CHAPTER VI
THE PUNCHEON RUN PREHISTORIC LANDSCAPE

A. THE GEOLOGICAL LANDSCAPE

The most basic part of the landscape is the earth itself. The activities of people and the lives of plants and animals are all acted out on the stage provided by rock and soil, so an understanding of the Puncheon Run landscape begins with the geology of the site. The geological history of the Puncheon Run Site is written in its soils, which have been shaped over the millennia by the variables of topography, climate, and time.

The weathering processes that create the soil profile take place over long periods. The degree of soil development can suggest how long a soil deposit remained stable and, in the right circumstances, can provide approximate ages for deposits. Soil formation has a strong tendency to follow predictable pathways, normally culminating in a standard sequence of layers, or "horizonation." Even in situations where only truncated remnants of soil profiles remain, these soils can still provide important clues. The record provided by the soil profiles can inform us about how and when soils were first deposited, about periods when they were eroded, about the age of land surfaces, and to some extent about the environmental conditions of the site.

1. Regional Setting

The central Delaware location of the Puncheon Run Site is within the Coastal Plain physiographic province that comprises all but the most northern portion of the state. Geographically, the site lies within the Mid-Drainage Zone of the lower Coastal Plain region. This zone occupies the middle stretches of eastward-flowing stream systems draining toward Delaware Bay. Elevations are generally less than 12 meters (40 feet). Geologic materials in the region consist of sands, silts, and gravels derived both from marine and fluvial sedimentation. In the study area marine deposits are restricted to fairly great depths, and the surface deposits in which the soils and landscapes are formed are considered to be of fluvial and terrestrial origin. These uppermost or surficial deposits are identified mainly as the Columbia Formation of Pleistocene age, which is extensive throughout much of the Delaware Coastal Plain and consists largely of stratified sand and gravel.

Columbia deposits were laid down by an ancient system of rivers whose flow and discharge patterns were influenced by the climatic variations of the Pleistocene glacial cycles. Based on the coarseness of the Columbia deposits, which indicate strong flow velocities, Jordan (1964) has speculated that most Columbia materials were amassed during and near the ends of glacial advances, with little or no deposition occurring during the more stable interstadial periods. Some of the sands and gravels in northern Delaware may even have been directly transported by glacial meltwaters, but such an intimate glacial linkage is not likely for Columbia deposits in the central and southern portions of the state. Most Columbia sediments probably date well into the Pleistocene, and even though early Holocene deposits, particularly those of fluvial origin, are not normally distinguished from the much more prevalent Columbia sediments, ages for most of the Columbia materials are well in excess of 30,000 years. Varying greatly in thickness across the state, Columbia sediments in the South Dover

area extend to depths corresponding to elevations on the order of about 8 to 10 meters below sea level (Johnston 1973). With a base at this elevation, the thickness of the Columbia Formation at the Puncheon Run Site would accordingly range from about 10 to 15 meters.

Although the bulk of the Columbia sediments are likely to be of mid-Pleistocene age, few if any of the existing land surfaces formed in these deposits would be so old. The land has been reshaped significantly since the Columbia sediments were first put down, so the landscapes we can see today are much younger than the deposits that comprise them. Erosion, directed by such forces as climate, vegetational changes, alterations in stream base levels in response to varying sea levels, and perhaps even tectonic movements of land masses, have acted on the Columbia Formation through multiple subsequent periods of the Pleistocene as well as the Holocene. Stream valley alluviation and the reworking of near-surface soils by a host of biological agents also help to limit the ages for most of the region's landscapes to a late Pleistocene through Holocene time frame.

Among the most important agents shaping the geological landscape in coastal areas of the Middle Atlantic region are the effects of the Pleistocene cycles of falling and rising sea levels accompanying glacial advances and retreats. Coastal Plain sediments of the regional uplands are for the most part distributed across a series of stepped terrace surfaces generally associated with former Pleistocene sea level stands. These surfaces were formed either as cut terraces or as terrace levels abandoned by rivers shifting and down-cutting in response to the changing base level of the sea. Even though they have often been partially reshaped by local tectonic, erosional, or alluvial processes during subsequent periods of the Pleistocene or Holocene, the major landforms associated with the sea level cycles are recognizable over great lengths of the Atlantic Coastal Plain. They occur not only in the vicinity of the study area but also in neighboring states to the north and south of Delaware. The entire sequence of these terraces is seldom present across any single landform, but their several levels are so distinctively bracketed within specific ranges in elevation that four major geologic terraces can be consistently recognized from region to region.

Based on their elevations, the four major terrace levels of the Atlantic Coastal Plain have been assigned standard designations. The lowest and youngest of these landforms is normally identified as the Pamlico terrace. Restricted to elevations of less than about 7 meters, the Pamlico surface is considered to be mainly of late Pleistocene age but may also include deposits of Holocene origin. Rising above the Pamlico to achieve a height range between 7 and 14 meters is the Talbot terrace level, which is believed to date well into the Pleistocene. Much more ancient Pleistocene terrace levels are the Wicomico terrace, which ranges between elevations of about 18 and 28 meters, and the oldest, or Sunderland, terrace, which, at elevations typically ranging between 30 and 60 meters above modern sea level, does not occur in Delaware. Based on this scheme the Puncheon Run landscape is contained mainly on the mid-Pleistocene Talbot surface, but at its easternmost end (i.e., Locus 3) falls to a level more compatible with the late Pleistocene Pamlico surface.

2. Wind, Sand, and Soil

Soils in the vicinity of the Puncheon Run Site are predominantly sandy, as they are on large expanses of the Delaware Coastal Plain. Landscapes of sandy soils are less stable than those formed on rock or loam. Sandy soils are more often reworked by such agents of the general landscape as aeolian (wind-generated) movement, and they are more readily mixed by animals and other agents of small-scale disturbance. Aeolian sand deposits are extensive in Delaware and are principally derived from the winnowing of previously water-lain Columbia or later sediments. Wind-blown sand is, of course, found in the form of dunes along modern coastlines, but it is also abundant over inland portions of the central Delmarva Peninsula, where the deposits may exhibit dunal forms marking relic dune fields or former Pleistocene beach lines (Denny and Owens 1979). Much more commonly, inland aeolian sands occur as widespread sheet deposits that may thinly mantle land areas kilometers in extent. Indeed, the leveling effect of the aeolian sand deposits is among the factors contributing to the vast areas of nearly flat terrain typical of southern Delaware.

In humid climates like that of Delaware, major periods of aeolian sand movement typically take place during periods of dry climate, when fluctuating stream flows and shrinking plant cover make more sand available from such sources as exposed river bars or bare soil areas on the land. Several comparatively dry periods are known to have occurred during the Holocene, and some, like the altithermal or xerothermic sub-boreal period about 2,000 to 4,500 years ago (Dent 1979), were probably significant enough to have left a patchy aeolian imprint distributed on a nearly continental scale. Deposits of this age have been found in many parts of Delaware.

Aeolian-induced landscape instability would obviously be limited to locations where sandy soils or other sources of sand are available for wind mobilization, but such locations are abundant in central and lower Delaware. Where deposits of aeolian sand are present, they can be recognized from stratigraphic or pedogenic discontinuities within soil profiles as well as by a very distinct particle size tendency skewed toward the finer sand fractions. Pebbles and coarser sand fractions too large for wind transport would not normally be present in deposits that have undergone significant aeolian sorting.

Sandy soils are highly susceptible to disturbance by biological agents, even where aeolian action has not been a significant factor. The most important floral agent is tree-fall. Tree falls have been widely studied and have long been known to be a major factor in the disturbance of forest soils. Studies have found that this single mechanism of soil churning is capable of reworking upper soil layers across an entire landscape at frequencies ranging from every several thousand years (Brewer and Merritt 1978; Mueller and Kline 1959) to, in extreme cases, as often as every few hundred years (Denny and Goodlett 1956).

Further disturbances are provided by the actions of animals, and can vary from the dramatic mixing produced by large burrowing animals to the much more subtle but in the long-term often more significant modifications caused by insects. For instance, studies in the Upper Midwest found that ants were capable of producing landscape-wide surface changes by bringing soil to the surface at rates ranging from roughly 1 centimeter per century (Hole and Nielson 1970) to a high of 15 centimeters per century (Salem and Hole 1968). Ants, of course, are only one of many burrowing

insects, and to their actions must be added those of earthworms, beatles, hornets, and others. Across thousands of years, the effects of the constant agitation of the soil by these creatures can have a considerable effect on archaeological artifacts, even burying whole archaeological sites. Johnson (1993) has coined the term "biomantle" for the portion of the soil that is always being mixed by plant and animal activity.

3. Basic Structures

The Puncheon Run Site is distributed across two landforms that together comprise a peninsula bounded by the St. Jones River to the east and north and Puncheon Run to the south. These two landforms occur in a stepped topographic sequence typical of many landforms along the Atlantic Coastal Plain. Most of the site area is distributed across a Coastal Plain upland composed of Columbia deposits and falling within the elevational range usually assigned to the mid-Pleistocene Talbot surface. A lower-lying terrace more closely associated with the St. Jones River valley forms the easternmost portion of the peninsula and can probably be correlated with the Pamlico terrace of late Pleistocene or perhaps very early Holocene age. This lower terrace is confined entirely to Locus 3 of the Puncheon Run Site; part of Locus 3 and all of Loci 1 and 2 are on the upland. Most of the lower terrace's nearly level to gently sloping surface is situated between elevations of 3 and 5.5 meters (10 and 18 feet). Along the St. Jones River and Puncheon Run shorelines as much as 3 to 4 meters of this elevation is gained from scarps produced by past undercutting actions of the two streams. Landward, the terrace surface rises gently to the west where it then joins with the Coastal Plain upland across a moderate (5-6%) slope which climbs to the upland surface elevation of somewhat over 8 meters (25 feet). This slope or transition zone between the two landforms spans about 70 meters (225 feet), and within this broad transition zone materials of mixed origin but generally dominated by Columbia sediments are present. Where the upland borders the waters of the St. Jones River to the north or the Puncheon Run valley to the south, its edges are defined by slopes that steeply fall to the near-sea level elevations of the adjacent waters and wetlands. Westward, the upland ranges beyond the site limits, where it becomes the principal regional landform.

The eastern and northern edges of the lower terrace are defined by a meander of the tidal floodplain of the St. Jones River. This floodplain has changed greatly over time owing to the natural effects of a rising sea level as well as to historic modifications. Supporting a melange of marshland and mud flats, and coursed by a channel artificially straightened by the Army Corps of Engineers, the valley floor adjacent to the Puncheon Run Site now bears little resemblance to its predominant form during the Holocene. Until perhaps 4,500 years ago, this stretch of the St. Jones valley adjacent to the site supported a strictly freshwater river system, with an actively migrating channel ranging across a low-lying, variably swampy floor contained within a broad (300- to 500-meter), steep-walled valley.

Even before the drastic meander cut-off by the Army Corps of Engineers channelization project early in the twentieth century (see Figure 3), shifts in flow and sedimentation had already brought changes to the St. Jones River. Greatly increased rates of sedimentation resulting from historic land clearing, agricultural erosion, and development are so common to Coastal Plain rivers that, except for the artificial dredging, the river's channel can assume to have been much reduced from its

original depth. Silting in of the channel and burial of the former valley floor had, however, already begun by the late Holocene. As a consequence of rising sea level, sluggish flows retarded by the higher regional base level together with the eventual introduction of tidal sediments would have so increased riverine and pallustrine sedimentation as to substantially change the environment around Puncheon Run. Kellogg and Custer (1994) have reported that roughly 4 meters of such sediments have accumulated within the past 2,000 years near the Carey Farm Site, about 1 kilometer downstream from Puncheon Run. Such sedimentation has led to an increase in the area of marsh and swamp habitat around the Puncheon Run Site. Consideration of those sediments also shows that the river previously coursed at a level well below the modern one. The shoreline scarps that today rise 3 to 4 meters above the river would have loomed twice as high (7 to 8 meters) 3,000 years ago.

The floodplain of Puncheon Run has also been greatly influenced by late Holocene and historic changes. In the center of the site, near the densely occupied portion of Locus 2, an intermittent drainage runs from the upland down through the scarp to the Puncheon Run floodplain. This cut in the bank may have made it easier for people to climb up from the creek to the upland, so it may be one reason why prehistoric Indians camped in this location. It also provided a passage for soils eroded from the upland to move downward. The pronounced alluvial fan formed where the drainage empties onto the floodplain, readily visible on topographic maps of the site (Figure 60), shows how much soil, carried downward in this way, has been deposited. This fan is only one example of several ways in which historic sediment was deposited onto the Puncheon Run valley; not even all of the sediments exiting the small intermittent drainage would have been laid down in the fan. Some of the sediments would have been carried beyond the fan to join other historic sediments entering the valley from more inland stretches of the watershed. Together, these sediments would be expected to form a mantle of historic alluvium over the entire floodplain. The distribution of this alluvium along the valley was also no doubt influenced by the millpond (Nixon Mill) formerly impounded behind the earthen dam crossing the valley near the eastern end of Locus 1. Now breached to allow free flow of Puncheon Run, this dam would previously have captured some of the sediments that otherwise would have found their way to points further down the valley. The overall effect has been to raise the level of the floodplain and improve the drainage. Whereas today Puncheon Run is confined to a single channel and much of its floodplain is readily traversable, before historic land clearing the floodplain would most likely have been swampy, with braided channels and more strands of shallow open water.

4. Soils of the Lower Terrace (Locus 3)

The lower terrace of Locus 3 included the most intensely occupied parts of the Puncheon Run Site and most of the archaeological efforts in Locus 3 were focused there. The Metate block and the Feature 30 block were both on this landform. Detailed examinations of the soils at several different places revealed similar profiles (Table 34), all consisting of well-drained soils. These soils developed in coarse-textured deposits consisting of 1 to 2 meters of sandy material atop underlying gravels. As would be expected for soils formed in a sandy parent material, subsoil development is mostly weak to moderate. Upper subsoil horizons (E and BE) are typically dark yellowish brown

loamy sand, and these grade into weakly developed, slightly clay-enriched argillic (Bt) subsoil horizons of strong brown light sandy loam or sandy loam at depths ranging from about 40 to 60 centimeters. Below the argillic horizons textures again coarsen to become yellowish brown to brownish yellow sand, normally within a depth of about a meter. Similarly colored gravelly sand then underlies the sand at variable depths.

TABLE 34: SOIL PROFILE IN UNIT 58, LOWER TERRACE, LOCUS 3

Horizon	Depth (cm)	Texture	Color
Ap	0-21	loamy sand	Brown (10YR 3/3)
E	21-41	loamy sand	Dark yellowish brown (10YR 4/4)
BE	42-50	loamy sand	Dark yellowish brown (10YR 4/4-4/6)
Bt	50-65	sandy loam	Strong brown (7.5YR 4/6)
BC	65-88	sand	Strong brown (7.5-10YR 4/6)
C	88-115+	sand	Yellowish brown (10YR 5/6)

Although soil development on the lower terrace is only weak to moderate, it is sufficiently advanced to indicate a landform age approaching or reaching into the Pleistocene. Strong soil development is seldom characteristic of sandy soils, which are resistant to weathering and vulnerable to frequent disturbance. The degree of both clay and iron enrichment observed in the subsoil of the lower terrace can actually be considered fairly substantial given the sandy parent material. Also, there are no known geomorphic events of the Holocene that could have produced such a pronounced terrace landform in the central Delaware region. Thus the terrace is likely to have been formed at some time during the Pleistocene, possibly when flow volumes were greater or perhaps under conditions of higher sea level, which would have raised the base flow of the St. Jones River. The balance of time-driven progressive soil development and regressive soil disturbances together account for both the limited degree of soil formation and the relatively narrow range of soil conditions now present across the terrace.

Aeolian activity has probably had very little impact on the soils of the lower terrace. Separate sand fractions within the upper horizons do not show the trend toward finer sizes that would be expected for soil materials subject to appreciable sorting by wind. Laboratory data on particle size, presented in Volume II, Appendix A, show that more coarse than fine sand was present in all of these soils. Also, in nearly every examined soil profile small pebbles and occasionally gravels up to several centimeters in diameter were scattered throughout most levels. Soil disturbance caused by tree falls and large animals could account for some of this coarse material, but the predominance of particles too large to be readily transported by wind is strong evidence against a major aeolian influence on the site. Moreover, neither the field examinations nor laboratory particle size analyses identified any soil discontinuities within the artifact-bearing zones of any of the profiles. Some minor, highly localized aeolian reworking cannot be ruled out, and indeed, given the sandy nature of the soil parent material, almost surely took place at some points, particularly once the land was cleared for historic agriculture. However, soil profile characteristics suggest that any aeolian sorting that might have occurred prehistorically would very likely have been much less of a site formation process than disturbance by plants and animals.

It is difficult to provide firm estimates for the ages of deposits solely on the basis of soil development in such sandy soils as those of the lower terrace. The fact that all of the examined profiles except for those associated with obvious recent disturbances or subsurface features contained argillic subsoil horizons suggests that most of the terrace deposits below an average depth of about 50 centimeters have been largely stable for a considerable length of time. Since argillic horizons form so slowly in Columbia Formation sands, the argillic horizon levels have probably not been destabilized by some major event since the early Holocene, or more likely the late Pleistocene, when the retreat of the glaciers led to great changes in the landscape. In the terrace soils, levels above the average depth of 50 centimeters have regularly been disturbed by plant and animal activity and therefore comprise an active biomantle.

The distances that artifacts in the upper biomantle zone have been moved probably varies a great deal from place to place on the terrace. In some instances, subsurface artifacts could be pretty much where they were dropped, and they might even be vertically distributed in a chronological sequence, whereas only a short distance away artifacts from more than one occupation could be thoroughly mixed in the same level. Except where there are deep disturbances, few artifacts should be found at argillic horizon levels.

5. Soils of the Coastal Plain Upland

a. Loci 2 and 3

The Coastal Plain upland extended from the western or inland half of Locus 3 across the remainder of the site. Throughout most of this area the soils were strongly developed, indicating that the surface is old, dating well back into Pleistocene times. Each of the examined profiles contained well-developed argillic horizons of strong brown color and textures typically in the range of heavy sandy loam to sandy clay loam (Table 35). Argillic horizon textures of sandy loam and loam were also encountered. Upper horizons (Ap, E, and BE) overlying the argillic horizons were mainly of sandy loam or loam texture, and the average combined thickness of these biomantle horizons was more on the order of 40 centimeters, rather than the 50-centimeter thickness of the lower terrace soils. Lower subsoil horizons and substrata beneath the argillic horizons are considerably more variable than the those of the river terrace soils and were found to range from sand and gravelly sand to finer textures of loam and, in one unusual case, clay. Where the southern edge of this landform plunges sharply toward Puncheon Run, gravels are widely scattered over a surface, suggesting that the steep landform is relatively unstable.

TABLE 35: SOIL PROFILE IN UNIT 214, COASTAL PLAIN UPLAND, LOCUS 2

Horizon	Depth (cm)	Texture	Color
A	0-5	loam	Dark grayish brown (10YR 3/3-3/2)
Ap	5-24	loam	Brown (10YR 4/3)
BE	24-43	loam	Yellowish brown (10YR 5/4)
Bt1	43-64	loam	Strong brown (7.5YR 4/6)
Bt2	64-89	sandy clay loam	Strong brown (7.5YR 4/6)
BC	89-106	sandy loam	Strong brown (7.5YR 4/6)
C	106-120+	sand	Strong brown (7.5YR 5/8)

As with most well-drained upland settings occupied by moderately to strongly developed soils, archaeological interpretations are relatively straightforward. Although the degree of soil development varies somewhat across the landscape, this is primarily a reflection of variability in the Columbia sediments that serve as the soil parent material. Where not limited by an excessively coarse parent material, the typical degree of subsoil development across the upland is advanced enough to indicate that the surface has been largely stable since the Pleistocene.

Natural soil disturbance is less of a factor in the potential distribution of artifacts in the Coastal Plain upland soils than in the lower terrace soils. The upland soils are more loamy in texture than the terrace soils and lacking a fine-sandy surface mantle to even suggest an appreciable aeolian component. Any surface disturbances in the upland soils would be limited to the usual amounts caused by animal and plant activity, erosion, or historic plowing. Since the more loamy soils of the upland would not be as susceptible to these processes as the sandy soils of the lower terrace, prehistoric artifacts should be contained within a thinner biomantle. Most artifacts should therefore be concentrated in the plowed surface horizons (Ap) but could also extend into underlying eluvial (E) horizons where these layers are present. Minor artifact concentrations may tail off through upper transitional (BE) horizons but should generally not continue into argillic horizons, which are typically encountered at the average depth of about 40 centimeters.

b. Locus 1

Locus 1 is also contained entirely on the Coastal Plain upland, but the landscapes of this locus span a much greater range of elevations than those of Locus 2. The eastern portion of Locus 1 occupies a high position similar to that of Locus 2 and the western part of Locus 3. However, most of Locus 1 is spread along the descending northern flank of the Puncheon Run valley, where slopes fall to elevations of about 4 to 5.5 meters. These elevations are actually within the upper end of the height range for the lower terrace of Locus 3, but this area should not be structurally correlated with the lower terrace. The location is well up the Puncheon Run valley from the St. Jones River, and the variability of the soils within the locus is consistent with the mixing and erosional reworking often encountered along the sideslopes of Delaware's Coastal Plain uplands.

Soil variability in Locus 1 is greater than in Locus 2, and reflects ranges in elevation and landscape position as well as varying parent material composition and soil drainage class. At the highest landscape position in the area of Block 19, strongly developed and well-drained loamy soils are similar to those of Locus 2, and readily indicate that mostly stable landscape conditions have existed since a time well into the Pleistocene. On lower slope positions where the majority of the locus is concentrated, soils are well to moderately well drained and are formed in more mixed soil parent materials often exhibiting dramatic textural changes across relatively short distances. This trait, together with varying degrees of soil development, suggests that this lower, sloping portion of the Coastal Plain upland has been less geologically stable than the nearly level areas.

Much of the instability probably occurred prior to the Holocene, however, and may be related to periglacial climatic conditions during the Pleistocene. The freeze-thaw cycles of such a climate lead to surface instability, particularly for sloping terrain. Solifluction deposits, which are derived through gravity-induced movements of thawed, gel-like soil masses, characteristically exhibit

seemingly bizarre melds of sharply contrasting soil types. Surface instability induced by a periglacial climate is only a speculation, but the notion that the last major period of instability is likely to have occurred prior to the Holocene is also supported by degrees of soil development. Subsoil formation in the locus soils is moderate to strong even along the lower elevational positions, and thus demonstrates that most of the landscape has been relatively stable through the Holocene. The surfaces in the most intensely occupied portions of Locus 1 may, therefore, be about the same age as the lower terrace of Locus 3.

Most of the soils of Locus 1 are loamy and gravelly, but there was an area of silty to loamy soils at the far western end of the site, in the Buried Plowzone area. Subsoil development in the predominant loamy and gravelly soils was variable, but in every case there was enough development to indicate that the surface had been largely stable throughout the Holocene. In the silty soils of the Buried Plowzone area, development was even more pronounced. However, the soils of the Buried Plowzone area had been capped by deposits of historic slope wash (Table 36). This area occupied a nearly level footslope position. The covering mantle of historically accumulated wash derived from the tilled fields lying upslope to the north of the locus has afforded partial protection of the original prehistoric surface. The wash deposits and underlying original surface occur in a stacked sequence of two or three Ap-horizons. Even though all of the surface horizons observed in a number of units displayed indications of former plowing, the original surface marked by the lowest Ap-horizon was probably only subject to a relatively brief period of plowing before being effectively isolated by the accumulating slope wash. This is suggested both by a darker color relative to those of the overlying horizons as well as by fully intact E-horizons beneath. A darker color indicates a higher organic matter content, which implies both less oxidative carbon loss due to tillage and possible residuals of the much higher organic matter concentrations typical of forested A-horizons. The intact underlying horizonation also demonstrates minimum plowing, since prolonged plowing tends to eventually destroy E-horizons through incorporation with the surface horizon. This has occurred over most of the locus, particularly in the main feature cluster.

TABLE 36: SOIL PROFILE IN UNIT 233, BURIED PLOWZONE AREA, LOCUS 1

Horizon	Depth (cm)	Texture	Color
Ap1	0-19	sandy loam	Dark brown (10YR 3/3)
Ap2	19-30	sandy loam	Dark yellowish brown (10YR 3/4)
Ap3	30-36	loam	Dark brown (10YR 3/3-3/2)
E	36-55	loam	Yellowish brown (10YR 5/4)
BE	55-76	loam	Dark yellowish brown (10YR 4/4-4/6)
Bt1	76-97	heavy loam	Strong brown (7.5YR 4/6)
Bt2	97-112	silt loam	Olive brown (2.5Y 4/4)
Bcg	112-122	silt loam	Gray (5Y 5/1)
2Cg	122-130+	sandy clay loam	Gray (5Y 5/1)

The implications of the surficial cover of slope wash for the distribution of prehistoric artifacts are significant. The apparent protective burial of the original surface within relatively short order subsequent to the introduction of historic agriculture allows for the prospect of somewhat more favorable *in situ* context. Most of the prehistoric artifacts recovered should have been found very near their original points of deposition, and they should have been found, as they were, concentrated

in the lowest plowzone. Some mixing as the slope wash was being laid down has probably caused minor upward dilution of artifacts into the overlying historic deposits, and some may also tail off into upper subsoil horizons as would be normal in soils on an old landscape. As with other strongly developed Coastal Plain soils, the top of the argillic horizon, which because of the surface wash deposition may be as much as 75 centimeters below the surface, marks the effective lower boundary of the artifact deposits.

B. THE BOTANICAL LANDSCAPE

1. Introduction

Superimposed on the geological landscape is the biotic landscape of plants and animals. The Indians of Delaware, like all hunter-gatherers, depended on their detailed knowledge of the natural world around them. In particular, they had to know where to find useful animals and plants at every season of the year, as well as those that were important to them for spiritual or social reasons. Their movements, both large-scale, seasonal movements and daily foraging trips, were in part determined by the distribution of animal and plant resources, so that understanding the biotic landscape is vital to understanding how Native Americans lived.

Also, one of the most important theoretical foci of the Puncheon Run investigations has been understanding the development of complex societies in the St. Jones valley. Custer (1994) has suggested that the Barker's Landing and Delmarva Adena cultures created surplus wealth through the more efficient exploitation of plants, a process he calls "productive intensification." Signs of this shift include the presence of greater numbers of grinding stones on sites and the greater number of pits dug to store the surplus food. The large metate found in the Metate block at the Puncheon Run Site, and the clusters of storage pits in the Silo Pit area and the Feature 30 block, may reflect the kind of changes Custer has described. These and other signs of prehistoric activity at Puncheon Run were not distributed randomly across the landscape, but were clustered in certain well-defined locations. Understanding the distribution of human activity at Puncheon Run, and therefore the economy of its Native American inhabitants, depends on understanding the biological landscape of the site.

To acquire such an understanding of a biological landscape at a given time in the past is a considerable challenge. It is tempting, when trying to reconstruct the prehistoric landscape from its fragmentary modern remains, to imagine a "natural" condition as a beginning point. But such an approach presupposes a static state in natural systems, when in fact natural systems are never static. Rivers cut their banks, deposit silt, and are drowned by rising sea levels; forests grow, die, and regenerate; plant and animal populations are ravaged by disease and then recover; rainfall and temperature vary from year to year and from century to century. These factors, and others, ensure that landscapes undergo constant change. Humans, even hunter-gatherers, are also prominent ecological factors in shaping the "natural" world. Native American burning practices, hunting (alteration of animal populations), the establishment and use of habitation areas, the creation of travel routes, forest clearing, and the introduction of plant species into new geographic areas all worked to alter the natural landscape. The ancient landscape was not a virgin canvas subsequently

colored by human activities, and efforts to understand past environments should acknowledge cultural forces as co-evolutionary with natural processes in landscape formation.

The ever-changing nature of past landscapes makes it difficult to achieve a detailed description of any point in time. Further difficulties are created by the poor survival of botanical and zoological evidence. Essentially no animal bones were found on the Puncheon Run Site, and very few have been found in the entire region. Some archaeological evidence of plants was found at Puncheon Run, but not enough to allow for the detailed reconstruction of the local environment for even one part of the site's long history. The landscape reconstruction therefore depends largely on knowledge of what kinds of plants and animals live today on the least disturbed areas resembling the various parts of the Puncheon Run landscape. Such projections inevitably miss the small-scale differences that might have meant a great deal to Native Americans, such as the appearance and disappearance of berry patches, the growth and death of nut-bearing trees, and the denning habits of particular herds of deer. Still, these projections can tell us something about the range of plants and animals that might have been found, especially when reinforced by the available data on the plants we know to have been present at Puncheon Run.

2. Botanical Investigations at Puncheon Run

Archaeological research at the Puncheon Run Site has included four distinct investigations of plants and plant use. Flotation-processing and analysis of archaeological soils for plant macro-remains has accompanied all stages of field investigation. A total of 134 soil samples (totaling 265.5 liters) were processed and analyzed at the Puncheon Run Site. Little unambiguous evidence of prehistoric subsistence practices was found, just a few carbonized seeds, thick-walled hickory nutshell, and acorn shells. The remains of cultivated plants were conspicuously absent from the assemblage. Wood charcoal was more abundant, and much of it could be identified to the species level, providing direct information on forest composition. These investigations are described in more detail in Volume II, Appendix C.

Concurrently, 27 soil samples were analyzed for plant phytoliths. Again, little direct evidence of prehistoric subsistence was found. The assemblage was dominated by a truncated grass phytolith assemblage, which can be considered a sort of "natural" phytolith background over which culturally significant phytoliths can be viewed. The presence of the grass phytoliths suggests that parts of the site were not wooded during the prehistoric occupations, and differences between the phytoliths from Locus 1 and Locus 3 suggest differences of some kind between those two parts of the site. The interpretation must be tentative, however, because the presence of modern, uncharred seeds in most of the flotation samples indicates that modern contamination may also have influenced the phytolith record; certainly the differences between the phytoliths from Locus 1 and those from Locus 3 reflect very well the difference between the two areas during the late twentieth century, when the archaeological excavations were carried out. The phytolith research is described in Volume II, Appendix F.

The project research design also included a review of the early historic literature germane to Native American plant use in the Delaware River Valley (Volume II, Appendix E). The ethnohistorical literature review provides a discussion of economically useful plant taxa documented for the region,

by plant type (i.e., trees, vines, marsh plants), and by plant part (i.e., roots, nuts, seeds), and relates these data to the environment and the likely functions of the Puncheon Run Site.

These investigations were supplemented by a study of the current botanical landscape of the site and the immediate surrounding area; that study is contained in Volume II, Appendix B. Field surveys consisted of a random meander on foot through all terrestrial zones. Aquatic environments were surveyed by canoe. The field survey included the mapping of vegetative communities, and the recordation and collection of plant species observed (Nelson 1985). To document unusual species, voucher specimens were secured for identification.

3. Landscape Context

a. Aquatic Environment

Aquatic resources local to the Puncheon Run Site include the St. Jones River, which bounds the site on the east and north, and Puncheon Run, which flanks the site's southern periphery. The St. Jones River is a meandering tidal stream, 35 kilometers (21 miles) in length. In the vicinity of the project area today, the St. Jones River is a tidal stream bordered by freshwater marshes and wooded wetlands. At the western end of the site, Puncheon Run is a swift-flowing perennial stream, and the site extends to within a few feet of its banks. As it nears the St. Jones River, Puncheon Run bottomland extends across a broad floodplain. At the confluence of the St. Jones River and Puncheon Run is a broad freshwater marsh.

TABLE 37: CHARACTERISTIC PLANT SPECIES OF THREE WETLAND COMMUNITIES ALONG THE ST. JONES

MID-PENINSULAR DRAINAGE DIVIDE
Red Maple (*Acer rubrum*)
Sycamore (*Platanus occidentalis*)
Willow oak (*Quercus palustris*)
Arrowwood (*Viburnum recognitum*)
Blueberry (*Vaccinium species*)
MID-DRAINAGE ZONE
Cattails (*Typha* species)
Spatterdock (*Nuphar luteum*)
Arrowheads (*Sagittaria* species)
Pickerel Weed (*Pontederia cordata*)
Big Cordgrass (*Spartina cynosuroides*)
DELAWARE SHORE ZONE
Smooth Cordgrass (*Spartina alterniflora*)
Common reed (*Phragmites australis)*
Salt Hay Grass *(Spartina patens)*
Spike Grass *(Distichlis spicata)*
Wild Rice *(Zizania aquatica)*

Today, the St. Jones River includes three distinct wetland communities (Table 37). Near its source, the river is flanked by poorly drained wooded wetlands and freshwater swamps in the Mid-Peninsular Drainage Divide. The Mid-Drainage Zone refers to the section of the St. Jones River stretching from Dover south to Barker's Landing. The Puncheon Run Site is located here. The Mid-Drainage Zone occurs at the upstream limit of tidal influence, and at this location the river is very mildly salty and supports transitional marshes. This marsh is a very productive ecological zone, and contains many economically important plant and animal species that were used by prehistoric peoples. Below Barker's landing, the St. Jones broadens into a brackish river bordered by large tidal

marshes. This Delaware Shore Zone marsh includes salt-tolerant plant species that are generally less valuable as food sources (Tatnall 1946; Tiner 1985).

Sea level changes that occurred since the early Holocene (ca. 10,000 years ago) have greatly affected the St. Jones River (Rogers and Pizzuto 1994). During the late Pleistocene and very early Holocene, the St. Jones was a small, deeply incised freshwater river. Sea level has been steadily rising since that time. By the middle Holocene the river backflooded and exhibited a lowered stream gradient. Water movement was slower, discharging suspended sediments. By about 1,000 years ago, the St. Jones was a drowned river channel, and a tidal estuary was formed. Research has shown that the waters of Delaware Bay have risen 25.5 meters (84 feet) over the past 12,000 years (Kraft 1971). This transgressive environment has caused a major shift in ecological communities occurring along the rivers that empty into the lower Delaware Bay, including the St. Jones, and in the biota available to prehistoric peoples living within their watersheds.

Since colonial times, the St. Jones River and Puncheon Run have been greatly modified. Sedimentation of these waterways has significantly changed their shape and nature, and brought about major alterations in the types of biological resources available within their waters. The Delaware River Valley has historically been an area of immense agricultural value: European settlers to the region found fertile, well-drained alluvial soils well suited to field agriculture, and the area was farmed extensively in small grains, fruits, and vegetables through the twentieth century. The clearing of native forests since the colonial period and the ensuing rigorous cultivation of the landscape has resulted in the creation of open, unprotected soils which were easily eroded into local streams and rivers. Regional agricultural pursuits relied upon the St. Jones as a highway for moving crops to market, while at the same time they caused major siltation of the St. Jones River and its tributaries. Much of the acclaimed farm soils of the Delaware watershed ended up in its tributaries.

b. Terrestrial Environment

Kent County, Delaware, once supported a vast hardwood forest which was extensively cleared for agriculture during the eighteenth and nineteenth centuries. Characterized by a complex association of plant communities, species distribution within this forest was determined by local soil conditions and frequency of inundation (Canby 1881; Eyre 1980; Taber 1937; Tatnall 1946). Well-drained upland soils supported mixed forest dominated by oak and hickory, while poorly drained lands supported more diverse forest communities which included such species as sweet gum, red maple, sweet bay magnolia, and pine. Cypress trees commonly grew in swampy areas. During the Woodland I period, most of the Puncheon Run Site was probably covered with forests of this type (Table 38). In the later Woodland I and Woodland II periods the forests may have been deliberately modified by the human groups, either to facilitate hunting, or to clear the understory for a more effective nut harvest (Banister 1970:43; Day 1953:34; DeVries 1909 [1657]:15; Lindeström 1925 [1691]:213-244; Smith 1986 [1608]:164; Strachey 1967 [1612]:83). Habitation areas on the Coastal Plain upland portions of the site may have created partially cleared areas where sunlight penetrated the forest floor, and more light-tolerant plant taxa succeeded. Floodplain areas of the site would have been periodically inundated by high water, and unique plant communities would have thrived on gravel bars.

Vegetation across the project area today consists of fallow agricultural land (mown periodically to control natural forest succession) with limited woodlands: Tillable areas of the site have been used intensively for agriculture for centuries. The northern end of the site supports a shrub-scrub area in early forest succession (approximately 15-year growth). A fringe area of mixed deciduous forest is confined to scarps flanking Puncheon Run and the St. Jones River. Also, a fragment of the native oak-hickory forest persists along the south central edge of the site, abutting the old millpond. This mature forest remnant resembles the ancient forests that once stood throughout the area, but with some differences; it is dominated by American beech, pignut hickory, and mockernut hickory, with a variety of oak species, tulip poplar, and black cherry also present.

TABLE 38: CHARACTERISTIC PLANT SPECIES OF THE EARLY HISTORIC UPLAND FORESTS OF DELAWARE

CANOPY
Oaks (*Quercus* species)
Hickories (*Carya* species)
Tulip Poplar *(Liriodendron tulipifera)*
American Beech (*Fagus americana*)
American Chestnut (*Castanea dentata*)
Loblolly Pine (*Pinus taeda*)
UNDERSTORY
Dogwood (*Cornus florida*)
Mountain Laurel (*Kalmia latifolia*)
Arrow Wood (*Viburnum dentatum*)
STREAM MARGINS
Persimmon (*Diospyros virginiana*)
Black Gum (*Nyssa sylvatica*)

4. Microenvironmental Zones

The location of the Puncheon Run Site at the confluence of Puncheon Run and the St. Jones River offered site inhabitants ready access to a variety of microenvironmental zones, including Coastal Plain uplands, fertile floodplains, freshwater marshes, and open water environments (Figure 61). These environments provided prehistoric human populations with an array of important resources. In addition to providing transportation along an estuarine highway linking the site with others along the St. Jones, the Delaware River and its tributaries, and Delaware Bay, the St. Jones River and Puncheon Run held abundant fish, shellfish, and vegetable foods in the form of marsh plants. The peninsular location also afforded a naturally defensible and easily protected site. Understanding the landscape and the distribution of natural resources within it is critical to defining the shape and function of Woodland I and II settlements at the Puncheon Run Site. At the same time, it is important to acknowledge that thousands of years of human activity at this location constitute forceful ecological factors in the creation of the present landscape.

Four microenvironmental zones occurring at, or immediately adjacent to, the Puncheon Run Site were defined during this study: Coastal Plain uplands; transitional slopes; forested wetlands; and non-forested wetlands. Based on available evidence, these four zones have characterized the site since middle-Holocene times, and the zones persist today in modified form. Microenvironmental zones are determined by a combination of geological, geographic, biological, and hydrological factors and, in an ideal world, support a characteristic floral and faunal assemblage which typifies the zone for a given climatic regime. In a landscape in which humans are interacting with the environment, the same factors will determine the frequency and type of human use, with the added

consequence of the effects of human preference for particular plant species and anthropogenic habitat modifications. The zones are illustrated in Figure 62 and discussed below.

a. Coastal Plain Uplands

The uplands of the site are characterized by sandy acidic soils of the Sassafras series. The natural floral configuration for these soils is oak-dominated hardwood forest. Sassafras soils do not hold very much water and would seep rainwater into the transitional zone or below it. The dominant canopy and understory species for this landscape yield a significant volume and variety of hard mast.

b. Transitional Slopes

The transitional zone includes the steeper slopes of the upland edge and includes the transition from upland soils to wetland. This zone is intermediate in hydrology in that it would receive infrequent inundation during large storm events and seepage from rainfall in the associated uplands. Because of richer soils and a more consistent tree canopy, the slopes of the transitional zone would have been richer and moister than they are today. The transitional zone would also have been less stable than the uplands because of periodic scouring from both rising watercourses and overland rain runoff during deluges. This zone would have (as it does today) a higher rate or erosion and a flora more characteristic of dynamic, disturbed environments. The "edge" effect on transitional zones caused by decreased shade results in an increase of vegetative cover and creates a more productive, food-

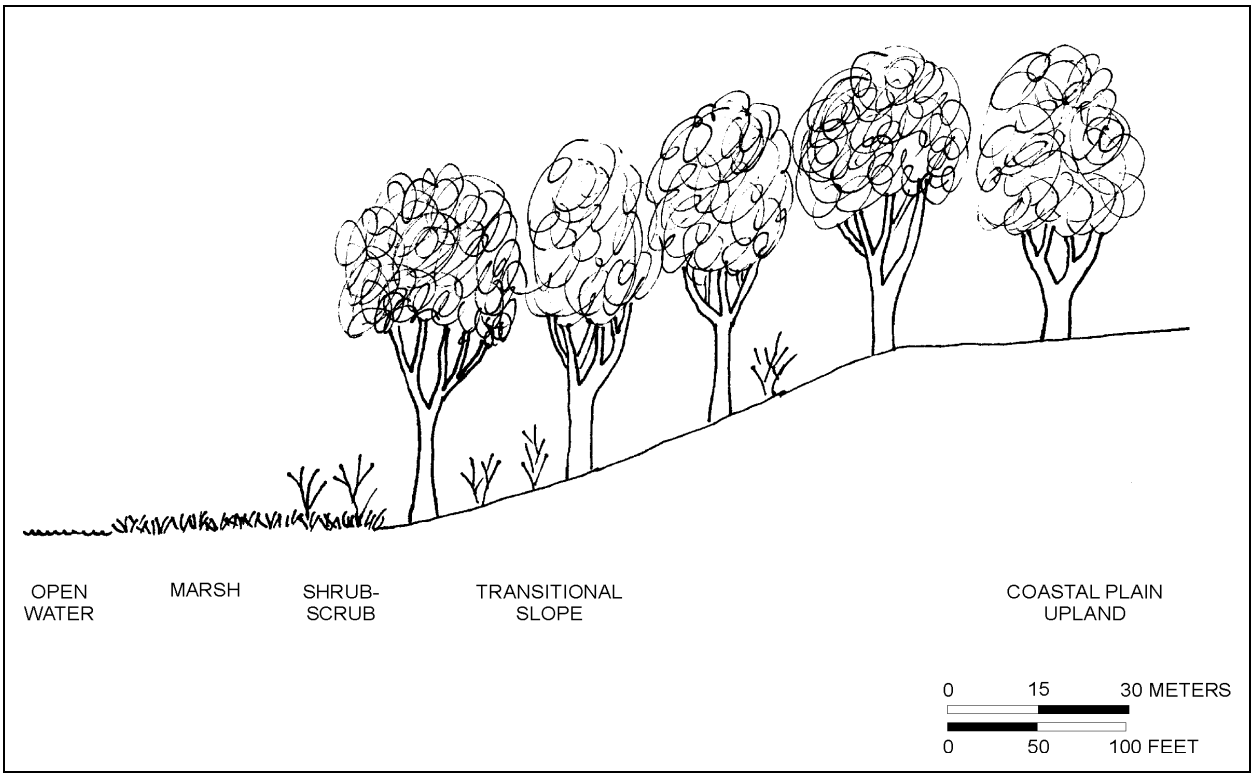

FIGURE 61: Idealized Landscape Section, Showing Microenvironmental Zones, Locus 3

rich environment. The transitional zone on the southern portion of the study area exhibits the best preserved transitional slopes on the site. This slope is probably quite similar to the prehistoric configuration, although with poorer soils and a modern component of non-native species.

It is difficult to determine the precise nature of the transitional zone at the northern border of the site because of accelerated erosion caused by increased storm flows in the St. Jones River in historic times. Today, this area is a high cutbank, but it may have been quite different in prehistoric times. The transitional zone on the eastern portion of the site is an artifact of the early twentieth-century re-engineering of the St. Jones River channel and has no prehistoric context. This area may have been quite important in prehistoric times, however, since unique plant communities may have grown on the point bar and at the water's edge.

c. Wetlands

It is a safe assumption that the modern wetland configuration is dramatically different from the pre-settlement configuration. Riverine wetlands in the Middle Atlantic Coastal Plain have changed a great deal since the advent of European agriculture, which has led to generally shallower open-water wetlands, an overall decrease in forested wetlands (from drainage and conversion), and, in rivers and streams, an acceleration of wetland succession, from floating mat, to emergent, to shrub-scrub, to forested conditions caused by siltation of waterways. The re-engineering of the river channel was an attempt to restore the navigability of the river, which had been lost to heavy siltation.

Two thousand years ago, the open water wetlands associated with the site would have been more extensive and the materials of the river floor sandier. Because of increased depth and water clarity, there would have been more submerged aquatic vegetation than exists today. The forested wetlands (swamp) associated with the millpond would probably been marsh (emergent) or floating mat.

The wetlands associated with the Puncheon Run Site can be broadly classified as forested wetlands and non-forested wetlands.

1) Forested Wetlands

Forested wetlands, commonly referred to as swamps, are areas of hydric soil where water is always or occasionally present at the surface and which have a more or less contiguous canopy of trees. Swamps in Delaware are commonly dominated by water-tolerant oaks, ash, red maple, alder, sycamore, and black gum. In the southern portions of the state, there are extensive cypress swamps.

In the Middle Atlantic region, forested wetlands have declined precipitously where it was feasible to ditch and drain them for adaptation to modern agriculture. Yet there has been a concurrent (though much smaller) creation of forested wetlands through the filling of deep water habitats with topsoil and subsoil, again as a result of modern agricultural techniques. Deep plowing of erodible soils and the settlement of the ensuing runoff has filled many former deep-water habitats. The Middle Atlantic Coastal Plain has a number of colonial-era shipping ports that became landlocked and decayed into obscurity as navigation channels clogged with farm runoff.

It is likely that the forested wetlands at the Puncheon Run Site were deeper during prehistoric times and consequently supported an entirely different suite of plant species from those present today. These deeper waters likely supported fewer woody species and more emergent species and floating mat species. Some portions of the wetlands associated with Puncheon Run were also undoubtedly periodically altered by the activities of beavers, resulting in an alteration of wetland depth and subsequent floral composition on a time scale of years or decades.

2) Non-forested Wetlands

Non-forested wetlands fall into four general categories: shrub-scrub, emergent, floating mat, and open water.

Shrub-scrub wetlands are to some degree an intermediate form between forested wetlands and non-forested wetlands. They are dominated by woody vegetation, such as willow, viburnum, high-bush blueberry, and chinquapin, but they lack both the height and the formation of defined canopy layers typical of a forest. Shrub-scrub wetlands are usually successional in nature and are either temporally transient habitats or are arrested in this stage by habitat dynamics. Constant or occasional scour, beaver activity, salinity, and human manipulation can all perpetuate this otherwise usually intermediate state. Shrub-scrub wetlands dominated the wetland landscape flanking the present St. Jones River channel and the confluence of Puncheon Run and the river. Their predominance in this area appears to be an artifact of river re-engineering efforts and channel maintenance which have involved the deposition of dredge spoil and the erosion of created cutbanks at the margins of the river.

Emergent wetlands, commonly referred to as marshes, are created and maintained by deeper waters. They are highly productive habitats that are rooted in soils that are never dry except in extreme conditions. The marshes of the Mid-Drainage Zone, where Puncheon Run is located, are described above (see Table 37). Two distinct marsh communities are present at Puncheon Run, a freshwater marsh in the mouth of Puncheon Run as it meets the St. Jones and an oligahaline marsh in the St. Jones itself. Dense stands of herbaceous vegetation dominate the landscape in both locations. In Puncheon Run, wakerobin, pickerel weed, and golden club (Plate 38) grow in wide margins at the stream confluence, and span its entire width further upstream. These plants all have edible roots, and any of them would fit the description of the "tuckahoe" described by John Smith (1986[1608]:110) as the most important wild food of the Powhatans.

In the very slightly salty waters of the St. Jones marsh zone grow stands of pickerelweed, sweet flag, bulrush, arrowhead, spatterdock, narrow-leaf cattail, and broad-leaf cattail. A shrub-scrub zone flanks the margins of this herbaceous marsh, dominated by such species as buttonbush, wax myrtle, and bayberry, along with willow and pond pine.

Floating mat wetlands occur in the deepest waters that will support non-submerged vegetation. Submerged aquatic vegetation may also be an important component of floating mat complexes. Floating mat plants float freely atop the water surface (like "lily pads") and are connected to the substrate by flexible stalks that allow the plants to move vertically with the tide or fluctuating water

levels and horizontally around animals or floating debris. Today, floating mat wetlands do not occur in the near vicinity of the Puncheon Run Site. Historic records, however, indicate that American lotus (*Nelumbo lutea*) once formed the dominant wetland plant in the south Dover riverine landscape. American lotus is a characteristic floating mat species, and where it grows, it most often grows in exclusion of other taxa. When subjected to the influence of human activities (agriculture, construction, river "improvement"), the wetland environment tends to progress from open water, to floating mat, to emergent marsh, to shrub-scrub, to swamp, and this process of wetland change is clearly apparent at Puncheon Run.

Open water is present in the St. Jones and in the mouth of Puncheon Run.

PLATE 38: Golden Club Root (*Orontium aquaticum*). Ethnobotanist Justine McKnight harvests a golden club plant from the St. Jones River. Golden club was probably one of the aquatic root crops used by coastal Native American groups.

5. Procurement Potential

Based on the physiography and biology of the Puncheon Run Site, we know that the site offered easy access to a variety of resource-rich microenvironmental zones. The prehistoric landscape of Puncheon Run included Coastal Plain uplands, transitional environments, and a variety of wetland habitats situated on a riverine highway in the very productive Mid-Drainage Zone of a major tributary of Delaware Bay. One way to identify which plants would have been found in which areas is through the National Wetland Inventory (NWI) classification (Table 39). This system shows which plants are always or usually found in wetland environments, and which are usually or always found in uplands (Huffman 1981; Sipple 1988; Wentworth and Johnson 1986). Various lists of plant species that occur in wetland and non-wetland habitats have been compiled for the Delmarva Peninsula (Dawson and Burke 1985; Reed 1988) using the national indicator categories.

The literature survey carried out on Native American plant use for this project (Volume II, Appendix E) documented the economically useful plant taxa of the Delaware River Valley (McKnight 1999b). Based on this study, a list of potentially useful and locally available plant taxa has been compiled for the Puncheon Run Site. Table 40 shows the number of plant resources from different microenvironments, as determined by wetland indicator category. It is clear that all environmental

zones contained useful plants, with a slightly greater number in the upland zones. This finding is quite striking because archaeologists have long observed that most archaeological sites in the Middle Atlantic region are associated with wetlands, and they have therefore assumed that wetland resources were more important to ancient Native Americans. The data in Table 40 suggest that upland environments were also quite important. Table 40 also shows the number of archaeologically documented plant resources from each microenvironment identified at Puncheon Run, as determined by wetland indicator category. It should be noted that all of the samples were taken from upland environments. Comparison of the two data sets (Figure 63) clearly points out the limited amount of archaeological data for wetland exploitation and a correspondingly greater representation of species whose range extends over various microenvironmental zones.

TABLE 39: PLANT SPECIES INDICATOR CATEGORIES, NATIONAL WETLAND PLANT LIST

Indicator Categories	
Obligate Wetland (OBL)	Occur almost always (estimated probability >99%) under natural conditions in wetlands
Facultative Wetland (FACW)	Usually occur in wetlands (estimated probability 67%-99%), but occasionally found in non-wetlands
Facultative (FAC)	Equally likely to occur in wetlands or non-wetlands (estimated probability 34%-66%)

TABLE 40: PLANT SPECIES BY WETLAND INDICATOR CATEGORY, ETHNOGRAPHIC LITERATURE VS. ARCHAEOLOGICAL ASSEMBLAGE

Wetland Classification	No.* Species Identified in Ethnographic Literature	No.* Species Identified in Archaeological Context
Obligate Upland (UPL)	30 (26)	9 (18)
Facultative Upland (FACU)	26 (22)	9 (18)
Facultative (FAC)	26 (22)	9 (18)
Facultative Wetland (FACW)	16 (14)	.
Obligate Wetland (OBL)	15 (13)	2 (4)
Range of habitats (VAR)	4 (3)	21 (42)

*column percentages given in parentheses

Among the upland plant species of known importance to historic Indians are nut-bearing trees; fruit trees such as plums, cherries, and mulberries; strawberries, grapes, passionflower, mayapple, gooseberries, and wild sweet potatoes. Besides the marsh plant or "tuckahoe," John Smith (1986 [1608]:27) also commented on the importance of a root found in the uplands known as puccoon: "a small root that groweth in the mountaines, which being dryed and beate in powder turneth red. And this they use for swellings, aches, annointing their joynts, painting their heads and garments. They account it very precious, and of much worth."

As this analysis points to the importance of upland environments, perhaps sites located on the edge of wetlands should be considered to be associated with the transition between uplands and wetlands rather than simply with the wetlands. After all, the forests to the interior of the site are every bit as accessible as the marshes on the other side. Access to a diversity of environments, rather than to a single key zone, may have been the criterion for campsite location.

The site paleoethnobotanical assemblage contains a range of useful and economically important wild plant species from prehistoric contexts, which are listed in Table 41. This list should not, however, be viewed as a complete inventory of the plants that were growing on the site when it was occupied. One of the greatest obstacles confronting paleoethnobotanical studies is the issue of preservational bias owing both to the cultural factors involved in the deposition of plant refuse, and to the physical factors governing the differential preservation of deposited plant remains. The great majority of plant remains deposited prehistorically decompose quickly, leaving a limited and grossly prejudiced sample of the original vegetative material. From most open-site environments, only plant material subjected to charring (burning in specific low-oxygen environment) will be preserved archaeologically. Plant foods requiring cooking have a much higher likelihood of entering the archaeological record than those foods that are eaten raw. Even when burned, not all plant material has an equal chance of being preserved—denser plant remains (such as hickory nutshell) tend to survive longer than fragile plant remains (such as popped corn).

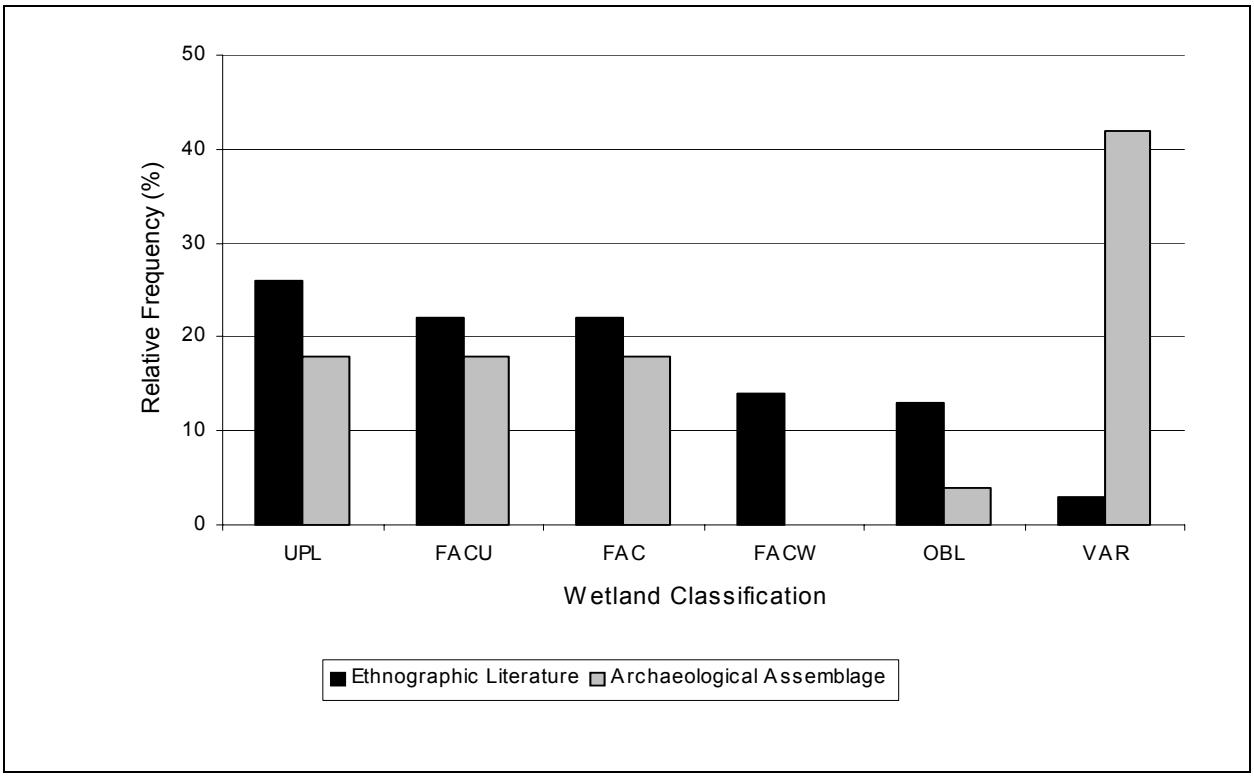

FIGURE 63: Relative Frequency of Ethnobotanical Species, Ethnographic Literature Versus Archaeological Assemblage

TABLE 41: PLANT TAXA DOCUMENTED ARCHAEOLOGICALLY AT THE PUNCHEON RUN SITE

Taxa	Common Name	Part Recovered	Native/ Non-Native	Indicator Category*
Acalypha virginica	copperleaf	seed	native	UPL
Castanea dentata	American chestnut	wood	native	UPL
Eleusine indica	goosegrass	seed	exotic	UPL
Fragaria sp.	strawberry	seed	native	UPL
Oxalis stricta	wood sorrel	seed	native	UPL
Robinia pseudoacacia	black locust	wood	native	UPL
Solanum rostratum	buffalo bur	seed	exotic	UPL
Trifolium sp.	clover	seed	exotic	UPL
Vicia sp.	vetch	seed	exotic/native	UPL
Cornus florida	flowering dogwood	wood	native	FACU
Crotolaria sagittalis	rattlebox	seed	native	FACU
Ilex opaca	holly	wood	native	FACU
Juglans nigra	black walnut	wood	native	FACU
Lactuca serriola	wild lettuce	seed	exotic	FACU
Liriodendron tulipifera	tulip poplar	wood	native	FACU
Morus rubra	red mulberry	wood	native	FACU
Prunus serotina	black cherry	wood, seed	native	FACU
Sassafras albidum	sassafras	wood	native	FACU
Ambrosia artemisiifolia	common ragweed	seed	native	FAC
Diospyros virginiana	persimmon	wood	native	FAC
Liquidambar styraciflua	sweetgum	wood	native	FAC
Mollugo verticillata	carpetweed	seed	native**	FAC
Myrica sp.	bayberry	seed	native	FAC
Phytolacca americana	poke	seed	native	FAC
Sambucus canadensis	elder	seed	native	FAC
Stellaria media	chickweed	seed	exotic	FAC
Vitis labrusca	fox grape	seed	native	FAC
Acer sp.	maple	wood	native	VAR
Acer/Betula	maple/birch	wood	native	VAR
AMARANTHACEAE	pigweed	seed	native	VAR
Amaranthus sp.	pigweed	seed	native	VAR
Carya sp.	hickory	wood, nutshell	native	VAR
Chenopodium sp.	goosefoot	seed	native	VAR
Euphorbia sp.	spurge	seed	exotic/native	VAR
Fraxinus sp.	ash	wood	native	VAR
LEGUMINOSAE	bean	seed	exotic/native	VAR
Lespedeza sp.	lespedeza	seed	exotic/native	VAR
Pinus sp.	so. pine group	wood	native	VAR

TABLE 41 (continued)

Taxa	Common Name	Part Recovered	Native/ Non-Native	Indicator Category*
POCEAE	grass	seed	exotic/native	VAR
Polygonum sp.	knotweed	seed	native	VAR
Quercus sp.	red oak group	wood	native	VAR
Quercus sp.	white oak group	wood	native	VAR
Quercus sp.	oak	wood, nutshell	native	VAR
Rumex sp.	dock	seed	native	VAR
Panicum sp.	panic grass	seed	exotic/native	VAR
Polygonum/Rumex	knotweed/dock	seed	native	VAR
Rubus sp.	raspberry/blackberry	seed	native	VAR
Vitis sp.	grape	seed	native	VAR
Nelumbo lutea (?)	American lotus	seed	native***	OBL
Polygonum pennsylvanicum	knotweed	seed	native	OBL

Source: Material recovered during excavation and from analysis of flotation and phytolith samples.

* Indicator categories described in Table 39. The code VAR indicates that species within the particular genus or family occupy a range of habitats.

** *Mollugo verticillata* was originally native to the tropics or subtropics of the northern and southern hemispheres, but archaeological evidence from the Tennessee River Valley confirms that the species was introduced prehistorically (Chapman et al. 1974).

*** *Nelumbo lutea* occurs only in isolated populations on the Eastern Seaboard of North America. Its presence in this region may be a result of anthropogenic introduction during prehistoric times.

The coarse, acidic soils of Delaware's Coastal Plain provide very poor conditions for the preservation not only of archaeobotanical material but also of many other classes of material culture. Even among those plant remains that are burned, some will be identifiable (i.e., seeds, corn, nuts) while others will be unrecognizable (i.e., starchy roots, fleshy fruits). Moreover, processed plant products (such as meal made from ground grains, nuts, or roots) are often invisible archaeologically. This loss of data is of tremendous concern to archaeologists interpreting paleoethnobotanical data. While there is no adequate correction for this loss, it is important to acknowledge it when extrapolating prehistoric plant use based on archaeological plant remains. So, while the archaeobotanical assemblage secured from Puncheon Run does include a myriad of plant taxa, including some obviously introduced modern species, it should not be viewed as a conclusive indicator of the full range of plant resources that were important to the site's prehistoric residents.

6. Site Loci

a. Locus 1

Locus 1 occupies a gently sloping alluvial terrace at the western limits of the site, abutting Puncheon Run. Existing vegetation consisted mainly of weedy species growing in a fallow agricultural field which extends across the Coastal Plain upland and upper transitional portions of the area, and a narrow, wooded transitional zone flanking the upper reaches of Puncheon Run (see Figure 62;

Figure 64). Within Locus 1, Puncheon Run is a narrow stream with a seasonally inundated floodplain. The transition to uplands in this area of the watershed is gradual, and this gentle slope would have been well-suited to cultivation.

Microenvironmental zones immediately accessible from Locus 1 during prehistoric times would have included Coastal Plain upland (forest), a gently sloping transitional (riverine terrace) zone well-suited to agriculture, wooded wetlands along the edges of the Puncheon Run basin, freshwater emergent marsh and floating mat wetlands throughout the central portions of the stream, and open-water environments linking the upper Puncheon Run channel with other riverine environments.

Plant remains were recovered from two areas of Locus 1, the Buried Plowzone area and the Silo Pit area. Flotation processing of 44 samples from Locus 1 yielded little charcoal or other plant remains, but a range of economically useful species were identified. The wood assemblage was dominated by hickory, white oak, red oak, maple, birch, American chestnut, flowering dogwood, ash, American holly, black walnut, tulip poplar, and pine. Hickory and acorn nutshell were identified. Carbonized seeds were scant, with only a single seed coat fragment being tentatively identifiable as American lotus (*Nelumbo lutea*). This fragment was found in Feature 66, one of the silo pits in the main pit cluster. Non-carbonized seeds were abundant within the Locus 1 feature samples; the seeds included Eurasian and tropical American species that could not have been present on the site before AD 1600, and whose presence compromises the integrity of the seed assemblage. Recovered remains suggest a reliance on upland forest resources (wood and mast), as well as the utilization of species occupying the ecological transitional spanning upland and wetland portions of the site. The recovery of birch and maple woods may indicate the utilization of wooded wetlands (the identifications were only made to the genus level, but the species most commonly found in Delaware, such as red maple, are Facultative Wetland species usually found in swamps), and the tentative identification of American lotus points to the use of floating mat marsh plants.

b. Locus 2

Locus 2 encompasses the central portion of the site, bisected by an intermittent runoff channel. It extends over disused agricultural land on Coastal Plain upland portions of the area (now maintained in mixed herbaceous cover) and a mixed hardwood forest transition on the bluff edge and scarps flanking the Puncheon Run floodplain. At the convergence of the runoff channel and the bluff edge there is a mature forest remnant that is unique within the site. This forest is dominated by hickory, beech, and oak species with an understory of mountain laurel, dogwood, and holly, and offers the closest approximation of native forest cover available in the site area. The Locus 2 uplands presently flank the defunct millpond. The very steep slope indicates that the bluff was actively eroded by the stream in the past, and therefore that Locus 2 once directly overlooked the active stream channel.

During the site's period of most intensive use, the Woodland I period, the associated ecological zones would have included Coastal Plain upland forest, a more steeply sloping transitional community, and a very broad stream bottom (approximately 160 meters at maximum width). The broad floodplain zone probably supported a variety of wetland communities, including swamp, emergent freshwater marsh and floating mat communities, and open water environments.

Archaeological investigations revealed an area of high artifact density in the wooded portions of Locus 2, occupying upland edge overlooking an area of steep topographic relief above Puncheon Run. Evidence of use in the Archaic and Woodland I periods was found, but this area was preserved rather than being subjected to intensive excavation. As a result, relatively little is known about the prehistoric use of this area.

Paleoethnobotanical investigation within Locus 2 included the processing of four flotation samples from Block 18 in the western portion of the Locus. The flotation samples contained an average density of 0.05 grams of carbonized plant remains per liter, and the plant assemblage was dominated by white oak and unspecified oak charcoal and hickory nutshell. Little can be said other than that these represent upland resources; no plants representative of wetland environments were identified.

c. Locus 3

Locus 3 describes the eastern end of the site adjacent to the St. Jones River and its confluence with Puncheon Run. Vegetative cover in this area consists of old field and early successional forest on the level and gently sloping Coastal Plain uplands, flanked by more mature mixed hardwood transitional zone along the St. Jones River and Puncheon Run. Wetland environments associated with Locus 3 include a wide shrub-scrub wetland off the eastern edge of the site adjacent to the active St. Jones River channel, and a fringe of emergent marsh around this shrub-scrub wetland and extending up into Puncheon Run. This marsh broadens within the "delta" of Puncheon Run, occupying a wide zone on either side of the stream bed. The open waters of both the St. Jones River and Puncheon Run are easily accessible from Locus 3.

Prehistoric microenvironments directly accessible from Locus 3 would have included Coastal Plain upland forests, transitional woodlands between upland and wetland areas, and extensive wetland environments, including shrub-scrub (probably less prevalent than today), emergent and floating mat marshes, and open water.

Archaeology within Locus 3 identified numerous intact hearth features in the northeastern portion of the locus, deep storage-type pits similar to those identified in Locus 1 (the Feature 30 block), and the Metate block, which included a large grinding stone and associated fire-cracked rock clusters.

Locus 3 was the most intensively investigated area of the site; a total of 86 soil samples were submitted for flotation processing, representing 18 features, various non-feature contexts and non-cultural (control) sediments. Recovered charred plant remains from cultural contexts averaged 0.22 grams per liter. The Locus 3 flotation samples were by far the most productive samples sitewide, yielding almost twice the concentration of archaeobotanical remains per liter than the Locus 1 samples, and more than four times greater than the Locus 2 assemblage. Recovered plant remains included a suite of upland canopy and fringe (forest edge) wood taxa dominated by oak, hickory, and sweetgum. Hickory nutshell was recovered from across the Locus 3 contexts sampled. Carbonized seeds were recovered, including some edible species mixed with historically introduced Eurasian taxa and abundant non-carbonized seeds, conditions which cast doubt upon the integrity of the seed assemblage.

The Locus 3 archaeobotanical data reveal the utilization of a diverse array of wood and mast from Coastal Plain upland forest, as well as wood species representative of a transitional forest edge such as that between site upland areas and the wetlands of the St. Jones River and Puncheon Run. Although the seed assemblage includes some wetland-associated species, such as goosefoot, poke, and knotweed, the seed data are compromised by the factors mentioned above. Use of wetland plant resources was also suggested by the recovered charcoal, which included maple, ash, tulip poplar, sweetgum, and persimmon.

7. Seasonality

The greatest, but certainly not the only, determining factor in the movement of hunter-gatherer groups from one location to another is the seasonal availability or seasonal fluctuation of food resources. In the planning of seasonal movement to and from the Puncheon Run Site, the reliability and predictability of given resources as well as their ease of procurement, efficiency of procurement, and nutritional value would have been considered.

A diverse array of economically useful plants and plant products would have been available throughout the year from the Puncheon Run Site and its surrounding environs. Figure 65 shows the optimal seasonal availability of plant food types utilized during the Woodland periods on Delaware's Coastal Plain. All of these plant food types would have been available in some form or another from the Puncheon Run Site.

Overall, no clear pattern of seasonal utilization is suggested by the archaeobotanical assemblage from the Puncheon Run Site. The recovery of charred nutshell suggests that nuts were used at the site. Native masts—which locally were dominated by hickory, American chestnut, chinquapin, beech and oak acorns—usually ripen in October and are available for weeks and even months following this time. No other secure identification was made of comestible plant remains from prehistoric contexts. A single American lotus seed-coat fragment was tentatively identified. Seeds of this species ripen in late September and October and would probably be available into November.

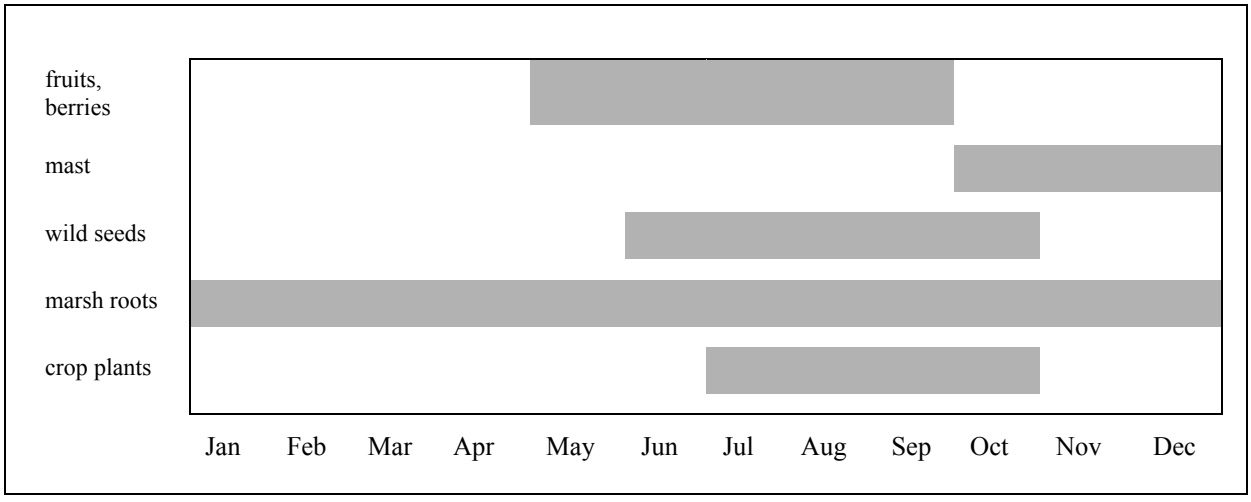

FIGURE 65: Dominant Procurement Season for Plant Food Types

The remainder of the carbonized seed assemblage consists of berries that ripen in mid to late summer, but it is doubtful that these specimens relate to economically important activities. Marsh roots are edible year-round, but most of them tend to be largest and most nutritious during the winter months, prior to the eruption of new foliage.

8. Summary

Development of an ecological framework for the Puncheon Run Site has suggested some new insights into plant utilization and site settlement processes during the Woodland I and Woodland II periods. While the site's flotation sample assemblage was quite large by regional standards, the samples were impoverished and relatively uninstructive in terms of aboriginal plant use. Reconstruction of environmental conditions throughout the Holocene, and definition of site microenvironments has helped to assess the types of plant resources that would have been available to the prehistoric residents of the Puncheon Run Site. A review of ethnohistorically documented regional ethnobotany helped to identify a broad range of plants and plant products that may have been economically significant within the Delaware River Valley region. This ethnohistorical information provided some guidance for determining which vegetative communities at the Puncheon Run Site may have provided useful and desirable resources.

It is clear that the full range of culturally useful plant taxa available from the Puncheon Run Site is under-represented in the archaeological record, almost certainly because of poor preservation. In addition to the expected biases inherent in archaeobotanical assemblages from open site environments, local soil conditions, especially acidity, do not favor the preservation of archaeological plant remains. While flotation assemblages analyzed throughout the region have involved copious sediments from cultural contexts, their analysis has yielded limited data on which to construct adequate understanding of regional plant use during the Woodland I and Woodland II periods.

At the Puncheon Run Site, the paucity of agriculturally related tools and the complete absence of cultivated plant remains suggest that plant cultivation was not important at the site; this pattern is generally true for Delaware as a whole. While Coastal Plain upland forests would have been easily utilized by site residents, relatively low concentrations of nut remains (nutshell is extremely dense and durable archaeologically) imply that mast harvest was not the focus of human subsistence activities. Likewise, seeds were not abundant, perhaps indicating that wild-gathered seeds were unimportant in site economy.

Evaluation of microenvironments has determined that a variety of distinct vegetative zones were easily accessible from the site, including both wetlands and uplands. The species diversity, concentration of comestible taxa and prolonged seasonal availability of plant resources from the wetland zones suggest an emphasis on fluvial environments by prehistoric inhabitants.

The Woodland residents of Puncheon Run were well-poised for the collection of ethnohistorically documented marsh-root resources. Marsh-root resources are edible throughout the year, but they would be most nutritious during the late winter, just prior to eruption of spring foliage. At Puncheon

Run and other sites throughout the region, seasonal camps or procurement sites would have been established adjacent to broad wetlands where great quantities of these roots could have been harvested and stored in subterranean pits for future use. The work force required to accomplish these tasks may have been composed of the less-mobile members of the group (the elderly, child-bearing women, and young children). Encampments at Puncheon Run may have constituted a period in the seasonal migration where the group separated, with one party remaining to harvest easily accessible marsh resources, while another, more mobile group traveled to secure less easily procured resources such as open-water fishes or upland game.

Combined research efforts suggest that, despite its large size, the Puncheon Run Site was not a large, enduring, multifunctional habitation area. Rather, the site was utilized on a repeated, possibly regular (seasonal) basis for the procurement of particular anticipated and reliable resources. The distribution of activity areas and the nature of recovered features at the site suggest that it was used for the various seasonal extractive areas it offered, perhaps, in part, for the predictable, periodic harvest of the abundant starchy roots and tubers of local marsh plants.

Repetitive, periodic reuse of the site by mobile hunter-gatherer groups over hundreds or thousands of years might produce the kind of settlement pattern seen at the Puncheon Run Site. The caching of a seasonal surplus of wild plant foods in concealed subterranean pits, shifts in campsite location in response to the local availability of resources or the discovery of storage facilities by hostile humans and animals, and artifact-poor processing areas (plant processing was often accomplished using non-stone tools: Callahan 1981:232, 234, 236) would leave the kinds of dispersed activity areas and cultural features documented archaeologically at the site.

The Puncheon Run Site was but one settlement among many in a local cultural landscape focused on the resources offered by the biologically rich mid-riverine drainage zone of the St. Jones River. While changes in the local landscape associated with the Holocene transgression led to changes in the local plant and animal communities, the duration of human activities in the areas confirms the economic significance of the local landscape's natural bounty.

C. THE ZOOLOGICAL LANDSCAPE

1. Animals in Indian Life

Animals and their activities are important for understanding the Puncheon Run Site in two distinct ways. First, they were crucial to the subsistence, the ritual life, and even the self-definition of historic Indians, and almost certainly were to their ancestors as well. Second, animals and their activities help to shape the landscape, and particularly the soil, leaving a strong imprint in the archaeological record. A full understanding of the prehistoric landscape at Puncheon Run requires the consideration of animals in both of these aspects.

It is hard to imagine a Native American of the colonial period without seeing evidence of their close relationship with wild animals. Deerskin clothes and moccasins, buffalo hide robes, feather, shell,and porcupine quill decorations—these are all parts of our image of an Indian that are firmly rooted in historical reality. John Smith (1986[1608]:115) wrote,

> For their apparell, they are sometime covered with the skinnes of wilde beasts, which in Winter are dressed with the hayre, but in Sommer without. The better sort use large mantels of Deare skins, not much differing in fashion from the Irish mantels. Some imbrodered with white beads, some with Copper, other painted after their manner. . . .

The most important animals from an economic standpoint were deer and fish. Deer skins were made into clothes, shoes, drum coverings, blankets, and other products. Antlers were used for flaking stone and could be made into arrow heads, harpoon points, knives, and mattocks; scapula bones were formed into shovels and hoes. Venison was one of the most important foods, so much that whole villages decamped and moved to hunting areas in the late fall. Fish, especially those that ran in the rivers in the spring and fall, were vital sources of food and oil. Other animals that are frequently mentioned in historical sources are turtles (Plate 39), bear, turkey, ducks, geese, beaver, and oysters. All of these animals had uses beyond what they may have contributed to the diet: turtle shells were used as cups, bowls, and rattles; turkey claws could be made into arrowheads, turkey bones into needles and awls, and turkey feathers into warm cloaks; a beaver tooth could serve as a knife blade; oyster shells were used to scrape wood.

The relationship between Native Americans and animals went well beyond economics. For Indians the human and animal worlds were woven together in special ways, much more so than for Europeans (Harrington 1921; Speck 1945). Indians were often named for animals, sometimes because of a physical resemblance or a character trait, sometimes because of a spiritual vision that included animal messengers. Animals had contact with the spirit world just as people did, and, also like people, they could impart wisdom, see the future, and participate in rituals. Animals had major parts in almost all the Native American creation stories. Some Indian groups were divided into clans named for animals, such as the Algonquian Wolf, Bear, and Turtle clans. Animals were major themes in Native American art, painted onto skins and boards, woven into textiles, tattooed onto bodies. Because of the symbolic and spiritual importance of animals, the use of animal food and the manufacture of objects from skin and bone were fraught with meaning. The selection of feathers for arrows, to take just one example, might depend on the color of the feathers and the characteristics of the bird they came from as well as their aerodynamic properties. Because animals were considered close to humans in spiritual stature, some Indian groups asked the pardon of the animals they killed, or tried to ensure the safe passage of the animals' spirits to the other world. John Lawson (1952 [1714]:52) encountered one tribe in North Carolina with an interesting ritual: "All the Indians hereabouts carefully preserve the Bones of the Flesh they eat and burn them, as being of Opinion, that if they omitted that Custom, the Game would leave their Country, and they should not be able to maintain themselves."

Native Americans also kept animals as pets and companions. Dogs were the most common animals around camp, but accounts also speak of tame birds, raccoons, and even skunks (Lawson 1952 [1714]:29, 120-124).

The Puncheon Run Site was no doubt home to many animal species of great importance to the people who lived there. Fish have already been mentioned a number of times. It appears that the site would have been a good place from which to exploit the spring and fall fish runs, and that

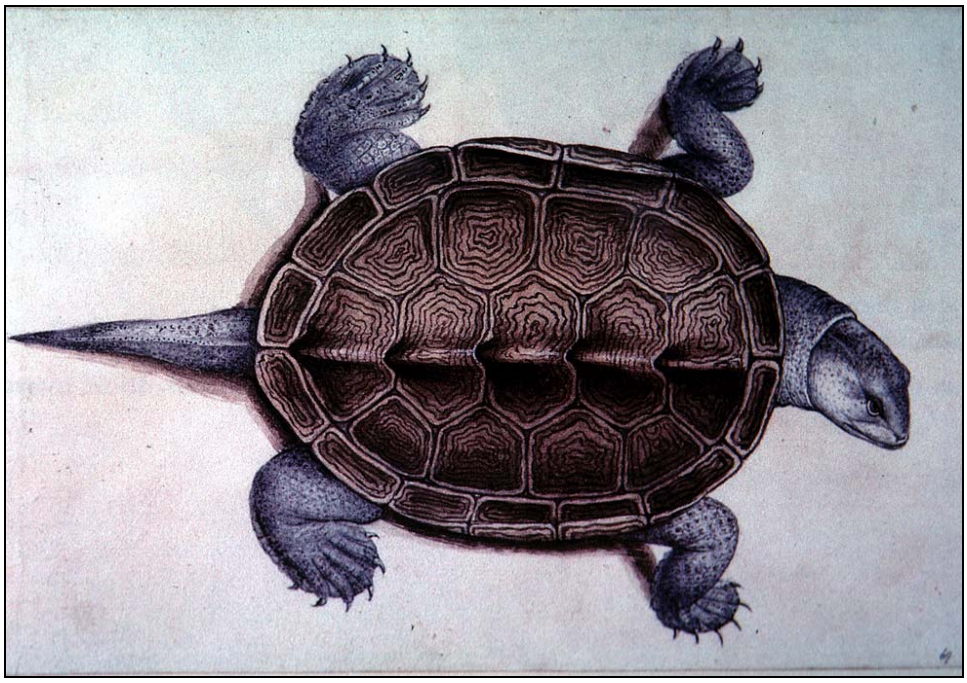

PLATE 39: Diamondback Terrapin *SOURCE: Painting by John White, circa 1585*

people came to the site many times for this purpose, especially between 2800 and 1200 BC. Puncheon Run was probably a good place to catch turtles, and the marshes along the river may have attracted ducks and geese. Deer are found throughout the woodlands of Delaware, but during the winter when food is scarce they kept to places with particularly lush undergrowth, such as forested wetlands. The Puncheon Run peninsula was no doubt frequented by some deer, and some hunting probably took place there, but there is no reason to think it was a hunting ground of any special merit. The situation with other animals was probably similar. Some could be found at Puncheon Run, but no more than in other parts of the forests that covered most of Delaware. The small-scale distinctions that made a great difference at a particular time, such as the place where a bear denned for the winter or the presence of a tree that housed a porcupine, are too ephemeral to have left any recoverable traces.

2. Animals and the Soil

a. Woodchucks at Puncheon Run

Both humans and animals dig holes in the ground for their special purposes, and it is sometimes difficult to distinguish between human-dug pits and animal burrows (Butzer 1982; Schiffer 1983). Two of the possible prehistoric pit features identified in the Silo Pit area of Locus 1, Features 68 and 69, had been so thoroughly disturbed by tunneling that their original outlines could not be defined. One of the pits investigated during the testing of Locus 3, Feature 25, was eventually identified as an animal burrow of some kind. The overall research program for the Puncheon Run Site therefore included an effort to understand the behavior of burrowing animals native to the region and to develop criteria for distinguishing burrows from cultural features. The most active burrowers in central Delaware today are woodchucks or groundhogs (*Marmota monax*). When the Puncheon Run

Site was excavated, the large fields that made up much of the site were heavily populated with these rodents. As part of the archaeological investigations, one of the larger den complexes was excavated, to find out what sort of impact this one species of burrowing animal was having on the landscape (Volume II, Appendix L). Measurements of the burrows were made, and soil samples were taken from several locations within the den which might reveal specific chemical signatures of animal occupation.

Den No. 8, the one chosen for excavation (Plate 40), contained approximately 13.6 meters of burrowed tunnels and chambers with a depth of up to 1.5 meters. Three holes were present on the surface, a main entrance and two vertical "plunge holes" for emergency entrance or exit. The whole complex was contained within an area of 4x5 meters. The tunnels were 18 to 25 centimeters in diameter. Four denning chambers were present, defined by bulges in the tunnels' lines, with diameters of 30 to 40 centimeters and containing deposits of grass and shredded plastic. The soil chemistry showed high levels of phosphorus, potassium, and manganese. One test from the subsoil below a bedding chamber had a phosphorus level of 1,013.6 parts per million, the highest level recorded anywhere at Puncheon Run.

Woodchuck dens do not contain large underground chambers that might easily be mistaken for prehistoric pits. Their impact on the archaeological record comes from the repeated reuse of the

PLATE 40: Excavation of Woodchuck Den No. 8

same locations. One of the tunnels of Den No. 8 had collapsed, and a detour had been dug around the collapsed section. Such redigging, if it were common, would eventually disturb all the soil in the vicinity of the den, to the depth of the woodchucks' deepest tunnels, as at Features 68 and 69. However, only one section of collapsed tunnel was noted, so it is possible that woodchucks are able to use the same tunnels for generations. A large den such as Feature 25 must have been excavated by some larger animal, perhaps a fox or a wolf. Many thousands of years would be needed, it seems, for woodchucks to disturb all of the soil even in a heavily populated area like the old fields at Puncheon Run. On the other hand, their impact on some of the Locus 1 features has already been noted. The chemical analysis of Den No. 8 also has important archaeological implications, since concentrations of phosphorus and potassium are often taken as signs of human habitation. In truth they reveal only the presence of animals, and the identification of those animals as human must be made by other means.

b. Other Burrowers

Woodchucks by themselves seem to have had only minor impacts on the archaeological record over the past 3,000 years. Other creatures, both large and small, however, have also been at work on the site, and their cumulative impact has been considerable. Ants, beatles, earthworms, and other small invertebrates have been constantly digging through the soil, churning and mixing the upper layers. Small mammals such as moles, voles, and mice have also been active. As they have dug through the soil, they have moved artifacts and erased the boundaries of features and strata. By constantly moving soil to the surface, ants in particular can cause objects too big for them to lift, such as artifacts, to fall down through the soil. The upper layers of the soil therefore constitute an active "biomantle" (Johnson 1993), a zone of instability within which the spatial relationships of artifacts can shift and features are rapidly erased.

D. THE CULTURAL LANDSCAPE

The word *landscape* has meaning only in the context of human presence, when a people view the physical world through personal perspective, tradition, and motivation. Without a human perspective, there is not a landscape, but simply space. Humans do not create space, which exists independently, but they do create *place* wherever they go, assigning meaning to every bend in the river and each looming hillside within a specific cultural landscape. The landscape, of course, is not simply an empty room which people enter, scattering meanings around them. In nearly all human situations, the landscape is familiar as a place of ancestors, birth, growth, and relations, and imparts a sense of belonging. When people leave their ancestral lands for a new place, they never fully leave behind their old home; it remains in the consciousness, memories, and practices of individuals and the community. The widespread habit of naming the features of the new landscape for places in the old country reflects this psychic continuity. This continuity is experienced as tradition, which powerfully unifies what lies ahead with what has been left behind, both in time and space. A particular landscape thus acquires its meaning in reference to others already experienced, and unfamiliar terrain is understood in terms of how it accords and contrasts with the known world (Hood 1996, Ingold 1993).

Humans are not passive inhabitants of a landscape, but shape the terrain both physically and imaginatively, transforming it to satisfy physical, social, and spiritual needs. This shaping is indeed one of the hallmarks of human existence (Figure 66). The transformations of the terrain create social realities and experiences for the people inhabiting the land, reinforcing community traditions and values through a common set of visual perspectives and shared historical settings. These memories make the landscape a focus of emotional attachment. This attachment is not the same thing as ownership or territoriality, which is thought to be set in motion by competition over resources, but does, like them, confer a sense of identification with a place. The love of "home" probably has antecedents that extend far into antiquity.

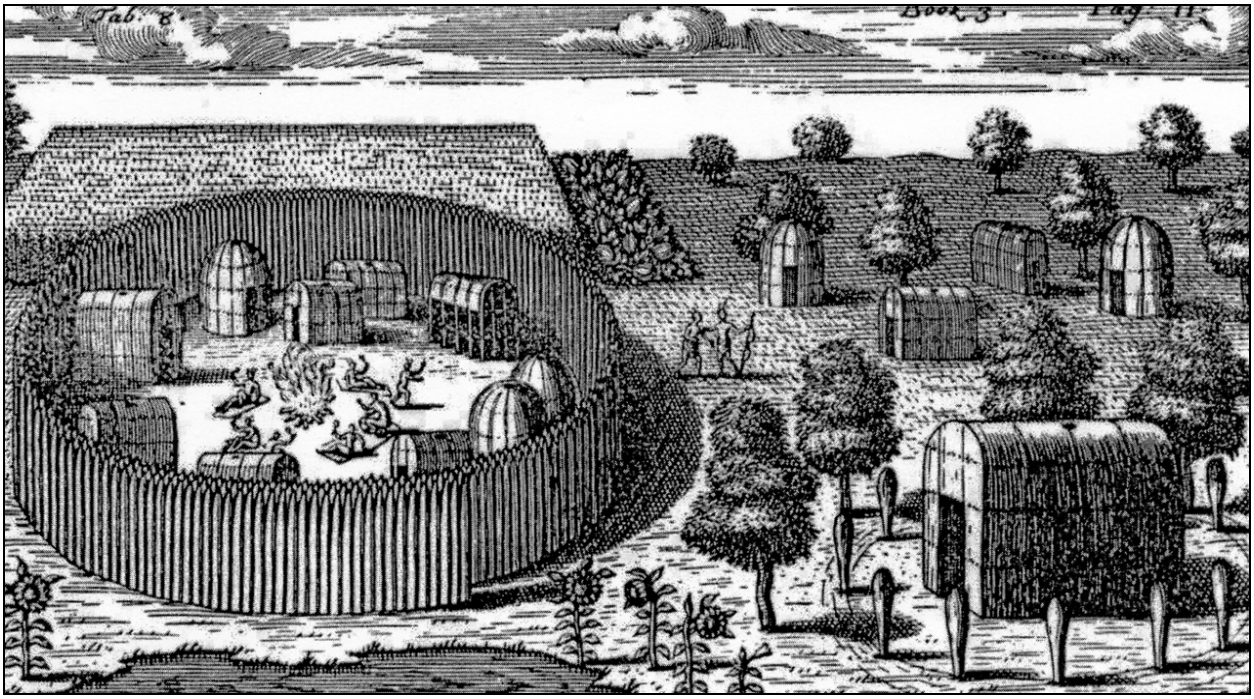

FIGURE 66: Arrangement of Gardens and Cultivated Fields *SOURCE: Beverley 1705:175*

People have used the Puncheon Run peninsula in many ways: as a camping spot, a fishing station, a place to gather and store food, a hunting ground, and a source of timber, as well as for agricultural fields, and as a place to walk through in their travels back and forth across the landscape. They may have withdrawn to a secluded area on the site to meditate, or hidden there in times of trouble. Some of these uses have left clear traces in the archaeological record. The challenge posed by the study of prehistoric landscapes is to reconstruct some semblance of the overall pattern of land use from evidence that pertains, directly, to just a few activities. This can be done only with the help of the imagination, moving from testable scientific hypotheses into realms of probability and possibility. Imagination, however, is also personal, and the present investigators cannot claim any special status for the way they imagine the vanished landscape of 2,000 or 5,000 years ago. The Native Americans who lived on this land undoubtedly imagined it differently, and others today will have their own perspectives.

1. The Archaic Forest

The earliest evidence from the site indicating human occupation on the Puncheon Run peninsula is a small group of spear points or knives of the Kirk variety, dating to perhaps 9,000 years ago. Such points are rather common along the St. Jones River and elsewhere in central Delaware, indicating that bands of people regularly passed through these areas. The largest Delaware sites from this period, including the Hughes Complex and the Deneumoustier Site, are located on sandy rises surrounded by swamps. No direct information is available on the resources that were exploited from these sites, but their location shows that the swamps were a key environment for people of this time.

The landscape of Puncheon Run would have been quite different 9,000 years ago than it is today. The forest was in transition from the spruces and firs of the late Ice Age to the mixed hardwoods of the modern era (Carbone 1976; Willard et al. 2003). Sea level was still much lower than it is today, and the St. Jones River would have been a small stream in a deeply cut valley, much like it now is north of Dover. The confluence of the St. Jones River and Puncheon Run would have been a broad area of wetlands, but those wetlands would have been swamps or forests rather than marsh and open water(Kraft and John 1978; Pizzuto 1996).

One of the possible Kirk points found at the site was recovered from Locus 2, in the center of the site. This location, along the bluff edge overlooking the floodplain of Puncheon Run, also yielded evidence of occupation in the AD 600 to 900 period, and it was probably used to some degree in other periods as well. Today this spot commands an excellent view across the floodplain, as it probably did in ancient times. It therefore made a good base for people hunting or gathering in the swamps along the stream. The presence of fire-cracked rock shows that people camped on this spot, and the potsherds, utilized flakes, and bifacial tools show that a variety of activities were carried out here. Hunter-gatherers had an intimate knowledge of their surroundings, and they would have known of this bluff, where they could camp within easy reach of the highly productive wetlands, keeping an eye out for game or other signs of life in the lowlands below, or simply viewing the changing seasons.

2. Fishing Camps

The first prolonged occupation at Puncheon Run took place between 3000 and 1800 BC, on the lower terrace at the eastern end of Locus 3. The archaeological remains dating to that period included numerous hearths, a large number of small, narrow-bladed, stemmed spear points, quantities of debitage derived from cobbles, and a few other tools.

Around 3500 BC the St. Jones was still a small river flowing through a floodplain that was dry for at least part of the year. After that time the effects of sea-level rise began to be felt and the floodplain was slowly drowned, creating swamps and marshes. The large marshes that characterize Delaware's Mid-Drainage Zone today, however, with their stands of edible plants, did not begin to form until after 1000 BC. At the tip of the Puncheon Run peninsula, where the river channel was narrow even in historic times, an active person would probably have been able to jump across the stream. The peninsula sloped gradually down from the high terrace, where the hearths were found in Locus 3, to its tip, which was an old point bar facing the Hickory Bluff Site across the river. Just

south of the peninsula, what is now the broad area of open water at the confluence of Puncheon Run and the river was probably a developing wetland. Herring and shad on their way upstream to spawn would have had to pass the Puncheon Run peninsula through the narrow channel, bringing them within easy reach of Native American fishermen. Perhaps much of the channel was blocked off by a weir, making it even easier to spear the trapped fish.

From the location of the hearths and other cultural remains, it would appear that the processing of the fish was done inland, on the level terrace, rather than on the river shore. Radiocarbon dates from hearths in the Metate block span the period from 2800 to 1200 BC, so this terrace was a well-used camping spot for centuries. The predictable behavior of anadromous fish, the stability of the landform, and the slow rate of change in the river itself drew people to this spot again and again. Grass phytoliths were found in the hearth features, suggesting that the area was at least partly cleared, no doubt because of these repeated visits to the camp.

3. Storage Pits and the Earth's Bounty

After around 1000 BC, people began to camp more regularly in the inland areas of the Puncheon Run Site, designated as Locus 1 in this study. Locus 1 occupied a broad, gently sloping area along a free-flowing stretch of Puncheon Run, with easy access to the stream. One thing we know is that people were digging large pits in this area, and we have good reasons for thinking that these pits, which we refer to as "silo pits," were intended for the storage of food. The earliest of these silo pits was Feature 69, which contained large amounts of Marcey Creek and Selden Island pottery that date it to before 800 BC. Activity in this area peaked between about AD 1 and 400, when a cluster of a dozen such pits were dug and used. Phytoliths recovered from the pits showed that grass grew in the vicinity, so the pits may have been in a clearing or glade, and they also showed that one of the pits had been lined with grass or reeds. Although no direct data were obtained on what food items were stored in these pits, "tuckahoe" and other marsh roots may be the best candidates. Why were these pits dug in Locus 1, rather than near the river where the fishing camps of Locus 3 had been?

There are at least two ways of answering this question, both of which should be at least partly accurate. Today, the plants from which edible roots can be harvested grow along the edges of the main channel of the St. Jones River and at the mouth of Puncheon Run. Data from the cores taken near Carey Farm, a kilometer downstream from Puncheon Run, show that between 1500 BC and around AD 800, the river was a slightly brackish estuary with large areas of open water, bordered by emergent wetlands (Pizzuto 1996). No coring was done in Puncheon Run itself, so the exact history of how the competing forces of sea-level rise and sedimentation played out in its lower reaches is not known. It is possible, however, that some of what is now the lower floodplain of the stream was marsh when the St. Jones River was primarily open water. The most extensive stands of pickerel weed, arrow arum, and golden club may have been farther up Puncheon Run than they are today, and the silo pits may have been more convenient to the food sources than they now seem to be. Also, much of the floodplain was probably swampy—hard to pass through either by canoe or on foot; it may have been simpler to paddle a hundred meters or so against the current than to offload several baskets of roots through muddy water and cypress roots. The steep banks that border the floodplain further down could also have been a factor. Since Native Americans often traveled by canoe, it is important that we try to view the site from the water as well as from the land.

It is also possible that the storage pits were dug where they were for concealment. Much of our knowledge of the use of storage pits among the Indians of the seventeenth, eighteenth, and nineteenth centuries comes from accounts of military expeditions in which such pits were destroyed (DeBoer 1988). Since there does not seem to have been any long-term occupation around the silo pits, they were probably used to cache food at a location well removed from any large campsite. It would have made sense, therefore, to put them where they would not be easily come upon by enemies or by hungry strangers, whether those people were traveling by water or by foot. The Silo Pit area was well hidden from anyone paddling the main channel of the St. Jones, and also from people walking along the inland route on the present alignment of South State Street. Although there is no direct evidence connecting the two sites, these pits may have been used by people camping across the St. Jones River at Hickory Bluff, which was intensely occupied during this period.

Practical considerations in the siting of these pits may have been reinforced by the emotional and symbolic meanings of the place. The cluster of 12 storage pits in the center of the Silo Pit area represents a continuity in the use of that one small place that extended over at least 200 and possibly 400 years. Over that time, this location may have become associated, in the minds and traditions of those who used it, with memories of many harvests and notions of shared security and planning for the future. This tradition could have been the property of a whole band of people, or of a single family. In historic times, the gathering and storing of roots was primarily women's work, and if that was the pattern 2,000 years ago, the glade around the silo pits may have been place where women celebrated the bounty of the earth and shared with their daughters their knowledge of how to gather that bounty, store it for their families, and give thanks to the powers that provided it.

4. Pots and Paths

At the far western end of the Puncheon Run Site, very close to the stream, a concentration of artifacts was identified that has been designated the Buried Plowzone area. Finds in this area include potsherds and diagnostic projectile points spanning the period from around 1000 BC to after AD 1000. Nearby gravel bars along Puncheon Run were exploited, and the most common artifacts were flakes and cores derived from the manufacture of stone tools from local cobbles. The pottery and tools show, however, that other activities took place on the site, and fire-cracked rock suggests use of the location for heating or cooking.

Considering the long time span during which this area was used, and the range of activities indicated, the number of artifacts recovered was not great. The evidence suggests only sporadic use of the area. On the other hand, the presence of pottery and a range of other artifacts shows that the visitors were carrying with them much of their gear. The simplest explanation is that the Buried Plowzone area represents a camping site along a well-used trail or path. People traveling by foot along the St. Jones would not have walked along the bank, because there are large wetlands where tributary streams enter. They would have walked further inland, where the streams are fordable, possibly passing a springhead, now extinct. South State Street follows the route of the old King's Highway just a hundred meters west of the Buried Plowzone area, and we know that colonial roads often followed Indian trails. The presence of the gravel bars along Puncheon Run may also have

been a factor, and the trail may have passed by this point so that people traveling from the coast could replenish their toolkits on their way to inland hunting grounds.

Trails or paths are not simply routes people walk along, nor do they follow the Euclidean path of the shortest distance between two points. Recurring movements across the landscape open trails and encourage their continued use. Trails can persist for long periods, certainly hundreds and probably thousands of years. Their presence can change the names and even the identities of the places they pass through, as those places evolved as way stations on the trail. Paths can survive profound cultural changes—as with the Indian trails that became colonial roads—and when trails persist, places along them are likely to be revisited and reused. Rivers, which were also transportation routes, had the same effect. The persistence of transportation corridors, along with the continued attraction of the resources along the St. Jones River and Puncheon Run, begins to explain the temporal depth of some of the parts of the Puncheon Run Site.

5. Pits on the Peninsula

The Feature 30 block was a complex overlay of occupations located on the lower terrace of Locus 3, near the southeastern corner of the Puncheon Run peninsula. The artifacts suggest occupation of this area from before 800 BC to after AD 1000, perhaps with the most intensive use coming in the AD 600 to 900 period. The terrain in this area sloped gently down toward Puncheon Run to the south, so this location had easy access to a variety of environmental zones. The pits were dug at the edge of the transitional slope zone, which is characterized by plan communities that are more diverse and dynamic than in the uplands; important species found in this zone today include pignut and mockernut hickory, beech, several species of oak, red mulberry, two species of grapes, hackberry, elderberry, blueberry, raspberry, wild yam (*Dioscorea villosa*), and wild potato (*Ipomoea pandurata*). The Feature 30 block was also within easy reach of uplands, marshes, and the open water of the St. Jones River.

The most distinctive discovery in the Feature 30 block was a pair of very large pits, Features 30 and 38, each with a depth of 135 to 165 centimeters and a volume of about 4,000 liters. Feature 38 produced a radiocarbon date of 1,330±80 BP, or AD 615-895 (Beta-131145). These pits had been dug down into very sandy soil, and they seemed to have been lined with siltier soil from higher in the profile; Feature 30 also had some evidence of earthen shelves around the sides. These pits were unlike any others found at the Puncheon Run Site, and no close parallels have yet been identified from anywhere in the region. If they were storage pits, they were of an unusual type. The most likely candidate for a food product to be stored in these pits is marsh roots. The marshes south of the area today contain large stands of arrowroot and pickerel weed, and a number of Turk's-cap lilies, which have an edible root, were noted along the shore. The care taken in constructing these pits suggests that they were intended to be used many times. This spot, like the Silo Pit area, may have been for some Native American group a traditional place to process and store the bounty of the marsh and a familiar part of the seasonal round.

Since a very large site of this period was located only a kilometer down the St. Jones River at Carey Farm, it may be that Features 30 and 38 were used by people who camped at Carey Farm for part of the year. The archaeological habit of dividing the landscape into "sites" may not describe very

well the habits of hunter-gatherers, who lived on the land and spent much of their time traveling it. The journey from Carey Farm to Puncheon Run was a short one, and it may have seemed to those Indians that it was easier, simpler, and safer to keep their food stored across the river next to where they dug it up. To them, many different locations along the river may have been home, and they may have distributed their activities across the landscape in whatever ways were appropriate and convenient.

It is also possible that these unusual pits were used for burying, not marsh roots, but human bodies. The historic Nanticokes and some other eastern tribes practiced a burial rite known to the Nanticokes as *chiacosan* (Flannery 1939:109; Zeisberger 1910 (1780): 90). In this practice, the bodies of the recently deceased were placed in the ground until the flesh had rotted from the bones, and then the bones were dug up for a second round of ritual. No evidence of human burials was found at the Puncheon Run Site, but, if carried to completion, a *chiacosan*-like ritual would not leave much evidence for archaeologists to find. Features 30 and 38 were certainly unusual pits, and their use in ritual activities cannot be ruled out. If these features were *chiacosan* pits, the location would have been one of great spiritual importance to the people who used it. The Nanticokes valued the bodies and bones of the recently deceased so highly that one Nanticoke group carried a large number of bones with them when they left Maryland for Pennsylvania in the eighteenth century. We can imagine them arriving on the shore by canoe, dressed in their finest clothes and ornaments, carrying the body of the deceased on a wooden hurdle to the grave site, accompanied by singing, or by the sound of rattles and drums (Lawson 1952:182).

The archaeological record of life along the St. Jones includes several ceremonial centers, and the study of these sites has shown that Woodland I Indians considered some places to have special ceremonial significance. The St. Jones Adena burials were within a circular enclosure that marked off the holy ground where the burials were performed, and the burials at Island Field were also grouped in one particular part of the site. The Island Field burials spanned more than 500 years, so the spot was used for ceremonial purposes for a very long time (Custer et al. 1990; Thomas 1974).

Archaeologists do not understand very well what factors helped to make a place holy to Native Americans of the Woodland I period. The only type of ritual behavior for which much archaeological evidence survives is burial, and we must assume that many other kinds of actions and places were holy in different ways. The distribution of spiritual power across the landscape was no more random than the distribution of food resources. Some of the holy precincts we have identified seem to have been quite close to, or even within, settlements, as with the St. Jones Adena Site. Other spiritual sites, such as the Frederica Adena burials, seem to have been more isolated, but we do not know what this difference means. If the Feature 30 block was a spiritual precinct, it was of the isolated kind, removed from dwelling places at Carey Farm and elsewhere along the river.

6. "Empty" Space

The Puncheon Run Site included large areas with very low artifact densities, no pit features, and no other evidence of activity by ancient Native Americans. The absence of evidence from these areas does not mean that the areas were not used, because the archaeological record represents only a small part of the spectrum of life. The manufacture of stone tools is the activity that is best

represented at Puncheon Run. Since stone tools have to be resharpened fairly frequently, break often, and were generally not valuable enough to be carefully guarded, evidence of these tools accumulated wherever a large amount of work was done with them. The situation is similar for pottery, making broken potsherds one of archaeology's favorite obsessions. Many other activities can also leave evidence that archaeologists may find and try to interpret, such as holes dug in the ground for burial, storage, or postholes, and fire, especially when built in a prepared hearth.

It is obvious that a large number of human activities are missing from this short list. Even within the realm of subsistence activities, the aspect of life archaeologists understand best, a vast array of activities can be overlooked. Hunting with stone-tipped spears or arrows leaves evidence, but hunting with snares or arrows tipped with turkey claws does not. Berry picking and nut gathering sometimes leave traces, in the form of charred seeds or nut hulls, at the place where the food was stored and eaten, but not at the place where the gathering was done. The artifact-free zones of the Puncheon Run peninsula could have been the site of root digging, grape picking, rabbit trapping, honey collecting, gathering moss for diapers, and so on.

Large parts of Indian life escape detection by the archaeologist altogether. Recreation, for example, generally leaves few traces. Ethnographic accounts tell us that Indians were avid gamblers who spent many hours wagering with stick dice, walnut shell dice, acorn cup dice, and numerous other randomizing devices, none of which are likely to survive in the ground (Culin 1975). Lawson (1952:176) described the gambling utensils of the North Carolina Indians as "small, split reeds. . . about seven inches long"; "the kernels or stones of persimmons" were also used. Men, women, boys, and girls all participated. To find a hearth and ask what may have been cooked over it is sometimes missing the point; the purpose of the fire may have been to keep the gamblers warm while they played. Other common Indian games included hoop and pole, cat's cradle, and the ball game from which lacrosse descends. In historic times, the game was usually played with a ball made of wood or leather, but some stone balls have been noted (Culin 1975:675), and use in such a game is one possible explanation for the rounded stones that have been found on Delaware archaeological sites (Heite and Blume 1995). The woods around any Native American village or campsite could have resounded with the noise of these activities; even the river itself, if it ever froze hard enough, could have become a field for a ball game.

The central rituals of Native American life, rites of passage, from initiations to funerals, were accompanied by feasting and dancing, two pursuits that combined pleasure with spiritual, social, and political activity (Newcomb1956; Weslager 1972). Dancing might be done at a special ground set aside on the edge of a village, as in John White's famous painting, another in the long list of activity areas that would leave little or no archaeological evidence. Other aspects of Native American religion would leave even less evidence. The study of ancient religion has been part of archaeology since its inception, particularly through the study of burials. Burial rites, however, are not synonymous with spiritual life; and although some Indian groups built temples, these were not necessarily central to their religion. Historic Indians had many of their most profound spiritual experiences in the forest, alone or with a teacher, and we can hardly expect to find evidence of this. The famous "blake boys" initiation of the Powhatan Indians in Virginia included a long stay in the forest (Smith 1986[1608]:124). According to some accounts, young women of the Lenape and related tribes gave birth by themselves, in seclusion:

> when the time of their delivery is near . . . they depart alone to a secluded place near a brook, or stream of water, where they can be protected from the winds, and prepare a shelter for themselves with mats and covering, where, provided with provisions necessary for them, they await their delivery without the company or aid of any person [Van der Donck 1971:23].

This birthing practice must have originated as an initiation of sorts for the young women, like the tests of endurance and bravery imposed on the young men, and a spiritual event of the highest importance for those who experienced it. The shores of Puncheon Run perfectly match the sort of location described by Van der Donck, and young women from the larger settlements at Hickory Bluff and Carey Farm may have built many birthing huts on the site.

7. Summary

Although it is impossible for us to fully understand how the landscape appeared to the ancient Indians who worked and camped at Puncheon Run, we can identify many of the features that formed parts of their worlds. The St. Jones River itself was of central importance, as a transportation route, as a source of food, and as a defining feature of the landscape and the people who lived along it: in historic times, many Indian tribes shared their names with the most important rivers that ran through their lands. The banks of the river were high and steep in some places, low and gentle in others, providing differing degrees of protection and ease of access. Some parts of it were easy to cross, others good places to trap fish, still others good places to gather oysters or dig roots. Smaller streams like Puncheon Run were also important features; their lower reaches contained rich marshes and swamps, and higher up they provided access to protected inland locations where food could be stored safely. The gravel bars exposed in their banks were crucial sources of raw material for stone tools. Other natural features of importance were groves of nut trees, marshes where waterfowl congregated in the winter, wet woodlands where deer denned, and stands of edible plants.

To the natural world humans added their own landscape features. These included trails coursing through the forests, clearings where people regularly camped, storage pits, fishing weirs, and even large, heavy tools like the metate from Locus 3. They included burial precincts and other spiritual sites. Perhaps most important of all, they included the network of names, memories, and meanings through which people oriented themselves in space, ordered the landscape, and made it their home.