample Measurements and Components

Savannah River Hearths (Rock Clusters)

Feature Number	188 (2225eb1824)	242	48	161	77	176
Type of Sample	CC	CC	DC	DC	SS	SS
Pre-Processing Weight	203.15	.27	7	113	978	227
Pre-Processing Volume	750	2	30	150	1150	225
Pre-Processing Volume	.27	.14	.23	.75	.85	1.01
Modern Organic	.26				.05	
Rock and Soil	58.64	.03	.10	.19	.03	
Flakes	.04					
Wood	132.22		.03	4.96	3.53	2.11
Hickory	.13		.02			
Walnut		.23				
Butternut						
Acorn						
Unidentified Seeds						-
Total Processed Weight	191.29	.26	.15	5.15	3.61	2.11
Artifact/Ecofact Weight	132.39	.23	.05	4.96	3.53	2.11
Total Plant Remains	132.39	.23	.05	4.96	3.53	2.11
Food Plant Remains	.13	.23	.02	.00	.00	.00
Categories of Food Plants	1	1	1	0	0	0

APPENDIX II (Continued)

Sample Measurements and Components

Savannah River Hearths (Rock Clusters)

Feature Number	188 (2225m1823)	239	21	33	35	156
Type of Sample	SS	SS	W	W	W	W
Pre-Processing Weight	737	992	198	879	57	652
Pre-Processing Volume	850	900	135	625	125	150
Pre-Processing Density	.87	1.10	1.47	1.41	.46	4.35
Modern Organic		.25	.08	.89	3.16	.02
Rock and Soil			2.41	3.65	2.33	.58
Flakes				-		
Wood	46.41	.05	8.70	2.64	10.12	7.88
Hickory		-	.14	.04	.30	
Walnut			.22	.67	1.40	
Butternut				.04		
Acorn			-			
Unidentified				.01	-	
Seeds					-	
Total Processed Weight	46.41	.30	11.55	7.94	17.31	8.48
Artifact/Ecofact Weight	46.41	.05	9.06	3.40	11.82	7.88
Total Plant Remains	46.41	.05	9.06	3.40	11.82	7.88
Food Plant Remains	.00	-	.36	.75	1.70	.00
Categories of Food Plants	0	1	3	3	3	0

APPENDIX II (Continued)

Sample Measurements and Components

Savannah River Hearths (Rock Clusters)

Feature Number	CC Totals	DC Totals	SS Totals	W Totals	Feature Class Totals	% in Total Sample Weight
Type of Sample						
Pre-Processing Weight	203	120	2934	1786	5043	
Pre-Processing Volume	752	180	3125	1035	5092	
Pre-Processing Density	.27	.67	.94	1.73	.99	
Modern Organic	.26		.30	4.15	4.71	1.60
Rock and Soil	58.67	.29	.03	8.97	67.96	23.07
Flakes	.04			-	.04	.01
Wood	132.22	4.99	52.10	29.34	218.65	74.23
Hickory	.13	.02	-	.48	.63	.21
Walnut	.23			2.29	2.52	.86
Butternut				.04	.04	.01
Acorn				-	-	-
Unidentified			-	.01	.01	-
Seeds				-	-	-
						100.00
Total Processed Weight	191.55	5.30	52.43	45.28	294.56	
Artifact/Ecofact Weight	132.62	5.01	52.10	32.16	221.89	
Total Plant Remains	132.58	5.01	52.10	32.16	221.85	
Food Plant Remains	.36	.02	-	2.81	3.19	
Categories of Food Plants	2	1	1	5	5	

APPENDIX II (Continued)

Sample Measurements and Components

Savannah River Hearths (Rock Clusters)

Feature Number	% of Plant Remains	% of Plant Food Remains
Type of Sample		
Pre-Processing Weight		
Pre-Processing Volume		
Pre-Processing Density		
Modern Organic		
Rock and Soil		
Flakes		
Wood	98.56	
Hickory	.28	19.75
Walnut	1.14	79.00
Butternut	.02	1.25
Acorn	-	-
Unidentified	-	
Seeds	-	-
	100.00	100.00

APPENDIX II (Continued)

Sample Measurements and Components

Savannah River Pit Hearths

Feature Number	34	44	46	52	82	262 (2310eb2263)[s]
Type of Sample	CC	CC	CC	CC	CC	CC
Pre-Processing Weight	49.46	64.67	25.27	69.91	91.88	.19
Pre-Processing Volume	150	130	25	140	150	-[u]
Pre-Processing Density	.33	.50	1.01	.50	.61	-[u]
Modern Organic	1.05	1.05	.44	.14	.04	
Rock and Soil	1.56	34.96	18.78	3.56	44.84	
Flakes		2.12			.17	
Animal Bone						
Pine Bark						
Wood	43.58	23.64	5.04	61.96	38.60	
Hickory	.12	.75	.09	.02		
Walnut	.30	.75	.61			
Butternut	.03					
Acorn	-	.03	.03	-		
Beech	-					
Unidentified	.01	.01		-	.01	.19
Seeds	-	.01			.05[t]	
Total Processed Weight	46.65	63.32	24.99	65.68	83.70	.19
Artifact/Ecofact Weight	44.04	27.31	5.77	61.98	38.82	.19
Total Plant Remains	44.04	25.19	5.77	61.98	38.66	.19
Food Plant Remains	.45	1.54	.73	.02	.05	.00
Categories of Food Plants	6	7	3	2	1	0

APPENDIX II (Continued)

Sample Measurements and Components

Savannah River Pit Hearths

Feature Number	92	103	119	122	123	124	132
Type of Sample	DC	DC	DC	DC	DC	DC	DC
Pre-Processing Weight	7	14	7	85	425	7	14
Pre-Processing Volume	15	25	10	100	500	20	10
Pre-Processing Density	.47	.56	.70	.85	.85	.35	1.40
Modern Organic							
Rock and Soil						.04	.01
Flakes							
Animal Bone							
Pine Bark							
Wood	.95	3.58	2.18	19.64	26.13	.71	1.60
Hickory		.01					
Walnut							.44
Butternut							
Acorn							
Beech							
Unidentified							
Seeds							
Total Processed Weight	.95	3.59	2.18	19.64	26.13	.75	2.05
Artifact/Ecofact Weight	.95	3.59	2.18	19.64	26.13	.71	2.04
Total Plant Remains	.95	3.59	2.18	19.64	26.13	.71	2.04
Food Plant Remains	.00	.01	.00	.00	.00	.00	.44
Categories of Food Plants	0	1	0	0	0	0	1

APPENDIX II (Continued)

Sample Measurements and Components

Savannah River Pit Hearths

Feature Number	203	261	43	71	81	83	84
Type of Sample	DC	DC	SS	SS	SS	SS	SS
Pre-Processing Weight	156	71	468	482	595	624	85
Pre-Processing Volume	160	75	500	750	700	775	100
Pre-Processing Density	.98	.95	.94	.64	.85	.81	.85
Modern Organic	.07						
Rock and Soil	.11						
Flakes							
Animal Bone							
Pine Bark							
Wood	12.28	5.77	6.46	12.69	12.61	35.07	.65
Hickory	-						
Walnut				-			
Butternut							
Acorn							
Beech							
Unidentified Seeds					-		
Total Processed Weight	12.46	5.77	6.46	12.69	12.61	35.07	.65
Artifact/Ecofact Weight	12.28	5.77	6.46	12.69	12.61	35.07	.65
Total Plant Remains	12.28	5.77	6.46	12.69	12.61	35.07	.65
Food Plant Remains	-	.00	.00	-	-	.00	.00
Categories of Food Plants	1	0	0	1	1	0	0

APPENDIX II (Continued)

Sample Measurements and Components

Savannah River Pit Hearths

Feature Number	94	99	100	174	238	240	241
Type of Sample	SS	SS	SS	SS	SS	SS	SS
Pre-Processing Weight	7	7	7	99	1460	595	595
Pre-Processing Volume	10	10	10	100	1100	500	500
Pre-Processing Density	.70	.70	.70	.99	1.33	1.19	1.19
Modern Organic				.01	.03	-	
Rock and Soil	.39	.05				-	
Flakes							
Animal Bone							
Pine Bark							
Wood	2.49	2.28	.58	3.04	.39		.11
Hickory			.04		.21		.07
Walnut					.15	.06	.04
Butternut							
Acorn							
Beech							
Unidentified							
Seeds							
Total Processed Weight	2.88	2.33	.62	3.05	.78	.06	.22
Artifact/Ecofact Weight	2.49	2.28	.62	3.04	.75	.06	.22
Total Plant Remains	2.49	2.28	.62	3.04	.75	.06	.22
Food Plant Remains	.00	.00	.04	.00	.36	.06	.11
Categories of Food Plants	0	0	1	0	2	1	2

APPENDIX II (Continued)

Sample Measurements and Components

Savannah River Pit Hearths

Feature Number	283	291	32	98^{v}	121	157	205
Type of Sample	SS	SS	W	W	W	W	W
Pre-Processing Weight	1247	510	340	28	14	71	539
Pre-Processing Volume	1200	500	250	25	10	100	500
Pre-Processing Density	1.04	1.02	1.36	1.12	1.40	.71	1.08
Modern Organic	-	-	.39	.03			.24
Rock and Soil	.08		.95	.07	.23	2.76	.12
Flakes							
Animal Bone				.03			
Pine Bark				.07			
Wood	6.15	3.21	4.56	3.17	1.52	3.07	72.21
Hickory			.84		.02		
Walnut	.04		.64	.69			-
Butternut			-				
Acorn				.07			
Beech							
Unidentified Seeds				.01			
Total Processed Weight	6.27	3.21	7.38	4.14	1.77	5.83	72.57
Artifact/Ecofact Weight	6.19	3.21	6.04	4.04	1.54	3.07	72.21
Total Plant Remains	6.19	3.21	6.04	4.01	1.54	3.07	72.21
Food Plant Remains	.04	.00	1.48	.77	.02	.00	-
Categories of Food Plants	1	0	3	3	1	0	1

APPENDIX II (Continued)

Sample Measurements and Components

Savannah River Pit Hearths

Feature Number	262 (2310m2261)	CC Totals	DC Totals	SS Totals	W Totals	Feature Class Totals
Type of Sample	W					
Pre-Processing Weight	454	301	786	6781	1446	9314
Pre-Processing Volume	400	595	915	6755	1285	9551
Pre-Processing Density	1.14	.51	.86	1.00	1.13	.98
Modern Organic	.85	2.72	.07	.04	1.51	4.34
Rock and Soil	1.16[W]	103.70	.16	.52	5.29	109.67
Flakes		2.29				2.29
Animal Bone					.03	.03
Pine Bark					.07	.07
Wood	3.79	172.82	72.84	85.73	88.32	419.71
Hickory	2.72	.98	.01	.32	3.58	4.89
Walnut	.68	1.66	.44	.29	2.01	4.40
Butternut		.03			-	.03
Acorn		.06			.07	.13
Beech		-				-
Unidentified		.22				.22
Seeds	-	.06			.01	.07
Total Processed Weight	9.20	284.54	73.52	86.90	100.89	545.85
Artifact/Ecofact Weight	7.19	178.12	73.29	86.34	94.09	431.84
Total Plant Remains	7.19	175.83	73.29	86.34	94.06	429.52
Food Plant Remains	3.40	2.79	.45	.61	5.67	9.52
Categories of Food Plants	3	10	2	3	7	11

APPENDIX II (Continued)

Sample Measurements and Components

Savannah River Pit Hearths

Feature Number	% in Total Sample Weight	% of Plant Remains	% of Plant Food Remains
Type of Sample			
Pre-Processing Weight			
Pre-Processing Volume			
Pre-Processing Volume			
Modern Organic	.80		
Rock and Soil	20.09		
Flakes	.42		
Animal Bone	.01		
Pine Bark	.01	.02	
Wood	76.89	97.72	
Hickory	.90	1.14	51.37
Walnut	.81	1.02	46.22
Butternut	.01	.01	.32
Acorn	.02	.03	1.37
Beech	-	-	-
Unidentified	.04	.05	
Seeds	.01	.02	.74
	100.00	100.00	100.00

APPENDIX II (Continued)

Sample Measurements and Components

Savannah River Charcoal Concentrations

Feature Number	90	91	Feature Class Totals	% in Total Sample Weight	% of Plant Remains	% of Plant Food Remains
Type of Sample	W	W				
Pre-Processing Weight	85	71	156			
Pre-Processing Volume	75	50	125			
Pre-Processing Density	1.13	1.42	1.25			
Modern Organic	-	.41	.41	3.70		
Rock and Soil	.73	.87	1.60	14.43		
Pine Bark		.14	.14	1.26	1.54	
Gall		.05	.05	.45	.55	
Wood	2.58	3.69	6.27	56.54	69.05	
Hickory	2.52	.05	2.57	23.17	28.30	98.47
Walnut	.04		.04	.36	.44	1.53
Unidentified	.01		.01	.09	.11	
				100.00	100.00	100.00
Total Processed Weight	5.88	5.21	11.09			
Artifact/Ecofact Weight	5.15	3.93	9.08			
Total Plant Remains	5.15	3.93	9.08			
Food Plant Remains	2.56	.05	2.61			
Categories of Food Plants	2	1	2			

Savannah River Burial Pit (?)			Overbank Midden	
Feature Number	282	% of Total Sample Weight	295	% of Total Sample Weight
Type of Sample	SS		CC	
Pre-Processing Weight	680		1.75	
Pre-Processing Volume	525		10	
Pre-Processing Density	1.30		.18	
Modern Organic	.10	90.91	-	-
Rock and Soil			.01	.64
Wood	.01	9.09	1.56	99.36
Total Processed Weight	.11	100.00	1.57	100.00
Artifact/Ecofact Weight	.01		1.56	
Total Plant Remains	.01		1.56	
Total Food Plant Remains	.00		.00	
Categories of Food Plants	0		0	

APPENDIX II (Continued)

Sample Measurements and Components

Feature Data Summary by Phases

Pisgah Phase	Pre-Processing Weight (grams)	Pre-Processing Volume (ml)	Pre-Processing Density (gm/ml)
Clean Charcoal	26	63	.41
Dirty Charcoal	598	1080	.55
Soil Samples	18394	17575	1.05
Washings	5698	5325	1.07
Sub-Total	24716	24043	1.03
Swannanoa Phase			
Clean Charcoal	1	4	.25
Dirty Charcoal	1602	2084	.77
Soil Samples	6335	5625	1.13
Washings	2395	1825	1.31
Sub-Total	10333	9538	1.08
Savannah River Phase			
Clean Charcoal	504	1347	.37
Dirty Charcoal	906	1095	.83
Soil Samples	10395	10405	1.00
Washings	3388	2445	1.47
Sub-Total	15193	15292	.99
Overbank Midden			
Clean Charcoal	2	10	.20
Totals (Including Overbank Midden)	50244	48883	1.03
Totals (Excluding Overbank Midden)	50242	48873	1.03

APPENDIX II (Continued)

Sample Measurements and Components

Feature Data Summary by Phases

Pisgah Phase	Total Plant Remains	Plant Food Remains	Plant Food Remains / Total Plant Remains	Types of Food Plants Present
Clean Charcoal	7.79	1.27	.16	4
Dirty Charcoal	112.91	40.92	.36	6
Soil Samples	54.97	15.09	.27	8
Washings	367.50	73.41	.20	24
Sub-Total	543.17	130.69	.24	26
Swannanoa Phase				
Clean Charcoal	.60	.00	.00	0
Dirty Charcoal	153.82	.97	.01	2
Soil Samples	36.34	6.71	.18	3
Washings	25.74	1.60	.06	4
Sub-Total	216.50	9.28	.05	4
Savannah River Phase				
Clean Charcoal	308.41	3.15	.01	10
Dirty Charcoal	78.30	.47	.01	2
Soil Samples	138.45	.61	-	4
Washings	135.30	11.09	.08	8
Sub-Total	660.46	15.32	.02	11
Overbank Midden				
Clean Charcoal	1.56	.00	.00	0
Totals (Including Overbank Midden)	1421.70	155.29	.11	29
Totals (Excluding Overbank Midden)	1420.13	155.29	.11	29

APPENDIX II (Continued)

Sample Measurements and Components

Component Weights and Percentages by Phases

Components	Pisgah Total Weight	%[x]	% TPR[y]	% TFPR[z]	Swannanoa Total Weight	%
Modern Organic	22.82	3.66			8.72	3.29
Rock and Soil	45.57	7.31			39.51	14.91
Feces	.01	-[aa]				
Sherds	1.32	.21				
Daubed Clay	3.98	.64				
Flakes	.24	.04			.23	.09
Animal Bone	6.19	.99				
Shell	.19	.03				
Sycamore Bark	9.41	1.51	1.73			
Pine Bark	3.09	.50	.57			
Pitch	.21	.03	.04			
Grass Stem	.03	-	.01			
Cane	.22	.04	.04		.03	.01
Fungus and/or Gall	.10	.02	.02			
Wood	397.82	63.81	73.24		207.14	78.18
Hickory	40.07	6.43	7.38	30.66	2.77	1.05
Bitternut	.71	.11	.13	.54		
Walnut	2.93	.47	.54	2.24	2.19	.83
Butternut						
Acorn	12.23	1.96	2.25	9.36	4.32	1.63
Hazel Nut	.02	-	-	.02		
Beech						
Unidentified Nut	.04	.01	.01	.03	-	-
Corn Cupules	66.57	10.68	12.26	50.49	-[bb]	-
Corn Kernels	7.69	1.23	1.42	5.88		
<u>Cucurbita</u>	.06	.01	.01	.05		
<u>Lagenaria</u>	.06	.01	.01	.05		
Unidentified Plant	1.60	.26	.29		.05	.02
Seeds	.31	.05	.06	.24	-	-
Total Sample Weight	623.49				264.96	
Total Plant Remains	543.17				216.50	
Plant Food Remains	130.69				9.28	
Total %		100.00	100.00	100.00		100.00

APPENDIX II (Continued)

Sample Measurements and Components

Component Weights and Percentages by Phases

	Swannanoa		Savannah River			
Components	% TPR	% TFPR	Total Weight	%	% TPR	% TFPR
Modern Organic			9.56	1.12		
Rock and Soil			179.23	21.05		
Feces						
Sherds						
Daubed Clay						
Flakes			2.33	.27		
Animal Bone			.03	-		
Shell						
Sycamore Bark						
Pine Bark			.21	.02	.03	
Pitch						
Grass Stem						
Cane	.01					
Fungus &/or Gall			.05	.01	.01	
Wood	95.68		644.64	75.70	97.60	
Hickory	1.28	29.85	8.09	.95	1.22	52.81
Bitternut						
Walnut	1.01	23.60	6.96	.82	1.05	45.53
Butternut			.07	.01	.01	.46
Acorn	2.00	46.55	.13	.02	.02	.85
Hazel Nut						
Beech			-	-	-	-
Unidentified Nut	-[bb]	-[bb]				
Corn Cupules	-	-				
Corn Kernels						
Cucurbita						
Lagenaria						
Unidentified Plant	.02		.24	.03	.04	
Seeds	-	-	.07	.01	.01	.46
Total Sample Weight			851.61			
Total Plant Remains			660.46			
Food Plant Remains			15.32			
Total %	100.00	100.00		100.00	100.00	100.00

APPENDIX II (Continued)

Sample Measurements and Components

[a] Weight in grams.

[b] Volume in milliliters.

[c] Grams/milliliter.

[d] Clean Charcoal.

[e] Less than .005 grams.

[f] Includes daub in Feature 172.

[g] Dirty Charcoal.

[h] Soil Sample.

[i] Washings.

[j] To nearest gram.

[k] Soil sample from clay lining.

[l] Includes dirt.

[m] No separate column for Washings total since only one sample present.

[n] 8-row cobs.

[o] Includes teeth and fish scales.

[p] No separate column for soil samples since just one sample analyzed.

[q] No separate column for clean charcoal samples given.

[r] One corn cupule considered contaminant.

[s] Scraped from sides of steatite sherds.

[t] Questionable large "seed" fragments (unidentified).

[u] Not measured.

[v] Questionable Savannah River Period.

[w] Daub-like particles included.

[x] Per cent of Total Sample Weight.

[y] Per cent of Total Plant Remains.

[z] Per cent of Total Food Plant Remains.

[aa] Less than .005.

[bb] One corn cupule considered contaminant.

APPENDIX III

Carbonized Seed Totals: Current Analysis

Cultigens[a]	Pisgah Borrow Pit Washings Feature 78	Pisgah Borrow Pit Washings F. 190	Pisgah Borrow Pit Washings F. 199	Pisgah Clay-Lined Storage Pit Soil Sample F. 232
Beans (*Phaseolus vulgaris*)				
Sumpweed (*Iva annua*[b])				
Fleshy Fruits				
Maypops (*Passiflora incarnata*)			2	
Grape (*Vitis* sp.)	2/2/4[c]		1	
Persimmon (*Diospyros virginiana*)				
Bramble (*Rubus* sp.)				
Cherry or Plum (*Prunus* sp.)				
Unidentified Fruit[d]		1		
Grass				
Unidentified Grass	1			
Forbs				
Chenopod (*Chenopodium* sp.)			1	
Knotweed (*Polygonum* sp.)				
Bedstraw (*Galium* sp.)	1			
Bearsfoot (*Polymnia uvedalia*)				
Unidentified Fabaceae				
Uncertain Identifications[e]				
Apiaceae			3/3/5	
Euphorbia maculata			2	
Flowering spurge (*E. corollata*)				
Acalypha sp.				
Brassica sp.				
Unidentified	3	1	1	1
Totals	7/9	2	10/12	1

APPENDIX III (Continued)

Carbonized Seed Totals: Current Analysis

Cultigens	Pisgah Clay Hearth Washings F. 179	Pisgah Pit Hearth Clean Charcoal F. 108	Pisgah Pit Hearth Dirty Charcoal F. 148
Beans (*Phaseolus vulgaris*)			
Sumpweed (*Iva annua*)			
Fleshy Fruits			
Maypops (*Passiflora incarnata*)			
Grape (*Vitis* sp.)	1		
Persimmon (*Diospyros virginiana*)			
Bramble (*Rubus* sp.)			
Cherry or Plum (*Prunus* sp.)			
Unidentified Fruit			1
Grass			
Unidentified Grass			
Forbs			
Chenopod (*Chenopodium* sp.)		1	
Knotweed (*Polygonum* sp.)			
Bedstraw (*Galium* sp.)			
Bearsfoot (*Polymnia uvedalia*)			
Unidentified Fabaceae			
Uncertain Identifications			
Apiaceae			
Euphorbia maculata			
Flowering spurge (*E. corollata*)			
Acalypha sp.			
Brassica sp.			
Unidentified			
Totals	1	1	1

APPENDIX III (Continued)

Carbonized Seed Totals: Current Analysis

Cultigens	Pisgah Pit Hearth Dirty Charcoal F. 247	Pisgah Pit Hearth Washings F. 167	Pisgah Pit Hearth Washings F. 266	Pisgah Ditch/Moat Soil Sample F. 213
Beans (*Phaseolus vulgaris*)				
Sumpweed (*Iva annua*)				
Fleshy Fruits				
Maypops (*Passiflora incarnata*)				
Grape (*Vitis* sp.)	1	1		
Persimmon (*Diospyros virginiana*)				1/5/4
Bramble (*Rubus* sp.)				
Cherry or Plum (*Prunus* sp.)		1		
Unidentified Fruit				
Grass				
Unidentified Grass				
Forbs				
Chenopod (*Chenopodium* sp.)			2	
Knotweed (*Polygonum* sp.)				
Bedstraw (*Galium* sp.)				
Bearsfoot (*Polymnia uvedalia*)		1		
Unidentified Fabaceae			1	
Uncertain Identifications				
Apiaceae				
Euphorbia maculata				1
Flowering spurge (*E. corollata*)				
Acalypha sp.	3/1/4			
Brassica sp.				
Unidentified		1	1	
Totals	4/5	4	4	2/5

APPENDIX III (Continued)

Carbonized Seed Totals: Current Analysis

Cultigens	Pisgah Ditch/Moat Soil Sample F. 216	Pisgah Ditch/Moat Soil Sample F. 229 (Zone IV)	Pisgah Ditch/Moat Soil Sample F. 229 (Zone VI)
Beans (*Phaseolus vulgaris*)			
Sumpweed (*Iva annua*)			
Fleshy Fruits			
Maypops (*Passiflora incarnata*)			
Grape (*Vitis* sp.)			
Persimmon (*Diospyros virginiana*)		1/1/2	1/2/2
Bramble (*Rubus* sp.)			
Cherry or Plum (*Prunus* sp.)			
Unidentified Fruit			
Grass			
Unidentified Grass			
Forbs			
Chenopod (*Chenopodium* sp.)			
Knotweed (*Polygonum* sp.)			
Bedstraw (*Galium* sp.)			
Bearsfoot (*Polymnia uvedalia*)			
Unidentified Fabaceae			
Uncertain Identifications			
Apiaceae			
Euphorbia maculata			
Flowering spurge (*E. corollata*)			
Acalypha sp.			
Brassica sp.			
Unidentified	1		
Totals	1	1/2	1/2

APPENDIX III (Continued)

Carbonized Seed Totals: Current Analysis

Cultigens	Pisgah Ditch/Moat Soil Sample F. 246	Pisgah Ditch/Moat Washings F. 246	Pisgah Ditch/Moat Washings F. 244	Pisgah Posthole Cluster Washings F. 178
Bean (*Phaseolus vulgaris*)			1	
Sumpweed (*Iva annua*)			1	
Fleshy Fruits				
Maypops (*Passiflora incarnata*)			26/20/36	
Grape (*Vitis* sp.)			3/2/5	1
Persimmon (*Diospyros virginiana*)				
Bramble (*Rubus* sp.)			2	
Cherry or Plum (*Prunus* sp.)				
Unidentified Fruit				
Grass				
Unidentified Grass		1		
Forbs				
Chenopod (*Chenopodium* sp.)		3	1	1
Knotweed (*Polygonum* sp.)				
Bedstraw (*Galium* sp.)				1
Bearsfoot (*Polymnia uvedalia*)				
Unidentified Fabaceae				
Uncertain Identifications				
Apiaceae				
Euphorbia maculata	1	2	2	
Flowering spurge (*E. corollata*)			1	
Acalypha sp.				
Brassica sp.		1		
Unidentified		5	11	1
Totals	1	12	48/60	4

APPENDIX III (Continued)

Carbonized Seed Totals: Current Analysis

Cultigens	Pisgah Posthole Cluster Washings F. 256	Pisgah Totals	Swannanoa[f] Hearth (Rock Cluster) Washings F. 13	Sav. Riv. Hearth (Rock Cluster) Washings F. 35
Bean (*Phaseolus vulgaris*)		1		
Sumpweed (*Iva annua*)		1		
Fleshy Fruits				
Maypops (*Passiflora incarnata*)		28/38		
Grape (*Vitis* sp.)		10/14		
Persimmon (*Diospyros virginiana*)		3/8		
Bramble (*Rubus* sp.)		2		
Cherry or Plum (*Prunus* sp.)		1		
Unidentified Fruit		2		
Grass				
Unidentified Grass		2		
Forbs				
Chenopod (*Chenopodium* sp.)	1	10		
Knotweed (*Polygonum* sp.)				
Bedstraw (*Galium* sp.)		2	1	1
Bearsfoot (*Polymnia uvedalia*)		1		
Unidentified Fabaceae		1		
Uncertain Identifications				
Apiaceae		3/5		
Euphorbia maculata		8		
Flowering spurge (*E. corollata*)		1		
Acalypha sp.		3/4		
Brassica sp.		1		
Unidentified		26		
Totals	1	106/128	1	1

APPENDIX III (Continued)

Carbonized Seed Totals: Current Analysis

Cultigens	Sav. Riv. Pit Hearth Clean Charcoal F. 34	Sav. Riv. Pit Hearth Clean Charcoal F. 44	Sav. Riv. Pit Hearth Clean Charcoal F. 82	Sav. Riv. Pit Hearth Soil Sample F. 81
Bean (*Phaseolus vulgaris*)				
Sumpweed (*Iva annua*)				
Fleshy Fruits				
Maypops (*Passiflora incarnata*)				
Grape (*Vitis* sp.)		1		
Persimmon (*Diospyros virginiana*)				
Bramble (*Rubus* sp.)				
Cherry or Plum (*Prunus* sp.)				
Unidentified Fruit				
Grass				
Unidentified Grass				
Forbs				
Chenopod (*Chenopodium* sp.)		1		1
Knotweed (*Polygonum* sp.)	1			
Bedstraw (*Galium* sp.)		1		
Bearsfoot (*Polymnia uvedalia*)				
Unidentified Fabaceae				
Uncertain Identifications				
Apiaceae				
Euphorbia maculata				
Flowering spurge (*E. corollata*)				
Acalypha sp.				
Brassica sp.				
Unidentified		3	4	
Totals	1	6	4	1

APPENDIX III (Continued)

Carbonized Seed Totals: Current Analysis

Cultigens	Sav. Riv. Pit Hearth Washings F. 32	Sav. Riv. Pit Hearth Washings F. 98	Sav. Riv. Pit Hearth Washings F. 262	Sav. Riv. Totals
Bean (*Phaseolus vulgaris*)				
Sumpweed (*Iva annua*)				
Fleshy Fruits				
Maypops (*Passiflora incarnata*)				
Grape (*Vitis* sp.)		1		2
Persimmon (*Diospyros virginiana*)				
Bramble (*Rubus* sp.)				
Cherry or Plum (*Prunus* sp.)			1(?)	1
Unidentified Fruit				
Grass				
Unidentified Grass				
Forbs				
Chenopod (*Chenopodium* sp.)				2
Knotweed (*Polygonum* sp.)				1
Bedstraw (*Galium* sp.)				2
Bearsfoot (*Polymnia uvedalia*)				
Unidentified Fabaceae				
Uncertain Identifications				
Apiaceae				
Euphorbia maculata				
Flowering spurge (*E. corollata*)				
Acalypha sp.				
Brassica sp.				
Unidentified	1			8
Total	1	1	1	16

APPENDIX III (Continued)

Carbonized Seed Totals: Current Analysis

Cultigens	Totals from all Phases
Bean (*Phaseolus vulgaris*)	1
Sumpweed (*Iva annua*)	1
Fleshy Fruits	
Maypops (*Passiflora incarnata*)	28/38
Grape (*Vitis* sp.)	12/16
Persimmon (*Diospyros virginiana*)	3/8
Bramble (*Rubus* sp.)	2
Cherry or Plum (*Prunus* sp.)	2
Unidentified Fruit	2
Grass	
Unidentified Grass	2
Forbs	
Chenopod (*Chenopodium* sp.)	12
Knotweed (*Polygonum* sp.)	1
Bedstraw (*Galium* sp.)	5
Bearsfoot (*Polymnia uvedalia*)	1
Unidentified Fabaceae	1
Uncertain Identifications	
Apiaceae	3/5
Euphorbia maculata	8
Flowering spurge (*E. corollata*)	1
Acalypha sp.	3/4
Brassica sp.	1
Unidentified	34
Total	123/145

[a] Excluding maize kernels.

[b] Variety *macrocarpa*: Carbonized seed length=4.9 mm. Carbonized seed width=3.8 mm. Reconstructed achene dimensions (Yarnell 1976)=6.2 X 4.6 mm.

[c] The first integer in the series refers to the number of entire seeds recovered. The second integer in the series refers to the number of seed fragments. The third integer is an estimate of the total number of entire seeds based upon the first two readings. When only two integers are referenced, they refer to the number of entire seeds recovered and an estimate of the total number of seeds respectively.

[d] Entire fruit instead of seed.

[e] These are suggested identifications only.

[f] No separate total given for Swannanoa features.

APPENDIX IV

Niche Breadth

	Pisgah Features		Swannanoa Features	
	Number of Samples Containing Item	Proportion (p) by Item	Number of Samples Containing Item	Proportion (p) by Item
Hickory	38	.259	7	.333
Bitternut	2	.014		
Walnut	10	.068	9	.429
Butternut				
Acorn	23	.156	4	.190
Hazelnut	1	.007		
Beech				
Maize	21	.143		
Bean	1	.007		
Sumpweed	1	.007		
Squash	1	.007		
Gourd	1	.007		
Maypops	2	.014		
Grape	7	.048		
Persimmon	3	.020		
Rubus sp.	1	.007		
Prunus sp.	1	.007		
Unidentified fruit	2	.014		
Unidentified grass	2	.014		
Chenopod	7	.048		
Knotweed				
Bedstraw	2	.014	1	.048
Bearsfoot	1	.007		
Fabaceae	1	.007		
Apiaceae?	1	.007		
Euphorbia maculata?	5	.034		
Flowering spurge?	1	.007		
Acalypha sp.?	1	.007		
Brassica sp.?	1	.007		
Unidentified	10	.068		
# of Samples	60		19	
# of Items	27		4	
Item Identifications by Sample	147		21	
$\Sigma p_i^2 =$	.129		.333	
$B = (\Sigma p_i^2)^{-1} =$	7.776		3.000	
# of Features	52		19	

APPENDIX IV (Continued)

Niche Breadth

Savannah River Features

	Number of Samples Containing Item	Proportion (p) by Item
Hickory	20	.339
Bitternut		
Walnut	18	.305
Butternut	3	.051
Acorn	6	.102
Hazelnut		
Beech	1	.017
Maize		
Bean		
Sumpweed		
Squash		
Gourd		
Maypops		
Grape	2	.034
Persimmon		
Rubus sp.		
Prunus sp.	1	.017
Unidentified fruit		
Unidentified grass		
Chenopod	2	.034
Knotweed	1	.017
Bedstraw	2	.034
Bearsfoot		
Fabaceae		
Apiaceae?		
Euphorbia maculata?		
Flowering spurge?		
Acalypha sp.?		
Brassica sp.?		
Unidentified	3	.051
# of Samples	50	
# of Items	11	
Item Identifications by Sample	59	
$\Sigma p_i^2 =$	.228	
$B=(\hat{\Sigma} p_i^2)^{-1} =$	4.390	
# of Features	46	

APPENDIX V

Feature Ratios

		V/TPR[a]		V/TFPR[b]		TPR/TFPR[c]	
		All Samples	Deleted or Combined Samples	All Samples	Deleted or Combined Samples	All Samples	Deleted or Combined Samples
Pisgah Borrow Pits							
Clean Charcoal							
Arithmetic Mean	$\bar{x}$	29[d]		-[e]		-	
Standard Deviation	s	42		-		-	
Sample Size	n	4		4		4	
Dirty Charcoal	$\bar{x}$	4		500		117	
	s	-		-		-	
	n	1		1		1	
Soil Samples	$\bar{x}$	2063		-		-	
	s	1080		-		-	
	n	3		3		3	
Washings	$\bar{x}$	12		285		25	
	s	3		361		33	
	n	3		3		3	
Pisgah Clay-Lined Storage Pits							
Soil Samples	$\bar{x}$	10115	5153	18438	16250	3	4
	s	10190	2834	4767	2320	2	2
	n	4	3[f]	4	3[f]	4	3[f]
Pisgah Clay Hearths							
Soil Samples	$\bar{x}$	-	2143	-		-	
	s	-	1310	-		-	
	n	6	5[g]	6		6	

APPENDIX V (Continued)

Feature Ratios

		V/TPR All Samples	V/TPR Deleted or Combined Samples	V/TFPR All Samples	V/TFPR Deleted or Combined Samples	TPR/TFPR All Samples	TPR/TFPR Deleted or Combined Samples
Pisgah Clay Hearths (Cont.)							
Washings							
	$\bar{x}$	35		278		8	
	s	-		-		-	
	n	1		1		1	
Pisgah Pit Hearths							
Clean Charcoal							
	$\bar{x}$	14	15 16	-		-	
	s	14	10 11	-		-	
	n	3	6[h] 5[i]	3		3	
Dirty Flotations							
	$\bar{x}$	14		-		-	
	s	9		-		-	
	n	7		7		7	
Soil Samples							
	$\bar{x}$	1974	2250	-		-	
	s	2087	2090	-		-	
	n	8	7[i]	8		8	
Washings							
	$\bar{x}$	40		448		46	
	s	31		382		71	
	n	3		3		3	
Pisgah Ditch/Moats							
Soil Samples							
	$\bar{x}$	365	399	-	3989 5515	- 13	17
	s	195	214	-	2705 2676	- 10	12
	n	10	6[j]	10	9[k] 5[j,k]	10 9[k]	5[j,k]
Washings							
	$\bar{x}$	11		41		4	
	s	4		10		0	
	n	2		2		2	

APPENDIX V (Continued)

Feature Ratios

		V/TPR		V/TFPR		TPR/TFPR	
		All Samples	Deleted or Combined Samples	All Samples	Deleted or Combined Samples	All Samples	Deleted or Combined Samples
Pisgah Ditch/Moats (Cont.) Feature 229							
Soil Samples							
	x̄	297		2355		9	
	s	160		2043		5	
	n	5		5		5	
Pisgah Posthole Clusters							
Soil Samples							
	x̄	175		5556		32	
	s	-		-		-	
	n	1		1		1	
Washings							
	x̄	110		249		3	
	s	110		233		2	
	n	4		4		4	
Swannanoa Hearths (Rock Clusters)							
Clean Charcoal							
	x̄	7		-		-	
	s	-		-		-	
	n	1		1		1	
Dirty Charcoal							
	x̄	19		-		-	
	s	15		-		-	
	n	4		4		4	
Soil Samples							
	x̄	-	235	-		-	
	s	-	314	-		-	
	n	4	3[1]	4		4	
Washings							
	x̄	60		570		18	
	s	33		306		10	
	n	4		4		4	

APPENDIX V (Continued)

Feature Ratios

		V/TPR		V/TFPR		TPR/TFPR	
		All Samples	Deleted or Combined Samples	All Samples	Deleted or Combined Samples	All Samples	Deleted or Combined Samples
Swannanoa Pit Hearths							
Dirty Charcoal							
	$\bar{x}$	20		-		-	
	s	8		-		-	
	n	2		2		2	
Soil Samples							
	$\bar{x}$	-	3304	-		-	
	s	-	4406	-		-	
	n	4	3^{m}	4		4	
Savannah River Hearths (Rock Clusters)							
Clean Charcoal							
	$\bar{x}$	8		2889		510	
	s	2		4073		719	
	n	2		2		2	
Dirty Charcoal							
	$\bar{x}$	315		-		-	
	s	403		-		-	
	n	2		2		2	
Soil Samples							
	$\bar{x}$	4613		-		-	
	s	8926		-		-	
	n	4		4		4	
Washings							
	$\bar{x}$	57		-	700	-	12
	s	85		-	283	-	11
	n	4		4	3^{n}	4	3^{n}
Savannah River Pit Hearths							
Clean Charcoal							
	$\bar{x}$	4		-	2090	-	799
	s	1		-	3011	-	1325
	n	6		6	5^{o}	6	5^{o}

APPENDIX V (Continued)

Feature Ratios

		V/TPR All Samples	V/TPR Deleted or Combined Samples	V/TFPR All Samples	V/TFPR Deleted or Combined Samples	TPR/TFPR All Samples	TPR/TFPR Deleted or Combined Samples
Savannah River Pit Hearths (Cont.)							
Dirty Charcoal							
	$\bar{x}$	12		-		-	
	s	8		-		-	
	n	9		9		9	
Soil Samples							
	$\bar{x}$	918		-		-	
	s	2237		-		-	
	n	14		14		14	
Washings							
	$\bar{x}$	25		-		-	
	s	22		-		-	
	n	6		6		6	
Savannah River Charcoal Concentrations							
Washings							
	$\bar{x}$	14		515		41	
	s	1		687		54	
	n	2		2		2	

[a] Pre-Processing Volume (in milliliters) divided by Total Plant Remains (grams).

[b] Pre-Processing Volume divided by Total Food Plant Remains.

[c] Total Plant Remains divided by Total Food Plant Remains.

[d] Rounded to nearest integer.

[e] Less than .5 or not calculable.

[f] Without Feature 234 (Clay Lining).

[g] Without Feature 212 (less than .005 grams plant remains).

[h] Combining Samples from Feature 247 (Possible hide-smoking pit).

APPENDIX V (Continued)

Feature Ratios

[i] Deleting Feature 247.

[j] Combining Feature 229 samples.

[k] Deleting Feature 216 (less than .005 grams plant food remains).

[l] Deleting Feature 275 (less than .005 grams plant remains).

[m] Deleting Feature 272 (less than .005 grams plant remains).

[n] Deleting Feature 156 (no plant food remains).

[o] Deleting Feature 262 (crust from steatite sherds).

APPENDIX VI

Genera of Food Plants by Period and Subsystem

Historic

Fruits: Seeds Not Destroyed	Greens	Nuts	Fruits: Seeds Destroyed	Underground Plant Parts	Flowers	Flavorings
Celtis	Osmunda	Juglans	Zea	Acorus[a]	Yucca	Betula
Morus	Polysticum	Carya	Amphicarpa[f]	Smilax[a]	Cercis	Liriodendron
Podophyllum	Acorus	Corylus	Phaseolus	Medeola		Sassafras
Asimina	Tradescantia	Fagus	Cucurbita	Polygonatum		Lindera
Calycanthus	Polygonatum	Castanea	Lagenaria	Lilium		Thlaspi
Fragaria	Uvularia	Quercus		Allium		Hydrangea
Rubus	Streptopus			Apios[a]		Liquidambar
Malus	Allium			Oenothera[a]		Acer
Ribes	Diasporum			Oxypolis[b]		Oxydendron
Amelanchier	Sysyrinchium			Ipomea[a]		Gaultheria
Prunus	Polygonum[d]			Helianthus		Monarda
Crataegus	Chenopodium[d]			Eupatorium[c]		Pycanthemum
Gleditsia	Amaranthus					Mentha
Rhus	Phytolacca					Cacalia
Vitis	Ranunculus[e]					
Passiflora	Cardamine					
Gaylussacia	Dentaria					
Vaccinium	Rubus					
Diospyros	Saxifraga					
Physalis	Hydrangea					
Mitchella	Oxalis					
Sambucus	Passiflora					
Cucurbita	Oenothera					
	Epilobium					
	Osmorhiza					
	Ligusticum					
	Viola					
	Phacelia					
	Solanum					
	Chelone					
	Pedicularis					
	Prenanthes					
	Lactuca					
	Rudbeckia					
	Penthorum					
23[g]	35	6	5	12	2	14

APPENDIX VI (Continued)

Genera of Food Plants by Period and Subsystem

All Prehistoric Periods

Fruits: Seeds Not Destroyed	Greens[i]	Nuts	Fruits: Seeds Destroyed	Underground Parts	Flowers	Flavorings
Rubus	Scirpus	Juglans	Phalaris	Ipomea[h]		Liriodendron[h]
Malus	Polygonum	Carya	Zizania			
Prunus	Chenopodium	Corylus	Zea			
Crataegus	Amaranthus	Fagus	Scirpus			
Gleditsia	Phytolacca	Castanea	Polygonum			
Rhus	Portulaca	Quercus	Chenopodium			
Vitis	Rubus		Amaranthus			
Passiflora	Passiflora		Portulaca			
Cornus	Solanum		Amphicarpa			
Vaccinium	Galium		Phaseolus			
Diospyros			Cucurbita			
Cucurbita			Lagenaria			
			Helianthus			
			Iva			
			Ambrosia			
			Polymnia			
12	10	6	16	1	0	1

Mississippian

Fruits: Seeds Not Destroyed	Greens	Nuts	Fruits: Seeds Destroyed	Underground Parts	Flowers	Flavorings
Rubus	Polygonum	Juglans	Phalaris	Ipomea		
Malus	Chenopodium	Carya	Zea			
Prunus	Phytolacca	Corylus	Polygonum			
Crataegus	Rubus	Quercus	Chenopodium			
Gleditsia	Passiflora		Amphicarpa			
Rhus	Solanum		Phaseolus			
Vitis	Galium		Cucurbita			
Passiflora			Lagenaria			
Cornus			Helianthus			
Vaccinium			Iva			
Diospyros			Ambrosia			
Cucurbita			Polymnia			
12	7	4	12	1	0	0

APPENDIX VI (Continued)

Genera of Food Plants by Period and Subsystem

Early Woodland Phases

Fruits: Seeds Not Destroyed	Greens	Nuts	Fruits: Seeds Destroyed	Underground Parts	Flowers	Flavorings
Rubus	Scirpus	Juglans	Scirpus	Ipomea		
Prunus	Chenopodium	Carya	Chenopodium			
Gleditsia	Amaranthus	Quercus	Amaranthus			
Rhus	Phytolacca		Helianthus			
Vitis	Rubus		Iva			
Vaccinium	Galium		Polymnia			
Diospyros						
7	6	3	6	1	0	0

Savannah River Phase

Rubus	Polygonum	Juglans	Phalaris			
Prunus	Chenopodium	Carya	Zizania			
Rhus	Phytolacca	Fagus	Polygonum			
Vitis	Galium	Quercus	Chenopodium			
Diospyros						
5	4	4	4	0	0	0

Morrow Mountain Phase

Rubus	Phytolacca	Juglans	Portulaca			Liriodendron
Gleditsia	Portulaca	Carya				
Vitis	Rubus	Castanea				
		Quercus				
3	3	4	1	0	0	1

Pre-Morrow Mountain Phases

Rubus	Polygonum	Juglans	Phalaris	Ipomea		
Gleditsia	Chenopodium	Carya	Polygonum			
Rhus	Amaranthus	Corylus	Chenopodium			
Vitis	Phytolacca	Fagus	Amaranthus			
Passiflora	Portulaca	Castanea	Portulaca			
	Rubus	Quercus				
	Passiflora					
	Galium					
5	8	6	5	1	0	0

APPENDIX VI (Continued)

Genera of Food Plants by Period and Subsystem

Archaic Period (All Phases Combined)

Fruits: Seeds Not Destroyed	Greens	Nuts	Fruits: Seeds Destroyed	Underground Parts	Flowers	Flavorings
Rubus	Polygonum	Juglans	Phalaris	Ipomea		Liriodendron
Prunus	Chenopodium	Carya	Zizania			
Gleditsia	Amaranthus	Corylus	Polygonum			
Rhus	Phytolacca	Fagus	Chenopodium			
Vitis	Portulaca	Castanea	Amaranthus			
Passiflora	Rubus	Quercus	Portulaca			
Diospyros	Passiflora					
	Galium					
7	8	6	6	1	0	1

[a] Requires processing before consumption.

[b] Dangerous or poisonous.

[c] Root processed for salt.

[d] Species listed in literature are actually introduced species.

[e] Fernald and Kinsey (1958) list as edible. Peterson (1978) lists as toxic.

[f] Underground seed.

[g] Total number of genera for category.

[h] Usage inferred from other plant parts preserved archaeologically.

[i] All archaeological greens inferred from seeds.

APPENDIX VII

Vascular Plant Families Represented Historically or Archaeologically in the Cherokee Area as Possible Food Plants

Family	Fruits: Seeds Not Destroyed	Greens	Nuts	Fruits: Seeds Destroyed	Underground Parts	Flowers	Flavorings
Osmundaceae		H[a]					
Aspidaceae		H					
Poaceae				P[b],H			
Cyperaceae		P		P			
Araceae		H			H		
Commelinaceae		H					
Liliaceae		H			H	H	
Iridaceae		H					
Juglandaceae			P,H				
Betulaceae			P,H				H
Fagaceae			P,H				
Ulmaceae	H						
Moraceae	H						
Polygonaceae		P,H		P			
Chenopodiaceae		P,H		P			
Amaranthaceae		P,H		P			
Phytolaccaceae		P,H					
Portulacaceae		P		P			
Ranunculaceae		H					
Berberidaceae	H						
Magnoliaceae							P(?),H
Annonaceae	H						
Calycanthaceae	H						
Lauraceae							H
Brassicaceae		H					H
Crassulaceae		H					
Saxifragaceae		H					H
Hammamelidaceae							H
Rosaceae	P,H	P,H					
Fabaceae	P,H			P,H	H	H	
Oxalidaceae		H					
Anacardiaceae	P,H						
Aceraceae							H
Vitaceae	P,H						
Violaceae		H					
Passifloraceae	P,H	P,H					
Onagraceae		H			H		
Apiaceae		H			H		
Cornaceae	P						
Ericaceae	P,H						H
Ebenaceae	P,H						
Convolvulaceae					P,H		
Hydrophyllaceae		H					

APPENDIX VII (Continued)

Vascular Plant Families Represented Historically or Archaeologically in the Cherokee Area as Possible Food Plants

Family	Fruits: Seeds Not Destroyed	Greens	Nuts	Fruits: Seeds Destroyed	Underground Parts	Flowers	Flavorings
Lamiaceae							H
Solanaceae	H	P,H					
Scrophulariaceae		H					
Plantaginaceae		I[c]					
Rubiaceae	H	P					
Caprifoliaceae	H						
Valerianaceae		I					
Cucurbitaceae	P,H			P,H			
Asteraceae		H		P	H		H

[a] Historic Period.

[b] Prehistoric Period.

[c] Probably introduced in the historic period.

APPENDIX VIII

Re-Examination of Unidentified Seeds from the 1976 Analysis of Warren Wilson Plant Remains

The plant remains that Richard Yarnell (Dickens 1976: Appendix A) analyzed from the Warren Wilson Site (31Bn29) were not re-located in time to incorporate any newly identified seeds from the "unidentified" category in the foregoing analyses. The following table reflects changes in the unidentified seed counts reported by Yarnell in 1976.

Feature #	1976 Unidentified Count	Identified in 1983
7	12 + 5 "Kamp Mound"	The "Kamp Mound" seeds were determined to be Triosteum sp. or Horse Gentian. The species is probably aurantiacum or perhaps perfoliatum. The species was first recognized in paleoethnobotanic samples by Paul Gardner (n.d.*) from the Hidden Valley Rock Shelter in Bath County, Virginia. Gayle Fritz recognized the species in the Warren Wilson sample. The species, in the honeysuckle family (Caprifoliaceae), is also known as "wild coffee" from the use of its seeds for that purpose by early settlers (Fernald and Kinsey 1958, Peterson 1978). An edible pulp is suspected for the seed although this is not mentioned in the literature. 1 carbonized Solanum sp.
56	6	1 Grape. Eliminate the 1 Chenopodium sp. seed which is not carbonized. 1 possible fruit carpel.
57	26	2 persimmon. 1 Unidentified grass. 1 possible hackberry (calcined).
136	18	None.
137	4	1 Triosteum sp. and 1 Polymnia uvedalia.
140	12	9 unidentified grass.

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