CHAPTER III
RESEARCH DESIGN

The research design for the investigation of the Puncheon Run Site developed over the course of the project. Some issues that seemed important when the study began were not major parts of the final approach, whereas other research avenues were discovered or expanded as the excavations and analysis progressed. The overall approach was guided by the research issues that are generally prominent in the prehistoric archaeology of the Middle Atlantic region, as well as by the experience and knowledge of the many professionals who have been involved in the project, including DelDOT and DESHPO personnel. The research issues particularly important in Delaware archaeology are described in several documents published by the state. For the Puncheon Run Site, the most important is the Woodland I context developed by Custer (1994). The issues identified in this document (Custer 1994:171-177) correspond to research questions that are widely employed in contemporary prehistoric archaeology: chronology, subsistence, settlement patterns (household, community, and regional levels), technology, and environmental adaptation. Berger's investigations at Puncheon Run focused on subsistence and settlement patterns, with some attention given to issues of technology, chronology, environmental adaptation, and two important themes not discussed in the state plans, site formation processes and landscape (Berger 1998).

A. SUBSISTENCE

Information on subsistence practices was identified in the early stages of the project as a major research need, and this focus continued throughout the investigations. Eating is a fundamental human activity, and knowledge about the procurement, storage, and consumption of food is essential to understanding a culture's economic basis. There is a general paucity of good information about prehistoric subsistence on the Middle Atlantic Coastal Plain, created in part by environmental and soil conditions. The lack of good subsistence data makes it difficult to understand many aspects of regional prehistory, including the broad trends of cultural change. It has often been hypothesized that during the Woodland I period people throughout the Middle Atlantic region shifted from a more generalized foraging strategy of seeking resources in many different niches to one focused on large wetlands, especially rivers. This change, in turn, set the stage for increasing sedentism and the development of complex, ranked societies. This model was based initially on the increasing size of sites along major rivers, supported by the increasing frequency of certain stone artifacts, such as netsinkers that indicate fishing and large grinding stones that suggest greater use of plant foods.

Questions About Prehistoric Subsistence

- What did people eat?
- How did their diets vary over the year?
- How abundant were the available food resources, and how many people could they feed?
- What resources determined where they lived?
- Did they move seasonally to take advantage of different food resources?
- Did they store food for lean times? If so, how?
- How did their food collecting and storage technology change over time, and how were those changes related to broader social changes, such as the origin of ranked societies?

In his model of Woodland subsistence patterns in Delaware, Custer (1994) calls this change *productive intensification*. Custer focuses particularly on a more intensive pattern of plant food use, which he infers from the presence of heavy woodworking tools, soapstone and ceramic containers, grinding stones, and pit features employed for food storage. Pit storage is crucial, says Custer, because the ability of hunter-gatherer groups to accumulate surplus foods was the essential background to the emergence of complex, stratified societies.

Direct archaeological evidence of subsistence practices from Woodland I sites in Delaware is rather sparse, as it is much of the Middle Atlantic region, but it is not totally absent. According to Custer (1994:128) common plant remains assignable to this period include hickory nut (*Carya* sp.), goosefoot (*Chenopodium* sp.), and pigweed (*Amaranthus* sp.). The best data come from shell middens in the southern part of the state, such as the Wilgus Site, but some information has also been recovered from sites closer to Puncheon Run, such as the Leipsic Site (Custer, Riley, and Mellin 1996), the Carey Farm Site (Custer, Watson, and Silber 1996), and the Snapp Site (Custer and Silber 1995). A wide range of plant remains has been found. Some of the plants may have been important food sources and some may have had medicinal or other uses. However, there are serious questions regarding the validity of these archaeobotanical assemblages, since they typically contain modern (uncharred) and non-native plant species. Faunal remains are very rare and come almost entirely from shell middens in the southern part of the state, and while they provide important data, one cannot necessarily extrapolate from shell middens to other types of sites.

In much of the country the most important technique for recovery of prehistoric subsistence information has been soil flotation, coupled with detailed floral and faunal analysis. Because flotation has not been particularly successful in Delaware, other techniques have been employed at Puncheon Run, including protein residue and phytolith analysis.

1. Flotation

Flotation recovery techniques have provided some of the most significant information on prehistoric subsistence patterns (e.g., Scarry 1993). Botanical data, however, present a unique set of interpretive problems. Plants are part of the natural environment, so it does not necessarily follow that all seeds, charred or otherwise, recovered from archaeological contexts represent plants that were consumed or intentionally used by the site inhabitants (Holt 1991; Keepax 1977; Minnis 1981; Moeller 1986; E. Smith 1985). Custer (1994:130-131) has also specifically discussed this issue in relation to Delaware sites.

Flotation recovery has been successful at a few Middle Atlantic sites (e.g., see Dent and Kauffman 1985; LeeDecker et al. 1991; Potter 1993); however, the recovery of analytically significant material from flotation samples taken from Delaware sites has been inconsistent, for reasons which are not fully understood at present. At the Two Guys Site (7S-F-68) in Sussex County, a very small but analytically significant assemblage of charred sumpweed (*Iva annua*) was recovered from Woodland I and Woodland II contexts (LeeDecker et al. 1996). Sumpweed (Plate 8), which has not been reported from other sites in Delaware, was one of the earliest domesticated plants in eastern North America, having been recovered from contexts dating as early as 7,000 years BP, and it is believed

to have played a prominent role in the transformation from gathering wild plants to intensive agriculture (Smith 1992). However, flotation analysis for the Drawyer Creek South Site (Wall et al. 2001) and the Whitby Branch Site (Jacoby et al. 2001), which were Woodland sites with an unusually high level of integrity, was somewhat disappointing. The results of flotation at Woodland sites excavated by the University of Delaware Center for Archaeological Research have already been mentioned. Historically introduced taxa, such as copperleaf, carpetgrass, and bristlegrass, were present in the assemblages recovered from supposedly intact pit house features at most of these sites. A large amount of flotation analysis was undertaken at the Carey Farm Site, but the investigators found it "difficult to understand the meaning" of the presence of European seeds in almost all of the samples (Custer, Watson, and Silber 1996:282). In other words, they could not determine if the seed assemblage was associated with the Native American occupation or whether it entered the archaeological record in historic times.

PLATE 8: *Iva annua* (Sumpweed)

An extensive program of flotation recovery was carried out at the Puncheon Run Site during Berger's extended Phase II investigations (LeeDecker, Holt, et al. 1998; LeeDecker, Jacoby, et al. 1998), with limited results. Charred seeds from species of known importance to prehistoric peoples were very rare, outnumbered by non-native seeds such as copperleaf, chickweed, and carpetweed. No dietary bone or shell was found. Although the recovered flotation assemblage, especially the wood charcoal, contributes to an interpretation of the site landscape, and its utilization, the data are problematic and do not make possible any significant dietary reconstruction.

Because of these difficulties, research plans for the Phase III investigation of the Puncheon Run Site reduced the emphasis on flotation and instead focused on alternative techniques. Flotation samples were still taken from all features and selected non-feature contexts, but only a limited number of these samples were processed. Those chosen for processing included a number from charcoal-rich layers in the silo pit features of Locus 1, which appeared to be good candidates for flotation analysis, and a selection from other contexts on the site. A full account of the methods and results of the flotation is given in Volume II, Appendix C.

2. Phytoliths

Archaeologists working in Delaware may have had little success in recovering significant assemblages of charred plant remains, but plants leave other signatures in the soil. One that has recently attracted attention from archaeologists is opal phytoliths. Phytoliths are small silicaceous bodies formed by plants in their cell walls. Some plant families or genera form phytoliths in distinctive shapes, or in distinctive patterns of shapes, so the presence of these plants in large numbers can be detected from the presence on the site of their distinctive phytoliths. Because phytoliths are essentially rocks, they are extremely durable. However, because they are

microscopically small, they can move fairly easily through soil and can be transported by wind and water just as soil particles can. Soil samples for phytolith analysis were taken throughout the Puncheon Run Site as part of the standard sampling regime, and a selection of these samples was sent for analysis to Dr. Irwin Rovner of Binary Analytical Consultants. The Puncheon Run Site had been plowed, and grass crops such as wheat, as well as the other grasses that thrive in agricultural fields, leave behind them enormous numbers of phytoliths that usually overshadow all other assemblages. The samples selected for analysis were therefore taken from deeply buried contexts, such as pit fills and the lower levels of the Metate block. The existing type collections for plants native to eastern North America are not complete, and they did not include some of the plants of interest for the study of the Puncheon Run Site, especially marsh plants with edible roots such as arrow arum, pickerel weed, and goldenclub. Examples of these plants were collected in the Puncheon Run vicinity, dried, and then reduced to extract the phytoliths, so these samples would be available for comparative purposes. A detailed account of the phytolith analysis is given in Volume II, Appendix F.

3. Protein Residue

Aside from coastal shell middens, very little archaeofauna has been found in Delaware that can be used to interpret Woodland subsistence patterns. The Phase I and Phase II investigations at the Puncheon Run Site demonstrated that little, if any, identifiable dietary bone was preserved at the site. Therefore, plans were made to use the recently developed techniques for the identification of "blood residue" on stone tools during the Phase III excavations. These techniques appear to have some potential for interpreting prehistoric subsistence patterns. However, the results in this area have not yet matched initial expectations, and there is debate regarding the utility of these techniques for archaeological analysis (Custer et al. 1988; Dent 1995:173; Eisele et al. 1995; Inashima 1992; Kooyman et al. 1992; Petraglia et al. 1998; Smith and Wilson 1992).

Analysis of protein residues on stone tools has met with equivocal results in the Middle Atlantic region. Skepticism about the validity of such analysis has been a common response to negative results, or to results that one may intuitively see as suspicious. This has led to a belief among some researchers that protein residue analysis is based on questionable methodology, or that residues are so poorly preserved in northeastern environments that reliable results will be unobtainable. Given these doubts, many believe that scientific resources should be targeted toward other procedures. The generally poor preservation of floral and faunal assemblages that characterizes most inland Delaware sites requires that new analytical techniques be explored.

Recent investigations on the North Branch of the Susquehanna River, however, indicate that some of the difficulties encountered in residue analysis may be the result not of fundamental principles, but rather the kinds of protein antisera against which stone implements have been tested (Jacoby 1998, 2000b; Jacoby et al. 1999). Artifacts are often tested against antisera developed from nonlocal species that share protein signatures with indigenes only to the family level. In an effort to obtain species-specific results, live fish specimens known to have been indigenous to the Susquehanna River during the major occupational phases of two sites (36CO17 and 36CO18) were used to prepare antisera (Jacoby 1998, 2000b; Jacoby et al. 1999). Artifacts were then tested against these local

species, as well as several commercially available terrestrial and aquatic species. Strongly positive results were obtained from two of the locally caught fish species, gizzard shad (*Dorosoma cepedianum*) and American eel (*Anguilla rostrata*). The same technique has been employed at Puncheon Run (Plate 9). Protein antisera were developed from 11 native fish species, selected to represent a range of environments and strategies of exploitation, and tools from selected areas of the site were tested against these antisera, as well as commercially available antisera for several terrestrial species. A more detailed description of the methods used, and the results, are presented in Volume II, Appendices I and J.

PLATE 9: Experimental Butchering of Eel with Stone Tool. Butchering of locally available fish was undertaken in association with protein residue studies.

4. Soil Strontium

Chemical analysis of soil samples taken during the Phase II testing of the Puncheon Run Site indicated generally higher levels of strontium in Locus 3, with particularly high concentrations in found in some areas. Strontium is rare in Delaware's soils, but it is common in sea water, and marine organisms incorporate it into their bodies. Investigations were therefore begun into whether the elevated strontium levels may be related to the processing of anadromous fish. Such fish would have passed from salt water up the St. Jones to Puncheon Run in a matter of days, too quickly for the fresh or oligohaline river water to flush the strontium from their systems. The butchering of large numbers of these fish might leave the ground littered with their bones and other offal, and

when these remains had dissolved in the acidic soil, they might have left behind elevated strontium levels as a signature of their marine past. Appendix A, Volume II, provides a detailed discussion of soil chemistry test results.

5. Storage Pits

Another important piece of evidence regarding prehistoric subsistence is pit features that may have been used for storage. The group of storage pit features in Locus 1 of the Puncheon Run Site provided an important physical expression of the ability of Woodland groups to accumulate surplus foods. Pit features are an important component of most large and some small Woodland sites in Delaware (Custer 1994), but there are, nonetheless, important questions regarding how these pit features were used. Only a few pits have contained identifiable remains of animal or plant matter, so it is generally not known what was being stored in the pits. In addition, the origin of many pits is also disputed, and some pits considered cultural by some archaeologists are considered natural by others. Because of these questions, analysis of the pits at Puncheon Run was given a high priority. Flotation analysis carried out during the Phase II investigations demonstrated that the pit fills at Puncheon Run contained very little organic material that would provide information on what had been stored in these features (LeeDecker, Holt, et al. 1998; LeeDecker, Jacoby, et al. 1998), so a battery of techniques was used to study the pits, including soil chemistry, phytolith analysis, and soil micromorphology.

Custer (1994) suggests that small storage pits were located within or immediately adjacent to pit houses that were occupied during the winter months; this model, however, does not appear to be applicable to the Puncheon Run Site, where the storage pits are located in an area with no evidence of long-term occupation. Roger Moeller has examined a number of questions relating to the use of pit features, using data from the Upper Delaware River Valley (Moeller 1992). One of Moeller's most interesting hypotheses is that many of the Woodland pit features found in the Upper Delaware Valley were associated with processing camps occupied during the late summer and fall, and that the storage pits were used only for the temporary caching of processed and preserved foods, which were then taken to the winter camps where they were consumed. If applied to the Puncheon Run Site, Moeller's model would suggest that the pits were used only for temporary caching of foods during the late summer, and that actual consumption of the processed foods would have occurred at another location, that is, a winter camp. A comparative study of pit clusters as reported at three other Delaware Sites (Delaware Park, Carey Farm, and Lums Pond) was undertaken to test Moeller's ideas and search for generalizations about these clusters (see Chapter V). Descriptions of the pits and other features excavated at Puncheon Run are given in Volume II, Appendix K.

6. Ethnohistory

Because the archaeological data on prehistoric subsistence patterns is so sparse for the Middle Atlantic region, the Puncheon Run study included a review of the ethnohistorical literature to see what light it might shed on this question. Evidence was also sought for certain other questions of importance to interpreting the archaeological record of Delaware, such as housing, technology, and burial practices. The review covered all of the available accounts of Indians along the Delaware River written before 1700. This includes the accounts of the Dutch explorers De Vries and Van der

Donck, the Swedes Lindstrom and Campanius Holm, and the Englishman William Penn. These accounts, however, are rather brief, and to develop a fuller description of Native American practices in the region, sources were also consulted from other colonies. The most useful accounts are those of Thomas Hariot and John Lawson in North Carolina, John Smith in Virginia, Isaack de Rasieres and Daniel Denton in New York, and William Wood and Thomas Morton in New England. The purpose of the ethnohistorical literature review was not to use data on historic Indians as direct evidence for the lifeways of prehistoric peoples, but to find in the historic accounts possible interpretations of the archaeological record, and to obtain a sense of the possible ways of living in eastern North America. For the subsistence theme, some of the important questions concerned what species were used and for what purposes, how they were caught or collected, what seasons they were available, where they were available, and what importance historic Indians attached to them. Further details are provided in two appendices: Volume II, Appendix D, provides a general discussion, and a more detailed study of the ethnobotanical information is provided in Volume II, Appendix E.

B. SETTLEMENT PATTERNS

The study of settlement patterns is concerned with how people have distributed their activities across the landscape. The Woodland I context for Delaware (Custer 1994) recognizes three distinct scales of patterning: household settlement patterns, community settlement patterns, and regional settlement patterns. The study of settlement patterns at the Puncheon Run Site has been carried out through the study of the natural and cultural landscape of the peninsula as well as through excavations.

1. Household Settlement Patterns

Previous household settlement studies for the Woodland I period in Delaware have focused on the possible presence of pit houses (Custer 1994:46, 172-173). The "household clusters" analyzed by Custer all include a pit house; sometimes they also include other sorts of features, such as storage pits and knapping features. No pit houses were identified at Puncheon Run. Instead, analysis of small-scale site patterning has focused on a large slab grinding stone (*metate*) as a possible center of interaction.

Questions on Household Settlement Patterns

- How many people lived in each household?
- Were all households similar, or were some much bigger or richer?
- Did each household have its own hearth, house, and storage pit, or were some of these things shared?
- How many households or people made up a community?

Based on ethnographic information from various hunter-gatherer societies and excavation data, Binford (1983) has identified a number of cross-cultural similarities in the way individuals and groups carry out tasks and discard debris in residential and nonresidential sites. Within a campsite, hearth areas are normally the foci around which a broad range of activities are carried out. Binford (1983:149) suggests that many tasks were performed "according to a spatial pattern that appears to be universal." According to the Binford model, the patterning of refuse deposits around hearths typically exhibits a concentric form. Small items, such as waste products from craft activities, are normally found between the hearth and the seating area, while larger items are discarded to a "toss

zone" away from the primary seating and work area. This pattern is one of a small group of refuse disposal patterns among hunter-gatherers that account for the major patterns of archaeological site structure. These basic disposal modes include: (1) dropping or discarding objects in their place of use, (2) tossing individual items away from their place of use or consumption, and (3) dumping a group of items *en masse*. Small dumps often appear to have a "magnetic" effect, as they accumulate material from subsequent refuse disposal episodes (Binford 1983; O'Connell 1987; Yellen 1977). At the Whitby Branch Site, spatial analysis of refuse deposits demonstrated a clear separation of lithic debris dumps from the processing areas represented by fire-cracked rock clusters (Jacoby et al. 2001).

Distinct disposal patterns may be observed inside and outside of structures. While the concentric, or donut-shape, pattern is typically left by groups around an outside hearth, greater effort is normally made to maintain the cleanliness of indoor domestic spaces. Refuse dumps are typically located immediately outside the door, left there after cleaning a domestic space. Activities that produce large amounts of waste material are typically located away from the primary living area. Sites that are intended for re-use, including the peripheral areas adjacent to the primary habitation areas, are typically cleaned of debris (Binford 1983). Attempts were made to apply this model to the best preserved portion of the Puncheon Run Site, the Metate block, in Locus 3. Even in this area, however, interpretation was complicated by the possible reuse of the site and other issues that come under the heading of site formation processes (Schiffer 1972, 1987).

2. Community Settlement Patterns

Ethnographic studies of modern hunter-gatherers have shown that some groups move through their territories in carefully patterned ways. During certain seasons they may move frequently, but at other times they may settle down for weeks or months in a single location. Such a long-term camp is known to archaeologists as a "base camp." Ethnographic studies suggest that such a base camp may be surrounded by smaller sites where people stayed for a short time while performing some special task, such as hunting caribou or gathering nuts. These specialized sites are sometimes called "procurement sites," which is the language used in the Delaware prehistoric contexts.

What Kind of Site Was Puncheon Run?

- A "base camp" was a place where people camped for weeks or months at a time, performing many activities; sometimes small groups left the base camp to hunt or gather plant foods, which they brought back to the base camp, or to do some other specialized task.
- A "procurement site" was a place where people stayed for a short time while performing some special task, such as hunting deer, collecting nuts, or harvesting roots.
- The same site could have been used as a "base camp" at one time and as a "procurement site" at another.

While the concepts of "base camp" and "procurement site" are well established in some of the ethnographic literature, it is not entirely clear how these site types are to be recognized archaeologically. Some of the criteria that have been used to identify base camps are the presence of houses or other substantial infrastructure and evidence that a wide variety of activities was carried out on the site.

Evidence of varied activities includes, in particular, the presence of a wide variety of tool types and ceramics or soapstone bowls.

After the Phase II research had been completed at the Puncheon Run Site it was difficult to say whether the site was a base camp, a cluster of procurement sites, or should be placed in some other category. One of the reasons the Silo Pit area was chosen for further investigation was that it appeared to contradict part of the base camp model: here was a large cluster of storage pits that seemed to be located in a place where only short-term occupation had occurred. If this were found to be the case, it might call into question both the connection between pit storage and sedentism and the assumption that a site with an infrastructure representing a substantial amount of work is necessarily a base camp where there was long-term occupation. Other questions about these storage pits, such as what was stored in them and for how long, what time of year they were used, and whether they were associated with any sort of residential site, also had implications for settlement pattern studies.

The question of how to identify a base camp is related to a second, very important question: how many people lived at a site like Puncheon Run? This question is extremely difficult to answer, creating an interpretative problem that is recognized throughout the Middle Atlantic region. The large number of artifacts found on some sites has led archaeologists to classify them as "macro-band base camps," and to speculate that prehistoric groups may have coalesced into larger communities at certain times of the year. However, most of the putative "macro-band" camps on the Delmarva Peninsula have been plowed, resulting in such a lack of chronological control that the artifacts in question may have come from a period of as long as 5,000 years. Over such a time span, very small groups of people can use and discard impressive numbers of artifacts. Custer, who once freely employed the "macro-band" terminology, has come to question whether such camps exist (1994:83), and he suggests (1994:173) that the search for a clear-cut example of a Woodland I macro-band base camp be given a high priority in archaeological studies in the region.

Other questions about the structure of archaeological sites are dogged by the same problems. It is usually impossible to say whether two nearby activity areas were used by the same people, or if the storage pits in a cluster were all in use at the same time. On some kinds of sites, large-scale patterning of features can give a strong indication that they were used simultaneously; for example, if a group of houses is arranged in a circle around a central plaza, with trash disposal around the outside, the site could plausibly be interpreted as a village. Such patterns, however, have not been observed on many sites dating earlier than AD 800 in the Middle Atlantic region. Custer and his colleagues have attempted to identify clusters of pit houses at several Delaware sites that may, because of their close association, have represented single communities. At the Carey Farm Site, on the St. Jones River not far from Puncheon Run, groups of pit features were found that were interpreted as representing communities of two to six families, and the excavators inferred that this was the normal size of Woodland I communities in Delaware (Custer, Watson, and Silber 1996:262). However, most other archaeologists working in Delaware do not accept the identification of these pits as houses, which calls into question the conclusions about community size arrived at from these studies; in addition, radiocarbon dates from one of the best defined clusters of pit features suggest that those features were not, in fact, used simultaneously, creating further difficulties (Custer, Watson, and Silber 1996:159). The questions of how many people lived at sites like Puncheon Run,

and how long they stayed—months, weeks, or days—remain open, posing many dilemmas for our attempts to understand prehistoric lifeways.

3. Regional Settlement Patterns and the Cultural Landscape

The Puncheon Run Site would have been a component of a larger settlement system during the Woodland I period. The residents were nomadic hunter-gatherers who moved regularly through the landscape, and regional settlement models for the Woodland I period emphasize their seasonal movements through different resource zones. For example, people might have moved in early spring to the tidal rivers to take advantage of the annual fish runs, and in the fall may have traveled inland to hunt deer and harvest nuts. To understand the movements of Woodland I people it is therefore important to understand the distribution of the resources they were exploiting and the seasons of availability of these resources (Thomas et al. 1975).

Questions About Regional Settlement Patterns

- At what time or times of the year did people live at Puncheon Run? What were they doing there?
- How many times did people move during the year?
- Did their movements follow a regular seasonal pattern?
- What drew them to the particular spots they chose to camp in? Were any spots chosen for non-economic (social, spiritual, political) reasons?
- How big an area did their wanderings take in?
- How big were their communities? Did they divide into small groups in some seasons and come together in larger groups in others?
- Did people become more sedentery over the course of the Woodland I period, spending more time in their biggest base camp sites?

The study of regional settlement patterns intersects with the growing field of landscape studies, a rapidly developing hybrid of geography, architectural history, cultural studies, and archaeology. The landscape of Delaware in the Woodland I period (3000 BC to AD 1000) contained many elements that might have influenced where and how people lived. These elements included stands of seasonally rich resources, such as patches of sumpweed or amaranth, groves of hickory trees, and streams where fish ran in the spring; stands of resources available all year, such as oyster beds; transportation routes, e.g., rivers and fords; sources of fresh water; and sources of stone for making tools. Other landscape elements were created by the people who used the land: settlements, camps, burial grounds and other sacred sites, fish weirs, storage pits, platform hearths, deer traps, and paths. Certain kinds of artifacts that were heavy and hard to move, such as soapstone bowls, large pots, and large grinding stones, may themselves have become landscape elements, helping to draw people back repeatedly to the same camping spots.

The dominant view of settlement patterns used by archaeologists working in the Middle Atlantic region has been that people adapted themselves to their environments, living in the places where needed resources were available and in and ways best suited to extracting the available resources (Custer 1984a, 1989; Gardner 1987). In the past 20 years, some archaeologists have questioned this uni-dimensional approach and have emphasized that human life also has other components, such as

the spiritual and the political (Hodder 1990). Certain sites along the St. Jones River, such as the elaborate burial grounds at Island Field and the St. Jones Adena Site, suggest that non-environmental factors were indeed important to their locations, and these ceremonial sites must have played some part in people's movements; the distribution of spiritual power in the landscape may have been no more random than the distribution of food sources. The threat from enemies may have determined the placement of some settlements, and storage pits may have been dug in places hidden from grasping chiefs or even greedy relatives (DeBoer 1988).

The Puncheon Run Site, because of its structure, makes an interesting test case for exploring ideas about how Woodland I people related to the landscape. Rather than being tightly clustered in a small area which archaeologists could easily treat as a "site" or a single camp, the features and artifact concentrations at Puncheon Run were widely dispersed across the landscape, covering an area of more than 20 acres. The fire-cracked rock clusters were concentrated in Locus 3, at the eastern end of the site, while storage pits were clustered in a small part of Locus 1. Lithic workshop areas were found in Locus 3 and in Locus 1, at the western end of the site. The characteristics of the Puncheon Run Site provide an opportunity to examine some of these basic questions about prehistoric settlement patterns, which may lead to the development of new models for prehistoric use of the landscape.

Reconstruction of the landscape of Puncheon Run during its occupation period has therefore been a main focus of the investigations. The research has included an attempt to map the distribution of useful plants across the peninsula and to correlate their presence with the locations of storage pits and occupation areas. This research was based on a detailed study of the existing landscape and study of the plant remains found in the flotation and phytolith studies. The soil geology of the peninsula has also been examined in detail for clues to the prehistoric landscape. To reconstruct the cultural landscape has been one of the main overall goals of the field investigations, and excavation units and blocks have been placed in ways that sample the various parts of the site landscape and provide sufficient data for comparing different occupation areas with each other.

In order to provide a broader context for the Puncheon Run Site the project has also included a review of archaeological work that has been done on other sites in the drainage of the St. Jones River. This review has included artifact collections and field notes kept by the Delaware State Museum as well as published reports.

C. SITE FORMATION PROCESSES

An understanding of past cultural activities that may have occurred at a site must depend on at least a general understanding of the processes that formed the archaeological features and deposits used in analysis (Schiffer 1972, 1983, 1987). Objects can become deposited in the ground, and features formed, through a variety of cultural and natural processes. The Puncheon Run Site was originally considered eligible for listing in the National Register of Historic Places in large part because of the presence of pit houses. Investigators from HRI identified several pit features on the site which they thought might be parts of houses, and they estimated, based on the average number of pit houses found on other large sites in Delaware, that 300 to 400 pit houses would be found on the site. These

features are a highly controversial topic among archaeologists, and some archaeologists consider them to be mostly natural disturbances, possibly tree throws (Plate 10); these features therefore present a classic question of site formation. There are many natural and cultural processes which create what archaeologists describe as "pit features" across the landscape, and any given pit feature may be the result of multiple, sequential processes.

For this reason, Berger planned its extended Phase II testing in large part to investigate the pit features. The plowzone was stripped from twenty 5x20-meter blocks, distributed across the site in areas of high, moderate, and low artifact density, to search for pit features. Before stripping, a five percent sample of each block was dug by hand and screened. A protocol for feature testing was developed to determine, if possible, whether any pit features that might be encountered were cultural in origin, or whether they were instead of natural origin. This protocol included cross trenching through the features and extensive sampling of feature and non-feature contexts for soil chemistry, micromorphology, and other analyses. In parts of Locus 3, a thick E-horizon was present beneath the plowzone. HRI's research at Puncheon Run and Hickory Bluff (across the river) had shown that feature fills are often very similar to the E-horizon and that features can be very difficult to detect where E-horizons are present. Therefore, three techniques for locating features beneath the horizon were tried: systematic sampling with a split spoon, systematic measurement of soil compaction, and, in one block, use of the backhoe to remove the E-horizon.

PLATE 10: Uprooted Tree Near Locus 1. During excavations at Puncheon Run, a storm uprooted a large tree near Locus 1. Crew Chief Jim Skocik examines the root ball.

No features that appeared to be possible pit houses were identified during the extended Phase II testing. Instead, other types of archaeological resources were identified. A number of round storage pits (Feature 30 and the silo pits in Locus 1) were found, as well as several areas in which artifacts were recovered from subplowzone strata that appeared to have high integrity. The field strategy was therefore reoriented toward these discoveries and away from the investigation of possible pit houses. One possible pit house discovered by HRI in Locus 3, Feature 32, was investigated during the Phase III investigations.

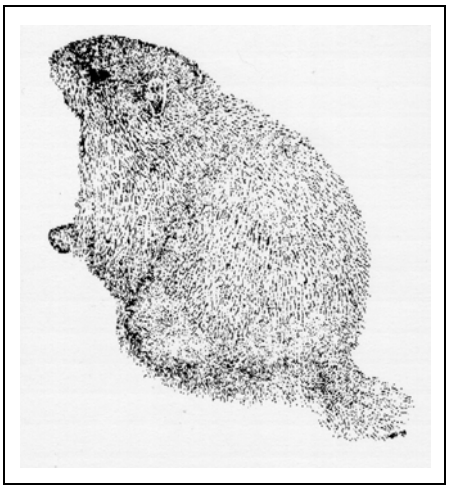

FIGURE 10: *Marmota monax* (Groundhog)
ARTIST: Matt Doherty

Sometimes features that resemble pits are interpreted as rodent burrows, but little useful information is available on what such burrows actually look like. The open fields that made up much of the Puncheon Run Site were dotted with the burrows of groundhogs or woodchucks (*Marmota monax*) (Figure 10). These large rodents are prodigious excavators and archaeological investigation focused on one of the burrows as a means of examining natural site formation processes. One of the larger burrows was selected and excavated in several stages, using a backhoe. The tunnels and rooms were all mapped at three levels, and samples were taken for soil chemistry analysis. A complete description of the investigation is given in Volume II, Appendix L.

A separate issue of site formation that was studied in some detail during the Phase III investigations concerns how archaeological sites may come to be buried. Throughout Delaware, artifacts are sometimes found in subplowzone contexts in geological situations that do not provide an obvious mechanism for site burial, such as through slope wash or waterborne sediment. The burial of these artifacts is often ascribed to aeolian action, that is, wind-blown soil (Ward and Bachman 1987). HRI identified aeolian action as the mechanism that buried the subplowzone artifacts found in Locus 3 of the Puncheon Run Site. While dunal deposits are known to be present throughout central and southern Delaware, detailed soil and geomorphological investigations at the Puncheon Run Site, carried out during the Phase II investigations, did not identify any aeolian deposits. Lacking evidence of the introduction of new material by aeolian deposition, the investigators turned to the *biomantle* concept (Johnson 1993), which provides an alternate model to account for the shallow burial of artifacts and features. According to this view, artifacts are moved down through the soil over long periods of time by the action of earthworms, insects, groundhogs, and other burrowing animals. Upper soil horizons without soil development are not considered to have been recently deposited, but to have been so regularly churned by animal action that no soil development has taken place. A detailed report of the geomorphological investigations is contained in Volume II, Appendix A.

One method used to study site formation processes in Locus 3 was the refitting of fire-cracked rock (see Volume II, Appendix N). Information about which pieces of fire-cracked rock found on a site were once part of the same rock can suggest the degree and kind of disturbance that has taken place on the site since its abandonment. When mending fragments are found close to one another, this may be evidence that the site has not been disturbed since its abandonment. If, on the other hand, such fragments are widely distributed, either horizontally or vertically, then the site may have been disturbed. The issue is complicated by the many different ways hot rocks were used in cooking. For example, heated rocks were buried in pits with food to be roasted or placed in water to make it boil, and rocks were used as platforms on which to build fires, all of which uses might leave different patterns of mends (Ellis 1997). Moreover, the individual fragments of broken rocks may also have been reused by later visitors to the site, making the interpretation of refitting an even less

simple and straightforward task. However, since the question of how the artifacts in Locus 3 came to be buried is so important to understanding this component of the site, it was thought that even the tentative information from fire-cracked rock refitting would be helpful in the analysis.

D. TECHNOLOGY

"Technology" can refer to both the cultural means that people use to deal with their environments, such as tools and structures, and the techniques of making and using these objects. Technology is an important part of human life in itself, and it tells us many things about how people live. The technology theme was addressed at the Puncheon Run Site primarily by analysis of the lithic technology, the ceramic technology, and the features represented. The storage pits were the most intriguing features at the site, and a major emphasis of the investigation has been to understand their purpose. Excavation of the features was combined with soil flotation, soil chemistry, and the study of plant phytoliths in order to examine this issue using a number of different approaches.

Although only a small quantity of prehistoric ceramics were found during the Phase II excavations at Puncheon Run, much of that material was concentrated in one small part of the site, in the Buried Plowzone area, at the site's western end (in Locus 1). Historic clearing in this area had led to the rapid burial of the original ground surface by slope wash, and the deposits protected by this occurrence included moderate numbers of potsherds. Some of the sherds thus protected were large enough to retain some information with respect to their surface treatments or decorations, vessel curvature, and other attributes. The sherds recovered had a variety of tempers, including grit, sand, shell, and stone, and it was hoped that the recovery of larger numbers of these sherds during Phase III excavations would allow vessel reconstructions as well as some analysis of the types of ceramics used at the site and the reason for their concentration in one area. However, the additional material recovered during the Phase III excavations of the Buried Plowzone area in fact added relatively little to the sample; the highest sherd counts and the largest sherds were those in the Phase II units. Still, analysis of this material has provided some information on the range of ceramics used in one very small location of the site over the period from 1000 BC to AD 1000.

Most of the artifacts found at the Puncheon Run Site, and at similar sites, are stone, and the technology most available for study is the manufacture and use of stone tools. Most of the stone recovered from the site was of types that can be found in the cobbles readily available in central Delaware. The Phase II evidence suggested that cobbles were regularly quarried from gravel bars along Puncheon Run. To obtain further evidence of this activity, including information about the reduction techniques, the selection of raw materials, and the kinds of formal or expedient tools made, a small block excavation was carried out in the Cobble Bar area of the site, part of Locus 1.

By far the most common formal stone tools at the Puncheon Run Site were the small, stemmed projectile points made from local cobbles, known colloquially as "pebble points." In order to better understand the manufacture of these points, and to aid in recognizing the debitage left by various stages of the manufacturing process, a series of experiments was carried out. In these experiments, a number of these small points were replicated by Keith Googins, a skilled flint-knapper, using cobbles gathered along Puncheon Run near the site. Some of the points were completed, while

others were abandoned at earlier stages. All of the debitage was collected and catalogued by both trait and mass analysis (Plate 11). The variations in the findings from these studies were then compared to the variation across the site, to see if the manufacture of formal points, and their maintenance, could be readily distinguished from the earlier stages of the reduction process or the manufacture of expedient tools. Volume II, Appendix M, contains a description and discussion of the experimental points.

In an attempt to determine the functions for which the stone tools were used, the edges of a selected sample of tools from the Puncheon Run Site were examined under a microscope for evidence of use-wear or use-related edge damage. This functional analysis was integrated with the overall approach to the site, which was to study how different prehistoric living areas and activity areas were distributed across the landscape. Groups of tools were therefore chosen for analysis from the main excavation foci, to determine if significant differences existed between the different areas in terms of stone tool use. The tools chosen for examination were first inspected with a hand lens, and those selected for microscopic analysis all appeared to have edge wear at this low magnification. Because different kinds of stone wear differently, to simplify the research it was focused on tools made of chert and jasper, the two materials most amenable to this type of analysis. Tools made of quartz, quartzite, and argillite were excluded. The microscope employed had a range of 5 to 400 power; most of the edges were inspected in the 16 to 100x range. A detailed account of this analysis is given in Volume II, Appendix G.

PLATE 11: Experimentally Produced Projectile Point and Associated Debitage

E. CHRONOLOGY

Although the basic chronological framework of Delaware prehistory has been established, further refinement is needed before many important developments can be fully understood. The Puncheon Run Site was occupied primarily in the Woodland I period, 3000 BC to AD 1000, and there are a number of uncertainties in the dating of Woodland I sites and artifacts. Custer (1994:172) emphasizes the need to refine the temporal placement of Woodland I diagnostic assemblages, especially with respect to linking projectile point types and ceramic types. The most common projectile points from Delaware sites of this period are small stemmed and side-notched varieties whose date ranges have never been accurately delineated. There are also difficulties with the chronological placement of certain ceramics, especially the various grit-tempered wares (Wolfe Neck, Hell Island, Minguannan) and the highly variable "experimental" wares made between 800 and 400 BC. The archaeology at Puncheon Run provided a rather limited opportunity to study such assemblages because rather few diagnostic artifacts were recovered from most parts of the site. Thirty-five radiocarbon dates were obtained, however, and these dates allow a certain amount of chronological analysis. The "horizontal stratigraphy" of the site, that is, its division into activity areas primarily occupied during a single period, makes it possible to date some nondiagnostic artifacts, such as scrapers, possibly identifying changes in the overall tool kit over time.

"Pebble points," the small stemmed points fashioned from a pebble, often with cortex remaining on the basal edge, were the most common projectile points recovered during Berger's investigations at Puncheon Run. It is uncertain whether these points are temporally diagnostic and whether their shape or manufacturing technique changed over time. The excavations in the Metate block provided a significant sample of these points radiocarbon dated to between 2000 and 1200 BC, and one was recovered from Feature 33 nearby, a small pit dated to circa 800 BC.

Joffre Coe, based on his work in North Carolina, clearly expressed one of the advantages of excavating a deep, stratified alluvial site in a floodplain setting, as opposed to the usual palimpsest encountered in Piedmont plowzones:

> ". . . When an occupation zone can be found that represents a relatively short period of time, the usual hodgepodge of projectile point types are [sic] not found—only variations of one specific theme. In the light of this evidence, there can no longer be any doubt as to the diagnostic value of projectile points, but to be useful the types must be defined with precision" [Coe 1974:9].

Lou Brennan dubbed this the "Coe Axiom." However, Custer (1994:172) has questioned the applicability of the Coe Axiom for the Woodland I period in Delaware, arguing that Woodland I projectile point assemblages typically exhibit a great deal of variability. Custer would attribute this stylistic variability—such as the apparent contemporaneous existence of narrow stemmed points and broadspears—mainly to functional distinctions within a single cultures's toolkit. In contrast, Dent (1995:214) has offered an alternative explanation for the evident contemporaneity of stemmed points and broadspears, and their occasional co-occurrence within the same Woodland I assemblages:

> ". . . This co-occurrence of diagnostic artifacts is more likely a case of expected interaction between very different yet contemporary groups, perhaps even evidence of the development of symbiotic dependencies. . . . It is to be expected in situations where one group is pushed into less productive areas by another entity that arrives to occupy very productive ecological niches."

Similar interpretations of narrow stemmed points and broadspears as markers of competing societies have been presented by, among others, Kinsey (1972), Mouer (1991), and Bourque (1995). [See Appendix O, Volume II, for additional discussion of the importance of inter-societal competition in prehistory].