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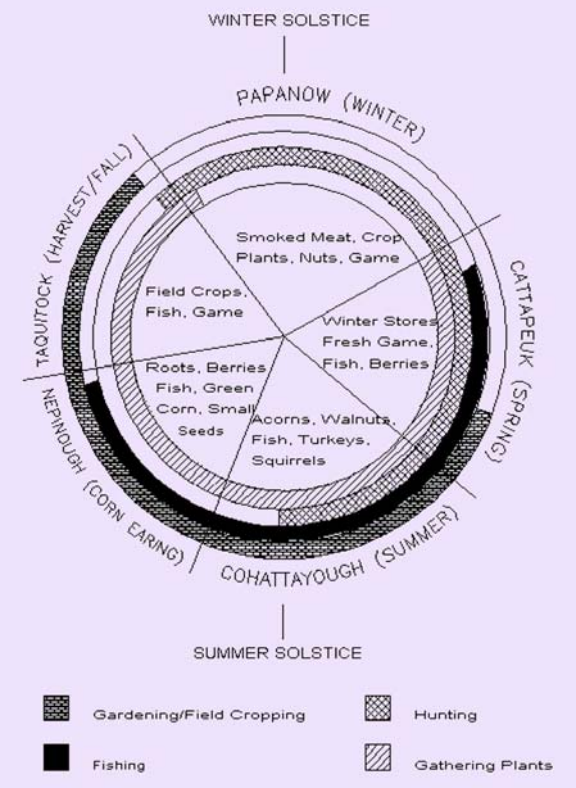

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ETHNOHISTORY OF ABORIGINAL LANDSCAPES IN THE SOUTHEASTERN UNITED STATES

by
Julia E. Hammett

Abstract

Problems with past attempts at historical and archaeological reconstructions of the environment are discussed, and two key concepts--*patches* and *disturbance*--are proposed to aid in more dynamic reconstructions of landscape and land use by human groups of the past. The study region is defined as Virginia, North Carolina, South Carolina, and northern Georgia. The time period of the study is set from first contact of the aboriginal inhabitants with Europeans until the early 1700s. Historical documents and journals are used to obtain information about how the native inhabitants of this region altered and managed their landscape to increase productivity of plants and animals, particularly those of interest as human food resources. It is argued that through the well-organized use of burning, clearing, and planting these Indians created and maintained a mosaic of managed patches that yielded high subsistence returns and ensured the short-term stability of their anthropogenic ecosystem.

Recent interest in ecological anthropology (e.g., Martin 1971) has led to an almost obligatory environmental "background" or "setting" chapter in many archaeological reports and ethnographies; however, this material is rarely integrated with research findings, even in reports which include ethnobotanical and ethnozoological sections. A major reason for this is because the setting is most often drawn from information about current environmental conditions surrounding the site area, or from reconstructions based on pollen evidence. These "still-life" reconstructions fail to do justice to the dynamic processes active in any environmental setting.

The purpose of the current work is to develop an approach for reconstructing a dynamic environmental setting. Such a setting cannot be just a backdrop in front of which actors play out their scenes, but must be the scene as it changes with new kinds of actions. Drawing upon early ethnohistorical evidence of the southeastern United States, this study will examine the nature of human disturbance and the techniques and methods Indians of that region used to alter or modify their physical environment. The specific results of their actions will be examined to determine what type of mutualistic relationships or "patches" they initiated or maintained. These findings will be compared with the habitat conditions and preferences of their important food crops in order to evaluate their effectiveness and their intentionality. Finally, implications of this study for understanding changes in human behavior and for purposes of resource management will be proposed.

The Setting

A Patchy and Disturbed Ecosystem

Ecologists long have recognized the role of disturbance for increasing the net productivity in an ecosystem (Odum 1959), yet until recently, most theoretic works on communities have been framed with concepts like *steady state*, *homeostasis*, and *equilibrium*. During the past few years, interest in the dynamics of an ecosystem has grown, and the process of natural disturbance and patch dynamics has become the focus of attention (Pickett and White 1985). *Patch* has been described by Wiens (1976:83) as an area "distinguished by discontinuities in environmental character states from [its] surroundings." This description has intentionally been made flexible so that boundary conditions relevant for the organism under study can be applied. In this sense, patchiness must be "organism defined" (Wiens 1976:83; Winterhalder 1981:152). Patches are discrete enough to be isolated for purposes of study, and yet they vary in terms of

spatial and temporal qualities, and in diversity, density, and productivity. For human groups, we may add that patches are perceived as discrete spaces where specific resources are concentrated.

Due to dynamic interactions within patches, each organism contributes somewhat to the makeup of the patch. From this standpoint, relatively highly mobile organisms such as vertebrates can be considered patch producers (Wiens 1985). For example, herbivores affect the frequency and distribution of food resources by differential grazing patterns. Granivores bury caches of seeds which may affect plant distributions. Burrowing animals can contribute significantly to the disturbance regime of their local environment. These types of disturbance activities contribute immensely to on-site "heterogeneity of the vegetation as a whole and maintain a state of non-equilibrium patch structure (Wiens 1985:187).

In general, various types of natural disturbance increase the heterogeneity, or patchiness, of the ecosystem. A relatively small disturbance such as a tree fall has an effect on many organisms in the general vicinity. Ecologists have noted that such a disturbance opens a space in the forest from the forest floor to the treetops. This space is called a "canopy gap," and it has an important role in ecological rejuvenation of the affected area. The rejuvenation is often associated with changes in availability of other resources, namely light and soil nutrients which affect the general makeup of biotic communities. This in turn affects the heterogeneity of the site (Denslow 1985:310-311). Denslow has recognized that the scale of natural disturbance both temporally and spatially, the ability of various species to exploit the gap, and other environmental factors may affect habitat heterogeneity as well. On the other hand, major catastrophic disturbances such as volcanic eruptions or large wildfires can lead to greater homogeneity--that is, large areas having similar environmental conditions such as soil type and plant and animal distributions.

Like other ecologists, those who have concentrated on humans have acknowledged the importance of disturbance, and

to a certain extent they have examined spatial concentrations which could be considered patches. In fact, much attention has been devoted to developing models and theories about the human role in creating and maintaining secondary successional plant and animal associations, or anthropogenic communities (Bye 1981; Ford 1985). Human disturbance often simulates other types of physical disturbance, but human disturbance may also change the interactions between community neighbors through processes of repetition and intensification.

David Rindos (1984) has noted that through time these processes may produce mutualistic relationships which can lead to domestication. In such cases, two organisms co-evolve in a relationship he has described as "symbiotic" (Rindos 1980:753).

Humans can take the role of instigator in creating or managing patches in order to enhance their net productivity in terms of human gain. When studying patch dynamics, the anthropogenic ecosystem becomes a "shifting mosaic" (Bormann and Likens 1979; Pickett and White 1985) of patches of various degrees of human and nonhuman derivation and maintenance. Pickett and White (1985:5) have noted that the term "shifting mosaic" connotes "a uniformity of patch distribution in time and space such that an overall landscape equilibrium of patches applies." They argue that such equilibria are to be expected where: (1) feedback occurs between community characteristics and disturbance events; (2) patch size is small relative to the homogeneous landscape unit; and (3) disturbance regimes are stable. It will be argued here that the situation in the southeastern United States immediately prior to European contact was an example of a shifting mosaic of patches. Thus the patch concept provides a tool with which to explore the landscape and the land-use pattern of any human group.

Humans have an impact on the ecology of any region they inhabit. The extent of their impact is a byproduct of their technology, their numbers and density, and the history of past environmental events. Archaeological evidence suggests that, overall, the environmental impact of aboriginal Americans increased through time as their numbers grew and their

technology developed. These trends are consistent with general cultural evolutionary models, although such observations fail to be very explicit.

The Contact period should produce the most information about how humans interacted with their micro-environments because it provides the richest documentation of aboriginal behavior. By examining the letters and journals that have survived from early European explorers and settlers, the interactions between Indians and their environment can be considered more fully than with archaeological work alone.

The region of the Atlantic seaboard which includes present-day Virginia, North Carolina, South Carolina, and northern Georgia (Figure 1) has been selected for study because there were early contacts here between native peoples and the Spanish and English. The study area encompasses three basic geographic zones--the Coastal Plain, the Piedmont, and the Appalachian Highlands--and several cultural groups, including Algonkian, Siouan, Muskogean, and Iroquoian-speaking peoples. This diversity of cultural groups and environments should have fostered variation in cultural adaptations to different environmental conditions.

Some general questions that will be considered are: (1) In what ways did the native inhabitants alter the natural vegetation of their region?; (2) How did the native inhabitants perceive their actions?; (3) To what degree were their actions intentional or unintentional?; (4) What were the cumulative effects of their actions?; and (5) What were the accrued benefits (or detriments) of their actions?

Historical Accounts

The primary sources of information for this study were drawn from observations made by early explorers, traders, and settlers from Spain and England (see Table 1). Like most sources of cultural information, historical documents are loaded with distortions, biases, and contradictions; consequently, it is

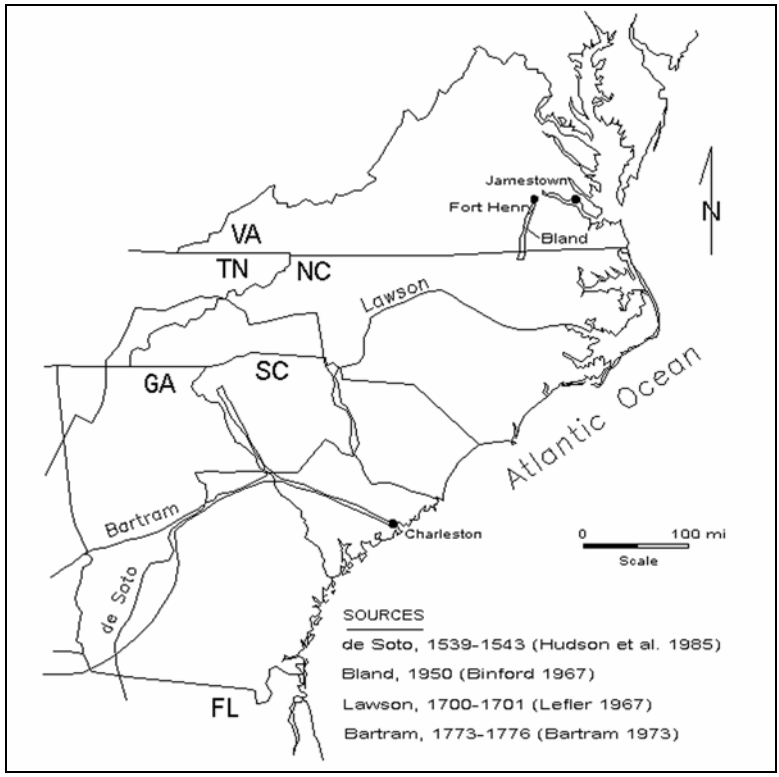

Figure 1. Map of the study area showing the routes of Spanish and English explorers and traders.

Table 1. Primary Sources Used in This Study.

Source	Dates	Context	Reference
Hernando de Soto	1539-1543	Spanish Explorer	Varner and Varner 1951
Thomas Hariot	1586	English Explorer	Quinn 1955
John Smith	1607-1609	Jamestown Settler	Arber 1910
George Percy	1607-1609	Jamestown Settler	Percy 1907
Edward Bland	1650	English Explorer	Bland 1651
John Lawson	1700-1709	Naturalist and Surveyor	Lefler 1967
Robert Beverley	1705	Virginia Settler	Wright 1947
William Byrd II	1719-1732	Virginia Planter and Trader	Wright 1966
William Bartram	1773-1776	Artist and Naturalist	Bartram 1973

necessary to recognize their strengths and weaknesses if they are to prove useful. An important key to understanding the limitations of such documents is to determine the cultural context of the writer--that is, the background of the writer and his or her intentions for these records. By understanding these factors, a more realistic evaluation of the interpretive value of the documents can be made.

It should be noted from the outset that the Europeans who first "discovered" the American continents were not looking for a new land but a passage to the other end of the world known to Europe. Their realization of this discovery is perhaps best demonstrated in the use of the terms "Old World" and "New World." Their initial impressions suggest they had no conception of the extent of this land mass. Early explorers repeatedly interviewed the Indians regarding a passage across the continent. Their questions and observations revealed their belief that the continent was not very sizable. For example, several stories were collected in the Carolinas regarding a falls beyond which there was a great sea of salt (Quinn and Quinn 1973:28).

Also, the major European powers during the Contact period--Spain, France, and England--were in competition for global resource control. This competition did not begin or end with their discovery of the New World. The geographic proximity of these political powers in the Old World made them obvious

competitors. In regard to the Carolinas, Ralph Lane's narrative of the Roanoke Island settlement claimed that:

> . . . for that the discovery of a good mine, but the goodness of God, or a passage to the Southsea, or someway to it, and nothing els can bring this country in request to be inhabited by our nation. And with the discovery of any of the two above shewed, it wilbe the most sweet, and healthfullest climate, and then will sassafras, and many other rootes & gummes ther found make good Marchandise and lading for shipping, otherwise of themselves will not be worth fetching [Quinn and Quinn 1973:33].

European interests in the New World were: (1) to find a passage to Asia; (2) to find any riches this new land afforded; and (3) to gain control over the natural resources of this new land.

Naturally the earliest accounts are richest in information about aboriginal technology because there would have been less time for "contamination" by European influences. Also, these descriptions were very detailed because of the uniqueness of their experiences. As time went on and as the novelty of discovery began to wear off, less detailed documentation occurred. By the 1700s, surveyors commissioned to explore interior areas of the Carolinas were instructed merely to report anything found that was new or unlike what had been seen in other villages.

The aim of these reporters is an important factor in evaluating the validity of their claims. In 1539, Hernando de Soto and his men were responsible for assessing the natural riches of the land with the intention of future apportionment and settlement (Varner and Varner 1951:324). They were interested in identifying the individuals and groups who had the most power and wealth and in discovering their sources of wealth. Rumors of riches in the form of gold, silver, and pearls were investigated and native holdings in the form of land, luxury items, food, and numbers of human subjects were assessed. Information about the environment along their route, particularly when near Indian towns, is useful because these were probably fairly accurate depictions of the landscape shortly after the time of first contact.

Among the earliest useful reports of Englishmen were the

accounts of Jamestown settlers Captain John Smith and George Percy in the early 1600s. Young Captain Smith was an adventurer who had seen action in various parts of the world prior to settling in the New World. Less is known of Percy except that he was a gentleman by birth and a contemporary and adversary of Smith. The original settlers of Jamestown apparently were plagued with dissention, jealousy, and competition from the start. Smith's work was clearly the most exhaustive of the time, and many contemporary and later works, such as those of William Strachey (1849) and Robert Beverley (Wright 1966), drew heavily upon his writings. These early settlers were dependent upon the continuing support of financiers in England and it suited their purposes to portray the countryside as attractive to the English eye as possible so that their sponsors would believe their investments were worthwhile. Also, these early pioneers were encouraging other potential settlers to join their ranks. This led them to play up or embellish what they considered to be the good qualities of the Americas and to downplay or neglect to mention the bad.

Captain Smith's encyclopedic accounting of Virginia surely suffers from these biases, but the subject matter and detailed descriptions of Indian customs and agricultural techniques make his work a valuable asset to the present study. To a great extent, the well-being and survival of Smith and the other settlers was dependent upon the hard-won lessons of the Indians. From this standpoint, Smith and the settlers benefitted from their accurate observations of Indian subsistence technology.

Both Edward Bland and George Percy provided accounts of exploratory trips away from the English settlements. It is difficult to conceive of a way they could have benefitted from distorting the truth, but intrinsic biases due to English upbringing and attitudes, and perceptions of the landscape as seen through English eyes, must be taken into account.

John Lawson, a surveyor and naturalist at the turn of the eighteenth century, was the first explorer in the region with any obvious background in the natural sciences. Nevertheless, one researcher has questioned the accuracy of Lawson's observations

due to his apparent exaggerations in the form of agricultural propaganda (Lindgren 1972). Lawson's (Lefler 1967) report is the first extensive documentation from the interior part of the Carolinas; this fact, coupled with the subject matter of his observations, makes his information of considerable value.

William Bartram's (1973) observations in the 1770s were too late to record many impressions of aboriginal conditions in the central Piedmont areas, although his training as a naturalist and an artist prepared him to make detailed observations of the landscape. At times, his artistic background led him to romanticize his accounts, and yet other aspects of his reports, such as detailed and thoughtful descriptions of plant succession in ancient Indian fields, provided noteworthy documentation.

In southern coastal Virginia near Jamestown, the early settlers found "by chance" upon walking into the woods

> a pathway like an Irish Pace: We traced along some foure miles, all the way as wee went, having the pleasantest Suckles, the ground all flowing over with faire flowers of sundry coloured and kinds, as though it had been in any Garden or orchard in England. There be many Strawberries, and other fruits unknowne. Wee saw the woods full of Cedar and Cypresse trees, with other trees, which issued out sweet Gummes like to Balsam. We kept on our Way in this paradise. At length, wee came to a Savage Towne [Arber 1910:lxviii].

This passage demonstrates some of the biases inherent in this kind of documentation. Critics might rightly argue that such accounts are too inaccurate to be considered of real value. But if the biases are recognized, perhaps some information can be gained from this type of literature. For this particular quote, several questions come to mind: (1) What part of the description is due to propaganda?; (2) Has the writer embellished the experience to make it more attractive to his audience?; and (3) Could the environment have been as attractive and productive as this writer reported? These questions shall be reconsidered later in this work.

Comparisons are made to "an Irish pace," and "any Garden or orchard in England." It may be productive to examine what

these images would have meant to a person back in England reading this account. In a study devoted to early colonial gardens in New England, Favretti (1974) has suggested that the garden of the Plymouth settlers can best be visualized by recalling the cottage gardens of England. These gardens typically had

> a central path of grass or gravel with irregular beds on either side. The plants within these beds were well cultivated and the beds maintained neatly, but no order of plant material prevailed. Vegetables, useful flowering plants, and herbs grew side by side without regard to kinds, height, or balance. The main characteristics of these gardens were informality and neatness, with little actual design [Favretti 1974:5)].

Favretti (1974:7) added that the more formal English Manor garden was more the prototype of the wealthier people of Massachusetts. This garden "was actually a formal garden informally planted." Apparently the climate of Great Britain produced "a lush plant growth that favored informality in the use of plants. The English, too, unlike the French, favored informality in the execution of the garden plan" (Favretti 1974:7).

With the seventeenth-century English model of a garden in mind, early accounts of southeastern North American landscapes and aboriginal land-use and management strategies will be examined.

Indian Environmental Management: Techniques and Strategies

This section examines how various techniques of disturbance were used by the Indians of the Southeast to alter their environment for productive gain. Indians of this region practiced a combination of hunting, fishing, plant collecting, and gardening strategies. Food resources which the Indians relied upon regularly are called *crops*. It is assumed that in order to ensure harvests, the Indians may have encouraged or protected

most crop resources. In the next section, information on preferred habitat conditions of these animal and plant crops will be considered in order to evaluate the effectiveness of the aboriginal management and harvest strategies.

Burning and Clearing

Fire ecologist P. J. Viro (1974) has identified three kinds of forest fire: (1) wildfire; (2) swaling; and (3) prescribed burning. Wildfires are uncontrolled and natural fires which normally occur in drier seasons and can be very destructive. "Swaling" is a term for a type of agricultural burning in which fields are periodically left fallow and then subsequently burned and tilled again. Viro's work centered on northern Europe, but he noted that "swaling was formerly practiced on a very large scale in the forested parts of the world." Swaling has been more commonly referred to in the anthropological literature as "swidden" or "slash-and-burn" agriculture, and also has been documented in tropical parts of the world, including Indonesia (Geertz 1963), New Guinea (Rappaport 1968), various other parts of southeast Asia and Oceania (Johnson 1972), and in the Amazon Basin of South America (Meggers 1971). One would expect to find a version of this system in forested parts of North America. Viro's (1974:8) final category, "prescribed burning," is "a means of preparing and improving a forest site for a new generation of trees." For purposes here, this category is broadened to include the enhancement or increase in any set of resources, plant or animal, that is considered desirable by the burners.

Two additional categories of fire are also relevant to the current study: (1) fire hunting, a form of communal hunting drive (described below); and (2) domestic fire which is used of for food preparation, heating, and other domestic purposes. The latter category is probably of minor importance in terms of its direct effects on the overall landscape except where fire escapes from a domestic setting and becomes a wildfire, or where the need for wood for domestic purposes becomes great enough to make a substantial impact on the surrounding environment. This

latter type of impact would tend to increase gradually as a function of length of occupation and the size of the human group. It is expected that, under most conditions, domestic fires had much less impact on the landscape than the other categories previously described.

Hunting with Fire. Fire drives for hunting game were an important use of burning in the Southeast prior to contact. In a survey of the ethnohistoric literature for the Eastern Woodlands, Waselkov (1978) found evidence for four techniques of deer hunting: (1) stalking; (2) the use of a decoy while stalking; (3) the use of surrounds or drives to water; and (4) the use of surrounds or drives using fire. The use of fire was associated with only some forms of communal drives.

Characteristically, these fires were made in the form of a ring around an area so that the deer would be driven to the center. They were low brush fires which probably were carefully controlled to enable the hunters to contain the game so they could be killed in such a way so that their coveted skins would not be burned or damaged. Control over the fire would have been critical in order to capture the game without losing the fire. Fire was used to capture rabbits, deer, bear, turkeys, and "what wild Creatures the Parts afford" (Lefler 1967:17, 127, 215).

Prescribed Burning. Prescribed burning is a technique for clearing areas and enhancing certain resources. For areas farther to the north in New England, there is good evidence that fire was used to stimulate vegetation. Adriaen Van der Donck (1846:20-21), writing about New Netherlands in about 1655, noted:

> The Indians have a yearly custom of burning the woods, plains and meadows in the fall of the year, when the leaves have fallen, and when the grass and vegetable substances are dry . . . . Those places which are then passed over are fire in the spring in April. This is done . . . to render hunting easier (for stalking), to thin out woods of all dead substances and grass, which grow better in ensuing spring . . . to circumscribe and enclose game . . . and because game is more easily tracked over burned parts of the woods.

In Massachusetts, Thomas Morton (1632) found that "The Savages . . . burne it (the woods) twize a yeare, viz: at the Spring and the fall of the Leafe."

It appears that the practice of prescribed burning extended to the study area as well. In 1709, Lawson noted for Carolina that:

> When these Savages go a hunting, they commonly go out in great Numbers, and oftentimes a great many Days Journey from home, beginning at the coming in of the Winter, that is when the Leaves are fallen from the Trees, and are become Any. 'Tis then they burn the Woods, by setting to the Leaves, and Wither'd Bent and Cross, they do with a Match made of the black Moss that hangs on the Trees in Carolina, and is sometimes above six Foot Long. In Places, where this Moss is not found, (as towards the Mountains) they make Lintels of the Bark of Cypress beatn, which serves as well [Lefler 1967:215].

William Byrd II described the same practice in early November of 1728 in the area of northern North Carolina and southern Virginia (Wright 1966).

Agricultural Clearing. On April 28, 1607, George Percy, one of the Jamestown settlers, entered these notes in his log:

> We marched to those smoakes and found that the Savages had beene there burning downe grasse, as we thought either to make their plantation there, or else to give signes to bring their forces together, and so to give us battell [Arber 1910:lxii-lxiii; Percy 1907:10-11].

Other early settlers in coastal Virginia described this method of clearing trees:

> The greatest labour they take, is in planting their corn, for the country naturally is overgrowne with wood. To prepare the ground they bruise the bark of the trees neare the roote, then do they scortch the roots with fire that grow no more . . . . The next yeare with a crooked peece of wood, they beat up the woodes by the rootes, and in that moulds they plant their corne [Arber 1910:61; Strachey 1849:116].

William Byrd's *Natural History of Virginia*, first published in 1737, provides a description of how "one may clean and clear

the land (of coastal Virginia) very easily and conveniently" by the technique used by the Indians:

> when the trees are full of sap, and skin about three or four feet of bark from the trunks, which causes them to dry up, so the foliage falls down. This no sooner happens than they begin at once to work the soil and to sow it with grain, or whatever they wish, which soon spring forth and produces manifold fruit. When the aforementioned trees have become quite withered by the removal of the bark, they then go and cut a broad strip from the nearest green trees, which are standing there, [to a point] as far as they wish to clear, in order to prevent the whole forest from burning. They then set fire to the dry trees, which burn immediately. Thus in a short time a very large section of land can be cleared and made neatly available for planting, [a practice] which saves the planters very much trouble and expense [Beatty and Mulloy 1940:92-93].

Similar evidence is lacking for agricultural clearing in the Piedmont.

Gardening

The initial stage in the agricultural sequence, clearing of the ground, has been discussed above. Now the methods used to cultivate or encourage specific plants will be addressed. Some plants can be classified as staples, whereas others supplemented the diet or provided some other value to the general subsistence, such as medicine or dye. All of these plants, staple or supplemental, may be considered to have been more or less crop plants because in order to ensure harvests they were planted or at least encouraged. The crop plants are divided into field crops, tree crops, and other crops.

Field Crops. Field and garden crops included corn, beans, squash, sunflowers, gourds, tobacco, possibly maypops, Jerusalem artichokes, sumpweed, maygrass, little barley, and chenopod. The best descriptions of field crops are from the early Jamestown settlers who considered such information vital to their own survival in coastal Virginia. Captain Smith (Arber 1910:62) noted that the Virginia Indians began to plant in April, but their chief planting occurred in May. They continued

planting until the middle of June. This type of successional planting appears to have been common in North America and is considered a security measure against late and early frosts. Such a technique also spreads out the harvest period since not all fruits ripen simultaneously: "What they plant in April they reape in August, for May in September, for Iune (June) in October" (Arber 1910:62).

There is good documentation of interplanting numerous crops in their fields. In 1607, Smith described this manner of planting near the southern Virginia coast:

> They make a hole in the earth with a sticke, and into it they put 4 graines of whet and 2 of beanes. These holes they make 4 foote one from another. Ther women and children do continually keep it with weeding, and when it is growne midle high, they hill it about like a hop-yard [Arber 1910:62].

Smith (Arber 1910:63) also noted that in May "also amongst their corne they plant pumpeons (pumpkins) and a fruit like unto a muske millen, but lesse and worse; which they call *Macocks* (probably squash)." In 1586 along the Carolina coast, Thomas Hariot (Quinn 1955:337-342) described a similar practice of interplanting fields of maize with beans, cucurbits, sunflowers, and small-seed crops (discussed below). Reasons or benefits for this practice were suggested. Smith (Arber 1910:cxii) noted that "when the wheat (corn) doe growe up havinge a straw as bigg as a canne reede the beanes runn up theron like our hopps on poles." In 1705, Robert Beverley (Wright 1947:141) of southern Virginia added that "Several kinds of Creeping Vines bearing Fruit, the *Indians* planted in their Gardens or Fields because they wou'd have Plenty of them always at hand; such as, Musk-melons, Water-melons, Pompions, Cushaws, Macocks, and Gourds."

According to Captain Smith (Arber 1910:63), the Virginia Indians also planted "*Maracocks*, a wild fruit like a lemmon, which also increase infinitely: they begin to ripen in September and continue till the end of October." This is contrary to the statement made by Robert Beverley:

> The *Maracock*, which is the Fruit of what we call the Passion Flower, our Natives did not take the Pains to plant, having enough of it growing every where; tho' they eat it with a great deal of Pleasure [Wright 1947:143].

From these two conflicting accounts it would seem that maypops, which thrive in disturbed field areas, were encouraged and possibly even planted whenever they did not occur substantially as volunteer plants.

There is no direct evidence that the Indians of the region added fertilizer to their fields. In New England, the "traditional" Indian technique of adding a fish to a corn hill dates back to the Pilgrims and an Indian named Squanto in 1621. It now appears that Squanto learned this technique from Europeans when he had been kidnapped some years earlier. At that time he visited England and various other European settlements in the Old and New Worlds (Ceci 1982).

There is a little information on field rotation, another strategy for maintaining a high crop yield. This technique necessitates the rotation of fields, which leaves some areas fallow so that their nutrients may be regenerated through the process of old field succession. Bartram (1973:353) noted a place which "had formerly been a very flourishing settlement, but the Indians deserted it in search of fresh planting land, which they soon found in a rich vale but a few miles distance over a ridge of hills." Similarly, much farther to the north in 1609, Adriaen Van der Donck (1846) observed the practice of rotating fields in the area called New Netherlands.

Tree Crops. The strongest evidence for orchards or tree crop management comes from Bartram in 1773 near a place called Wrightsboro, Georgia, located 80 miles west of Augusta and probably just south of Athens, where he found old Indian settlements with accompanying fields:

> I observed, in the ancient cultivated fields, 1. Diospyros (persimmon), 2. gleditsia triacanthos (honey locust), 3. prunus chicasaw (chickasaw plum), 4. Callicarpa (beauty berry), 5. morus rubra (red mulberry), 6. juglans exalta (hickory), 7. juglans nigra (black walnut), which inform

> us, that these trees were cultivated by the ancients, on account of their fruit, as being wholesome and nourishing food. These are natives of the forest, yet they thrive better, and are more fruitful, in cultivated plantations, and the fruit is in great estimation with the present generation of Indians, particularly juglans exalta, commonly called shell-barked hiccory [Bartram 1973:38].

Further in his journey, somewhere along the Altamaha River, he climbed a high shore where a venerable oak grew near an ancient Indian field encircled with an open forest of stately pines. In the field he found:

> verdered over with succulent grass, and chequered with coppices of fragrant shrubs, offered to my view the Myrica cerifera (wax myrtle), Magnolia glauca, Laurus benzoin (spicebush), Laur. Borbonia (redbay), Rhamnus frangula [buckthorn], Prunus Chicasaw, Prun. laurocerasus (carolina laurel cherry), and others [Bartram 1973:49].

In the "ancient famous town of Sticoe," Bartram (1973:343) found "old Peach and Plumb orchards; some of the trees appeared yet thriving and fruitful."

While travelling up along the Altapaha (Altamaha River), presumably near the same area Bartram visited two hundred years later, Hernando de Soto's men found a province of "peaceful and domesticated" people where there were "very large mulberry trees, although they had seen them elsewhere, the other were nothing in comparison to these" (Varner and Varner 1951:269). About two leagues from a town in the province of Cofachiqui, probably near present-day Camden, South Carolina (Hudson et al. 1985:724), de Soto's men found "a pretty place, cooled by great groves of mulberries and other trees heavy with fruits" (Varner and Varner 1951:296). Further on in that same province

> they journeyed a full league in garden-like lands where there were many trees, both those which bore fruit and others; and among these trees one could travel on horseback without any difficulty for they were so far apart that they appeared to have been planted by hand. During the whole . . . league [they] spread out gathering the fruit and noting the fertility of the soil. In this way they came to Talomeco, a town of

> five hundred houses situated on an eminence overlooking a gorge of the river [Varner and Varner 1951:314].

In southern coastal Virginia near Jamestown, an area which had a relatively dense Indian population, the early European settlers observed:

> Wheresoever we landed upon this River, we saw the goodliest Woods as Beech, Oke, Cedar, Cypresse, Walnuts, Sassafras, and Vines in great abundance, which hang in great clusters on many Trees, and other Trees unknowne; and all the grounds be spred with many sweet and delicate flowres of diverse colours and kinds. There are also many frutes as Strawberries, Mulberries, Rasberries, and Fruites unknowne [Arber 1910:lxviii-lxvx; Percy 1907:17].

The proximity of this described scene to actual Indian villages is difficult to determine; however, recall the quote in the introductory section which described a view "as though it had been in any Garden or orchard in England" (Arber 1910:lvviii) as they approached an Indian town.

Other Crops. Several other plants not considered field or tree crops were nevertheless very important to the economy of native groups in the study area. Several of these crops thrive in open areas. These include a small-seeded plant called *Mattoume*, a woody evergreen shrub called *Yaupon*, and various types of fruit and berry bushes, including blackberries, huckleberries, raspberries, and strawberries. Some of the herb and root crops are found in areas of greater shade and moisture, such as marshes, swamps, bogs, or more mature forests.

With the exception of *Yaupon* there is no evidence that any of these other crops were planted. The leaves of this shrub were commonly used for a tea known as the Black Drink. *Yaupon* prefers maritime and coastal plain environments, although it has been documented as far into the interior as Oklahoma, Arkansas, Tennessee, and Kentucky (Merrill 1979). Its dispersal outside of its native environment was due primarily to trade. There is, however, some evidence that it was transplanted to settlements in the Piedmont and the Appalachian highlands that were out of

its normal range (Merrill 1979). James Adair observed that it grew along the sea coast of the two Carolinas, Georgia, and Florida. "The Indians transplant, and are extremely fond of it . . . ." (Adair 1775:128). In the vale of the Cherokee town of Jore, William Bartram saw "a little grove" of Yaupon, which he said was the only place in the Cherokee country that he had seen it grow. According to him, "the Indians call it the beloved tree, and are very careful to keep it pruned and cultivated" (Bartram 1973:357).

Several small-seed crops have been identified archaeologically (Gremillion 1984; Yarnell and Black 1985). These include sumpweed (*Iva annua*), maygrass (*Phalaris caroliniana*), little barley (*Hordeum pusillum*), and possibly chenopod (*Chenopodium bushianum*). Unfortunately, there is little historic documentation of their use. Lawson (Lefler 1967:83) identified lambsquarters (*Chenopodium* sp.) but failed to indicate whether or not the Indians used it. Of the other crops, there are a few actual accounts of specifically identified, small-seed crops. Thus, their identity remains partially conjecture. In 1586, along the coast of the Carolinas, Thomas Hariot described one such plant:

> There is an herbe which in Duch is called Melden. Som of those that I describe it unto take it to be a kinde of seed thereof they make a thicke broth, and pottage of a very good taste: of the stalke by burning into ashes they make a kinde of salt earth, wherewithall many use sometimes to season their brothe; other salte they know not. Wee ourselves used the leaves also for pot-hearbes [Quinn 1955:340; Sturtevant 1965:64].

Sturtevant has suggested that this plant probably was either *Amaranthus* sp. or *Chenopodium* sp.

Captain Smith noted a plant called *Mattoume* that "groweth as our bents do in meddows." Smith said the seed was much like rye although much smaller. "This," he said, "they use for a dainty bread buttered with deare suet" (Arber 1910:58). This small-seed may have been one or more of the seed plants mentioned above. The plant's habit of growing as "bents"

suggests that it probably was a stiff, grass-like type of plant, such as little barley or maygrass.

Many known crops, such as berries, also occurred in these open areas. In the Congaree area near present-day Columbia, South Carolina, Lawson found:

> great copses of many Acres that bore nothing but Bushes, about the Bigness of Box-trees; which [in the season] afford great Quantities of Small Blackberries, very pleasant Fruits, and much like our Blues, or Huckleberries, that grow on Heaths in England [Lefler 1968:34].

A little past the Congaree he found old fields "now spread with fine bladed Grass, and Strawberry-Vines" (Lefler 1967:38).

On a field trip, Bartram (1973:354-355) made out into the mountains near Cowe (in western North Carolina) where he and his comrade were delighted to find "a most enchanting" if somewhat fanciful view:

> a vast expanse of green meadows and strawberry fields; a meandering river gliding through, saluting in its various turnings the swellings, green turfy knolls, embellished with pasterres of flowers and fruitful strawberry beds; flocks of turkies strolling about them; herds of deer prancing in the meads or bounding over the hills; companies of young, innocent Cherokee virgins, some busy gathering the rich fragrant fruits, other having already filled their baskets [Bartram 1973:354-355].

Smith claimed that another berry, called *Ocoughtanamnis*, was "very much like unto Capers." These grew in "the watry valleyes" (Arber 1910:58).

Herbs, roots, and other types of plants with high water content are difficult to recover archaeologically, although occasionally seeds from these plants have been identified. Of the herbs, Captain Smith mentioned several including "Violets, Purslin, Sorrell, . . . besides many we used whose names we know not [which] are commonly dispersed throughout the woods, [and are] good for brothes and sallets [salads]" (Arber 1910:58). Their chief root crop, which Smith called *Tockawhoughe*, "groweth like a flagge in low muddy freshes (Arber 1910:58).

Scheduling

According to Captain Smith, the coastal Virginia Indians recognized five seasons of the year: (1) *Papanow* (winter); (2) *Cattapeuk* (spring); (3) *Cohattayough* (summer); (4) *Nepinough* (the earing of their corn); and 5) *Taquitock* (the harvest and fall of leaf). Major feasts and sacrifices occurred from September until the middle of November when "they have plenty of fruits as well planted as naturall, as corne greene and ripe, fish, fowle, and wilde beastes exceeding fat" (Arber 1910:61). Shortly afterwards, the Indians made excursions to the mountains where they would burn and hunt. It is probable that burning and other clearing types of activities took place in the late fall and spring in the mountains and near coastal and piedmont settlements as well. Smith provided this synopsis of their seasonal dietary round:

> In March and Aprill they live much upon their fishing, weares; and feed on fish, Turkies and squirrels. In May and Iune they plant their fieldes; and live most of Acornes, walnuts, and fish. But to mend their diet, some disperse themselves in small companies, and live upon fish, beasts, crabs, oysters, land Torteyses, strawberries, mulberries, and such like. In Iune, Iulie, and August, they feed upon the rootes of *Tocknough*, berries, fish, and greene wheat [Arber 1910:68].

This schedule would allow the concentration of people at spring and fall in times of plenty so that the major tasks of harvesting, clearing, and planting could be accomplished, as well as allowing groups to split into smaller units in times of scarcity if necessary.

Although most of the information pertaining to management and scheduling of food crops has been drawn from an area of coastal southern Virginia, it is fairly safe to conjecture that similar types of strategies, with modifications, were used throughout the study region. Although evidence from the other areas is not as extensive as Smith's account, what details we do have fit well into his general scheme. A diagram is provided to illustrate the annual seasonal round of subsistence activities and available food crops (Figure 2).

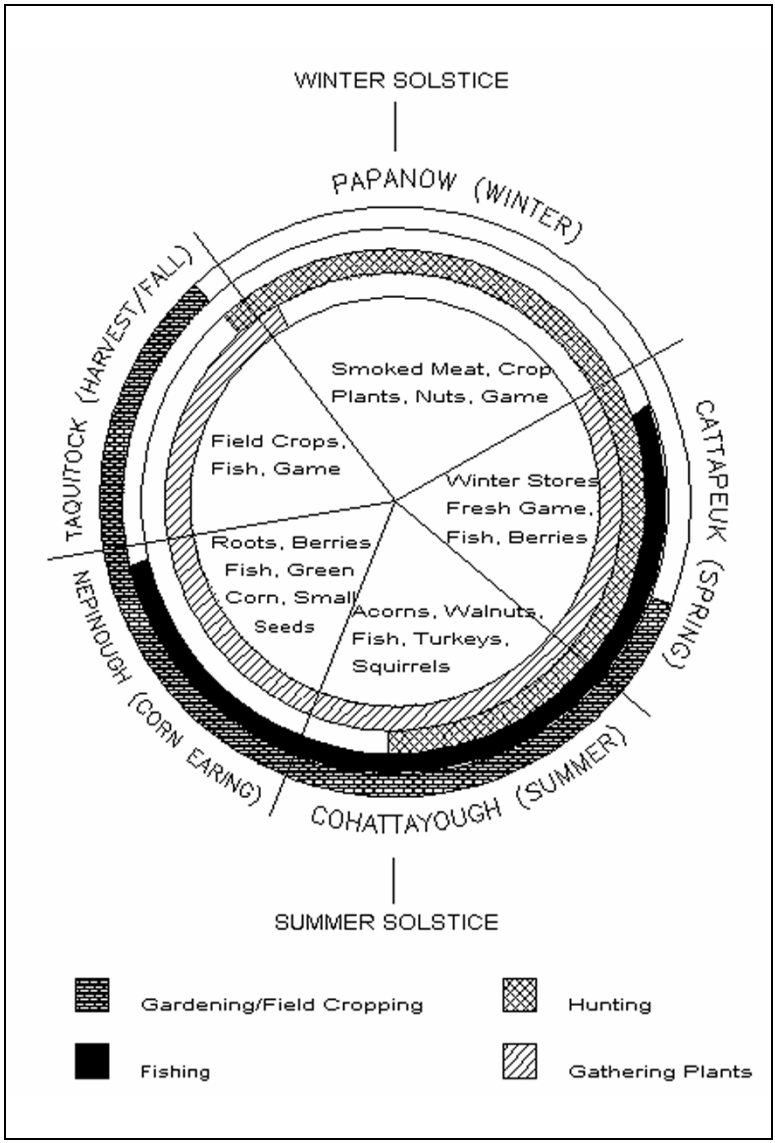

Figure 2. Seasonal round of subsistence activities for coastal Virginia Indians, based on observations by Captain John Smith (Arber 1910).

Habitat, Range, and Disturbance

In this section, the habitat conditions and preferences of important Southeastern Indian crops will be discussed. These crops are among the many plants and animals mentioned by early explorers and also include those reported from several Late Prehistoric and Protohistoric sites of north-central and western North Carolina (Table 2).

Plants

The field and garden crops are not discussed in detail here, other than to note that they were placed in open, disturbed areas created and maintained by humans. Most of the important crop plants were dependent upon such areas and would not have survived in less disturbed habitats. Some of these crops, such as maypops, were volunteer plants, meaning they did not have to be planted; however, most such crops relied upon humans for their propagation.

Other field and garden crops, such as some of the small-seeded crops, may have been field followers, relying on the open disturbed edge areas between fields and other types of patches. Thus, in a sense these edge areas should also be considered a kind of patch. The domestic status of these small-seeded crops has been discussed elsewhere (Yarnell 1983) and will not be dealt with here. However, it is important to note that in general these small-seeded crops prefer open, grassy (meadowy or marshy) types of conditions.

The nut-tree crops include hickory nuts, walnuts, hazelnuts, and acorns. All of these are more productive in open or edge areas where they receive ample sunlight and space (Smith and Hawley 1962:32; Talalay et al. 1984:340). For example, open-grown hickories produce about eight times more nuts than closed-canopy, old-growth hickories. The roots of *Juglans nigra* even produce a toxin called *juglone* which inhibits other walnuts from growing nearby (Talalay et al. 1984:341-342).

Table 2. Animals and Plants Mentioned by Early Explorers or Identified from Late Prehistoric and Protohistoric Archaeological Sites in North-Central and Western North Carolina.

Animals/Plants	Historical Reference	Archaeological Reference	
Animals			
Beaver	Lefler 1967	Holm 1985	
Black bear	Lefler 1967	Holm 1985	*[2]
Bluejay	Lefler 1967	Holm 1985	
Buffalo	Lefler 1967	-	
Catfish	Lefler 1967	Holm 1985	
Cottontail rabbit	Lefler 1967	Holm 1985	*
Deer	Lefler 1967, Bartram 1973	Holm 1985	*
Elk	Lefler 1967	-	
Fox	Lefler 1967	Holm 1985	
Horse[1]	Lefler 1967	Holm 1985	
Killdeer	Lefler 1967	Holm 1985	
Lesser scaup	-	Holm 1985	
Mink	Lefler 1967	-	
Mountain lion	Lefler 1967	Holm 1985	
Muskrat	Lefler 1967	-	
Opossum	-	Holm 1985	
Otter	Lefler 1967	-	
Passenger pigeon	Lefler 1967	Holm 1985	
Pig[1]	Lefler 1967	Holm 1985	
Quail	Lefler 1967	Holm 1985	*
Raccoon	Lefler 1967	Holm 1985	
Skunk	Lefler 1967	Holm 1985	
Sparrow	Lefler 1967	Holm 1985	
Squirrel	Lefler 1967	Holm 1985	*
Suckers	Lefler 1967	Holm 1985	
Toads & Frogs	Lefler 1967	Holm 1985	
Turkey	Lefler 1967, Bartram 1973	Holm 1985	*
Turtle	Arber 1910, Lefler 1967	Holm 1985	
Wildcat	Lefler 1967	-	
Wolf/Dog	Lefler 1967	Holm 1985	
Woodpecker	Lefler 1967	Holm 1985	
Plants			
Beans	-	Wilson 1977, Gremillion 1984	*
Beauty berry	Lefler 1967?, Bartram 1973		
Bramble (blackberry)	Lefler 1967	Wilson 1977, Gremillion 1984	*
Buckthorn	Bartram 1973	-	
Cedar	Arber 1910, Lefler 1967	-	

Table 2 Continued.

Animals/Plants	Historical Reference	Archaeological Reference	
Chenopod	Lefler 1967	Gremillion 1984	*
Cherry	Lefler 1967, Bartram 1973	-	*
Chestnut	Lefler 1967	-	*
Corn	Arber 1910	-	*
Cypress	Arber 1910, Lefler 1967	-	
Crabapple	Lefler 1967	-	
Grape	Lefler 1967	Wilson 1977, Gremillion 1984	*
Hawberry	Lefler 1967	-	
Hawthorn	Lefler 1967	Wilson 1977, Gremillion 1984	
Hazelnut	Lefler 1967	Wilson 1977	*
Huckleberry/ Blueberry	Lefler 1967	Wilson 1977, Gremillion 1984	
Hickory	Lefler 1967	Wilson 1977, Gremillion 1984	*
Honey locust	Lefler 1967, Bartram 1973	-	*
Maygrass	-	Gremillion 1984	*
Maypops (maracocks?)	Arber 1910	Wilson 1977, Gremillion 1984	*
Mattoume	Arber 1910	-	*
Mulberry	Varner & Varner 1951, Arber 1910, Lefler 1967, Bartram 1973	-	*
Little barley	-	Gremillion 1984	*
Oak acorn	-	Wilson 1977, Gremillion 1984	*
Peach[1]	Lefler 1967	Wilson 1977, Gremillion 1984	*
Persimmon	Lefler 1967	Wilson 1977, Gremillion 1984	*
Pine	Lefler 1967, Bartram 1973	Wilson 1977	
Plum	Lefler 1967	Wilson 1977, Gremillion 1984	*
Pokeweed	Lefler 1967(?)	Wilson 1977	
Purslin	Arber 1910, Lefler 1967	-	*
Raspberry	Arber 1910, Lefler 1967	-	*
Sassafras	Arber 1910, Lefler 1967, Bartram 1973	-	
Sorrel	Arber 1910	-	*
Spicebush	Lefler 1967, Bartram 1973	-	
Squash	Arber 1910	Wilson 1977, Gremillion 1984	*
Strawberry	Arber 1910, Lefler 1967, Bartram 1973	-	*
Sumpweed	-	Gremillion 1984	*
Sunflower	Lefler 1967	Wilson 1977	*
Sweet maple	Lefler 1967	-	
Tobacco	Arber 1910, Lefler 1967	-	

Table 2 Continued.

Animals/Plants	Historical Reference	Archaeological Reference	
Tockawhoughe (root crop)	Arber 1910	-	*
Violet	Arber 1910	-	*
Walnut	Arber 1910, Lefler 1967, Bartram 1973	Wilson 1977, Gremillion 1984	*
Wax myrtle	Lefler 1967,Bartram 1973	Wilson 1977	
Yaupon	Lefler 1967,Bartram 1973	-	*

[1]Introduced by Europeans; [2]Mentioned in text.

According to Deam (1921), the hickories typically are highly susceptible to fire, so that other means of clearing might have been employed in order create sufficient openings for these trees, while protecting them from fire damage (cited in Talalay et al. 1984:338). No evidence is available for the susceptibility to fire of the walnut trees and hazelnut shrubs. Talalay et al. (1984:343) have suggested that the characteristic small thickets of hazelnut would be relatively rare prehistorically except around natural openings or where disturbed areas had been created by slash-and-burn agricultural practices.

The numerous species of oaks in the study area and the difficulty in identifying acorns to species present extreme problems for establishing preferred habitat conditions based on their presence historically or archaeologically. Furthermore, Petruso and Wickens (1984) have noted the difficulty in determining criteria for evaluating acorn productivity. They found that even trees of the same species may vary considerably in their productivity. Two generalizations they observed were that: (1) trees which are good producers in any given year tend to be good producers overall; and (2) productivity of a given tree appears to be dependent upon the surface area of its crown. This would suggest that, in general, oaks are more productive in open areas. Another important observation for tree crops is that older trees tend to produce less that younger, mature trees (Petruso and Wickens 1984:371). In other studies, Little (1974) and

Komarek (1974) have noted that many of the oaks, including *Quercus virginiana*, *Quercus laevis*, and *Quercus myrtifolia* , have strategies such as crown or stump sprouting which allow them to survive and often thrive (in terms of productivity) in conditions of frequent brush or low intensity fires. On the other hand, *Quercus prinus* has a low tolerance to fire.

Fruit trees include plum, cherry, persimmon, peach, and mulberry. Persimmon is a native that occurs in dry deciduous forests, pinelands, and old fields (Radford et al. 1968:826). The peach tree was introduced historically. Its rapid dispersal in native North America, which is demonstrated through observations by John Lawson (Lefler 1967) in 1701 and William Bartram (1973) in old fields in 1773, was likely due to the Indians' previous knowledge of its relative, the plum. Lawson noted that both peach and mulberry were "spontaneous" (Lefler 1967:115, 117), presumably meaning they grew from seed with little or no encouragement.

Bartram (1973:38) footnoted that although he was certain the Chickasaw plum was native to America, he never saw it wild in the forests but always in old, deserted Indian plantations; and he suspected it was brought from "beyond the Mississippi, by the Chicasaws." Similarly, Radford et al. (1968:569) note that the Carolina laurel cherry is "believed to be rare as a native plant, more abundant as an escape from cultivation." Overall, the *Prunus* spp. appear to prefer open or edge areas. Little evidence is available of their reactions to burned areas. *Prunus pennsylvanica*, the fire or pin cherry, prefers cleared or burned areas (Radford et al. 1968:568).

The brambles (*Rubus* spp.), including blackberry, dewberry, and raspberry bushes, "occur in colonies or 'patches' in open and edge situations" (Munson 1984:469). Similarly, one species of strawberry (*Fragaria virginiana*) generally prefers old fields and edge areas (Radford et al. 1968:534-535).

Animals

Citing numerous studies in North America, J. F. Bendell

(1974) noted some of the animals that favor areas opened by fires. These include white-tailed and black-tailed deer, jack rabbits, moose, black bear, brush rabbits, hares, elk, blue geese, muskrat, beaver, coyote, and cougars. Because fires produce higher numbers of game on which to prey, humans can also be considered animals that benefit, at least indirectly, from this process.

At a more basic level, animals react indirectly to the responses of plants to environmental conditions. For this region in general, the short-term effects of burning are to

> increase protein, phosphorus and calcium content of the grasses, to enhance their palatability and to improve the composition of the rangeland for animals . . . . [N]utritive qualities do not last more than a few months after spring burning, but this is usually the time when livestock and plants need extra protein and minerals [Komarek 1974:260-261].

In an exhaustive study of the literature on fire ecology and game management, Mellars (1976) found that many factors contribute to the productivity of game animals. These include: the intensity (i.e., heat and duration) of the fire, the type of vegetation burned, and the periodicity of burning. Much of this section is based on his sources. Taber and Murphy (1971) have noted that prescribed burning generally tends to increase the carrying capacity of herbivores by doing the following: (1) markedly improving soil fertility by releasing a rich supply of nutrients (i.e., rapid recycling of nutrients); (2) allowing a greater penetration of sunlight; and (3) fire pruning which encourages vigorous sprouting of shrubs and mature trees.

In a study carried out in a mixed oak forest in Pennsylvania, Ribinski (1968) observed an area where a substantial overstory of tree canopy had been destroyed. Two years later the browse accessible to white-tailed deer was ten times that available in adjacent unburned sections. After two more years, the browse availability had been reduced to half that available two years prior.

Cowan et al. (1950:250) observed that clearing and burning

can lead to a marked improvement in the nutritive properties of forage, although these changes are short-lived. In a study in Maryland, DeWitt and Derby (1955) noted a deciduous forest which had been completely cleared in 1942 using a low intensity, "reburn" prescribed fire. Rapid increase in protein content of four out of the five plant species selected for the study was found, but the beneficial effects of this fire had largely disappeared by the following year. A hot, uncontrolled fire in 1950 produced substantial increases (10-26%) in protein with more increase the following year. Also, there was a slight decrease in fiber content, but no consistent changes of ash, ether extract, or nitrogen-free extract (Mellars 1976:19).

Naturally increased available browse has an effect on the population of herbivores. Increases in available browse due to disturbance caused by burning and logging have been correlated with increased numbers of large mammals, including moose, black-tailed deer, white-tailed deer, red-tailed deer, and sheep (Mellars 1976:22-23). For example, Cumming (1969:259) found that tree felling and burning of pine forest in New Jersey increased the white-tailed deer population from approximately six per square mile to 38 per square mile. Critics have cautioned that this increase may be due in part to a diversion of game from other less productive areas (Taber and Dasman 1957). One study on moose in a contained area demonstrated that although diversion may be one factor, overall increase in total numbers also occurred (Mellars 1976; Spencer and Chatelain 1953:546). This may be because of an overall improvement in general health due to better forage (Einarsen 1946).

Range managers have developed recommendations of "optimal areas of burns" for various animals. For deer, the ideal range must include patches of burned areas interspersed with areas of older growth of various stages (Cowan 1956:605; Hendricks 1968:225; Mellars 1976:26-27). The older growth provides equally essential protection from predators, winter cold, and summer heat. Similarly, "spot burning" has been recommended for such game birds as quail, turkey, and prairie chicken (Mellars 1976). On the other hand, too few small

patches make for over-browsing of the more desirable browse and permits undesirable browse of the overstory which causes range deterioration (Hendricks 1968:227).

In the southern forests, research has demonstrated that the season of burn affects the productivity and variability of available forage. Using 20-year measurements, Lewis and Harshbarger (1976:18) found that the "best" burning cycle for deer and turkeys was periodic winter burnings. For quail, they recommended annual winter burnings. Landers (1981) found that for quail, annual winter burning provides food (e.g., insects during summer, seeds during fall and winter), brood habitat, and control of parasites. Excluding fires for two to three years allowed the development of roughs for nesting habitat and summer fruit production. Landers also recommended developing thickets for escape cover and providing hard-mast components. Limited evidence suggests that turkeys benefit from prescribed fires in ways very similar to the quail (Hurst 1981).

For bear in the southern forests, Hamilton (1981) recommended prescribed burning on a three-year rotation in coastal areas and a five-to-seven-year rotation in mixed pine/hardwoods. He added that patch edges (ecotones) between pine or pine-scrub oak ridges and Carolina bays or hardwood swamps should be burned during winter on a medium-to-long rotation to enhance berry production.

There is very little information on the effects of fire on squirrel populations. Kirkpatrick and Mosby (1981) have reasoned that since squirrels are dependent upon hardwood forests, and current prescribed burning practices are intended keep down hardwoods, the practice would be detrimental. Of course, this is only true for the method practiced by range managers in the South today. Since the productivity of some hardwoods, notably many oaks, can be enhanced with small-scale periodic burning, prescribed burning cannot be conclusively proven to be entirely to the habitat preferences of squirrels.

In summary, current range-management research indicates that a pattern of prescribed burning in small patches, leaving adequate cover and edge areas, can increase the productivity of

many game animals. Aboriginally, such a practice would have increased the richness and yield of many important animals and plant crops in the native Southeast.

Aboriginal Land Use and Management Considered

Brush Management

The major and most basic result of human disturbance in the Southeast, as in most of the nonindustrial world, has been through the process of forest and brush clearing. From an ecological standpoint, the process of clearing has important consequences for the natural environment. Clearing serves to open up an area, to rejuvenate it so that ecological pioneers or shade-intolerant types of plants and animals may benefit. As fire was a major technological tool used by the Indians for clearing, it is worthwhile to consider how it operates in detail.

Studies have demonstrated that many factors affect the intensity of burning. Fire-control experts consider fire to be derived from a triad of oxygen, heat, and fuel. Knowledge of this seemingly commonplace notion is nevertheless critical if one is to use fire as a tool. For purposes here, the focus is on vegetation fires, where the fuel is some form of plant life. The intensity of heat is based on several factors, including the amount of resin and moisture in the fuel. Another factor is the density of the fuel stand, including the amount of dead wood and other litter on the ground. The density and amount of potential fuel at different heights in a stand of wood act differentially to induce the layers to be more or less susceptible to burning. In areas where there is a considerable quantity of surface litter, one would expect a fire to sweep through a stand along the floor level. Where there is adequate combustible fuel, fire will spread up into the major branches of trees or, if the fire gets hot or high enough, the fire is likely to climb up to the tree tops and spread as a crown fire.

The added amount of oxygen available at the tops of the trees

contributes significantly to the spread of such a fire. Consequently, different kinds of trees or plant associations react in different ways to fire. For example, if a crown fire gets established in a stand of pines with their high resin content and concentration of needle laden branches at the tops of the trees, the fire is likely to spread rapidly and can easily get out of control. If low brush and shrubs are maintained by controlled burning, there is less opportunity for an uncontrollable crown fire to occur. Additional factors include various weather conditions such as humidity, temperature, and air currents.

Certain types of vegetation are more suited to repeated burning, clearing, or other types of disturbance. Studies in fire ecology have identified plant and animal life that tend to have higher levels of productivity resulting from their residence in areas subject to periodic burning. Such populations or associations of populations may be called "fire subclimax" or "fire disclimax" communities. The incidence and productivity of many organisms are higher in such secondary successional stage (or disturbed conditions) than under conditions closer to a climax-level association.

Patch Management

In general, prescribed burning, unlike wildfires, produces a patchy landscape as not all places burn evenly. Some areas miss being burned altogether, and some are completely devastated. The remaining patchwork is a heterogenous mosiac of small patches or associations at various successional levels. This diversity of patches may be one of the most crucial long-term roles of burning. A list of the general types of anthropogenic patches for the study area is provided in Table 3.

Hunting Camps and Animal Crop Management. Prescribed burning may have occurred in conjunction with communal hunts when large groups gathered. At this time the participants would have benefitted from having greater numbers of people for both hunting and clearing activities. The use of fire would have served both purposes. Numerous low brush fires, if controlled,

Table 3. Types of Anthropogenic Patches in the Native Southeast.

Patch Type	General Characteristics	Important Resources
Hunting Camps	circular burned patches in forested areas away from settlements; probably less than 3 mi wide	deer, berries, nuts turkeys, bears, squirrels, rabbits
Fields/Gardens	open cleared areas near habitation sites	corn, squash, beans, maypops, sunflowers, small-seeded crops
Edge Areas/Meadows	open grassy and "weedy" areas bordering settlements and between different patches	small-seed crops, turkeys, other game birds, berries, rabbits, squirrels
Old Fields	similar to edge areas but more woody brush	same as edge areas plus some young fruit and nut trees (mostly saplings) and shrubs
Parklands/Orchards	open forested areas surrounding established settlements	adult nut and fruit trees and shrubs, deer, squirrel, and other small game
Wetlands/Swamps/ Marshes	shadier wetter wooded areas or swamps/marshes	herbs, root crops, berries
Waterways	in or adjacent to water's edge	fish, shellfish, turtles, frogs/turtles

would be unlikely to spread out of control and up into the trees, and would have maintained the park-like landscape described by early writers. Thus, the landscape characterized by Indian hunting activities was a series of small patches, each probably no more than a few miles wide. Repeated, periodic burning in the vicinity of previous hunts would have had the overall effect of a mosaic of small patches at various successional stages.

Waselkov's (1978) research on deer hunting suggests that fire drives were commonly used by small Piedmont Indian groups

only after contact when the deerskin trade became important. He added that, prehistorically, communal drives probably would have been used primarily by larger groups along the coast for annual or special-occasion feasts held by high chiefs.

Waselkov's work (1978) is provocative yet problematic. The most descriptive early account of Indian burning practices comes from the Jamestown settlement near the mouth of the Chesapeake Bay, not coastal Carolina (Arber 1910:61). Our best information from the Piedmont was recorded 100 years later by John Lawson (Lefler 1967:215). There appears to be no earlier evidence for the presence or absence of fire drives in the Piedmont. Where there are good descriptions of coastal groups, there are equally good accounts of individual stalking methods (Arber 1910). This does not discount Waselkov's hypothesis, but it remains to be substantiated by significantly reliable ethnohistorical or archaeological data.

The fire-drive technique was used to collect not only deer, but also other game including bear, turkeys, and rabbits. The evidence indicates that all of these animals have positive feedback responses to certain types of prescribed burning. This suggests that repeated seasonal burning by the Indians was not actually a "hunting" technique but more of a "harvesting" technique. Circular brush burning had the short-term result of entrapping game and the long-term effect of stimulating the foliage preferred by the game, which helped to ensure future harvests in the same vicinity (Kozlowski and Algren 1974; Mellars 1976).

Forested Parklands. Prescribed burning has been associated with the "park-like" setting described by so many early European explorers (Day 1953; Guffey 1977). Guffey has suggested that the "deserts" referred to by Bartram (1973) and John Smith in 1607 (Arber 1910) on the Coastal Plain may have been maintained by burning. This remains to be demonstrated. It is likely that extremely large, expansive, open areas were the result of occasional natural wildfires, which could have had far-reaching effects if left unchecked during a dry season. Park-like woodlands within several miles of large, well-established

settlements were probably due to periodic burning by Indians. This type of landscaping would have had the additional reward of reducing the probability of large wildfires that could devastate their resource areas.

Plant remains from archaeological sites in the Southeast indicate a reliance on various tree crops (Yarnell and Black 1985), and there is some direct historical evidence that the Indians had something approximating European orchards, gardens, or parklands surrounding their settlements. Nevertheless, preconceived notions of early European explorers restricted their abilities to recognize other tree management strategies, and they rarely recognized them as being managed. Indirect information relating to tree management is found in the descriptions of explorers travelling in the vicinity of well-established Indian villages. These park or woodland areas were full of fruit, nut, and other useful trees, as well as useful understory shrubs such as berry bushes and large and small game.

In areas of dense population and well-established settlements, human selection favored trees considered economically important. The proximity to settlements, population density, and duration of habitation in a specific locality increased these selection pressures. Areas within a few miles of well-established villages would have appeared to the European eye as gardens and orchards. In such cases, whether they deliberately opened areas or planted trees would be less important than the results of their general management strategies.

Field Crop Management. There is good evidence for the use of fire for agricultural clearing along coastal Virginia. Similar evidence is lacking for this practice in the Piedmont. However, given the late date of accounts in the Piedmont, the technique of clearing land may not have been considered noteworthy. Also, field-clearing activities were seasonal and oftentimes may have been missed by travelers. From Lawson's accounts of fall clearing in conjunction with hunting (Lefler 1967), it is safe to assume that Piedmont residents, at least in part, practiced the

same tradition of scheduling and burning techniques as their coastal counterparts.

The Indians of this region practiced a series of gardening techniques including staggered planting times, planting in evenly-spaced holes, and interplanting different kinds of crops. These methods appear to have been standard practice through much of the New World. There are several advantages to planting a variety of crops together.

A benefit of interplanting young squash and melon plants between corn and bean plants is that the young seedlings are protected from direct sunlight by growing in the shade of the more mature corn and bean plants. As the vine plants mature, they serve to retain moisture in the soil for all the plants.

Beans are good companion plants to corn because beans are able to produce most of their necessary supply of nitrogen though their symbiotic relationship with the microorganisms called *Rhizobium*. These bacteria, attached to the roots of legume plants such as beans, are effective in "nitrogen fixation," or the conversion of atmospheric nitrogen (N2) into a form of nitrogen usable by the plants (Hausenbuiller 1978). This leaves much of the nitrogen in the soil available for use by other plants, such as corn, which are not able to fix their own nitrogen. Conservation of nitrogen is essential when the soils are naturally nutrient poor or there is repeated cropping without the addition of fertilizer.

Soil ecologist Edward H. Graham (1944:50) has noted that "Southern farmers long ago learned" that the following types of vegetation cover can be cleared and corn can be grown for the specified amount of years without declining yields: longleaf pines (3 years); longleaf and shortleaf pines (5-7 years); mixed oaks and hickories (10-12 years); and shortleaf pines and oaks (12-15 years). After these times, fertilizer must be added to the ground if yields are to be maintained. This is due to the varying rates of depletion of soil nutrients and minerals from the diverse soil types supporting these different types of vegetation.

It is likely that traditional Indian techniques of mixed cropping and plant spacing conserved nutrients to a greater

extent than the modern agricultural practices of row planting and monocropping. Nevertheless, some nutrient depletion eventually would have occurred despite their more highly adapted gardening techniques. This means that in order to maintain high crop yields, the Indians had to practice field rotation or fertilization of their fields. From historical evidence, it appears that field rotation, an alternative to adding fertilizer to the soil, was the solution used by native Americans for maintaining themselves in a general locality. At times, soil depletion probably caused them to move their settlements to nearby vicinities.

Edge Areas, Old Fields, and "Weedy" Crops. Several small-seed crops, notably sumpweed, chenopod, maygrass, and little barley (Gremillion 1984), have been recovered archaeologically from this region but were not recognized by early explorers as field crop plants. Like tree crops, this was probably due in part to the biases of the European attitude about what constituted a "crop." When they were noted it was as a curiosity (e.g., Quinn 1955:340; Sturtevant 1965), or they were compared to a smaller version of a larger-seeded grass with which they were more familiar (Arber 1910:58). For these crops, our most substantial evidence for their nature, habit, and development remains in the archaeological record.

For the most part, the adventitious nature of the crop plants, or their preference for open areas, allowed them to thrive in disturbed conditions created by humans. Crops of this sort have sometimes been called "camp followers," as they often occur in disturbed areas in and around habitation sites. Open areas included meadows, old fields, and edge areas between different types of patches.

Wetlands. Plants that needed moister or shadier environments, such as some herb and root crops, were less likely to have been maintained by humans, although ensuring an adequate supply of such resources near habitation sites may have at times necessitated protecting them from fire and other types of disturbance. Whatever the criteria affecting plant dispersal, we can assume that the Indians recognized the habitat conditions of these plants, because they regularly relied upon them. They

would have taken certain steps to control such conditions in order to ensure the well-being of their crops.

Intentionality

A question remains: How purposeful was this anthropogenic patchwork of the native Southeast? In November, 1728, William Byrd II noted that the "atmosphere was so smoaky all round us . . . from the fireing of the Woods by the Indians, for we were now near the Route the Northern Savages take . . . to War" (Wright 1966:257-258). He considered these fires to be due to campfires left burning "which, catching the dry Leaves they ly near, soon put the adjacent Woods into a flame." He added that his men had recently seen evidence of a fire which had gone out of control where some people had a small hunting camp. He apparently did not consider the possibility that the fire was deliberately spread from the camp for the purpose of driving game.

It would seem unlikely for people who lived a lifestyle made possible by virtue of fire not to understand the principles well enough to guard against accidental spreading, unless there was little or no reason to prevent this. If there was great danger of damage from the fire, a great investment would be made to control for that hazard. It follows that if fires were frequently allowed to get loose, as Byrd suggested, the benefits of this practice of lack of caution probably outweighed the expense. Overall, information on the level of awareness of Indians regarding their actions are essentially absent from the early literature. Such a question apparently was not of interest to the European observers in the sixteenth and seventeenth centuries.

A recent study by Henry T. Lewis (1977) conducted in northern Alberta, Canada, where the traditional practice of burning has endured until the present, sheds light on this question. Lewis found that the Indians of northern Alberta were very cognizant of their actions. They understood fully the complications of timing, environmental conditions, and resultant effects. According to a 76-year-old Cree informant in 1975,

> Fires had to be controlled. You couldn't just start a fire anywhere, anytime. Fire can do a lot a harm or a lot of good. You have to know how to control it . . . the country has changed from what it used to be--brush and trees where there used to be lots of meadows and not so many animals as before [Lewis 1977:15-16].

Many of Lewis' informants were able to point to wooded areas that had formerly been maintained as meadows. It is quite likely that their sense of awareness extended throughout North America wherever fire was used, but evidence to substantiate this assumption remains to be seen.

Implications

Mellars (1976:36-39) has discussed several cultural developments that may follow from the use of prescribed burning to manage an environment. He has proposed that prescribed burning would lead to a marked reduction in the time and energy costs for harvesting food by: (1) increasing productivity (in human terms); (2) reducing travel and search costs by increasing mobility and visibility; and (3) reducing risk (uncertainty). As predictability increased, concentrations of food permitted the formation of larger, more sedentary patterns of residence.

Increased intensification of man-plant-animal relationships would allow influence over sex, age, and relative abundance of different species by varying the type, degree, seasonality, and frequency of burning. Such management policies might lead to emergence of ideas concerning ownership of economic resources and territorial boundaries.

This hypothesis would be difficult to test archaeologically. For the study area, however, it is clear from ethnohistorical records that these Indians practiced a form of resource management. This was done by establishing and maintaining mosaics of patches at a variety of successional stages through periodic burning, clearing, and gardening. Within each patch, greater or lesser amounts of heterogenous conditions existed as a result of specific management practices. At a larger scale, variability between these managed patches could have been

substantial in comparison to areas less affected by human disturbance in the surrounding landscape of the three subregions--the Piedmont, the Coastal Plain, and the Appalachian Mountains. Such a strategy increased the productivity and variability of their resource base. Increased environmental graininess on a local scale led to short-term stability for their anthropogenic ecosystem.

There is good evidence for cooperative management practices in the form of hunting, clearing, planting, and harvesting. With seasonal movement between patches to nurture and exploit various resources, it is very probable that the Indians in this region did have some concept of "home range" or "territoriality." This suggests a new meaning of the term "range manager." The Indians created and maintained the range upon which their plant and animal resources, and they in turn, relied.

An Aboriginally Maintained Landscape

This study has attempted to characterize the nature and consequences of human disturbance in the study area at the time of European contact. Indians of this region used fire and other techniques of clearing for a variety of purposes. It would appear that disturbance in the form of clearing was localized near settlements, in hunting areas, and along established paths. Length of occupation and human population density were important factors which helped determine the degree of disturbance. Established settlements had many gardens and fields near their houses which were often surrounded by a zone of economically important trees. Many open areas described by early explorers were actually old fields, meadows, and edge areas which were controlled by prescribed burning. Other types of patches exploited by these Indians included marshes, swamps, and bogs which also may have burned periodically.

Indian burning and clearing created and maintained a mosaic of patches. On a smaller and more controlled scale, they replicated the same kind of patchy condition that natural events such as natural disturbance can cause. By utilizing fire they

increased the richness and diversity of their environment, and decreased the likelihood of wildfires destroying what so many early writers deemed a paradise.

Some of the early writers highly romanticized their reports for many reasons. Nevertheless, a comparison of their observations about landscapes and Indian management strategies to current recommendations of resource and wildlife managers suggests that historic reports probably were relatively accurate for the areas immediately surrounding Indian habitations. Indeed, Indian practices may have produced a much more productive environment (in human terms) than what modern-day occupants are accustomed to seeing. Wildlife and range managers are just beginning to develop recommendations which are consistent with practices that the native inhabitants developed over hundreds, if not thousands, of years. This only stands to reason if one considers that the welfare of these people was dependent upon their hard-won knowledge.

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References Cited

Adair, James
1775 *The History of the American Indians*. London.

Arber, Edward (editor)
1910 *Travel and Works of Captain John Smith*. 2 vol. John Grant, Edinburgh.

Bartram, William
1973 *Travels Through North and South Carolinas, Georgia, and East and West Florida*. The Bee Hive Press, Savannah, Georgia.

Beatty, Richard C., and William J. Mulloy
1940 *William Byrd's Natural History of Virginia*. The Dietz Press, Richmond.

Bendell, J. F.
1974 Effect of Forest Fire on Birds and Mammals. In *Fire and Ecosystems*, edited by T. T. Kozlowski and C. E. Algren. pp. 73-138. Academic Press, New York.

Binford, Lewis R.
1967 An Ethnohistory of the Nottoway, Meherrin and Weanock Indians of Southeastern Virginia. *Ethnohistory* 14(3-4):103-218.

Bland, Edward
1651 *The Discovery of New Brittaine*. Thomas Harper, London. Reprinted by Readex Microprint Corp., U.S.A (1966).

Bormann, F. H., and G. E. Likens
1979 *Pattern and Process in a Forested Ecosystem*. Springer-Verlag, Berlin and New York.

Bye, Robert A., Jr.
1981 Quelites-Ethnoecology of Edible Greens--Past, Present and Future. *Journal of Ethnobiology* 1(1):109-123.

Byers, Douglas S.
1946 The Environment of the Northeast. In *Man in Northeastern North America*, edited by Frederick Johnson, pp. 3-32. Phillips Academy, Andover, Massachusetts.

Ceci, Lynn
1982 Fish Fertilizer: A Native North American Practice? *Science* 188:26-30.

Cowan, I. McT.
1956 Life and Time of the Coast Black-tailed Deer. In *The Deer of North America*, edited by W. P. Taylor, pp. 523-617. Stackpole, Harrisburg, Pennsylvania.

Cowan, I. McT., W. S. Hoar and J. Hatter
1950 The Effect of Forest Succession Upon the Quantity and Upon the Nutritive Values of Woody Plants Used as Food by Moose. *Canadian Journal of Research* 28:249-271.

Cumming, J. A.
1969 Prescribed Burning on Recreation Areas in New Jersey: History, Objectives, Influences and Technique. *Proceedings of the Annual Tall Timbers Fire Ecology Conference* 9:251-69.

Day, Gordon
1953 The Indian as an Ecological Factor in the Northeastern Forest. *Ecology* 34(2):329-346.

Deam, Charles C.
1921 *Trees of Indians*. Indiana Department of Conservation, Indianapolis.

Denslow, Julie Sloan
1985 Disturbance-Mediated Co-Existence of Species. In *The Ecology of Natural Disturbance and Patch Dynamics*, edited by S. T. A. Pickett and P. S. White, pp. 307-324. Academic Press, Orlando, Florida.

DeWitt, J. B., and J. V. Derby
1955 Changes in the Nutritive Value of Browse Plants Following Forest Fire. *Journal of Wildlife Management* 19:65-70.

Einarsen, A. S.
1946 Crude Protein Determination as an Applied Management Technique. *Transactions of the North American Wildlife Conference* 11:309-312.

Favretti, Rudy J.
1974 *Early New England Gardens, 1620-1840.* 3rd edition. Meridian Gavure Co., Connecticut.

Ford, Richard I.
1985 *Prehistoric Food Production in North America*. Anthropological Papers 75. Museum of Anthropology, University of Michigan, Ann Arbor.

Geertz, Clifford
1963 Two Types of Ecosystems. In *Agricultural Involution*, pp. 12-37. University of California Press, Berkeley.

Graham, Edward H.
1944 *Natural Principles of Land Use*. Greenwood Press, New York.

Gremillion, Kristen J.
1984 *Aboriginal Use of Plant Food and European Contact in the North Carolina Piedmont*. Unpublished Master's thesis, Department of Anthropology, University of North Carolina, Chapel Hill.

Guffey, Stanley Z.
1977 A Review and Analysis of the Effects of Pre-Columbian Man on the Eastern North American Forests. *Tennessee Anthropologist* 2(2):121-137.

Hamilton, Robert J.
1981 Effects of Prescribed Fire on Black Bear Populations in Southern Forests. In *Prescribed Fire and Wildlife in Southern Forests*, edited by Gene W. Wood, pp. 129-134. The Belle W. Baruch Forest Science Institute of Clemson University, Georgetown, South Carolina.

Hendricks, J. H.
1968 Control Burning for Deer Management in Chaparral in California. *Proceedings of the Annual Tall Timbers Fire Ecology Conference*.

Holm, Mary Ann
1985 *Faunal Remains From Two North Central Piedmont Sites*. Unpublished Master's thesis. Department of Anthropology, University of North Carolina, Chapel Hill.

Hudson, Charles, Marvin Smith, David Hally, Richard Polhemus, and Chester DePratter
1985 Coosa: A Chiefdom in the Sixteenth-Century Southeastern United States. *American Antiquity* 50(4):723-737.

Hurst, George A.
1981 Effects of Prescribed Burning on the Eastern Wild Turkey. In *Prescribed Fire and Wildlife in Southern Forests* , edited by Gene W.

Wood. pp. 81-88. The Belle W. Baruch Forest Science Institute of Clemson University, Georgetown, South Carolina.

Johnson, Allen W.
1972 Individuality and Experimentation in Traditional Agriculture. *Ecology* 1:149-159.

Kirkpatrick, Roy L. and Henry S. Mosby
1981 Effects of Prescribed Burning on Tree Squirrels. In *Prescribed Fire and Wildlife in Southern Forests*, edited by Gene W. Wood, pp. 99-102. The Belle W. Baruch Forest Science Institute of Clemson University, Georgetown, South Carolina.

Komarek, Edward V.
1974 Effects of Fire on Temperate Forests and Related Ecosystems: Southeastern United States. In *Fire and Ecosystems*, edited by T. T. Kozlowski and C. E. Algren, pp. 251-278. Academic Press, New York.

Kozlowski, T. T., and C. E. Algren (editors)
1974 *Fire and Ecosystems*. Academic Press, New York.

Landers, J. Larry
1981 The Role of Fire In Bobwhite Quail Management. In *Prescribed Fire and Wildlife in Southern Forests*, edited by Gene W. Woods, pp. 73-80. The Belle W. Baruch Forest Science Institute of Clemson University, Georgetown, South Carolina.

Lefler, Hugh T. (editor)
1967 *A New Voyage to Carolina, by John Lawson*. University of North Carolina Press, Chapel Hill.

Lewis, C. E., and T. J. Harshbarger
1976 Shrub and Herbaceous Vegetation After 20 Years of Prescribed Burning on the South Carolina Coastal Plain. *Journal of Range Management* 29:13-18.

Lewis, Henry T.
1977 Maskuta: The Ecology of Indian Fires in Northern Alberta. *The Western Canadian Journal of Anthropology* 7(1):15-52.

Little, Silas
1974 Effects of Fire on Temperate Forests: Northeastern United States. In *Fire and Ecosystems*, edited by T. T. Kozlowski and C. E. Algren, pp. 225-250. Academic Press, New York.

Martin, Paul S.
1971 The Revolution in Archaeology. *American Antiquity* 36:1-8.

Meggers, Betty J.
1971 *Amazonia: Man and Culture in a Counterfeit Paradise*. Aldine Atherton, Inc., Chicago.

Mellars, Paul
1976 Fire Ecology, Animal Populations and Man: A Study of Some Ecological Relationships in Prehistory. *Proceedings of the Prehistoric Society* 42:15-45.

Merrill, William L.
1979 The Beloved Tree: *Ilex vomitoria* Among the Indians of the Southeast and Adjacent Regions. In *Black Drink: A Native American Tea*, edited by Charles Hudson, pp. 40-82. University of Georgia Press, Athens.

Morton, Thomas
1632 *New English Canaan: or New Canaan*. Peter Force.

Munson, Patrick J.
1984 Comments on Some Additional Species, With Summary of Seasonality. In *Experiments and Observations on Aboriginal Wild Plant Food Utilizations in Eastern North America*, edited by Patrick J. Munson, pp. 459-473. Indiana Historical Society Prehistory Research Series 4(2). Indianapolis.

Odum, Eugene P.
1959 *Fundamentals of Ecology*. 2nd edition. W. B. Saunders Co., Philadelphia.

Percy, George
1907 Observations Gathered Out of a Discourse of the Plantation of the Southerne Colonie in Virginia by the English, 1606. In *Narratives of Early Virginia, 1606-1625*, edited by Lyon Gardiner. Barnes and Noble, Inc., New York.

Petruso, Karl M. and Jere M. Wickens
1984 The Acorn in Aboriginal Subsistence in Eastern Northern America: A Report on Miscellaneous Experiments. In *Experiments and Observations on Aboriginal Wild Plant Food Utilization in Eastern North America*, edited by Patrick J. Munson, pp. 360-378. Indiana Historical Society Prehistory Research Series 4(2).

Pickett, S. T. A. and P. S. White
1985 *The Ecology of Natural Disturbance and Patch Dynamics*. Academic Press, Orlando, Florida.

Quinn, David B. (editor)
1955 *The Roanoke Voyages, 1584-1590*. 2 volumes. Hakluyt Society, 2nd Series, Nos. 104-105. London.

Quinn, David B. and Alison M. Quinn
1973 *Virginia Voyages from Hakluyt*. Oxford University Press, London.

Radford, Albert E., Harry E. Ahles and C. Ritchie Bell
1968 *Manual of the Vascular Flora of the Carolinas*. University of North Carolina Press, Chapel Hill.

Rappaport, Roy A.
1968 *Pigs for the Ancestors*. Yale University Press, New Haven.

Ribinski, R. F.
1968 Effects of Forest Fires on Quantity and Quality of Deer Browse Production in Mixed Oak Forests of Central Pennsylvania. *Quarterly Report of the Pennsylvania Cooperative Wildlife Research Unit* 30(5):13-15.

Rindos, David
1980 Symbiosis, Instability, and the Origins and Spread of Agriculture: A New Model. *Current Anthropology* 21(6):751-772.

1984 *The Origins of Agriculture*. Academic Press, Orlando, Florida.

Smith, David M., and Ralph C. Hawley
1962 *The Practice of Silviculture*. Devin-Adair Co., New York.

Spencer, D. L., and E. F. Chatelain
1953 Progress in the Management of Moose of South Central Alaska. *Transactions of the North American Wildlife Conference* 18:539-52.

Strachey, William
1849 *The Historie of Travaile into Virginia Britannia*. The Hakluyt Society, London.

Sturtevant, William C.
1965 Historic Carolina Algonkian Cultivation of Chenopodium or Amaranthus. *Southeastern Archaeological Conference Bulletin* 3:66-67.

Taber, R. D., and R. F. Dasman
1957 The Dynamics of Three Natural Populations of the Deer *Odocoileus hemionus columbianus*. *Ecology* 38:233-46.

Taber, R. D., and J. L. Murphy
1971 Controlled Fire in the Management of North American Deer. In *The Scientific Management of Animals and Plant Communities for Conservation*, edited by E. Duffey and A. S. Watts, pp. 425-435. 11th Symposium of the British Ecological Society. Blackwell Scientific Publications, Oxford.

Talalay, Laurie, Donald R. Keller, and Patrick J. Munson
1984 Hickory Nuts, Walnuts, Butternuts, and Hazelnuts. In *Experiments and Observations on Aboriginal Wild Plant Food Utilization in Eastern North America*, edited by Patrick J. Munson. Indiana Historical Society Prehistory Research Series 6(2). Indianapolis.

Van der Donck, Adriaen
1846 *A Description of the New Netherlands*. New York Historical Society Collection, Series 2, Vol. 1:125-242. Reprinted in 1968, T. F. O'Donnel, editor. Syracuse University Press, Syracuse, New York.

Varner, J. G., and J. J. Varner (translators)
1951 *The Florida of the Inca*. University of Texas Press, Austin, Texas.

Viro, P. J.
1974 Effects of Forest Fire on Soil. In *Fire and Ecosystems*, edited by T. T. Kozlowski and C. E. Algren, pp.7-46. Academic Press, New York.

Waselkov, Gregory A.
1978 Evolution of Deer Hunting in the Eastern Woodlands. *Mid-Continental Journal of Archaeology* 3(1):15-34.

Wiens, John A.
1976 Population Responses to Patchy Environments. *Annual Review of Ecology and Systematics* 7:81-120.

1985 Vertebrate Responses to Environmental Patchiness in Arid and Semiarid Ecosystems. In *The Ecology of Natural Disturbance and Patch Dynamics*, edited by S. T. A. Pickett and P. S. White, pp.169-196. Academic Press, Orlando, Florida.

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

Winterhalder, Bruce
1981 Environmental Analysis in Human Evolution and Adaptation Research. *Human Ecology* 8(2):135-170.

Wright, Louis B. (editor)
1947 *The History and Present State of Virginia, by Robert Beverley*. University of North Carolina Press, Chapel Hill.

1966 *The Prose Works of William Byrd of Westover*. Belknap Press of Harvard University Press, Cambridge.

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

Yarnell, Richard A., and M. Jean Black
1985Temporal Trends Indicated by a Survey of Archaic and Woodland Plant Food Remains from Southeastern North America. *Southeastern Archaeology* 4:93-106.

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