APPENDIX B

LANDSCAPE ASSESSMENT OF THE PUNCHEON RUN SITE

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I. INTRODUCTION

A. PROJECT BACKGROUND

Extended Phase II and Phase III archaeological investigations at the Puncheon Run Site (7K-C-51) have been conducted by The Louis Berger Group, Inc. (Berger), on behalf of the Delaware Department of Transportation (DelDOT). This report was prepared in concert with archaeological investigations at the site, and encompasses an environmental survey of the project area to assist in interpreting the ecological origins of archaeological manifestations.

The Puncheon Run Site is a prehistoric site located south of Route 13 and east of State Street in the City of Dover, Kent County, Delaware (Figure B-1). The project area encompasses approximately 24 acres (9.7 hectares). The site is bounded by the St. Jones River and developed residential and commercial properties to the east and north, and by Puncheon Run (a tributary of the St. Jones River) and State Street to the west.

DelDOT's Phase I and preliminary Phase II work, conducted by Hunter Research, Inc., identified four loci at the Puncheon Run Site (Liebknecht et al. 1997). Locus 1 contains the western portion of the site on an upland terrace overlooking Puncheon Run. Locus 2 is located on both sides of an intermittent drainage channel east of Locus 1. Locus 3 includes the easternmost portion of the upland terrace from the east side of Locus 2 to the confluence of the St. Jones River and Puncheon Run. Locus 4 is located on an island in the St. Jones River, east of Locus 3. Locus 4 failed to yield evidence of prehistoric use, and was omitted from extended Phase II and Phase III investigations at the site.

Continuing research by Berger included extensive mechanical stripping to expose pit features identified by Hunter Research as pit houses (Liebknecht et al. 1997), and feature excavation. Pit-house-type features were not identified, but lithic workshop areas and various pits of unknown function were located. These features are not tightly clustered in a small area, but are widely dispersed across the landscape. These unique characteristics of the Puncheon Run Site have made it unclear whether the site is a base camp, or whether it is a series of dispersed activity areas, such as procurement stations or processing areas, associated with a central base camp. Archaeological investigations have established that the site was principally occupied during the Woodland I and Woodland II periods (Custer 1994), with limited evidence of an Archaic period component.

Current research has been largely concerned with the role of site and regional landscape in defining the form and function of prehistoric settlements at the Puncheon Run Site. The project area is uniquely situated on productive Coastal Plain soils flanked by the St. Jones River and its tributary, Puncheon Run. The aspect of the site, its accessibility via water-route travel, and its proximity to the productive potential of rich upland, floodplain, freshwater marsh and estuarine resources all contributed to the site's attractiveness to prehistoric peoples. Evaluating the value of these landscape features is critical to an adequate understanding of site formation processes. This report aims to document important landscape features and delineate productive plant microenvironments, while interpreting them within cultural contexts.

B. RESEARCH CONTEXT

Management plans for Delaware's prehistoric resources (Custer 1986, 1994; Custer and De Santis 1986) guide the research design for data recovery efforts at the Puncheon Run Site. These state management plans were developed in compliance with the U.S. Secretary of the Interior's *Standards and Guidelines for Archeology and Historic Preservation* (48FR 44716-44742), and provide explicit settlement pattern models for the various periods of Delaware's prehistory. Based on the existing plans, the research design for the Puncheon Run Site data recovery addresses specific research issues identified with the Woodland I context (Custer 1994:171-177), the period during which the Puncheon Run Site was principally occupied. These issues include chronology, subsistence, settlement patterns (household, community, and regional levels), technology, and environmental adaptation.

Delaware's Woodland I context defines a number of associated property types, including base camps (microband and macroband), transient camps, procurement/processing stations, quarries, and quarry reduction stations. Assignment of the Puncheon Run Site to one of these property types is difficult, as it has some but not all of the characteristics of a base camp. The site extends over a large area (24 acres [9.7 hectares]), and it appears to contain a series of small, discrete activity areas which may have been used on a task-specific or resource-specific basis. Puncheon Run also lacks convincing evidence of pit houses, which are a key feature of Woodland I base camps in Delaware (Custer 1994).

Custer (1994) has used the term *productive intensification* to describe the emergence of more intensive plant food use during the Woodland I period—an economic shift supported by the presence of various tools and subterranean pits, which may signal advances in plant food processing and storage. Defining the significance of plant resource availability and distribution at the Puncheon Run Site by examining durable plant macroremains, and by assessing material culture remains and features associated with plant processing and storage, may help to better understand the role of the site in Woodland I culture.

As prehistoric plant use is of particular interest to archaeological efforts at Puncheon Run, a three-fold approach was taken to extract ethnobotanical information about the site. In addition to this landscape study, site research design included the analysis of archaeologically recovered plant remains, as well as a literature review of Contact period ethnobotany for the Delaware region (McKnight 1999a, 1999b; Rovner 2000).

1. Archaeobotanical Analyses

Flotation-processing and analysis of archaeological soils for plant macroremains, as well as phytolith analysis, have accompanied all stages of field investigation. The results of the archaeobotanical analyses accomplished to date have been somewhat disappointing in that relatively little analytically significant material was present in the processed samples.

Processing and analysis of 134 soil samples (totaling 265.5 liters) was undertaken at the Puncheon Run Site (McKnight 1999b). A variety of culturally important wild plant remains were recovered, including deciduous and coniferous wood, thick-walled hickory nutshell, acorn shells, carbonized seeds, abundant non-carbonized seeds, and other miscellaneous plant materials. The remains of cultivated plants were conspicuously absent from the assemblage.

Concurrently, 27 soil samples were for analyzed for plant phytoliths, again, with disappointing results. The assemblage was dominated by truncated grass phytoliths, which generally form the "natural" phytolith background over which culturally significant phytoliths can be viewed (Rovner 2000).

Although considerable effort and resources were focused on this plant macrofossil recovery effort, our work yielded a paucity of analytically significant data in regard to vegetative catchment, extent of plant husbandry, and technologies for plant food processing and storage. Despite the site's suitability for agriculture, cultivated plant remains are absent from the assemblage, and, considering the variety of productive vegetative zones accessible from the site, edible wild plants are underrepresented.

2. *Review of Ethnohistoric Literature*

Berger's research design also included a review of the early historical literature germane to Native American plant use in the Delaware River Valley (McKnight 1999a). The ethnohistoric study provides a discussion of economically useful plant taxa documented for the region by plant type (i.e., trees, vines, and marsh plants), and by plant part (i.e., roots, nuts, and seeds). Prehistoric plant use at the Puncheon Run Site is also discussed in light of regional ethnohistoric evidence.

3. *Landscape Assessment*

It was quickly apparent that the limited results of archaeobotanical investigations and the findings generated by the literature survey were of limited utility without a landscape context in which to place them. This assessment of environmental conditions and vegetative zones composing the project area and adjacent to it provides an essential foundation for the interpretation of the potential role of plant resources in the lives of prehistoric inhabitants at the Puncheon Run Site.

Recent years have seen the emergence of the subdiscipline of landscape archaeology (Kelso and Most 1990; Yamin and Metheny 1996). This more widespread consideration of landscape within archaeological research has served to contextualize archaeological data within an ecological framework, linking cultural manifestations to natural systems and helping to define intrasite relationships on a regional level.

The definition of limits of prehistoric landscape is both essential and perplexing. For mobile or seasonally mobile groups, landscape, referring to the backdrop of the activities of one cultural group, may encompass vast areas. For archaeologists concerned with the exploration of a specific site, the archaeological site is commonly perceived as the center point of the landscape. Alternatively, the site may actually represent a hinterland to a distant cultural center, an element in a greater landscape that was accessed periodically for the exploitation of certain key physical and biological features (i.e., food or lithic materials, or sacred or ritual aspects). For example, the relationship between Puncheon Run and nearby contemporaneous settlements (i.e., Hickory Bluff Site [7K-C-411], Carey Farm Site [7K-D-3], and Island Farm Site [7K-C-13]) that shared the regional landscape is yet to be defined.

It is fundamental to our approach to interpreting landscape that a site's natural setting is an artifact that reflects cultural practice. The use of natural setting surveys as a procedure for archaeological site assessment includes the survey of site geology, topography, relief, drainage, soil morphology, biological reconnaissance, and the establishment of successional stages of vegetative communities for determining the nature and duration of previous land use.

Landscape has direct application to archaeological investigations because many alterations to the landscape are related to human activities, and these activities shape the development of subsequent vegetative communities (Cronon 1983; Watts 1975). Plant associations reflected in each ensuing succession are based on the age of dominant taxa, their rate of growth, tolerance to growth in the shade, the size of the existing plant community, the composition of plant species present, and the proximity of seed sources (Newmann and Sanford 1987). This approach has a direct application to exploring the prehistory of the Puncheon Run Site. Assessment of a site's environmental setting provides a persistent, living link between prehistoric land use, historical activities, and the physical site as it exists in the present. Appraisal of a site's natural setting provides a critical baseline environmental context from which to launch environmental reconstruction efforts.

This approach is most illustrative when applied to the assessment of historic properties, and is often less effective when used to assess prehistoric sites, simply because of the length of time since occupation, the persistence of key markers, and wholesale change (especially in areas under the plow and subject to rigorous alluvial changes, as is the case at Puncheon Run). At the Puncheon Run Site, the natural landscape has been significantly altered in almost all respects since the Woodland Period, upon which our research is focused. Forest cover, topography, and local waterways have all undergone enormous physical and biological alteration, especially over the last century. However, understanding landscape is critical to our understanding of human activities at the Puncheon Run Site.

One of the greatest obstacles to evaluating landscapes is the supposition of a "natural" condition as a beginning point for reconstructing cultural landscapes. Such an approach is problematic in that it presupposes a static state in natural systems, when in fact natural systems are never static. River fluctuations; forest growth, demise, and regeneration; epidemiology in plant and animal populations; climatological variation and episodes (including rainfall); as well as other factors all ensure that landscapes are constantly changing. This acceptance of staticity also fails to acknowledge the role of humans as prominent ecological factors in shaping the "natural" world. Native American burning practices, hunting (alteration of animal populations), the use of habitation areas and travel routes, forest clearing, and the introduction of plant species into new geographic areas all worked to alter the natural landscape. Rather than approaching landscape as a virgin canvas subsequently imposed upon by human activities, environmental assessment should acknowledge cultural forces as co-evolutionary with natural processes in landscape formation.

C. NAVIGATING THIS REPORT

This landscape analysis of the Puncheon Run Site focuses on documenting the existing ecological conditions within the project area and overlaying archaeologically indicated and ethnohistorically documented plant species of cultural importance on the local landscape. Section II provides a detailed discussion of all ecological zones contained within, and directly accessible from, the Puncheon Run Site. Plant species dominant within these ecological zones are extrapolated, and vegetative cover for the project area is loosely reconstructed based upon the available data. In Section III, the cultural landscape is overlaid upon the natural features identified in Section II. Section IV explores some ideas for site formation processes and proposes land-use (land resource use) models that focus on available vegetative catchment areas in light of the available archaeobotanical and ethnohistoric evidence and documented archaeological features.

II. LANDSCAPE CONTEXT

A. SITE DESCRIPTION

The Puncheon Run Site (7K-C-51) occupies a peninsula encompassing approximately 24 acres (9.7 hectares) at the confluence of the St. Jones River and Puncheon Run, just south of Dover in Kent County, Delaware (see Figure B-1). The Puncheon Run Site was occupied by prehistoric populations during the Woodland I (3000 BC to AD 1000) and Woodland II (AD 1000 to 1500) periods, and possibly also in the Archaic period (6000 to 3000 BC). The site is composed of a broad lithic scatter with numerous subsurface features, including fire-cracked rock clusters, lithic reduction areas, and soil anomalies, such as cylindrical storage pits and what have been hypothesized to be possible semisubterranean pit houses. This large site is not classifiable as a particular site type (i.e., procurement site or base camp); rather, the term *site* is used to describe a broad landscape that includes separate activity areas that may or may not have composed a single settlement (The Louis Berger Group, Inc. 1998:4).

1. *Physiographic Setting*

The site is located within the Upper Coastal Plain physiographic province, mid-peninsular drainage management unit (Custer 1986) (Figure B-2). The landscape of this mid-drainage zone generally lies at elevations of less than about 40 feet and occupies the middle stretches of eastward-flowing stream systems traveling towards Delaware Bay. The site occupies a peninsula formed by the St. Jones River to the east and north and Puncheon Run to the south. Nearly level upland areas of the site give way to sloping alluvial terraces, with surface elevations ranging from 10 to 30 feet (3 to 9 meters) above mean sea level across the site.

Kent County, Delaware, has a continental climate with well-defined seasons. The Delaware Bay, Chesapeake Bay, and Atlantic Ocean have an ameliorating effect on local climatic conditions. Easterly winds off Delaware Bay and the Atlantic have the effect of lowering normal summer temperature and raising normal winter temperature. Prevailing winds travel from west to northwest most of the year, but tend to be more southerly during the summer months. Annual precipitation in the vicinity of Dover averages 46 inches (117 centimeters), with monthly distribution being fairly uniform throughout the year. Agriculture is practiced throughout Kent County, and the growing season, the period between the last freezing temperature in the spring and the first freeze in the fall, averages 199 days (Matthews and Ireland 1971:2-3).

2. *Paleoecology*

DelDOT's paleoenvironmental study for the State Route 1 corridor (Kellogg and Custer 1994) provides the best source for recreating prehistoric landscape in the vicinity of the Puncheon Run Site. Dramatic climatic shifts over the past 15,000 years have effected major environmental changes on the Delmarva Peninsula. These climatic changes precipitated the Holocene transgression, which has had tremendous effects on prehistoric coastal settlements. At the onset of the Holocene epoch, the Chesapeake and Delaware Bays were large rivers, and the St. Jones River was a down-cutting system much different from the tidal estuary we know today. Data show that at the close of the Pleistocene, sea level was 300-350 feet below the present level (Kellogg and Custer 1994).

The Pleistocene glaciers exerted temperature influences on the Middle Atlantic region, and in the cooler climes of 10,000 to 15,000 years ago, the terrestrial landscape in the vicinity of the Puncheon Run Site was dominated by a largely coniferous forest composed of pine, spruce, fir, and birch (Whitehead 1965). As the glaciers receded, the forest composition shifted to a pine, spruce, birch, and alder forest, with minor components of the hardwoods oak and hickory. By 10,000 years ago, a wholesale shift to deciduous species occurred, and local forests were dominated by oak and hickory, with species such as black gum and cypress advancing from the south as warm conditions prevailed. Evolutions of this general forest type continue through the present day.

3. *Aquatic Environment*

a. *Present Conditions*

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 sites' southern periphery. The St. Jones River is a winding tidal stream, 22 miles in length, which enters Delaware Bay from the northwest 72 miles below Philadelphia and 26 miles northwest of Cape Henlopen at the mouth of the bay. 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; the site extends to within a few feet of its banks. As Puncheon Run nears the St. Jones River, it widens across a broad and shallow floodplain. The confluence of the St. Jones River and Puncheon Run is a broad freshwater marsh.

Today, the St. Jones River includes three distinct wetland communities. Near its source the river is flanked by poorly drained, wooded wetlands and freshwater swamps. The "mid-drainage zone" describes the section of the St. Jones River stretching from Dover south to Barker's Landing. The Puncheon Run Site is located in this zone. The mid-drainage zone occurs at the upstream limit of tidal influence. Here the river is very mildly salty and supports transitional marshes communities that include cattail species (*Typha* spp.), spatterdock (*Nuphar luteum*), arrowheads (*Sagittaria* spp.), marsh mallow (*Hibiscus moscheutos*), arrow arum (*Saggitaria latifolia*), and pickerel weed (*Pontederia cordata*), as well as some salt-tolerant species, such as big cordgrass (*Spartina cynosuroides*). This marsh is a very productive ecological zone and contains many economically important plant and animal species that would have been of use to 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 such as smooth cord grass (*Spartina alterniflora*), common reed (*Phragmites australis*), salt hay grass (*Spartina patens*), spike grass (*Distichlis spicata*), and black grass (*Juncus gerardii*) (Tatnall 1946; Tiner 1985).

b. River History

Sea level changes occurring since the early Holocene (circa 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 84 feet (25.5 meters) over the past 12, 000 years (Kraft 1971). This transgressive environment has caused a major shift in ecological communities occurring along the St. Jones River and in the biota that would have been available to prehistoric peoples living within its watershed.

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 effected 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 have resulted in the creation of open, unprotected soils that 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 effected 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. By the early twentieth century, the St. Jones River was heavily sedimented, and its course had become narrow and sluggish, as attests the following description by C.A.F. Flagler, Chief of Engineers for the U.S. Army Corps of Engineers: "the St. Jones River from the mouth to Lebanon flows through marsh lands, and above Lebanon to Dover through a narrow, crooked valley, widening occasionally into low, muddy flats. By natural action the river has become exceedingly crooked, and without improvement would become more so" (1908).

Sedimentation of local waterways created an impediment to navigation, the economically critical mechanism for moving farm products to market. The St. Jones River has been under improvement by the United States at various times since the 1880s, in efforts to maintain its navigability from Delaware Bay to Lebanon (a key shipping point in the late nineteenth and early twentieth centuries), and beyond to the capital city of Dover. Major projects on the river included realignment of the river channel, jetty construction, and maintenance dredging.

The original project for the improvement of the St. Jones River was begun in 1880 and was confined to work at the mouth of the river. The project was enlarged in 1884 and again in 1889 to provide for the removal of the shoals in the river to Dover to a depth of 6 feet at mean low water (United States House of Representatives 1896).

The River and Harbor Act of March 2, 1907, authorized projects along the St. Jones River to extend steamboat navigation from Lebanon to Dover and to make improvements to navigability as far as Delaware Bay. Authorization provided for a series of 16 cutoffs between Dover and the mouth of the St. Jones River; the construction of these cutoffs saved a distance of 5.9 miles of navigation between the two points (Miller 1908).

The channelization of the St. Jones River was ongoing for decades, but was largely complete by the mid-1930s. Three cutoffs (Cutoff Nos. 1, 2, and 3) were executed in the immediate vicinity of the Puncheon Run Site (Figure B-3). Cutoff No. 2 actually bisected the eastern limits of the penninsula on which the site is located, appropriating approximately 4 acres and annexing the easternmost limits of the site as an island. (This island was designated Locus 4 by Hunter Research, Inc., during their Phase I archaeological survey [Liebknecht et al. 1997]).

Channelization of the St. Jones changed both the form and the course of the river and its tributaries. After the mechanical alteration of the St. Jones, Puncheon Run emptied not into the main channel of the river, but into a meander channel, creating a more gentle convergence where reduced water speed permitted the discharge of suspended sediments. A new marshland community developed. The straightening and deepening of the main stem of the river also resulted in the regular influx of more saline waters from Delaware Bay, which had the effect of largely changing the aquatic biota. For example, prior to river channelization, a large colony of the showy American lotus (*Nelumbo lutea*) dominated the St. Jones River at Dover. After the straightening of the river, local water conditions were so changed that the lotus quickly died.

The greatest commercial use of the St. Jones River occurred during the period 1909-1913 (Pillsbury 1937), after which time commerce on the St. Jones steadily declined.

4. Soils

The Puncheon Run project area lies within the Sassafras-Fallsington association, which characterizes the central portion of Kent County, Delaware, from Smyrna south to Milford. The Sassafras-Fallsington association occupies Coastal Plain uplands and is dominated by level to gently sloping, well-drained and poorly drained soils that have a moderately permeable subsoil of sandy loam to sandy clay loam. Soils mapped for the Puncheon Run Site include Johnston silt loam, Sassafras sandy loams (ranging from 0 to 15 percent slopes), Sassafras and Evesboro soils (15 to 40 percent slopes), and swamp. Table B-1 provides a description of the soils at the Puncheon Run Site.

Table B-1: Soils of the Puncheon Run Site (7K-C-51)*

Soil Type	Description	Native forest cover	Coverage **	Loci
Johnston silt loam (Jo)	Very wet, very poorly drained floodplain soils formed in recently accumulated sediments and organic matter.	Red maple, black gum, American holly, pond pine, and water-tolerant oak species	4%	1, 2
Sassafras sandy loam, 0 to 2 percent slopes (SaA)	Deep, well-drained soils on uplands formed in very old, predominantly sandy sediments.	Mixed hardwoods with pine species common in second-growth and cut-over areas	7%	1, 3
Sassafras sandy loam, 2 to 5 percent slopes (SaB)			74%	1, 2, 3
Sassafras sandy loam, 5 to 10 percent slopes, moderately eroded (SaC2)			5%	1, 2
Sassafras sandy loam, 10 to 15 percent slopes, moderately eroded (SaD2)			3%	3
Sassafras and Evesboro soils, 15 to 40 percent slopes (SvE)			2%	3
Swamp (Sw)	Soils usually under standing freshwater, occurring along the lower courses of streams just above coastal marshes. Soil material consisting of sand, silt, clay, or muck—commonly stratified and without profile.	Water-tolerant species including red maple, American holly, sweet bay magnolia, pond pine, and black gum	5%	3, 4

* Adapted from Matthews and Ireland 1971
** Percentage estimated based on total site area.

Geologic material in the mid-drainage zone of the lower Coastal Plain region, in which the Puncheon Run Site is located, consist of variously textured, unconsolidated sediments derived from both fluvial and marine sedimentation. Within the project area, the deposits in which the soils are formed are considered to be of fluvial and terrestrial origin. Local geology consists of a mantle of Pleistocene sediments commonly referred to as the Columbia formation. The Columbia formation is composed of extensively reworked nonmarine sands and gravels deposited over the past few million years by glacial outwash. This mantle directly overlies rock from the middle of the Miocene (Pickett 1976).

Generally, soils within the Puncheon Run area can be characterized as friable and acidic, and organic preservation within this environment is fair to poor.

5. Vegetative Cover

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 frequence 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 that included such species as sweet gum, red maple, sweet bay magnolia, and pine. Cypress trees commonly grew in standing water.

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, and 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 is dominated by American beech (*Fagus americana*), pignut hickory (*Carya glabra*), mockernut hickory (*Carya tomentosa*), and a variety of oak species (*Quercus falcata*, *Q. phellos*, *Q. alba*, *Q. velutina*, *Q. rubra*), with tulip poplar (*Liriodendron tulipifera*) and black cherry (*Prunus serotina*). Understory in this area is dominated by dogwood (*Cornus florida*), arrowood (*Viburnum dentatum*), and mountain laurel (*Kalmia latifolia*).

At the time when the Puncheon Run Site was principally occupied, the landscape of the project area was vastly different. The most prominent vegetative feature was a mostly deciduous forest. Upland areas of the site would have been dominated by various oak species (*Quercus* sp.) and hickories (*Carya* sp.), with minor components of tulip poplar (*Liriodendron tulipifera*), American beech (*Fagus americana*), and American chestnut (*Castanea dentata*), and some loblolly pine (*Pinus taeda*) in the canopy. Understory species would have included dogwood (*Cornus florida*), mountain laurel (*Kalmia latifolia*), and viburnum species (*Viburnum* sp.). Stream margins would also have supported water-tolerant species, such as persimmon (*Diospyros virginiana*) and black gum (*Nyssa sylvatica*). Bald cypress (*Taxodium distichum*) trees may have occupied calm, shallow waters. Some "management" of local woodlands may have been practiced either to facilitate hunting or to clear the understory for a more effective nut harvest (Banister 1970:43; Day 1953:34; De Vries 1912:15; Lindeström 1925:213-244; Smith 1986:II:164; Strachey 1967:83). 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 would have succeeded. Floodplain areas of the site would have been periodically inundated by high water, and unique plant communities would have thrived on gravel bars. It is in these areas that plant cultivation, were it practiced, would have evolved.

6. Historical Modifications

The most obvious historical modifications to the Puncheon Run Site are the clearing of native oak-hickory forest and the use of level areas of the site for agriculture. Destruction of prehistoric features at the Puncheon Run Site has occurred as a result of plow agriculture over the entire site, except for a few small areas around the scarps leading to the St. Jones River and Puncheon Run. In addition to disruption of archaeological deposits, clearing and cultivation of the site increased erosion and had significant effects on the form and biology of local waterways.

There is evidence of late nineteenth- and early twentieth-century activities at the tip of the Puncheon Run penninsula. The northeast corner of Locus 3 (measuring approximately 0.25 acres [1,000 square meters]) was destroyed by borrow pitting at the end of the nineteenth century. Realignment of the St. Jones River during the first quarter of the twentieth century bisected the northeastern portion of the Puncheon Run Site and annexed Locus 4 as an island. Numerous borrow pits, which hail from the early twentieth century, are located at the northern limits of Locus 3.

Construction of a millpond across Puncheon Run was undertaken in the nineteenth century, with considerable impact upon the stream and its associated floodplain. The millpond berm runs northwest to southeast at roughly the interface between Loci 1 and 2. The mill lies outside the project area. The now-abandoned millpond consists of a wet swamp with seasonally standing water.

Remnants of a historical occupation are also evident at the eastern edge of the site adjacent to Puncheon Run. In this location concrete refuse is associated with naturalized garden plants, including periwinkle (*Vinca minor*) and privet (*Ligustrum vulgare*), and open-growth black walnut tree (*Juglans nigra*).

B. 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. These features provided an array of important resources for prehistoric human populations. 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 situation of the project area 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 human activity at the site for thousands of years constitutes a forceful ecological factor in creating the present landscape.

The following section details four microenvironmental zones occurring at, or immediately adjacent to, the Puncheon Run Site. Based on available evidence, these four zones have characterized the site since the middle of the Holocene, and the zones persist today in modified form. Following the descriptions of these four zones, relevant off-site ecological zones are also described, with an eye towards definition of site catchment area.

Microenvironmental zones are determined by a combination of geological, geographic, biological, and hydrological factors, and, in an ideal world, result in a characteristic floral and faunal assemblage that 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 factors that determine the delineation of the environmental zones at Puncheon Run include the following:

Geological factors. Geology, (as influenced over time by climate through the process of *weathering*) is the fundamental factor in determining the two most basic characteristics of the study area: the gross geomorphology of the site area, and, on a more localized level, the chemistry and composition of the soils that are the communicative interface between the biotic and abiotic elements of the site.

Geographic factors. At its most basic, geography, in the sense of a site's position on the earth, its distance from oceans, etc., is the driving force in the determination of climate. However, geography also determines the configuration of the microclimates on the site through *slope*, the degree to which a portion of the landscape deviates from level, and *aspect*, the direction in which the slope faces. Aspect and slope to a great degree determine the moisture of soils and consequently the associated flora.

Hydrological factors. In addition to determining the general geomorphology of the subject area through the action of fluvial sculpting of the river floodplain, *localized* hydrology plays a significant part in determining not only which portions of the site are wetlands, but also the class of wetlands and accompanying wetland biota in a particular area.

Four general microenvironmental zones at Puncheon Run are detailed in Figure B-4: 1) Coastal Plain uplands; 2) transitional slopes; 3) forested wetlands; and 4) non-forested wetlands

1. 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.

2. Transitional Slopes

The transitional zone includes the steeper slopes of the upland edge and 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 more moist 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 had, as it does today, a higher rate of erosion and a flora more characteristic of dynamic, disturbed environments.

The "edge" effect on transitional zones caused by increased lighting results in an increase of vegetative cover and creates a more productive, food-rich environment.

The transitional zone on the southern portion of the study area exhibits the best-preserved transitional slopes on the site. The current slope is probably quite similar to its prehistoric configuration, although with poorer soils and a modern component of exotic 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. 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.

3. Wetlands

Wetlands in the United States are generally classified under the U.S. Fish and Wildlife Service's National Wetlands Inventory system (Cowardin et al. 1979). Under this system, wetlands are grouped and classified by a hierarchical division based upon the general type of wetland (river, lake, swamp, etc.), the floral regime, and a series of modifiers that more exactly specify the first two factors. The general wetland type is always definitive, but the floral regime and the various modifiers may be and commonly are used in various combinations.

National Wetlands Inventory classifications for the wetlands associated with the Puncheon Run project area are shown in Figure B-5 and are described in Table B-2. The National Wetlands Inventory system relies heavily on the determination of plant indicator species for wetland classification (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 described in Table B-3.

Assignment of indicator categories for plant species documented at or associated with the Puncheon Run Site is instructive in determining past environmental conditions as well as the range of taxa utilized from different ecological zones.

Table B-2: National Wetlands Inventory Classification, Puncheon Run Site (7K-C-51)

Code	Classification
Forested Wetland	
PFO	Palustrine forested
PFO1	Palustrine forested, irregularly flooded
Non-forested Wetland	
PSS3	Palustrine shrub-scrub
R1FL	Riverine tidal flat
R1OW	Riverine open water
Open Water	General classification for Puncheon Run creek channel

Table B-3: Plant Species Indicator Categories - National Wetlands Plant List*

Code	Indicator Category	Description
OBL	Obligate Wetland	Occur almost always (estimated probability >99%) under natural conditions in wetlands
FACW	Facultative Wetland	Usually occur in wetlands (estimated probability 67-99%), but occasionally found in non-wetlands
FAC	Facultative	Equally likely to occur in wetlands or non-wetlands (estimated probability 34-66%)
FACU	Facultative Upland	Usually occur in non-wetlands (estimated probability 67-99%), but occasionally found in wetlands
UPL	Obligate Upland	May occur in wetlands in another region, but occur almost always (estimated probability >99%) under natural condition in non-wetlands in the region specified.

*Adapted from Reed 1988

It is a safe assumption that the modern wetland configuration is dramatically different from the configuration before settlement. Riverine wetlands in the Middle Atlantic Coastal Plain have undergone significant alteration with the advent of European agricultural methods, which has led to generally shallower open-water wetlands, an overall decrease in forested wetlands (from drainage and conversion), and, in fluvial (watercourse-associated) situations, an acceleration of wetland succession from floating mat, to marsh (emergent), to shrub-scrub, to forested conditions caused by siltation of waterways. Later perturbations from the re-engineering of the river channel were attempts to remedy the effects of this siltation on the navigability of the river.

Two thousand years ago, the open-water wetlands associated with the site would have been more extensive, and the materials of the river floor would have been coarser. 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 have been marsh (emergent) or floating mat.

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

a. 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. However, there has been a concurrent (albeit 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 as navigation channels clogged with farm runoff and decayed into obscurity.

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 than today. These deeper waters probably supported fewer woody species and more emergent 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.

b. Non-forested Wetlands (Emergent/Open Water/Shrub-Scrub)

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

Shrub-scrub wetlands are to some degree an intermediate form between forested wetlands and non-forested wetlands. They are dominated by woody vegetation, but they lack both 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 St. Jones. 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. Emergent wetlands in Delaware are either narrow-leaved (cattail, sweet flag) or broad-leaved (arrow arum, pickerelweed), or a combination of the two. Many marsh species have soft, edible roots that are useful as food. Emergent wetlands compose significant portions of the wetland landscape associated with the Puncheon Run Site.

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, (e.g., a lily pad) float freely atop the water surface and are connected to the substrate by flexible stalks that allow the plants to part to permit the passage of animals or debris, and to move vertically with the tide or fluctuating water levels. Today, floating mat wetlands do not occur in the near vicinity of the Puncheon Run Site. Historical records, however, indicate that American lotus (*Nelumbo lutea*) once formed the dominant wetland plant in the riverine landscape south of Dover. *Nelumbo* 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 (e.g., agriculture, construction, or river "improvement"), the evolution of wetland environments tends to move from open water, to floating mat, to emergent marsh, to shrub-scrub, to swamp—this process of wetland change is clearly apparent at Puncheon Run.

4. Relevant Off-Site Ecological Zones

Definition of site catchment area at Puncheon Run is difficult. The close proximity of the Puncheon Run Site to other contemporaneous sites (i.e., Hickory Bluff, Island Farm, and Carey Farm sites) calls for an exploration of the relationship between these part-time settlements in a local and regional procurement pattern. As it is certain that prehistoric peoples repeatedly visited the site because of the natural resources offered there, it is equally certain that they moved elsewhere to utilize other natural resources. How far did they travel from the Puncheon Run Site during their base camp stay before uprooting and moving on?

Using the river as a highway, additional off-site ecological zones could have been exploited, including the following three habitats. (1) Additional forest "edge" habitats flanked local stream banks and riverbanks and offered easily harvested berries and fruits in season. (2) Various marsh habitats were accessible from the site. Freshwater and brackish water marsh habitats vary considerably in specific vegetative components, and resources such as wild rice stands may have existed nearby. (3) The Delaware shore zone characterizes the St. Jones River south of Barker's Landing, where broad tidal marshes offer distinct salt-tolerant plant species.

In addition to off-site ecological zones accessible by water, various off-site terrestrial environments would also have been available to the residents of Puncheon Run. These would have included additional Coastal Plain uplands rich in forest resources, including mast, fruit, and berries.

C. RESULTS OF FIELD SURVEY

1. Survey Methods

Field surveys were conducted within the boundaries of the Puncheon Run project area and in adjacent waterways from July of 1998 through June of 1999. Field survey 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 unknown species, voucher specimens were secured for identification. Figure B-6 depicts existing vegetative communities associated with the Puncheon Run Site.

2. Vegetative Zones

As an overlay to the four microenvironmental zones described above, nine existing vegetative zones apparent at the site were delineated for field survey. These vegetative zones are recent in origin, and their composition is a result of historical land use and management practices. Their application to prehistoric landscape at the Puncheon Run Site is limited.

a. Open Field

A significant portion of the uplands on the site are cleared as a result of recent agricultural activity. The suite of plant species that characterizes this portion of the site is a distinctive rogue's gallery of invasive exotic species and includes only the heartiest of native species.

b. Terrace

The extant terrace zone at Puncheon Run roughly occupies the natural transitional zone described above. However, agricultural pursuits within the project area have maximized potentially cultivatable areas and portions of the transitional zone have been used for farming and maintained in an open field setting. Being exposed on both sides (the open field in addition to the water side), the existing terrace zone exhibits exaggerated elements of "edge" plant taxa.

c. Historical Signature

Historical modifications (see Section II.A.6, above) within the project area have left identifiable cultural imprints within existing plant communities.

d. Successional Forest Zone

Portions of Locus 3 support early successional forest cover dominated by black locust, sweet gum, and tulip poplar. This "successional forest zone" is confined to the northernmost limits of the site and two sections flanking the western and southern edge of Locus 3. Trees in these areas measure approximately 15 years in age and appear to be associated with a realignment of farming boundaries within the project area. It is possible that larger, more modern agricultural implements were ineffective at negotiating undulating field boundaries, and the existing field limits were determined to better accommodate modern farm machinery.

e. Old Growth Forest Remnant

The upper terrace above the Puncheon Run millpond within Locus 2 contains a mature forest remnant characteristic of the Coastal Plain upland forest described above (Section II.B.1). This existing forest community is dominated by American beech (*Fagus americana*), pignut hickory (*Carya glabra*), mockernut hickory (*Carya tomentosa*), and a variety of oak species (*Quercus falcata*, *Q. phellos*, *Q. alba*, *Q. velutina*, *Q. rubra*), with tulip poplar (*Liriodendron tulipifera*) and black cherry (*Prunus serotina*). Understory in this area is dominated by dogwood (*Cornus florida*), arrowood (*Viburnum dentatum*), and mountain laurel (*Kalmia latifolia*).

f. Swamp

The wooded wetland areas of the Puncheon Run Site today are undoubtedly more extensive than they were in prehistory. The construction of the milldam across Puncheon Run created an enhanced swamp community that persists in the present-day landscape.

g. Upper Stream Bed

The upper reaches of Puncheon Run within the project area have a closed canopy of transitional-zone trees. Extensive historical clearing to within mere feet of the streambed have created a mown floodplain habitat unique in the present landscape.

h. Emergent Freshwater Marsh

The emergent marsh community at Puncheon Run today occupies the broad floodplain of Puncheon Run as it meets the St. Jones. Dense stands of herbaceous vegetation dominate the landscape in this zone. Tuckahoe (*Peltandra virginica*), pickerel weed (*Pontederia cordata*), and golden club (*Orontium aquaticum*) grow in wide margins at the stream confluence and span the entire width of Puncheon Run further upstream.

i. Oligahaline Marsh

The very slightly salty waters of the St. Jones River at its confluence with Puncheon Run support a modified marsh environment that includes freshwater as well as some salt-tolerant plant species. In this marsh zone, pickerelweed (*Pontederia cordata*), sweet flag (*Acorus calamus*), bulrush (*Scirpus* spp.), arrowhead (*Sagittaria* spp.), spatterdock (*Nuphar luteum*), narrow-leaf cattail (*Typha angustifolia*), and broad leaf cattail (*Typha latifolia*) dominate, with dodder (*Cuscuta gronovii*), smartweed (*Polygonum* sp.), and sedges (*Carex* sp.). A shrub-scrub zone flanks the margins of this herbaceous marsh, dominated by such species as buttonbush (*Cephalanthus occidentalis*), wax myrtle (*Myrica cerifera*), and bayberry (*Myrica pensylvanica*), with willow (*Salix* sp.) and pond pine (*Pinus serotina*).

Attachment A presents dominant and indicator plant species identified during the field survey by extant vegetative zone. This list of observed species is by no means comprehensive for all taxa extant within the project area. Rather, the inventory serves to illustrate broad floral communities, with emphasis on potentially ethnobotanically useful plants.

III. DISCUSSION

A. PROCUREMENT POTENTIAL

Based on the physiographic setting and biological attributes 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. Below, the anthropogenic landscape (using knowledge derived from ethnohistoric research and archaeology) is overlaid upon the site physical and biological conditions detailed in Section II.

1. Plants of Potential Economic Significance

Data recovery efforts at the Puncheon Run site included a literature review of early ethnohistoric accounts of Native American life with regard to plant utilization. This literature survey resulted in a report detailing economically useful plant taxa documented for the Delaware River Valley (McKnight 1999a). Based on this study, a list of potentially useful and locally available plant taxa has been compiled for the Puncheon Run Site. Table B-4 shows the number of plant resources available from each microenvironment, as determined by wetland indicator category (see Section II.B.3, above). Table B-5 describes these taxa by microenvironmental zone, arranged alphabetically by genus.

Table B-4: Ethnohistorically Documented Plant Taxa by Wetland Indicator Category

Wetland Indicator Category (Code)	No. of Plant Taxa
Facultative (FAC)	26
Facultative Upland (FACW)	26
Obligate Upland (UPL)	31
Various Zones (VAR)	6
Facultative Wetland (FACW)	16

2. Plants Documented Archaeobotanically

As described in Section I (B.1), paleoethnobotanical sampling and analysis accompanied extended Phase II and Phase III archaeological investigations at the Puncheon Run Site (McKnight 1999b; Rovner 2000). The site paleoethnobotanical assemblage contains a range of useful and economically important wild plant species from prehistoric contexts, as well as (probably intrusive) non-carbonized seed species characteristic of an agricultural landscape rapidly expanding since colonial times.

One of the greatest obstacles confronting paleoethnobotanical studies is the issue of preservational bias due 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 that those foods eaten raw. Even when burned, however, not all plant material has an equal chance of being preserved. More dense plant remains (such as hickory nutshell) tend to survive longer than fragile plant remains (such as popped corn). This is a considerable bias on the Coastal Plain of Delaware, where prehistoric plant remains do not survive well within the region's coarse, acidic soils. Even among those plant remains that are burned, some plant remains will be identifiable (such as seeds, corn, and nuts) while others will be unrecognizable (such as starchy roots and fleshy fruits). Additionally, processed plant products (such as meal made from ground grains, nuts, or roots) are often invisible archaeologically. This loss of nonrandom data is of tremendous concern to archaeologists interpreting paleoethnobotanical data. While there is no adequate correction for this loss,

Table B-5: Useful Plant Resources Documented Ethnohistorically

Species	Common Name	Indicator Category*
Acer negundo	box elder	FAC
Acer rubrum	red maple	FAC
Acer Saccharinum	silver maple	FACW
Acorus calamus	sweet flag	OBL
Aesculus Hippocastanum	horse chestnut	UPL
Amelanchier arborea	shadbush, serviceberry	FAC
Amelanchier canadensis	canada serviceberry	FAC
Amaranthus sp.	pigweed	VAR
Ambrosia artemisiifolia	common ragweed	FAC
Andropogon sp.	beardgrass	VAR
Apios americana	ground nut, wild bean	FACW
Apocynum androsaemifolium	dogbane	UPL
Apocynum cannabinum	Indian hemp	FAC
Arundinaria gigantea	giant cane	FACW
Asimina triloba	paw paw	FAC
Betula nigra	river birch	FACW
Carya cordiformis	swamp hickory	FAC
Carya glabra	pignut	FACU
Carya ovata	shagbark hickory	FACU
Carya tomentosa	mockernut	UPL
Castanea dentata	American chestnut	UPL
Castanea pumila	chinquapin	UPL
Chamaecyparis thyoides	Atlantic white cedar	OBL
Chenopodium sp.	goosefoot	VAR
Cornus florida	common dogwood	FACU
Corylus americana	hazelnut	FAC
Dioscorea villosa	wild yam	FAC
Diospyros virginiana	persimmon	FAC
Fagus grandifolia	American beech	FACU
Fragaria virginiana	wild strawberry	UPL
Fraxinus americana	white ash	FACU
Fraxinus nigra	black ash	OBL
Gleditsia triacanthos	honeylocust	FAC
Hamamelis virginiana	witch hazel	FAC
Helianthus annuus	sunflower	UPL
Hierochloe odorata	holy grass, sweet grass	FACW
Humulus lupulus	common hop	UPL
Ipomoea pandurata	wild sweet potato	UPL
Iva annuua	sumpweed	FAC
Juglans nigra	black walnut	UPL
Juniperus virginiana	eastern red cedar	FACU
Laportea canadensis	wood nettle	FACW
Lilium supurbum	Turks cap lily	FACW
Liquidambar styraciflua	sweet gum	FAC
Liriodendron tulipifera	tulip poplar, yellow poplar	FACU
Lithospermum caroliniense	puccoon, Indian paint	UPL

Table B-5 (continued)

Species	Common Name	Indicator Category*
Morus rubra	red mulberry	FACU
Myrica cerifera	wax-myrtle, candleberry	FAC
Myrica pensylvanica	bayberry, candleberry	FAC
Nelumbo lutea	American lotus, lotus lily, water chinquapin, yellow lotus	OBL
Nyssa sylvatica	black gum	FAC
Opuntia humifusa	prickly pear, Indian fig	UPL
Orontium aquaticum	golden club	OBL
Passiflora incarnata	maypop, passion flower, passion vine	UPL
Peltandra virginica	arrow arum	OBL
Phytolacca americana	poke	FAC
Pinus echinata	short leaf pine	UPL
Pinus rigida	pitch pine	FACU
Pinus serotina	pond pine	OBL
Pinus strobus	eastern white pine	FACU
Pinus taeda	loblolly pine	FAC
Pinus virginiana	Virginia pine	UPL
Platanus occidentalis	sycamore	FACW
Podophyllum peltatum	may apple, mandrake, Indian apple, ground lemon	FACU
Pontedaria cordata	pickerelweed, tuckahoe	OBL
Prenanthes alba	white lettuce, rattlesnake root	FACU
Prunus alleghaniensis	Alleghany plum, sloe	UPL
Prunus americana	American wild plum	FACU
Prunus angustifolia	chickasaw plum	UPL
Prunus maritima	beach plum	UPL
Prunus persica	peach	UPL
Prunus virginiana	common chokecherry	FACU
Prunus serotina	black cherry	FACU
Pyrus coronaria	wild crab apple	UPL
Quercus alba	white oak	FACU
Quercus bicolor	swamp white oak	FACW
Quercus coccinea	scarlet oak	UPL
Quercus falcata	southern red oak	FACU
Quercus nigra	water oak	FAC
Quercus palustris	pin oak	FACW
Quercus Phellos	willow oak	FAC
Quercus prinus	chestnut oak	UPL
Quercus rubra	northern red oak	FACU
Quercus stellata	post oak	UPL
Quercus velutina	black oak	UPL
Ribes cynosbati	prickley gooseberry, dogbery	UPL
Ribes americanum	wild black currant	FACW
Ribes rotundifolium	Eastern wild gooseberry	UPL
Robinia pseudoacacia	black locust	FACU
Rubus sp.	raspberries, blackberries	VAR

Table B-5 (continued)

Species	Common Name	Indicator Category*
Saggitaria latifolia	arrowhead	OBL
Salix sp.	willow	VAR
Sanguinaria canadensis	blood root, puccoon root, red puccoon	NI
Sanicula gregaria	sanicula, clustered snakeroot	FACU
Sassafras albidum	sassafras	FACU
Smilax laurifolia	bamboo vine	OBL
Smilax pseudo-china	China-root, China briar	FAC
Taxodium distichum	bald cypress	OBL
Tilia americana	basswood, American linden	FACU
Typha angustifolia	narrow leaf cat tail	OBL
Typha latifolia	broad leaf cat tail	OBL
Ulmus americana	American elm	FACW
Ulmus rubra	slippery elm	FAC
Urtica dioica spp. *gracilis*	stinging nettle	FACU
Urtica gracilis	wild nettle	FACU
Vaccinium angustifolium	low sweet blueberry	FACW
Vaccinium atrococcum	black highbush blueberry	UPL
Vaccinium caesariense	New Jersey blueberry	OBL
Vaccinium corymbosum	highbush blueberry	FACW
Vaccinium macrocarpon	American cranberry	OBL
Vaccinium vacillans	low blueberry	UPL
Viburnum recognitum	smooth arrow-wood	FACW
Vitis aestivalis	summer or pidgeon grape	FACU
Vitis Labrusca	fox grape	FACU
Vitis riparia	riverbank grape	FACW
Vitis rotundifolia	muscadine grape	FAC
Vitis vulpina	winter or chicken grape	FAC
Xanthoxylum americanum	prickley ash, toothache tree, suterberry	UPL
Yucca filamentosa	Spanish bayonet, Adam's needle	UPL
Zizania aquatica	wild rice	OBL

* Indicator categories described in Table B-3. The code VAR indicates that species within the particular genus or family occupy a range of habitats.

it is important that it is acknowledged when extrapolating prehistoric plant use based on archaeological plant remains. Therefore, although the archaeobotanical assemblage secured from Puncheon Run includes a myriad of plant taxa, 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.

Table B-6 shows the relative percentage of archaeologically documented plant resources from each microenvironment identified at Puncheon Run, as determined by wetland indicator category (see Section II.B.3, above). Table B-7 provides a list of all taxa recovered archaeologically, through soil flotation, phytolith extraction, and in hand-collected carbon samples. The list is arranged alphabetically by genus and species. Table B-7 also provides information on the plant part recovered, the recovery technique, and the microenvironmental classification for each taxon. Below, taxa with probable prehistoric economic importance are detailed.

Table B-6: Archaeologically Documented Plant Taxa by Wetland Indicator Category	
Wetland Indicator Category	**No. of Plant Taxa**
Obligate Wetland (OBL)	2
Facultative (FAC)	8
Facultative Upland (FACU)	9
Obligate Upland (UBL)	10
Various Zones (VAR)	21

a. Maple (Acer sp.)

Native maple species have a tremendous north-south range throughout the eastern United States, and red maple (*Acer rubrum*), box elder (*Acer negundo*), and silver maple (*A. saccharinum*) are thought to be native to Delaware's Coastal Plain forests (Little 1980:578). Hariot's early historical accounts from Virginia mention the use of maple wood for fashioning bows (1893:34). An extract from red maple bark was used to make ink and fiber dye (Little 1980:578).

b. Pigweed (Amaranthus sp.)

Amaranthus species are starchy-seeded annual (or rarely perennial) herbs common to open settings. Species of amaranth, or pigweed, are opportunistic, weedy herbs that are abundant in cultivated fields and waste places. The seeds are very durable in the soil and remain viable for years (Brown and Brown 1984:425-427).

Many wild Amaranth species are native to the Atlantic Coastal Plain, and recent research suggests that a variety of now-extirpated quasi cultivars were once grown in the pre-maize gardens of Native Americans (Yarnell 1987). The recovery of large caches of amaranth seeds from archaeological contexts has established the plant's economic significance to prehistoric populations throughout much of the Eastern Woodlands of North America. However, little archaeobotanical documentation exists for the Atlantic Coastal Plain, where many early ethnohistoric accounts were focused. A single historical reference by Thomas Hariot to a cultivated herb called melden quite possibly refers to a domesticated amaranth cultivated by coastal Algonquian cultures (Sturtevant 1965:64-65):

> There is an herbe which in Dutch is called Melden. Some of those that I describe it unto, take it to be a kinde of Orage; it groweth about foure or five foote high; of the seede thereof they make a thicke broth, and pottage of a very good taste; of the stalke by burning into ashes they make a kinde of salt earth, wherewithall many use sometimes to season their brothes; other salte they knowe not. Wee ourselves, used the leaves also for pothearbes [Hariot 1893:22-23].

c. Common Ragweed (Ambrosia artemisiifolia)

Ambrosia artemisiifolia is a coarse, annual species common to open environments (Brown and Brown 1984:989). It bears an edible seed, and its leaves and stem have medicinal applications.

Seeds of the giant ragweed (*Ambrosia trifida*) have been recovered archaeologically, and it is supposed that the species was a quasi-cultivated grain plant in the Midwest (Yarnell 1987). *A. artemisiifolia* was used medicinally by the Delaware as a poultice to prevent blood poisoning (Tantaquidgeon 1972:35).

d. Birch (Betula sp.)

Birch are deciduous trees with slender twigs, common to rich woodlands. Five species are native to the Eastern Woodlands, occurring in specific environmental conditions. The river birch (*Betula nigra*) is the only birch species native to the Puncheon Run project area. *B. nigra* is the southernmost New World birch and is found from southwestern Connecticut south to northern Florida, west to east Texas, and north to southeastern Minnesota, and locally in Massachusetts and southern New Hampshire to 1,000 feet, and in the southern Appalachians to 2,500 feet.

Table B-7: Plant Taxa Documented Archaeologically at the Puncheon Run Site (7K-C-51)

Taxa	Common Name	Part Recovered	Carbonized/ Non-Carbonized	Native/ Non-Native	Recovery Technique	Indicator Category*
AMARANTHACEAE	pigweed	seed	non-carbonized	native	flotation	VAR
Acalypha virginica	copperleaf	seed	carbonized	native	flotation	UPL
Acer sp.	maple	wood	carbonized	native	flotation	VAR
Acer/Betula	maple/birch	wood	carbonized	native	flotation	VAR
Amaranthus sp.	pigweed	seed	non-carbonized	native	flotation	VAR
Ambrosia artemisiifolia	common ragweed	seed	non-carbonized	native	flotation	FAC
Carya sp.	hickory	wood, nutshell	carbonized	native	flotation, hand-recovered	VAR
Castanea dentata	American chestnut	wood	carbonized	native	flotation	UPL
Chenopodium sp.	goosefoot	seed	carbonized, non-carbonized	native	flotation	VAR
Cornus florida	flowering dogwood	wood	carbonized	native	flotation	FACU
Crotolaria sagittalis	rattlebox	seed	non-carbonized	native	flotation	FACU
Diospyros virginiana	persimmon	wood	carbonized	native	flotation	FAC
Eleusine indica	goosegrass	seed	non-carbonized	exotic	flotation	UPL
Euphorbia sp.	spurge	seed	non-carbonized	exotic/ native	flotation	VAR
Fragaria sp.	strawberry	seed	non-carbonized	native	flotation	UPL
Fraxinus sp.	ash	wood	carbonized	native	flotation	VAR
Ilex opaca	holly	wood	carbonized	native	flotation	FACU
Juglans nigra	black walnut	wood	carbonized	native	flotation	FACU
Lactuca serriola	wild lettuce	seed	non-carbonized	exotic	flotation	FACU
Lespedeza sp.	lespedeza	seed	non-carbonized	exotic/native	flotation	VAR
LEGUMINOSAE	bean	seed	non-carbonized	exotic/native	flotation	VAR
Liquidambar styraciflua	sweet gum	wood	carbonized	native	flotation	FAC
Liriodendron tulipifera	tulip poplar	wood	carbonized	native	flotation	FACU
Mollugo verticillata	carpetweed	seed	non-carbonized	native**	flotation	FAC
Morus rubra	red mulberry	wood	carbonized	native	flotation	FACU
Myrica sp.	bayberry	seed	non-carbonized	native	flotation	FAC
Nelumbo lutea (?)	American lotus	seed	carbonized	native***	flotation	OBL
Oxalis stricta	wood sorrel	seed	non-carbonized	native	flotation	UPL
POCEAE	grass	seed	carbonized, non-carbonized	exotic/ native	flotation, phytolith	VAR
Panicum sp.	panic grass	seed	non-carbonized	exotic/ native	flotation	VAR
Phytolacca americana	poke	seed	carbonized, non-carbonized	native	flotation, hand-recovered	FAC
Pinus sp.	so. pine group	wood	carbonized	native	flotation	VAR
Polygonum pensylvanicum	knotweed	seed	non-carbonized	native	flotation	OBL
Polygonum sp.	knotweed	seed	carbonized, non-carbonized	native	flotation	VAR
Polygonum/Rumex	knotweed/dock	seed	non-carbonized	native	flotation	VAR
Prunus serotina	black cherry	wood, seed	carbonized, non-carbonized	native	flotation	FACU
Quercus sp.	red oak group	wood	carbonized	native	flotation	VAR
Quercus sp.	white oak group	wood	carbonized	native	flotation	VAR
Quercus sp.	oak	wood, nutshell	carbonized	native	flotation	VAR
Robinia pseudoacacia	black locust	wood	carbonized	native	flotation	UPL

Table B-7 (continued)

Taxa	Common Name	Part Recovered	Carbonized/ Non-Carbonized	Native/ Non-Native	Recovery Technique	Indicator Category*
Rubus sp.	raspberry/blackberry	seed	non-carbonized	native	flotation	VAR
Rumex sp.	dock	seed	carbonized	native	flotation	VAR
Sambucus canadensis	elder	seed	non-carbonized	native	flotation	FAC
Sassafras albidum	sassafras	wood	carbonized	native	flotation	FACU
Solanum rostratum	buffalobur	seed	non-carbonized	exotic	flotation	UPL
Stellaria media	chickweed	seed	carbonized, non-carbonized	exotic	flotation	FAC
Trifolium sp.	clover	seed	non-carbonized	exotic	flotation	UPL
Vicia sp.	vetch	seed	non-carbonized	exotic/native	flotation	UPL
Vitis labrusca	fox grape	seed	non-carbonized	native	flotation	FAC
Vitis sp.	grape	seed	non-carbonized	native	flotation	VAR

✳ Indicator categories described in Table B-3. 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.

B. papyrifera (paper birch) is native across North America from northwestern Alaska east to Labrador, south to New York, and west to Oregon. It is from this species that bark canoes were constructed. Sheets of birch bark stripped from live trees was stretched over wooden frames and sewn together with the roots of Tamarack or some cordage; the gaps were sealed with pitch. Campanius (Du Ponceau 1834:130) mentions the construction of birch-bark canoes, and Beverley details the construction of birch-bark canoes during travel (1705:186). Paper birch would not have been locally available to the prehistoric inhabitants of Puncheon Run.

e. Hickory (Carya sp.)

The hickories (*Carya* sp.) include a variety of native species divided generally into two types, the "true" or "thick-walled" hickories, and the "pecan" or "thin-walled" hickories (Panshin and deZeeuw 1980:541). Only the thick-walled hickories occur in the Middle Atlantic region, and four of these species are native to Delaware's Coastal Plain: *C. cordiformis* (bitternut), *C. glabra* (pignut), *C. ovata* (shagbark hickory), and *C. tomentosa* (mockernut). These species occupy a variety of ecological zones and produce a heavy nut crop that ripens during September and October (Munson 1986). A dominant tree in the Eastern Woodlands (Eyre 1980), the prevalence of hickory trees in the virgin forests of the eastern United States is noted by Hariot: " . . . there are vary many walnuts; we saw some growing above fourscore feet, straight and without a bough. They make excellent timber four or five fathoms long" (Lorant 1946:256).

The prevalence of hickory remains from prehistoric archaeological contexts attests to the importance of the species to human subsistence, and the accessability of the resource to local populations. Hickory nutmeats offer a high-protein, high-fat and low-carbohydrate storable food (Wainio and Forbes 1941:634). Hickory nuts (often referred to as "walnuts") are mentioned in early historical accounts of Algonquian diets (Beverly 1705:132, 181; Hariot 1893:27-28; Lawson 1952:101; Lorant 1946:250; Quinn 1991:351; Smith 1986:I:152). The preparation of hickory milk was noted in early ethnohistoric accounts:

> . . . Besides their eating of them after our ordinarie maner, they breake them with stones and pound them in morters with water to make a milk which they use to put into some sorts of their spoonmeate; also among their sodde wheat, peaze, beanes and pompoins which maketh them have a farre more pleasant taste [Hariot 1893:27-28].

> The kernels of the Hiccories they beat in an Mortar with Water, and make a White Liquor like Milk, from whence they call our Milk Hickory [Beverly 1705:181].

> After they put it into a morter of wood, and beat it very small: that done they mix it with water, that the shels may sinke to the bottome. This water will be coloured as milke, which they cal Pawcohiscora, and keepe it for their use [Smith 1986:I:152].

Hickory wood is unsurpassed in its qualities of strength, hardness, and resiliency (Panshin and deZeeuw (1980:543), and was used to manufacture tools, containers, and utensils.

> There is another sort, which we call the red Hiccory, the Heart thereof being very red, firm and durable; of which Walking-Sticks, Mortars, Pestils, and several other fine Turnery-wares are made; The third is called the Flaying-barked Hiccory, from its brittle and scaly Bark. It bears a Nut with a bitter Kernel, and a soft Shell, like a French Walnut [Lawson 1952:101].

Hickory wood also has a high caloric value and serves as an excellent firewood (Graves 1919).

f. American Chestnut (Castanea dentata)

The American chestnut (*Castanea dentata*) was once a major component in the oak/chestnut forest dominating Piedmont areas of the Middle Atlantic region, and a minor component in oak/hickory forests of the Coastal Plain. Early historical accounts of tidewater Virginia mention the great abundance of American chestnut trees in some areas. American chestnut is nearly extinct today due to the ravages of the chestnut blight, a disease caused by the ascomycete fungus, *Cryphonectria parasitica*. The fungus was introduced to New York City in 1904 and quickly decimated the American chestnut throughout the Eastern Woodlands of the United States (Little 1980).

Descriptions of the preparation and consumption of chestnuts by Native Americans include eating the nuts raw or crushed and boiling them to extract the oil; the boiled nutmeats were used to make a bread dough (Force 1836-1846:II:27, 34; Hariot 1893:27; Lorant 1946:250; Smith 1986:I:153). Historically, chestnut lumber made durable fenceposts and lasting rails, and was used in the construction of homes and outbuildings. The species also provided the principal domestic source of tannin, used in the preparation of animal hides for leather. The species is poor as a fuel source (Graves 1919).

Chestnut was used ceremonially in the treatment of the dead in Delaware society during the mid-seventeenth century: “Now when this time has passed (one month) . . . each one takes a knife and thus cuts the flesh off the bones of the dead one, wrapping the flesh in chestnut bark, which they place on the second shelf or rack, wrapping in like manner the bones into chestnut bark . . .” (Lindeström 1925:250).

Chestnut bark was also used in home construction.

g. Goosefoot (Chenopodium sp.)

Goosefoot is a starchy-seeded annual or perennial herb common to a variety of open field and forest-edge settings. Goosefoot is an opportunistic, weedy species that quickly establishes itself on disturbed soils, such as those created on frequently inundated floodplains, cultivated fields, and roadsides (Brown and Brown 1984). Goosefoot bears an edible starchy seed, and the greens and stems are also comestible (Medsger 1966:129).

The recovery of goosefoot seeds from archaeological contexts has established the plant's economic significance to prehistoric populations throughout eastern North America. It is hypothesized that *Chenopodium* flourished in open areas created by humans, with the plant colonizing disturbed, open habitats created by sedentary or semisedentary populations (Anderson 1952; Heiser 1949; Smith 1984). In addition to the archaeological recovery of wild *Chenopodium* seeds, a gradual increase in *Chenopodium* achene size and seed coat thickness has been documented archaeobotanically, providing evidence for its prehistoric domestication (Asch and Asch 1977; Smith 1984).

The only historical account that *clearly* features the cultivation and use of small native grains is from far beyond the Puncheon Run project area. Antoine Simon Le Page du Pratz's observations of the Natchez area of the Lower Mississippi from the early eighteenth century (Le Page du Pratz 1758) describe the cultivation of the grain *Choupichoul*. The identification of *Choupichoul* has long eluded scholars, and over the years it has been speculated to be a kind of millet, a species of orach (buckwheat) (*Atriplex* spp.) (Asch and Asch 1977:97), cockspur (*Echinochloa crusgalli*) (Swanton 1911:76, 1946:291), or maygrass (*Phalaris caroliniana*) (Yarnell 1972:10). Recent research (Smith 1992) suggests that *Choupichoul* is actually *Chenopodium berlandieri*. This identification seems most probable in light of recent archaeobotanical data and field studies of the growth habit of modern stands of *C. berlandieri* in the lower Mississippi River valley.

The *Chenopodium* seeds recovered from archaeological contexts at Puncheon Run appear to be of a wild type, each having a thick testa measuring more than 50 microns in thickness (Smith 1985).

h. Common Dogwood (Cornus florida)

This small, flowering tree with a short trunk and spreading crown is a common understory species in deciduous forests. The wood is hard, close-grained, nearly white (Brown and Brown 1972), and extremely shock resistant, making it useful for fashioning small implements and utensils (Panshin and deZeeuw 1980:618). A red dye can be produced from dogwood root (Little 1980), and a black ink can be produced with the bark. The bark of the root, stem, and branches was used historically as a tonic, astringent, antiseptic, corroborant, and stimulant. This powdered bark had medicinal uses in treating fevers, typhus, and febrile disorders, as well as in veterinary applications (Erichsen-Brown 1979:141) and treatments against worms (Lawson 1952:96). Zeisberger, writing of the Delaware Indians, stated that "dogwood is also found in these parts. The rind of the root is used in the apothecary shops in place of Jesuit-bark (quinine)" (1779:133).

i. Persimmon (Diospyros virginiana)

This native tree would have been common to moist alluvial soils of Delaware's Coastal Plain in pre-colonial times. Persimmon wood exhibits inherent hardness, strength, and toughness, and it has the unique ability to stay smooth under friction, making it well suited for various kinds of tool manufacture and construction (Panshin and deZeeuw 1980:621). The date-like fruit of the persimmon was a dietary staple of historic Native American populations. Persimmon fruits are the *putchamins* observed by Captain John Smith (Smith 1986:I:151, 152) and the *pessemmins* noted by Strachey (1967:120). The persimmon was called the Indian plum by Hariot (Quinn 1991), Smith (1986), Purchas (1613, 1625), and de Laet (1633). The fruits were eaten fresh during the months of October and November when they ripen, and were dried and stored for later use (Smith 1986:I:152).

> . . . I must own that those who praised this fruit as an agreeable one have but done it justice. It really deserves a place among the most palatable fruits of this land, when the frost has entirely removed its bitterness [Kalm 1966:69].

j. Strawberry (Fragaria sp.)

Strawberry species are low, perennial plants that spread by runners. The wild strawberry (*Fragaria virginiana*) is native to the Puncheon Run project area, growing in open fields and woodland borders (Brown and Brown 1984:539). The red, pulpy berries are ripe in June or July and can be eaten fresh or dried (Medsger 1966:20-21). The root is astringent, and decoctions and teas made from it were used medicinally by historic Native American groups (Erichsen-Brown 1979:465-466).

k. Ash (Fraxinus sp.)

Ash is a group of deciduous trees with a furrowed bark. The fruit is a winged samara, and the seeds are eaten by wildlife (Brown and Brown 1972:278). White ash (*F. Americana*) and green ash (*F. Pennsylvanica*) are both native to Delaware's Coastal Plain.

The fine working qualities and strength of ash made it useful to Native Americans for manufacturing tools and containers (Hariot 1893:34). The bark was commonly used in aboriginal home construction, and the inner bark was a popular basket material. Ash was also important medicinally (Erichsen-Brown 1979:84).

l. American Holly (Ilex opaca)

Deciduous evergreen tree common in moist, sandy woodlands of the Coastal Plain (Brown and Brown 1972:203-204). Holly wood is close grained, pale, and of medium density. The red berries ripen in May and June, and are an important food source for wildlife.

m. Black Walnut (Juglans nigra)

Black walnut is a tree common to upland forests on Delaware's Coastal Plain. The unique purple-brown timber has a curious odor and taste, from which its nickname, "gumwood," is derived (Constantine 1959:318; Edlin 1969:156-157; Panshin and deZeeuw 1980:540). Black walnut meats were heavily relied upon and favored by historic Indian tribes throughout the range of the species (Gilmore 1919:74; Yanovsky 1936:17). Hariot comments on the use of black walnuts in his early accounts of Virginia: "the kernels of the fruit are very oily and sweet. The inhabitants either eat them or make a milk of them by breaking the nuts with stones and grinding the powder in a mortar with water. This they add to their spoon-meat, their boiled wheat, pease, beans, and pumpkins, thus giving the food a far more pleasant taste" (Lorant 1946:250). Nutmeats would have been available for harvest during September and October from local woodlands (Wainio and Forbes 1941:628). Husks of the black walnut provide a rich, durable purple/brown dye for fabric, leather, and basketry (Brooklyn Botanic Garden 1964:29).

Uses of *J. nigra* among the historic Delaware are many. Black walnut bark was used in home construction. Juice from the green hull of the fruits was used topically to treat ringworm, and the sap was used in applications for inflamation. Tea made from the bark was administered to remove intestinal bile (Tantaquidgeon 1972:29). In Oklahoma, the Delaware used the sap, green fruit hulls, and bark for similar purposes, and leaves were scattered about living quarters to dispel fleas (Tantaquidgeon 1942:24, 76). Crushed walnut or walnut bark was cast in the water to stupefy fish by the Delaware of Oklahoma (Harringon 1913:222), and traditionally by the Pamonkey, Mattaponi, and Chickahomini (Speck 1927:364-365).

n. Sweet Gum (Liquidambar styraciflua)

Sweet gum is a common forest component throughout the Coastal Plain of the Delmarva Peninsula (Eyre 1980; Society of American Foresters 1954). The species is common to moist soils of valleys and lower slopes in mixed woodlands, and is often a pioneer after logging or in old fields (Little 1980).

A gum obtained from the trunk of the sweet gum tree was used medicinally as well as for chewing gum, from which the species earned its common name.

o. Tulip Poplar, Yellow Poplar (Liriodendron tulipifera)

Tulip poplar is a native, deciduous tree common to the Coastal Plain of Delaware. The wood is soft, and the heartwood is yellowish to olive, light, and easily worked. The timber is not durable in contact with the soil (Brown and Brown 1972:107). The tree grows tall and straight without branching, making it well suited for the construction of log canoes.

> Rakíok, a kind of trees so called that are sweet wood of which the inhabitans that were neere unto us doe commonly make their boats or Canoes of the form of trowes; only with the helpe of fire, hatchets of stones, and shel; we have known some so great being made in that sort of one tree that they have carried well xx. men at once, besides much baggage: the timber being great, tal, streight, soft, light, & yet tough enough I thinke (besides other uses) to be fit also for masts of ships [Hariot 1893:34].

> The Tulip-Trees, which are, by the Planters, called Poplars, as nearest approaching that Wood in Grain grow to a prodigious Bigness, some of them having been found One and twenty foot in Circumference. I have been informed of a Tulip-Tree, that was ten Foot Diameter; and another wherin a lusty Man had his Bed and Household Furniture, and lived in it till his Labour got him a more fashionable Mansion. He afterwards became a noted Man in his Country for Wealth and Conduct. One of these sorts bears a white Tulip, the other a party-coloured, mottled one. The Wood makes very pretty Wainscott Shingles for Houses, and Planks for several Uses. It is reckoned very lasting, especially under-Ground for Mill-Work. The Buds made into an Ointment, cure Scalds, Inflamations, and Burns . . . as a proper remedy . . . for Distemper [Lawson 1952:96, 237].

Tulip poplar was also important in aboriginal home construction.

p. Red Mulberry (Morus rubra)

This native tree has a scattered distribution throughout the Atlantic Coastal Plain, occurring in rich woods and sometimes in fields (Brown and Brown 1972:93; Peattie 1991). The tree bears numerous small fruits that form a multiple fruit that ripens in June or July. The fruits are edible and delicious fresh or dried (Medsger 1966). The fruits are also a favorite food for many songbirds who aid in propagating the trees along field edges and fencelines. Historic Native American tribes used the pliable young shoots of the mulberry tree as a basket material and for weaving heavy garments (Densmore 1974). Early accounts of the natives of Louisiana (Le Page du Pratz 1758) mention the manufacture of cloaks from the pounded inner bark of young mulberry shoots. Mulberry wood was used to manufacture bows by the native peoples of the Carolinas (Lawson 1952:105-106). Mulberry wood and bark was also used in aboriginal home construction (Smith 1986:I:151).

Beverly and Lawson mention of three kinds of mulberries in Virginia, although only one, *M. rubra*, is native. The white mulberry (*M. alba*) was introduced to the New World from England during the colonial period, in an unsuccessful effort to establish a silk trade in the colonies.

> Our Mulberries are of Three sorts, two Black and one White; the long Black sort are the best, being about he Bigness of a Boy's Thumb; the other Two sorts are the Shape of the English Mulberry, short and thick, but their Taste does not so generally please, being of a faintish Sweet, without any Tartness. They grow upon well spread, large bodied Trees, which run up surpizingly fast [Beverly 1705:130-131].

> We have three sorts of Mulberries, besides the different Bigness of some Trees' Fruit. The first is the common red Mulberry, whose Fruit is the earliest we have (except the Strawberries) and very sweet. These Trees make a very fine Shade to sit under in Summer-time. They are found wild in great Quantities, wherever the Land is light and rich; yet their Fruits is much better when they stand open. They are used instead of Raisins and Currants, and make several pretty Kickshaws. They yield a transparent Crimson Liquor, which would make a good Wine; but few People's Inclinations in this Country tend that way. The others are a smooth leaved Mulberry, fit for the Silk-Worm. One bears a white Fruit, which is common; the other bears a small black Berry, very sweet. They would persuade me there, that the black Mulberry with the Silk-Worm smooth leaf, was a white Mulberry, and changed its Fruit. The Wood herof is very durable, and where the Indians cannot get Locust, they make use of this to make their Bows. This Tree grows extraordinary round and pleasant to the eye [Lawson 1952:105-106].

q. Bayberry (Myrica sp.)

Myrica pensylvanica and *M. cerifera* are deciduous to partly evergreen shrubs that bear fruits that mature into clusters of globose, bluish-white, hard, waxy drupes. These fruits were boiled to extract scented wax for use in candles and medicines (Brown and Brown 1972:43-44). Both species are common on the Coastal Plain of Delaware. *M. pensylvanica* prefers dunes and poor, dry soils, whereas *M. cerifera* grows in sandy swamps or wet woods.

Beverly (1705:137-138) and Lawson (1952:91) mention making candles from *M. pensylvanica*, but it is unclear whether they refer to a colonial or Native American practice.

r. American Lotus (Nelumbo lutea)

Nelumbo lutea is a native aquatic herb with fleshy rhizomes that grows in isolated populations in quiet freshwater (Brown and Brown 1984:459). The starchy seeds, shoots, and rhizomes are edible. Rafinesque states that the long, creeping roots are acrimonious when fresh, a condition that was remedied by local Indians through repeated washings prior to consumption (1817:23).

No ethnohistoric documentation of the use of *N. lutea* by the natives along the eastern seaboard of North America has been located. The paucity of data in support of the use of the plant by the Native Americans of the Delaware region may be due to the isolated and patchy distribution of the species.

Nineteenth- and twentieth-century ethnographic accounts of the consumption of *N. lutea* shoots, rhizomes, and seeds among Midwest and Great Lakes Indians are plentiful. The Comanche boiled the roots for food (Carlson and Jones 1940:523); the Dakota made soup with the hulled seeds combined with meat, and cooked peeled tubers with meat or hominy (Gilmore 1919:79). The Huron Indians considered *N. lutea* a starvation food when it was used along with acorns (Aller 1954:63); the Meskwaki cooked the seeds with corn, and cut terminal shoots crosswise and strung them on strings to be dried for use in the winter (Smith 1928:262). The Ojibwa Indians roasted the seeds in their hulls and ground them into a sweet meal, and cooked the shoots with venison, corn, or beans (Smith 1932:407). The Omaha Indians peeled the tubers and cooked them with meat or hominy (Gilmore 1919:70), or boiled the roots to eat as vegetables (Fletcher and La Flesche 1911:341).

The Pawnee hulled the seeds and used them with meat to make soup, or peeled the tubers and cooked them with meat or hominy (Gilmore 1919:79); the Ponca also used the hulled nuts in combination with other ingredients to make soup, and boiled the tubers with meat or hominy (Gilmore 1919:79). The Potawatomi gathered the seeds to be roasted like chestnuts, and cut, strung, and dried roots for winter use (Smith 1933:105). The Winnebago made soup from the seeds, and boiled lotus tubers with meat or corn (Gilmore 1919:79).

Archaeobotanical data in support of the use of *N. lutea* on the eastern seaboard are limited. A single lotus seed coat fragment was tentatively identified in Feature 66 (Locus 1) at the Puncheon Run Site. An entire charred seed was recovered from Slaughter Creek Phase contexts at the Hughes-Willis Site (Thomas et al. 1975).

A large population of American lotus once grew at Dover, Delaware, in the St. Jones River (Plate B-1). During the Victorian era, these famous "lotus lilies" were quite a tourist attraction, especially during the third week of August, when the lilies were in full bloom. Local legend held that the lilies originated in China and India, and were mysteriously transplanted to the St. Jones (Bragg 1980:164).

The St. Jones lilies are described in some detail in the diaries and memoirs of J. Alexander Fulton, 1865-1900:

> It is frequently said, but no one pretends to know how truly, that there are only a few places in the United States where the Lotus is indigenous, and that St. Jones Creek is one of them. Their rarity makes them especially interesting, particularly to visitors from other places and, as the beds are accessible only by water, a trip down the creek by boat is always a pleasant diversion and a lovely sight when the flowers are in bloom. There are small beds at different locations, but the finest display is at the mouth of a branch between Moore's Mill tract and the Hunn "Wild Cat Manor" farm, where there were acres of them without a break.
>
> The flower is white with a yellow center. It grows upon a single stem which is rooted on the bottom and varies in length according to the depth of the water. The stem is brownish in color, somewhat ropelike and supple in texture, and frequently grows to fifty inches in length. In picking, if pulled by the flower, the stem will break shortly below it, but, if grasped by two hands farther down, it will break at the bottom. The leaves are very large, rarely less than 12 inches and sometimes as large as 24 inches in diameter, and are dark green in color. In the beds where they are thick, and while growing, they hold up above the water and the edge stands at different angles but, when thinly set, they lie flat on the water and rise and fall with the tide. At that point the tide rises about fifteen inches, is still fresh and does not get brakish for a couple of miles lower down. The flower itself has five bottom or stem leaves and twenty four flower leaves proper. These are about four inches long and one and three quarter inches wide and are pure white. The seed head in the center, about one and one half inches in diameter and bright yellow in color, combined with the white petals, forms a very handsome blossom, and combined with and resting among the large green leaves, furnishes a beautiful and unusual spectacle when seen in such numbers [Fulton n.d.:69-70].

The St. Jones lilies are now nearly extinct, except for a small group of the plants off Lotus Lane in the vicinity of the Puncheon Run Site (William McAvoy, personal communication 1998). The population of *N. lutea* that once thrived around Dover suffered following the realignment of the St. Jones River after World War I. Changes in the depth and course of the river as a result of these improvements altered local environmental conditions, creating unsuitable conditions for the species.

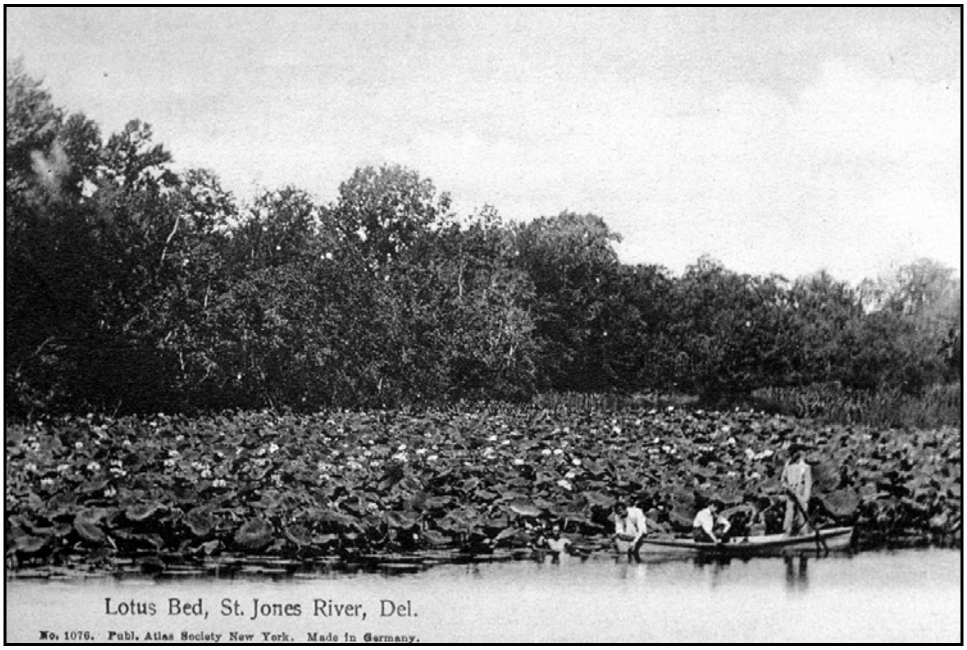

PLATE B-1: The 'Lotus Lilies' of the St. Jones River
SOURCE: Postcard of the Atlas Society, New York. No. 1076. Collection of William McAvoy

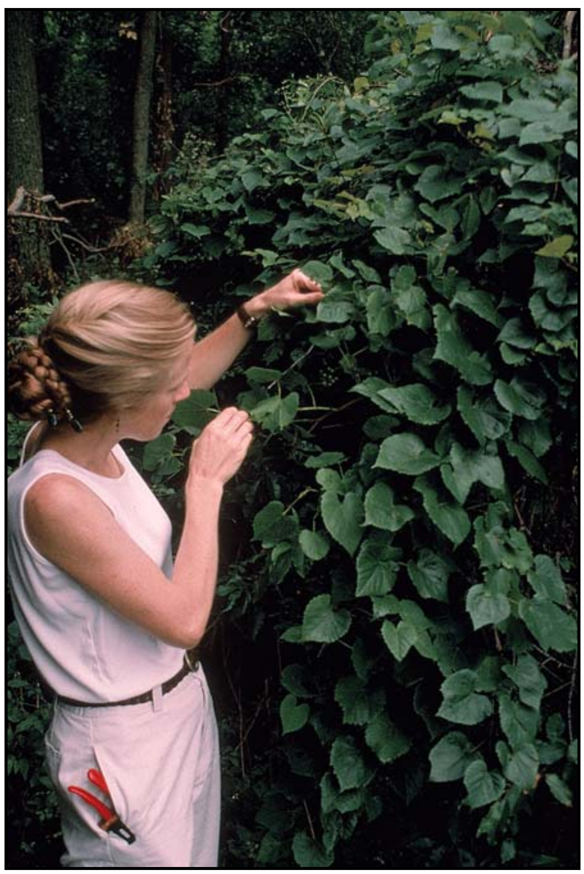

PLATE B-2: Fox Grapes (*Vitis labrusca*) at the Puncheon Run Site

s. Poke (Phytolacca americana)

The pokeweed is a stout perennial that grows in rich, loamy soil in neglected places, especially on newly disturbed soils. Poke establishes itself only where some external factor has opened up raw earth and eliminated more aggressive vegetation. The species flourishes in open-niche habitats, such as those created by natural agents (e.g., the scoured habitat of open streambanks) or cultural agents (open habitats created by human habitation) (Sauer 1952). New shoots emerge in early spring and are edible as a potherb (Medsger 1966). The root of the plant is poisonous if eaten, but has a long history of usefulness in medicine. Both the root and the berries are used for their emetic, cathartic, alterative, and deobstruent influences (Hutchens 1991). Poke berries were used by historic Native American populations as a fiber dye (Brooklyn Botanic Garden 1964).

t. Pine (Pinus sp.)

The pine charcoal recovered archaeologically from Puncheon Run was identified as yellow, or hard pine species. These pines of the southern and eastern United States cannot be separated on the basis of minute wood structure (Panshin and deZeeuw 1980:456-457). The southern pine group includes the following species: longleaf pine (*Pinus palustris*), shortleaf pine (*Pinus echinata*), loblolly pine (*Pinus taeda*), slash pine (*Pinus elliottii*), pitch pine (*Pinus rigida*), and pond pine (*Pinus serotina*). Contemporary lumber trade classifies southern pines according to structural density, with longleaf and slash pines frequently exhibiting multiple late-wood bands measuring up to 0.2 inches in diameter, in contrast to 0.1 inches or less for other southern pines (Kukachka 1960:43:887-896). Such classification does not translate well to pine specimens recovered from archaeological contexts, as considerable shrinkage of the wood structure over time is common. Although pine species are common throughout the project area today, it has been suggested (Brown et al. 1986:753) that pine was not a major component in Delaware's native forests. It is speculated that prevalence of pine species in the region has increased considerably as a result of historical clearing of native hardwood forests.

Early historical accounts document the economic and ceremonial importance of pine wood. Pine bark was employed in home construction when the bark of more desirable tree species was unavailable (Lawson 1952:187). Pine trunks were used for dugout canoes (Wood 1865:102). In the following passage, Lawson describes the use of a variety of pitch pine materials in a ceremonial burial:

> At last the Corps is brought away from that Hurdle to the Grave by four young Men, attended by the Relations, the King, old Men, and all the Nation. When they come to the Sepulcre, which is about six Foot deep and eight Foot long, having at each end (that is, at the Head and foot) a Light-Wood or Pitch-Pine Fork driven close down the sides of the Grave firmly into the Ground; (these two Forks are to contain a Ridge-Pole, as you shall understand presently) before they lay the Corps into the Grave, they cover the bottom two or three times over with Bark of Trees, then they let down the Corps (with two Belts, that the Indians carry their Burdens withal) very Leisurely upon the said Barks; then they lay over a Pole of the same Wood in the two forks, and having a great many Pieces of Pitch-Pine Logs, about two Foot and a half long, they stick them in the sides of the Grave down each End and near the Top thereof, where the other Ends lie on the Ridge-Pole, so that they are declining like the roof of a House. These being very thick placed, they cover them (many times double) with Bark. . . [Lawson 1952:192].

u. Knotweed (Polygonum sp.)

These starchy-seeded annual or perennial plants are common to a variety of terrestrial and marine settings on Delaware's Coastal Plain (Tatnall 1946). Knotweed has been recovered from prehistoric archaeological contexts throughout the Eastern Woodlands of North America, and certain species have been established as being economically important to prehistoric populations (Asch and Asch 1983; Crites 1984; Johannessen 1984). An opportunistic weed, knotweed is quick to establish itself on newly disturbed soils, such as those created by human habitation. It is thought that the use and eventual propagation of *P. erectum* by Woodland peoples was a natural outgrowth of this co-evolution (Smith 1992).

v. Black Cherry (Prunus serotina)

Cherry species native to the eastern woodlands of North America include the pin cherry (*Prunus pensylvanica*), black cherry (*P. serotina*), and chokecherry (*P. virginiana*) (Little 1980:504-507). Cherries are widely mentioned in the literature; however, particular species are not often distinguished. All cherry species bear an edible fruit (drupe) that ripens in June. The fruits can be consumed fresh or dried for storage. Considering that cherries were an orchard favorite in English gardens, explorers to North America were at first delighted to find a country teeming with wild cherries. This initial excitement faded quickly as the fruits of the wild cherry were tasted. Early colonial gardeners warned of the wild cherries "furring" the throat and being "as wild as the Indians" (Leighton 1986). Early accounts seem to focus on comparing the wild fruits to varieties that were known from the chronicler's homeland, and actual accounts of the aboriginal use of cherries are limited (Force 1836-1846:II:23, 27; Lawson 1952:106).

w. Oak (Quercus sp.)

The oaks indigenous to the Eastern Woodlands of North America are numerous, and together they formed a dominant component in native forests. Wood fragments belonging to both the red and white oak groups were encountered within the Puncheon Run paleoethnobotanical assemblage. Although segregation of the particular species of oak is not possible based on their minute anatomy (Panshin and deZeeuw 1980:586-587), the structure of these two groups of the genus *Quercus* is apparent. Species of the red oak group (*ERYTHROBALANUS*) native to the project area include southern red oak (*Quercus falcata*), northern red oak (*Quercus rubra*), black oak (*Quercus velutina*), and willow oak (*Quercus phellos*). The white oak group (*LEUCOBALANUS*) contains such species as white oak (*Quercus alba*), swamp chestnut oak (*Quercus michauxii*), post oak (*Quercus stellata*), and overcup oak (*Quercus lyrata*). The presence of oak species within this archaeobotanical assemblage is consistent with the regional forest cover for the period of site occupation (Kellog and Custer 1994; Sargent 1884; Sterrett 1908; Taber 1937).

The acorns of many oak species were relied upon as a food resource by historic Native American groups. Acorn nutmeats were roasted and ground for use as a beverage, used as a source of oil, or ground or pounded to make a meal (Smith 1923:66; Yanovsky 1936:18-19). Hariot reports five different sorts of berries or acorns growing on trees (Lorant 1946:252), and describes the process of drying the nuts upon a fire on a hurdle made of reeds. Dried nutmeats were later soaked until soft, then boiled, and eaten raw or pounded into bread. Oil extracted from acorns was used in cooking (Hariot 1893:16), and it also had cosmetic and medicinal uses (Smith 1986:I:151). Acorns were often harvested for storage, providing valuable food during the early spring, when other resources were scarce. Early accounts feature acorns in hanging baskets within dwellings (Lawson 1952:69, 71), and in baskets cached in underground storage pits (Cheever 1848:39).

Oak species exhibit positive qualities for construction, and tool and implement manufacture, and for firewood (Graves 1919; Panshin and deZeeuw 1980). Oak bark and oak saplings were commonly used in Native American home construction (Beverley 1705:175).

x. Black Locust (Robinia pseudoacacia)

This medium-sized leguminous tree would not have been common to Delaware's Coastal Plain during prehistoric times. Little (1980:522) reports that Virginia Indians "made bows of the wood and apparently planted the tree eastward." The presence of the species in the Middle Atlantic region today may be the result of human activities. The tree produces edible flowers in April, and the ensuing young pods are also edible. Medsger (1966:121) states that the seeds of the black locust were gathered and cooked (like peas or beans) by Native Americans.

Black locust wood is hard, close grained and heavy, tough and flexible, and very durable in the soil (Brown and Brown 1972:192), making it well suited for fashioning utensils and tools. The wood is also an excellent fuel. Locust was the choicest material for making bows (Lawson 1952:99).

y. Raspberries, Blackberries (Rubus sp.)

Rubus species are erect, trailing shrubs, usually armed with prickles or stiff bristles. Many species are native to Delaware's Coastal Plain, each bearing an edible, aggregate fruit (Brown and Brown 1972:158-159). Ethnohistoric accounts of raspberries and blackberries are numerous (Beverley 1705:131; Lawson 1952:107; Smith 1986:I:92). Fruits were likely eaten fresh as well as prepared dried for storage.

z. Dock (Rumex sp.)

Dock is a perennial or annual herb native to Eurasia and widely naturalized on the Coastal Plain (Ferguson 1959; Tatnall 1946; United States Department of Agriculture 1971). This pernicious weed is common to waste places and open field settings. The root has been used in medicine as an astringent tonic, laxative, and depurent, and the young leaves can be used as a potherb (Erichsen-Brown 1979).

aa. Elder (Sambucus canadensis)

Elderberry is a tall shrub common to old fields, thickets, and moist pastureland. The species is common throughout the project area. Elder flowers in May, and then yields dark purple fruits. Both the flower and the fruit are edible (Brown and Brown 1972:316).

ab. Sassafras (Sassafras albidum)

This aromatic tree is native throughout the Delmarva Peninsula. The species prefers moist, sandy soils, and often colonizes old fields, clearings, and forest openings (Little 1980:450-51). The roots and root bark provide oil of sassafras, which had a multitude of medicinal applications (Erichsen-Brown 1979:103-106; Medsger 1966:205-207).

ac. Grape (Vitis Labrusca, Vitis sp.)

A variety of grape species are native to eastern North America (Plate B-2). Early historical accounts of grapes are extensive, but seem to focus on the suitability of grapes for viticulture enterprises in the New World, rather than documentation of their use by native peoples (The Calvert Papers 1889:208; Force 1836-1846:II:26, III:13; Hariot 1893:16; Lawson 1952:105; Lindeström 1925:223; Smith 1986:I:152; Strachey 1967:121).

3. *The Marsh-Plant Root Hypothesis*

The richest microenvironmental zone specific to the Puncheon Run Site are the non-wooded wetlands associated with Puncheon Run and the St. Jones River (see Section II.B.3). However, the archaeobotanical assemblage from the site shows little focus on marsh resources. Regrettably, as a result of poor organic preservation at the Puncheon Run Site, the recovered paleoethnobotanical assemblage does not reflect the full breadth of prehistoric subsistence activities. It could be argued that plant resources were simply not part of the procurement agenda at the Puncheon Run Site; however, it is unlikely that even if fishing or lithic resource collection were the aim of encampments there, the food-rich aquatic environments surrounding the site would have gone unexploited, if even as a secondary focus of activity.

The general pattern of floral assemblages from prehistoric contexts on Delaware's Coastal Plain is that organic preservation is poor due to the sandy, acidic nature of Coastal Plain soils, which have the destructive effect of both physically abrading (weathering) and chemically eroding botanical remains (even when carbonized).

One hypothesis, although surely inconclusive, has been constructed that may explain prehistoric subsistence at the Puncheon Run Site—perhaps the Puncheon Run Site was utilized on a seasonal bases expressly for the harvest of aquatic resources, including the starchy roots of local marsh plants. Starch roots would have left negligible or unidentifiable durable remains within the local soil environment, which would explain the lack of paleoethnobotanical data in support of their use.

The following four factors support this hypothesis. (1) Ethnohistoric accounts of coastal Algonquian culture describe the importance of a variety of marsh plant resources to native subsistence, and emphasize the mass harvest and storage of the edible roots and tubers of certain wetland species. (2) The location of the Puncheon Run Site corresponds with regionally unique, economically important marsh plants. (3) Large, silo-shaped pits, which served an as-yet undefined purpose, are present at the site. (4) Significant durable food-plant remains are absent in the archaeological record. Fleshy plant parts such as roots and tubers leave no discernable trace macrobotanically and have a weak phytolith signature, making them extremely hard to identify.

There are a number of plants native to the project area that produce fat, potato-like starchy roots, which feature prominently in early ethnographic accounts of coastal Algonquian diet. Golden club (*Orontium aquaticum*), tuckahoe (*Peltandra virginica*), pickerel weed (*Pontederia cordata*), arrow head (*Sagittaria latifolia*), American lotus (*Nelumbo lutea*), and cattail species (*Typha latifolia*, *T. angustifolia*) are semisubmerged, aquatic plants native to freshwater tributaries of the St. Jones River. These are all perennial species that possess enlarged fleshy roots, rhizomes, or tubers that provide an accessible and plentiful food source.

Additional terrestrial species with edible roots would have been locally available at Puncheon Run from moist woods and marsh fringes. These may have included ground nut (*Apios americana*), Turk's cap lily (*Lilium superbum*), Jerusalem artichoke (*Helianthus tuberosus*), bamboo vine and china root (*Smilax* sp.), wild yam (*Dioscorea villosa*), and wild sweet potato (*Ipomoea pandurata*).

The Woodland I and Woodland II residents of the Puncheon Run Site were well poised for the collection of these root resources. The described roots are edible year-round, but the majority tend to be largest and most nutritious during the winter months, prior to the eruption of new foliage. It is plausible that seasonal encampments at the site were aimed at the exploitation of wild roots, which were harvested in great quantities and stored in subterranean pits for future use.

One species of particular interest to our investigation of prehistoric subsistence at the Puncheon Run Site is American lotus or water chinquapin (*Nelumbo lutea*) (see Section III.A.2.r, above). Although American lotus is common throughout the Mississippi River drainage system, the species is rare east of the Appalachians. However, an extensive population once grew between Dover and Puncheon Run. There are two possibilities that would explain the co-occurrence of human occupation and this anomalous vegetative feature: 1) settlement occurred to take advantage of this vegetative anomaly; or, 2) the St. Jones *Nelumbo* was introduced and even propagated by native peoples as a food plant. The St. Jones lotus beds did not survive the environmental changes caused by river channelization and salt-water infiltration in the nineteenth and early twentieth centuries, and today the population is reduced to a few specimens in one location.

Recent work in other areas of North America has yielded significant data regarding the value of wild root and tuber resources in prehistoric subsistence economies (Reeve 1986; Smith and McNees 1999; Smith and Martin 1998; Thoms 1989). These analyses have focused on camas (*Camassia* spp.) in the Pacific Northwest, and biscuitroot (*Cymopterus bulbosus*, *Lomatium cous*, and *L. ambiguum*) and sego lily (*Calochortus nuttallii*) in Wyoming. Research has documented patterned periodic reuse of root harvest campsites over thousands of years.

B. RESOURCE DISTRIBUTION

1. The Cultural Landscape

This landscape study has strived to be instructive in linking natural resources to procurement, processing, and storage areas, and other areas of prehistoric activity documented archaeologically at the Puncheon Run Site.

Based on feature type and artifact distribution, two kinds of activities appear to be reflected archaeologically at the site. These include lithic workshop areas, fire-cracked rock and hearth features, and concentrations of pit features of indeterminate function. While the Puncheon Run Site exhibits many of the characteristics of Woodland I and II settlement, the absence of key features (such as living surfaces and house features) is puzzling.

The four microenvironmental zones identified within, or adjacent to, the project area would have been accessible from all areas of the site. However, it is likely that plant processing activities would have taken place in an area most convenient to the point of procurement, and that (if practiced), storage of surplus plant products would have been accomplished near the same location in order to minimize the hauling of wild harvest. Although the lack of tangible evidence for plant food processing and storage precludes a clear determination of plant-related activities at the Puncheon Run Site, examination of the relationship between activity areas and locally available vegetative resources has been attempted. Below, areas of archaeological significance are described by cultural loci, and their proximity to economically important environmental zones is discussed.

2. Site Loci

Extended Phase II and data recovery efforts at the Puncheon Run Site were focused on three cultural loci that define the existing peninsular portion of the site (exclusive of Locus 4). Below, each of the three loci are physically described, an archaeological overview is given, and related microenvironments are reviewed in order to explore the cultural manifestations of ecological relationships.

a. Locus 1

Locus 1 measures 6 acres (2.4 hectares), and is located at the western limits of the site. Locus 1 occupies a gently sloping alluvial terrace abutting Puncheon Run. Existing vegetative cover is dominated by an array of herbaceous, weedy taxa over a fallow agricultural field that occupies Coastal Plain upland and upper transitional portions of the area, and a narrow, wooded transitional zone flanking the upper reaches of Puncheon Run. Within Locus 1, Puncheon Run is a narrow stream with a seasonally inundated floodplain (see Figures B-4 and B-6). 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 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.

Excavations within Locus 1 yielded two areas of archaeological interest: 1) ceramic concentrations with high artifact densities, and an associated buried plowzone area on the low terrace composing the western periphery of the site (Blocks 15 and 16); and 2) a cluster of prehistoric pits identified in the center of Locus 1 (Block 14). This feature cluster included natural (noncultural) features, a tight group of storage-type pits, and an unusual cluster of red-ringed pit features oriented along the edge of the upper riverine terrace. The function of all of these features remains indeterminate, but they may be linked with some activity associated with upper Puncheon Run. Overall, this feature cluster exhibited low artifact density.

Soil flotation of 44 samples from feature and nonfeature contexts within Locus 1 yielded an average density of 0.12 grams per liter of paleoethnobotanical material. Recovered macrobotanical remains were scant but included a range of economically useful taxa. The wood assemblage was dominated by hickory, and white and red oak, with maple and birch species, 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. Non-carbonized seeds were abundant within the Locus 1 feature samples, and included Eurasian and tropical American species that could not have been present on the site before AD 1600. The presence of these Eurasian and tropical American species compromise the integrity of the seed assemblage. Recovered remains indicate 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 (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 and is bisected by a dry natural drainage. Locus 2 measured 5 acres (2 hectares). Locus 2 occupies 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 dry drainage and the bluff edge, there is a mature forest remnant 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 (see Figures B-4 and B-6). The Locus 2 uplands presently flank the defunct millpond. Examination of site topography and river configuration suggest that this area of the Puncheon Run floodplain was naturally broad, and Locus 2 may have once directly overlooked the active river channel (ox-bow). However, the history of Puncheon Run channel migration and its relevance to human activities within Locus 2 has yet to be determined.

Ecological zones associated with Locus 2 during Woodland times would have included Coastal Plain upland forest; a more steeply sloping transitional community; a very broad stream basin (~160 meters at maximum width), suggesting significant changes in the course of Puncheon Run, which probably supported a variety of wetland communities, including swamp, emergent freshwater marsh, and floating mat communities; and open-water environments.

Extended Phase II testing revealed an area of high artifact density in the wooded portions of Locus 2; this area was preserved *in situ* and was not further investigated. The undetermined nature of prehistoric activities within Locus 2 precludes an accurate interpretation of site form and function. Locus 2 was obviously an area of cultural significance, occupying an upland edge overlooking an area of steep topographic relief above Puncheon Run.

Paleoethnobotanical analysis within Locus 2 included the processing of four flotation samples from the limited excavations conducted at the western portion of the locus. An average density of 0.05 grams of carbonized plant remains per liter of cultural fill was recovered. The identified plant assemblage was dominated by white oak and unspecified oak charcoal, and hickory nutshell. These data suggest that upland resources were important contributions to cultural activities within Locus 2. No plants representative of wetland environments were identified.

c. Locus 3

Locus 3 encompasses the eastern end of the site, adjacent to the St. Jones River and its confluence with Puncheon Run. Locus 3 consisted of 12.5 acres (5.6 hectares). 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 zones along the St. Jones River and Puncheon Run (see Figures B-4 and B-6). 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 streambed. 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.

Archaeological investigations 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, and the "Metate block," which included a large grinding stone and associated fire-cracked rock clusters.

A total of 86 soil samples were submitted for flotation processing and analysis from 18 different Locus 3 features, as well as from nonfeature contexts and noncultural (control) sediments. Recovered charred plant remains from cultural contexts averaged 0.22 grams per liter of cultural fill. The Locus 3 flotation samples were by far the most productive samples site-wide, yielding almost twice the concentration of archaeobotanical remains per liter than the Locus 1 samples, and more than four times the concentration of remains per liter 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 sweet gum. 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. These conditions cast doubt upon the integrity of the recovered seed assemblage. Use of wetland plant resources was indicated by the recovered remains.

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 the site upland areas and the wetlands of the St. Jones River and Puncheon Run. The seed assemblage includes some facultative and facultative wetland species, although the seed data are compromised by the factors mentioned above.

C. SEASONALITY

The greatest determining factor in the movement of prehistoric peoples from one location to another is the seasonal availability or seasonal fluctuation of food resources. The planning of seasonal movement to and from the Puncheon Run Site would have taken into consideration the reliability and predictability of given resources, their ease of procurement, efficiency of procurement, and nutritional value.

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 B-7 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 Puncheon Run. Based on archaeologically recovered plant remains, we know that nuts were used at the site. Masts native to the area, which was 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. The remainder of the carbonized seed assemblage includes mid- to late summer ripening ruderal species; it is doubtful that these specimens relate to economically important activities.

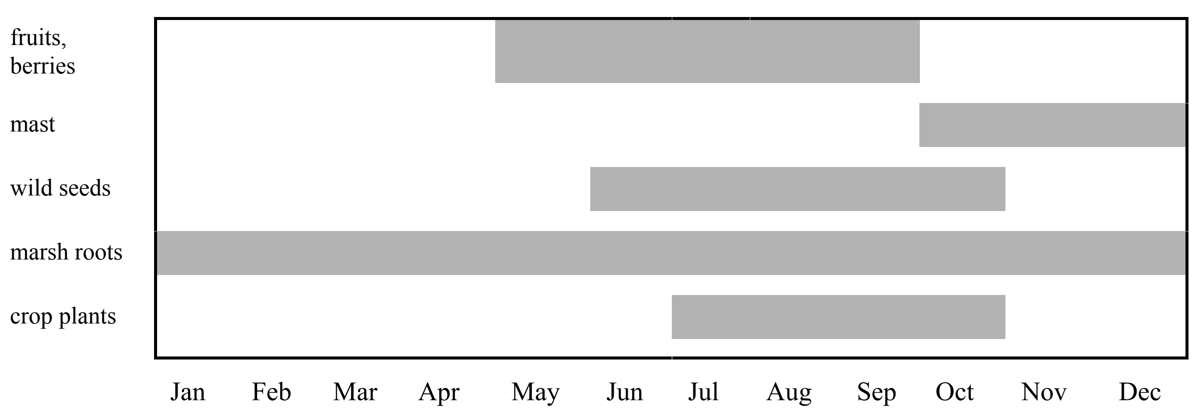

FIGURE B-7: Dominant Procurement Season for Plant Food Types

Research on subterranean storage pits occurring throughout the Eastern Woodlands of North America has identified that they are extremely important for the storage of surplus wild-gathered fall harvests (DeBoer 1988). The strong presence of pit features at Puncheon Run may be related to the caching of seasonally surplus foods in a location concealed from predatory animals or neighboring peoples.

D. SITE SETTLEMENT

The nature, duration, and temporal distribution of human activities at Puncheon Run remains undefined. Based on landscape elements, applicable ethnohistoric evidence, and the archaeobotanical data set, site settlement patterns can be explored.

> The location and duration of site occupation varies directly with two factors: 1) the seasonality and distribution of the desired resources and, 2) the mobility and division of labor of the sociocultural group involved [Thomas et al. 1975:59].

1. Unique Characteristics of the Puncheon Run Site

The Puncheon Run Site extends over a large area (24 acres [9.7 hectares]), and contains a series of small, discrete activity areas that appear to have been used for task-specific or resource-specific activities. The site does not fit clearly into any of the associated property types defined for Delaware's Woodland I context, which include base camps (both microband and macroband), transient camps, procurement or processing stations, quarries, and quarry reduction stations (Custer 1994). The Puncheon Run Site possesses some but not all of the characteristics of a base camp. Most important, the site lacks convincing evidence of pit houses, which are a key element of Woodland I base camps. Important features at the Puncheon Run Site include lithic workshop areas, fire-cracked rock and hearth concentrations, and various clusters of pit features of unknown function. The presence of storage pits is often associated with semisedentary, temporarily or seasonally occupied settlements (DeBoer 1988; Ward 1985). Based on the archaeological findings, prehistoric activities appear to be focused on gently sloping Coastal Plain upland areas of the site. Activity areas appear to be oriented on the southern and eastern portions of site, which are associated with Puncheon Run and the St. Jones River.

People came to the Puncheon Run Site because of the resources it offered. Understanding site landscape is key to determining what resources were available. Documentation of the physical and biological environment at Puncheon Run has illuminated key resource zones (based on microenvironments) that were of importance to prehistoric subsistence and which were undoubtedly the most important influence on site settlement patterns. Puncheon Run lies within the mid-drainage zone of the St. Jones River system, which is the most productive microenvironmental zone. The proximity of contemporaneous sites (i.e., Hickory Bluff, Island Farm, and Carey Farm sites) clustered within this zone may indicate the utilization of seasonally abundant riverine resources. Below, three land-use models are examined based on site landscape conditions and archaeological data.

2. Land-Use Models

a. Single use

The Puncheon Run Site does not appear to be characteristic of a single-use occupation. The site is composed of separate, small activity areas spread over a large landscape. The relationship between activity areas remains unclear, but it is unlikely that they were used contemporaneously as elements in a single settlement system. Human habitation of the site spans thousands of years of prehistory, yet subsurface features and recovered material culture do not indicate continuous occupation.

b. Multi-event Use

The multiple activity areas defined at the Puncheon Run Site indicate that people were engaged in a variety of activities that took place at different places on the local landscape. However, the full spectrum of activities anticipated for Woodland period culture and settlement are not represented; most importantly, house features are absent, as are stone tools associated with plant food processing and storage.

c. Focused Reuse

Multiple discrete activity areas in evidence over an expansive site support the notion that prehistoric peoples returned to the Puncheon Run Site repeatedly, over a time period spanning millenia, to conduct specific tasks or procure specific resources. The presence of storage pits located in spatially discrete clusters may reflect the storage of seasonally surplus resources (e.g., fish, nuts, and edible roots). It is plausible that the site was visited on a seasonal basis for the exploitation of reliable, predictable wild harvests that were harvested intensively, processed to the degree necessary, and concealed in subterranean pits for future use. The site may have been utilized in the autumn, when local mast and American lotus nuts (seeds) ripen, followed by the prime season for the harvest of starch-rich marsh plant roots and tubers.

IV. SUMMARY

The objective of this landscape analysis has been to provide an ecological framework for archaeological data in order to better understand subsistence patterns, landscape utilization, and site formation processes at the Puncheon Run Site. Our interpretation of the prehistoric landscape has involved an amalgam of studies focused on site cultural, physiographic, and biological properties. We have found that the physical and living resources within and accessible from the site provided a range of valuable opportunities for cultural utilization, and that the project area has undergone significant biophysical alterations resulting from both natural and cultural factors.

Development of an ecological framework for the Puncheon Run Site has permitted a critique of the available archaeobotanical data secured during extended Phase II and data recovery efforts and provided some new insights into plant utilization and site settlement processes during the Woodland I and Woodland II periods. While the Puncheon Run archaeobotanical assemblage was statistically significant and even large by regional standards, the samples were impoverished and uninstructive in terms of aboriginal plant use. Documentation of changes in site environmental conditions throughout the Holocene, and reconstruction of site microenvironments has helped to determine 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 ethnohistoric data offered some guidance for determining which vegetative communities at the Puncheon Run Site may have provided useful and desirable resources.

Our research has revealed that the full range of anthropically useful plant taxa available from the Puncheon Run Site is under-represented in the archaeological record. This is due to preservational bias. In addition to the expected biases inherent in archaeobotanical assemblages from open-site environments, data from other Coastal Plain sites in Delaware have established that local soil conditions are extremely erosive and corrosive to archaeological plant remains. Although flotation assemblages analyzed throughout the region have involved copious sediments from interesting cultural contexts, their analysis has yielded analytically insignificant and skewed data on which to construct adequate understanding of regional plant use during the Woodland I and Woodland II periods.

At Puncheon Run, the near-paucity of agriculturally related tools and the dearth of cultivated plant remains suggest that plant cultivation was not important at the site. 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; this may indicate that wild-gathered seeds were unimportant in site economy.

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

The Woodland I and Woodland II residents of Puncheon Run were well poised for the collection of ethnohistorically documented marsh-root resources. The described roots are edible year-round, but the majority tend to be largest and most nutritious during the winter months, prior to the eruption of new foliage. It is plausible that seasonal encampments at the site were aimed at the exploitation of wild roots, which were harvested in great quantities and stored in subterranean pits for future use. The work force required to accomplish these tasks may have been comprised of the less-mobile members of the group (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 (i.e., open-water fishes and upland game).

Combined research efforts point towards the probability that, despite its geographic 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 Puncheon Run Site may suggest that the site functioned as a seasonal, extractive locus, 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 differentially mobile hunter-gatherer groups over millenia might produce the kind of settlement pattern we see in evidence at the Puncheon Run Site. The caching of seasonally surplus wild plant foods in concealed subterranean pits, shifts in camp site 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. Although changes in the local landscape associated with the Holocene transgression influenced significant alterations in local floral and faunal populations, the duration of human activities in the area confirms the economic significance of the local landscape's natural bounty.

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ATTACHMENT A

PLANT SPECIES OBSERVED BY VEGETATIVE ZONE

PLANT SPECIES OBSERVED BY VEGETATIVE ZONE

Vegetative Zone	Latin Name	Common Name	Origin
Open Field			
	Apocynum cannabinum, L.	dogbane	native
	Asclepias syriaca, L.	common milkweed	native
	Aster spp.	aster	native
	Bidens frondosa, L.	beggar-ticks	native
	Campsis radicans, L. Seemann.	trumpet creeper	native
	Chrysanthemum leucanthemum, L.	ox-eye daisy	exotic
	Datura stramonium, L.	jimsonweed	native
	Daucus carota, L.	Queen Anne's lace	exotic
	Euphoribia sp.	spurge	native/exotic
	Fragaria virginiana, Duchesne.	strawberry	native
	Geum canadensis, Jacq.	white avens	native
	Krigia virginiaca, L. willd.	dwarf dandelion	native
	Lactuca serriola, L.	wild lettuce	exotic
	Liriodendron tulipifera, L.	tulip poplar	native
	Lonicera japonica, Thunb.	Japanese honeysuckle	exotic
	Mollugo verticillata, L.	carpetweed	native*
	Oxalis stricta, L.	wood sorrel	native
	POACEAE	grasses	native/exotic
	Parthenocissus quinquefolia, L.	Virginia creeper	native
	Phytolacca americana, L.	poke	native
	Plantago rugelii, Decne.	American plantain	native
	Prunus serotina, Ehrh.	black cherry	native
	Rosa multiflora, Thung.	multiflora rose	exotic
	Rubus sp.	blackberry/raspberry	native
	Rumex acetosella, L.	sheeps sorrel	native
	Rumex crispus, L.	curled dock	native
	Rumex obtusifolius, L.	bitter dock	native
	Smilax laurifolia, L.	greenbriar	native
	Smilax rotundifolia, L.	greenbriar	native
	Solanum nigrum, L.	black nightshade	exotic
	Solanum rostratum, Dunal	buffalo-bur	exotic
	Solidago sp., L.	goldenrod	native
	Stellaria media, L. Cyrillo	common chickweed	exotic
	Taraxacum officinale, Weber	common dandylion	exotic
	Toxicodendron radicans, L. Kuntze.	poison ivy	native
	Trifolium arvense, L.	rabbit foot clover	exotic
	Trifolium pratense, L.	red clover	exotic
	Trifolium repens, L.	white clover	exotic
	Vicia sativa, L.	common vetch	exotic
	Viola sp.	violet	native
	Vitis labrusca, L.	fox grape	native
	Vitis aestivalis, Michx.	pidgeon grape	native
Upper Stream Bed			
	Aescleias incarnata, L.	swamp milk weed	native
	Alnus serrulara, Aiton.	smooth alder	native

Vegetative Zone	Latin Name	Common Name	Origin
	Campsis radicans, L. Seemann.	trumpet creeper	native
	Eupatorium spp., L.	joe-pye weed	native
	Galium aparine, L.	goosegrass	native/exotic
	Impatiens capensis, Meerb.	jewel weed	native
	Liriodendron tulipifera, L.	tulip poplar	native
	Lonicera japonica, Thunb.	Japanese honeysuckle	exotic
	Magnolia virginiana, L.	sweet bay	native
	Parthenocissus quinquefolia, L.	Virginia creeper	native
	Prunus serotina, Ehrh.	black cherry	native
	Robinia pseudoacacia, L.	black locust	native
	Salix nigra, Marsh.	black willow	native
	Sambucus canadensis, L.	elderberry	native
	Soladago spp.	goldenrod	native
	Toxidodendron radicans, L. Kuntze	poison ivy	native
	Vernonia noveboracensis, L. Michx.	iron-weed	native
	Vitis labrusca, L.	fox grape	native
	Vitis aestivalis, Michx.	pidgeon grape	native
Historical Signature			
	Hedera helix, L.	English ivy	exotic
	Juglans nigra, L.	black walnut	native
	Ligustrum vulgare, L.	privet	exotic
	Pyrus malus	apple	exotic
	Robinia pseudoacacia, L.	black locust	native
Terrace			
	Acer negundo	box elder	native
	Campsis radicans, L. Seemann.	trumpet creeper	native
	Carya glabra, Mill. Spach.	pignut	native
	Carya tomentosa, Nutt.	mockernut	native
	Celtis occidentalis, L.	hackberry	native
	Cornus florida, L.	dogwood	native
	Dioscorea villosa, L.	wild yam	native
	Fagus grandifolia, Ehrh.	American beech	native
	Fraxinus americana, L.	white ash	native
	Ilex opaca, Aiton.	American holly	native
	Ipomoea pandurata, L. G. Meyer	wild potato	native
	Juglans nigra, L.	black walnut	native
	Lindera benzoin, L. Blume	spice-bush	native
	Liriodendron tulipifera, L.	tulip poplar	native
	Lonicera japonica, Thunb.	Japanese honeysuckle	exotic
	Onoclea sensibilis, L.	sensitive fern	native
	Parthenocissus quinquefolia, L.	Virginia creeper	native
	Pinus serotina, Michx.	pond pine	native
	Pinus taeda, L.	loblolly pine	native
	Prunus serotina, Ehrh.	black cherry	native
	Quercus alba, L.	white oak	native
	Quercus coccinea, L.	scarlet oak	native
	Quercus falcata, Michx.	southern red oak	native

Vegetative Zone	Latin Name	Common Name	Origin
	Quercus nigra, L.	water oak	native
	Quercus palustris, Meunch.	pin oak	native
	Quercus Phellos, L.	willow oak	native
	Quercus prinus, L.	chestnut oak	native
	Quercus rubra, L.	northern red oak	native
	Quercus stellata, Wang	post oak	native
	Quercus velutina, Lam.	black oak	native
	Robinia pseudoacacia, L.	black locust	native
	Rhus glabra, L.	smooth sumac	native
	Salix nigra, Marsh.	black willow	native
	Sambucus canadensis, L.	elder	native
	Sassafras albidum, Nutt. Nees	sassafras	native
	Taxodium distichum, L. Rich.	bald cypress	native
	Toxicodendron radicans, L. Kuntze.	poison ivy	native
	Vaccinium corymbosum, L.	high-bush blueberry	native
	Vaccinium angustifolium, Aiton.	common lowbush blueberry	native
	Viburnum dentatum, L.	southern arrow-wood	native
	Viburnum prunifolium, L.	black haw	native
Swamp			
	Acer rubrum, L.	red maple	native
	Arisaema triphyllum, L. Schott.	jack in the pulpit	native
	Carpinus caroliniana, Walter	hornbeam	native
	Cornus amomum, Miller	silky dogwood	native
	Ilex glabra, L. A. Gray	inkberry	native
	Lindera benzoin, L. Blume	spice-bush	native
	Lonicera japonica, Thunb.	Japanese honeysuckle	exotic
	Mitchella repens, L.	partridge-berry	native
	Quercus bicolor, Willd.	swamp white oak	native
	Quercus nigra, L.	water oak	native
	Quercus palustris, Muenchh.	pin oak	native
	Quercus Phellos, L.	willow oak	native
	Robinia pseudoacacia, L.	black locust	native
	Rumex verticillatus, L.	swamp dock	native
	Salix nigra, Marsh.	black willow	native
	Saururus cernuus, L.	lizzard's tail	native
	Smilax laurifolia, L.	greenbriar	native
	Smilax rotundifolia, L.	greenbriar	native
	Symplocarpus foetidus, L. Nutt.	skunk cabbage	native
	Toxicodendron radicans, L. Kuntze.	poison ivy	native
	Vaccinium corymbosum, L.	high-bush blueberry	native
Oligahaline Marsh			
	Acorus calamus, L.	sweet flag	native
	Carex spp.	sedges	native
	Cephalanthus occidentalis, L.	buttonbush	native
	Cuscuta gronovii, Willd.	dodder	native
	Hibiscus moscheutos, L.	rose mallow	native
	Myrica cerifera, L.	wax myrtle	native

Vegetative Zone	Latin Name	Common Name	Origin
	Myrica pensylvanica, Loisel.	bayberry	native
	Nuphar advena, Aiton.	spatterdock	native
	Nyssa sylvatica, Marshall.	black gum	native
	Peltandra virginica, L. Schott & Endl.	tuckaho	native
	Phragmites australis, Gav.Trin	wild reed	native
	Pinus serotina, Michx.	pond pine	native
	Polygonum spp.	knotweeds	native/exotic
	Pontederia cordata, L.	pickerel-weed	native
	Rosa palustris, Marsh	swamp rose	native
	Saggitaria latifolia, Willd.	arrowhead	native
	Scirpus spp.	bullrushes	native
	Toxicodendron radicans, L. Kuntze.	poison ivy	native
	Typha angustifolia, L.	narrow leaf cattail	native
	Typha latifolia, L.	broad leaf cattail	native
Emergent Fw Marsh			
	Alnus serrulara, L.	smooth alder	native
	Acorus calamus, L.	sweet flag	native
	Aster spp.	asters	native
	Bidens spp.	beggar-ticks	native
	Carex sp.	sedges	native
	Castanea pumila, L. Mill.	chinquapin	native
	Cephalanthus occidentalis, L.	buttonbush	native
	Chamaecyparis thyoides, L. BSP.	Atlantic white cedar	native
	Cornus amomum, Miller	silky dogwood	native
	Diospyros virginiana, L.	persimmon	native
	Impatiens capensis, Meerb.	jewel weed	native
	Iris pseudoacorus, L.	water flag	native
	Lilium suprubum	Turk's cap lily	native
	Myrica cerifera, L.	wax myrtle	native
	Myrica pensylvanica, Loisel.	bayberry	native
	Nyssa sylvatica, Marshall.	black gum	native
	Orontium aquaticum, L.	goldenclub	native
	Onoclea sensibilis, L.	sensitive fern	native
	Peltandra virginica, L. Schott & Endl.	tuckaho	native
	Phalaris arundinaceae, L.	reed canary grass	native
	Pinus serotina, Michx.	pond pine	native
	Polygonum sagittatum, L.	arrow-leaved tearthumb	native
	Polygonum spp.	knotweeds	native
	Pontederia cordata, L.	pickerel-weed	native
	Rosa palustris, Marsh	swamp rose	native
	Rhus copallinum, L.	shining sumac	native
	Scirpus cyperinus, L. Kunth	wool-grass	native
	Typha angustifolia, L.	narrow leaf cattail	native
	Typha latifolia, L.	broad leaf cattail	native
	Vaccinium corymbosum, L.	high-bush blueberry	native
Old Growth Remnant			
	Cornus florida, L.	dogwood	native

Vegetative Zone	Latin Name	Common Name	Origin
	Carya glabra, Mill. Spach.	pignut	native
	Carya tomentosa, Nutt.	mockernut	native
	Fagus grandifolia, Ehrh.	American beech	native
	Fraxinus americana, L.	white ash	native
	Ilex opaca, Aiton.	American holly	native
	Juglans nigra, L.	black walnut	native
	Kalmia latifolia, L.	mountain laurel	native
	Liriodendron tulipifera, L.	tulip poplar	native
	Pinus taeda, L.	loblolly pine	native
	Prunus serotina, Ehrh.	black cherry	native
	Quercus alba, L.	white oak	native
	Quercus coccinea, L.	scarlet oak	native
	Quercus falcata, Michx.	southern red oak	native
	Quercus nigra, L.	water oak	native
	Quercus palustris, Meunch.	pin oak	native
	Quercus phellos, L.	willow oak	native
	Quercus prinus, L.	chestnut oak	native
	Quercus rubra, L.	northern red oak	native
	Quercus stellata, Wang	post oak	native
	Quercus velutina, Lam.	black oak	native
	Taxodium distichum, L. Rich.	bald cypress	native
	Toxicodendron radicans, L. Kuntze.	poison ivy	native
	Vaccinium angustifolium, Aiton.	common lowbush blueberry	native
	Viburnum dentatum, L.	southern arrow-wood	native
	Viburnum prunifolium, L.	black haw	native
Early Successional Growth			
	Juniperus virginiana, L.	eastern red cedar	native
	Liquidambar styraciflua, L.	sweet gum	native
	Liriodendron tulipifera, L.	tulip poplar	native
	Lonicera japonica, Thunb.	Japanese honeysuckle	exotic
	Morus rubra, L.	red mulberry	native
	Rhus glabra, L.	smooth sumac	native
	Robinia pseudoacacia, L.	black locust	native
	Rubus sp.	blackberry/raspberry	native
	Sambucus canadensis, L.	elder	native
	Smilax rotundifolia, L.	greenbriar	native
	Toxicodendron radicans, L. Kuntze.	poison ivy	native

* Native to the tropics or subtropics of the Northern and Southern hemispheres, archaeological evidence from the Tennessee River valley confirms that *M. verticillata* was present in temperate eastern North America 3,000 years ago (Chapman et al. 1974).