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Department of Anthropology

AN INVENTORY AND ASSESSMENT
OF PREHISTORIC ARCHAEOLOGICAL RESOURCES
IN THE NEW JERSEY PINELANDS:
PHASE 1 OF A REGIONAL PREDICTIVE SURVEY

Submitted to the State Office of Historic Preservation
and the New Jersey Pinelands Commission
by the Archaeological Research Laboratory
Department of Anthropology
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The Red Man, at least, as far as Southern New Jersey is concerned, is forgotten. He and his people may be forgotten, as you say, but continually there are turned up tangible reminders of days before our coming, days when the Indian was lord of all he surveyed.

Henry Charlton Beck
Forgotten Towns of
Southern New Jersey
1936: 270-271

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ACKNOWLEDGEMENTS

The inventory and assessment of prehistoric archaeological site locations in the New Jersey Pinelands has been completed. This undertaking has resulted in the identification and mapping of 1,046 site locations within the region as federally and ecologically defined. By their sheer numbers alone, these sites represent a quantum leap toward increasing our understanding of a region which could only be dealt with by archaeologists in a speculative manner. The subsequent analysis of these sites will play an important role in the development of a regional predictive model.

The success of the initial inventory would not have been possible without the cooperation of a large number of individuals from both the amateur and professional communities. It is therefore incumbent upon state and federal agencies as well as individual professional archaeologists to see that this relationship is maintained; we have a great deal to offer each other.

We would like to extend our sincere appreciation and gratitude to the following agencies, institutions, and individuals for their contributions to this study:

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EXECUTIVE SUMMARY

This report presents the preliminary findings of an archaeological survey of prehistoric aboriginal sites in the New Jersey Pinelands. This study is an outgrowth of earlier research which set about to examine the relationships between site occurrence and environmental factors in an effort to identify any repetitive and predictable associations between the two (Cavallo 1978). Although this work was originally designed as a piece of academic research in a portion of New Jersey which is virtually unknown archaeologically, it was recognized that the study would also hold promise for establishing procedures and policies for managing cultural resources in a region where these resources have come under stress from a wide range of development pressures. In the interest of promoting both theoretically relevant research and responsible cultural resource management, this study was jointly funded by a matching-grant from the New Jersey Department of Environmental Protection (Office of Historic Preservation) and matching funds from Monmouth College and the New Jersey Pinelands Commission.

This research has been designed as a two-phase effort in which preliminary data acquisition and analysis is to be followed by the development and testing of a theoretical model of archaeological site prediction in the Pinelands region. This report addresses itself to the results of the first phase of this research, with respect to its status as a theoretical inquiry as well as its application to problems of cultural resource management.

Since, as Clark (1977) has said, "Environmental Management is a form of art that prospers in direct proportion to the scientific knowledge on which it is based," the present research has had as its principal goals the construction of an inventory and

evaluation of prehistoric sites within the Pinelands. To this end data concerning the distribution of prehistoric sites and find spots in the Pinelands were gathered from archival sources, publications, and from interviews with numerous professional and avocational archaeologists and artifact collectors.

This work has resulted in the listing of 1,046 prehistoric archaeological sites within the Pinelands as federally and ecologically defined. In each instance data about environmental settings were recorded so that interrelationships between site occurrence and ecological factors could be analyzed. Data concerning the cultural affiliations, chronology, content, and physical condition of each site were also recorded in as much detail as possible.

These data will serve as the basis for the development of a conceptual model which will allow the locations, and possibly the qualities, of aboriginal sites to be predicted in unsurveyed areas of the Pinelands. The underlying principal of this model is that cultural systems are significantly structured by, and dynamically related to the characteristics and configurations of the environments in which they occur. Repeatedly observed correlations of site locations with certain environmental settings should, therefore, provide a certain measure of predictability to the recognized patterns of site distribution, and this predictability should, in turn, allow the projection of recognized patterns of site occurrence into regions which have not been subjected to serious archaeological inquiry. Since predictive models have been used successfully elsewhere, it is believed that a useful and accurate model of aboriginal site prediction can be developed for the Pinelands as well. At this point sufficient information about site locations in a range of ecological contexts has been collected to

develop, test, and refine the model of site prediction.

The predictive model will lead to the definition of areas of high and low potential with respect to prehistoric cultural representation. These areas are to be indicated on sensitivity maps which will allow both planners and preservationists to identify appropriate levels of survey necessary to satisfy both research and management needs and/or to suggest ways and means of minimizing the loss or degradation of cultural resources as a result of proposed development.

For the purposes of present data analysis, all of the presently known cultural representations within the Pinelands National Reserve were organized into a set of 16 study units. Together these study units represent the known range of interrelationships between archaeological remains, their ecological settings, and their temporal distributions. The observed site frequencies, distributions, and context were described for each study unit. Each unit was then evaluated in terms of its potential research value and peculiar management requirements, taking into account past survey efforts, site frequency, site distribution and existing or anticipated development pressures. This analysis resulted in the division of the Pinelands into zones which are considered to be either critical or sensitive with respect to research potential, conservation needs, and management strategies. Recommendations concerning future research and/resource conservation, as well as project application and review, have been advanced on the basis of the data at hand and the analysis performed to date.

Even though the findings of the survey at this point must be recorded as tentative, the current research represents an advance over former conditions. In light of the immense size of the Pine-

lands region, the lack of adequate archaeological inquiry in the past, and the pressures exerted upon cultural resources by developers, relic collectors and others, it is obvious that the study of Pinelands archaeology is not only a task of tremendous proportions, but also one of great urgency. A sustained commitment to identify, locate, sample, evaluate, and conserve the archaeological resources of the region will be required if the structure and operation of prehistoric cultural systems in the Pinelands are to be well understood. Nevertheless, the results of the present inquiry, though tentative, provide support for the zonation of the region into critical and sensitive areas and a reasonable justification for the various recommendations offered in the body of this report.

Management of cultural resources entails the management not of discrete cultural representations alone (e.g. sites and/or find spots) but of whole cultural systems. These systems must be managed with respect to the interrelationships of the parts and the unity of the whole. For this reason certain apparently insignificant sites may assume a great deal of importance in any attempt to understand the structure and operation of the cultural system of which they formed a part. Even though the apparent frequency and density of certain sites in given settings is quite low, (e.g. on drainage divides) it must be remembered that the paleo-cultural exploitation of Pinelands habitats other than riverine settings has been routinely ignored by archaeologists in the past. The preliminary results of this study strongly indicate that past survey and research efforts seriously underestimated the complexity of aboriginal cultural systems in the Pinelands; it is also evident that existing inventories up to the time of this

writing grossly underrepresent not only the frequency, but also the ecological diversity of aboriginal settlements in this region. Renewed research in the Pinelands, and particularly in previously neglected environmental zones, will certainly augment and refine current perceptions about patterns of Native American life in this region.

Since no major portion of the Pinelands has been adequately surveyed archaeologically, it is imperative to conserve known or predictable cultural resources to the fullest extent possible so that these resources can be studied and interpreted for the benefit of present and future generations. The nature of the recommendations given in the body of the report reflects this concern and recognizes the need to strike a balance between contemporary and anticipated land uses in the region on the one hand, and the legitimate interest in historical preservation on the other. It is recognized that in the future, as circumstances change, revisions in the scope and thrust of management procedures and policies may, in turn, require modifications and refinements. In the meantime, it is the authors' conviction that the recommendations outlined in the text provide a tenable basis for structuring responsible cultural resource management in the Pinelands.

R. Alan Mounier
John A. Cavallo

PREHISTORIC OVERVIEW

The significance of the prehistoric cultural resource base of the New Jersey Pinelands can be best understood if one is generally acquainted with the prehistory of the State as a whole. Viewed from this broader perspective it will become apparent that continuing research in this unique region together with proper management of the resources could provide invaluable information and data specific to archaeological problems of the Pinelands, New Jersey, the Middle Atlantic region and the Northeastern United States in general.

What follows is a brief overview of New Jersey prehistory. It is no way complete and it should be stressed that there are numerous data gaps for each cultural period discussed. Due to the lack of intensive, systematic, State-wide surveys, much of what is known about New Jersey's prehistoric Indians emanates from excavations in the Upper Delaware Valley. These populations were adapting to and exploiting highly distinctive environmental settings. Since the excavated sites were primarily confined to areas along the river, the data generated from them are considered regionally restricted.

The prehistory of New Jersey and the Middle Atlantic coastal plain can be best understood by reference to three major cultural traditions defined for the eastern United States: the Paleo-Indian tradition, the Archaic tradition

and the Woodland tradition. Each of these is characterized by distinctive adaptations to dynamic or changing environments together with specialized technologies.

The Paleo-Indian Tradition (10,500 B.C. to 8000 B.C.):

The earliest recognized prehistoric population on the North American continent was represented by groups of hunter-gatherers known to archaeologists as the Paleo-Indians. They ranged over a wide geographic area of this hemisphere and evidence of their presence has been noted from Alaska eastward to the Atlantic Coast and as far south as the southernmost extent of the continent.

Their hallmark is a distinctive type of projectile point which was used to tip javelins, spears, or knives. They are easily recognized by the presence of single or multiple flake scars which extend vertically from the base of the artifact, upwards toward its tip. Because of this peculiar manufacturing technique, these points are collectively referred to as "fluted points". (See Figure 1).

Fluted points were first discovered in the mid-1920's on a number of sites in the American Southwest. Since the majority of these points were associated with the bones of extinct Ice Age mammals (bison and mammoth) the term "Big Game Hunting Tradition" was given to Paleo-Indian groups from that region (Willey 1966:37-38). Unfortunately, the term was applied to the occupants of all Paleo-Indian sites throughout the continent. While the largest numbers of fluted points have been found in states east of the Mississippi, none have been found in direct association with the remains of large Pleistocene (Ice Age) mammals.

To date, over 200 fluted points have been found in New Jersey. The largest number of these occurs in the area of the Delaware River and its principal feeders. With few exceptions, all of these points were found on the surface of sites. Attempts at locating below-surface or undisturbed Paleo-Indian sites within the State have met with disappointing results.

A classic example is the Plenge Site in Warren County reported by Herbert Kraft (1977). Surface collections from this extensive site yielded no less than 1500 Paleo-Indian implements, 131 of which were fluted points or preforms. Subsequent excavations produced no evidence of Paleo-Indian occupation in the subsoils (Kraft 1977:270).

Very recently, several Paleo-Indian sites and a number of fluted points have been documented for the Outer Coastal Plain and the New Jersey Pinelands. Their discovery is notable because of the contentions held by past researchers regarding the lack of Paleo-Indian sites and projectile points in the Outer Coastal Plain. The researchers implied that this region was environmentally unattractive to these early populations. The region of the Delaware River and the portion of the Continental Shelf exposed during Paleo-Indian times were thought to be the favored occupation areas.

During the past two years the Rutgers Archaeological Survey Office under the direction of Dr. Joel Grossman recovered two fluted points in subsurface contexts from two separate sites on the Manasquan River in Monmouth and Ocean Counties. Within the study area, John Cresson and

Anthony Bonfiglio have discovered a consistent pattern of Paleo-Indian and Archaic use of a particular type of periglacial feature called a pingo that abounds in the region. The end of the Ice Age or Pleistocene Epoch was marked by a general warming trend resulting in glacial melt and a rise in sea levels. At this time there was a shift in surface cover in the Pinelands from a boreal spruce parkland to pine-spruce-hemlock and finally, at the beginning of the Archaic, to oak-pine. Many of the cold-adapted animals probably retreated northward with the glaciers. These were replaced by deer, elk, moose, bear, and smaller mammals.

During this period there was a change in the style of projectile points and new items such as bola stones and spear-thrower weights were later added to the tool kit. The technique of fluting points was abandoned and the resulting changes in projectile point form has been used to mark the end of the Paleo-Indian Tradition and the beginning of the Early Archaic. Recently it has been suggested (Gardner 1974; and Bryan 1977) that a change in projectile point styles does not a new tradition make. They argue that Late Paleo-Indian populations and Early Archaic peoples made their living in much the same way and view the Early Archaic as a continuation of the Paleo-Indian Tradition.

Data from the Turkey Swamp Site near Freehold seem to support these contentions. The site is located on the oak-pine fringe of the Pinelands in Monmouth County. Four basally-thinned projectile points were excavated over two field seasons together with charcoal which was submitted for radio-carbon assay. The dates secured from these samples ranged between

6000 B.C. to 7042 B.C. Three of the four points were recovered slightly below the strata from which the dates originated. While analysis of these points and other associated tools has not been completed, John Cavallo, the site director, has assigned them to a Late Paleo-Indian context. Many of the stylistic attributes of the points appear to resemble Dalton points which have been assigned to the Late Paleo-Indian Period elsewhere (Cavallo 1978).

The Archaic Tradition (8000 B.C. to 1000 B.C.): Like the Paleo-Indian tradition, most of what we know about the Early Archaic period in New Jersey has been based upon surface-collected artifacts. The first excavated site to reveal evidence of Early to Middle Archaic was excavated by H. Kraft, the Harry's Farm Site (Kraft 1975) located just north of Tock^s Island in the Upper Delaware Valley. A small hearth located deep in the subsoil contains a point tentatively identified as a Kirk Stemmed. Charcoal associated with this feature yielded a radiocarbon date of 5430 B.C. \pm 120 years. Based on this date and several from a Staten Island site, Kraft contends that small bands of hunter/gatherers from the southeast may have made sporadic incursions into this area (Kraft 1975).

Sites of the Middle to Late Archaic periods (circa 5000 to 1750 B.C.) are far more ubiquitous throughout New Jersey. This is probably due to environmental shifts which were conducive to the support and growth of aboriginal populations during this span of time. The increase in resource availability also allowed for the exploitation of more diversified environments and a more sedentary lifestyle.

Milling stones and other food-grinding implements attest to an increased reliance on gathered wild plant species- nuts, roots, seeds, and berries. Net sinkers and harpoon heads indicate the importance of fishing and refuse pits have yielded the remains of freshwater mussels and other aquatic resources.

The majority of excavations of Late Archaic sites in New Jersey have been conducted by Herbert C. Kraft and Dr. W. Fred Kinsey, III in the Upper Delaware Valley. In the Outer Coastal Plain, a significant Late Archaic cemetery was excavated by Richard Regensburg at the Savich Farm Site in Marlton (Regensburg 1971). The complex produced 41 cremated burials and accompanying grave goods consisting of Koens-Krispin points, bi-pennate atlatl or spear-thrower weights, chipped stone adzes and full grooved axes. This occupation was radiometrically dated between 2300 and 1900 B.C. The site also contained extensive evidence of an Early Archaic occupation (Regensburg, personal communication).

Based on changes in lifestyle, or settlement, and the emergence of new tool technologies, the period between 1750 B.C.

1000 B.C. has been separated from the Late Archaic (Kraft 1970:19). John Witthoft (1949) and William Ritchie (1951) used the term Transitional (period or stage) to distinguish this epoch in the northeast. The hallmarks of this phase are circular and rectangular carved soapstone bowls with handles and distinctive styles of projectile points (see Figure 2).

The Woodland Tradition (1000 B.C. to A.D. 1700): This tradition is divided into three successive periods: Early, Middle and Late Woodland. The Early Woodland is separated from the previous Late Archaic and Transitional by the introduction and use of ceramic vessels and the probable beginnings of plant domestication. Settlement pattern appears to be similar to that of previous periods. The earliest ceramics are flat-bottomed, straight-sided vessels with lugs or handles of the Marcey Creek and Ware Plain types. These are thought to be followed by the Vinette I conical-based, coarse grit-tempered, coil-constructed vessels, whose interiors and exteriors are covered with the marks of cord-wrapped paddles (Kraft 1975:23). Recently, both of these ceramic types have been found associated in two refuse pits on two separate sites- The Turkey Swamp Site in Freehold and the Williamson Site in Frenchtown (Cavallo 1978; Chris Hummer, **personal** communication).

The Meadowood point is fairly prevalent on sites of this period and a number of them have been found in collections from Ocean and Monmouth Counties. One was recently excavated at the Turkey Swamp site in association with the Ware Plain and the Vinette I pottery mentioned above. Several refuse pits at this site have yielded charred hickory nuts

and floral remains which are currently being identified.

In western New York and western Pennsylvania and Ohio numerous burial mounds of this period have been excavated. These large earthen mounds usually contain the remains of elite members of the Adena and, later, the Hopewell Cultures. Along with these burials were the cremated remains of other individuals and large quantities of artifacts manufactured from copper, obsidian and conch shells. These fascinating and often bizarre objects, and the disposition of those upon whom they were bestowed, not only imply status differentiation, but extensive trade networks.

While no burial mounds have been found in New Jersey, several sites of such Early Woodland phases as Meadowood and Middlesex have been reported. The Rosenkrans Site in Sussex County was comprised of 13 graves containing cremated and uncremated human remains together with a copper boatstone, copper and whelk shell beads and a number of large broad-stemmed Cresap points (Kraft 1974:26).

During the Middle Woodland period (circa 500 B.C. to A.D. 700) coarse cord-marked pottery was replaced by net-impressed and, at the Abbot Farm site, zoned ceramics. Rossville, Fox Creek and Jack's Reef are the dominant projectile point styles. Hammerstones, anvilstones and pestles represent the processing implements of this period and netsinkers attest to the exploitation of fish as a food source. The only known house pattern of this period, consisting of a series of postmolds in an oval configuration approximately 30 by 25 feet, was

excavated on the Faucett Site in the Upper Delaware Valley. To date, no carbonized plant remains have been found on Middle Woodland sites.

The Late Woodland period (circa. A.D. 700 to A.D. 1700) is well represented throughout the state. The largest sites are usually located on major waterways and probably represent base camps which may have been occupied most of the year. Smaller sites are abundant on tributaries and feeder streams as well as near natural springs. These sites probably functioned as temporary or seasonal camps for the purpose of exploiting specific resources in a variety of rich micro-environments. The settlement units of the Late Woodland are known primarily through the work of Herbert C. Kraft who has excavated 13 Late Woodland house patterns in the Upper Delaware Valley.

While most of the artifacts of the Late Woodland period are similar to those of the Middle Woodland, there are distinct differences in several classes. Late Woodland projectile points (Fig. 3) lack stems and consist of either equilateral or isosceles triangular points primarily manufactured from flint. The bow and arrow was the principal weapon. Ceramic vessel collars became more prominent and incised geometric designs were the dominant decorative motifs in the later phases.

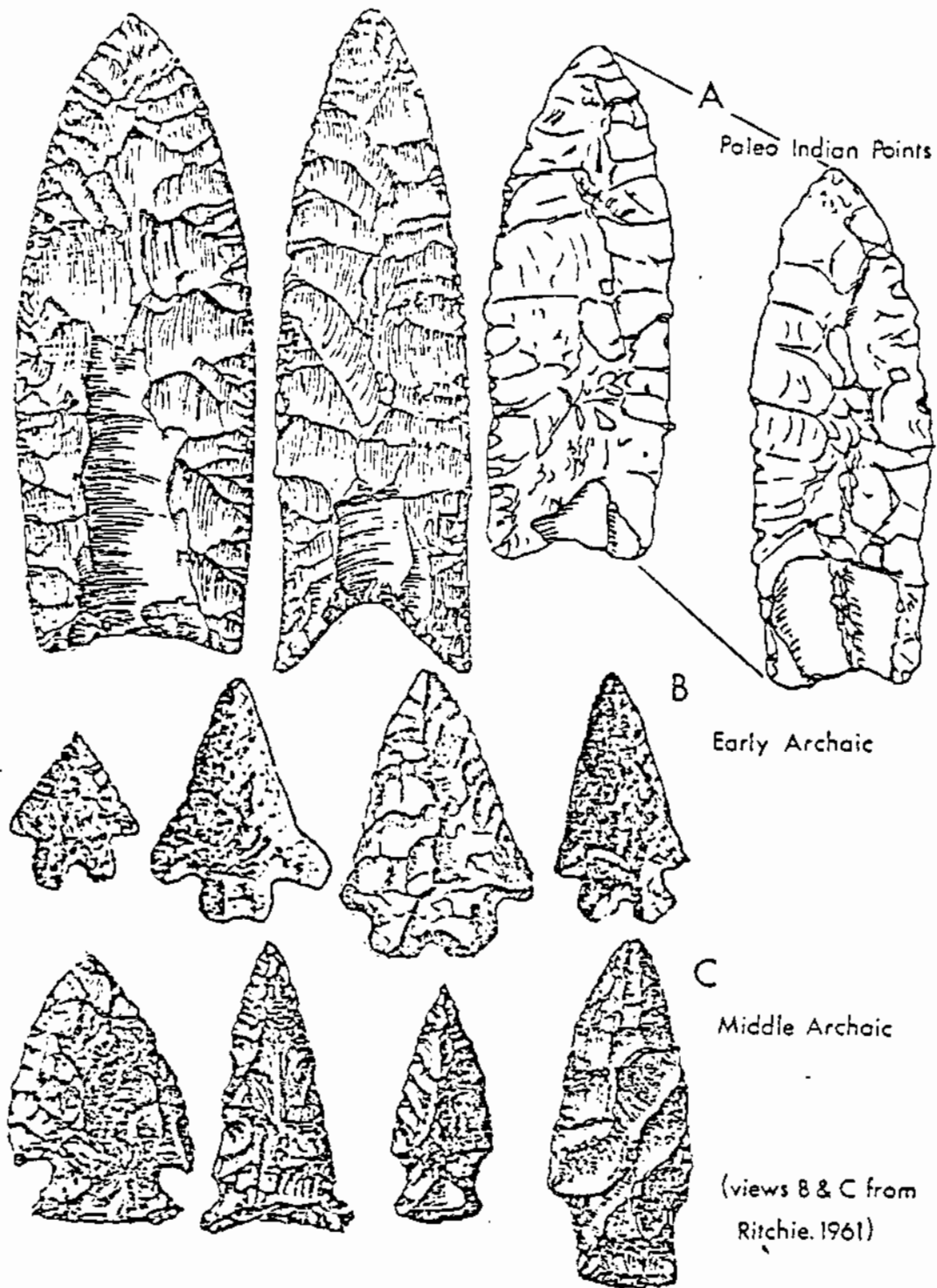
The practice of hoe-type horticulture was well-established although hunting, gathering and fishing continued as major subsistence activities (Cavallo 1977). Kraft mentions the discovery of a few charred beans and corn kernels at the Harry's Farm site (Kraft 1975:157-158). Late Woodland pits at the

Miller Field Site yielded small charred corn cobs (Kraft 1972: 42) and a Late Woodland pit at the Turkey Swamp site yielded charred corn kernels (Cavallo 1977) and the seeds of several species of wild plants. Hickory nuts and acorns were important collected wild foods as were butternut and blueberries. Fresh water mussels have been found by the thousands in many of the shell pits and middens on the river terraces in Upper Delaware Valley site (Kraft 1976; Kinsey 1972).

The historic period Indians of New Jersey called themselves "Lenape" but were renamed the "Delaware" by the Europeans. While their artifacts and general settlement pattern were very similar to that of the Iroquois, they differed linguistically; the Lenape were Algonquian speakers. They also differed in terms of socio-political organization. During the period of contact, the Lenape could not be described as a tribe in the strict sense but existed as loosely structured autonomous bands or lineages, residing in small dispersed settlements (Kraft 1974:32).

Increased contact brought about a breakdown of traditions and an increased reliance on European trade goods in exchange for furs and land. Warfare, disease and alcoholism decimated the aboriginal population to the extent that by 1759 it was estimated that only 300 Lenape remained in the state. Two hundred of these resided in America's first Indian Reservation, located in the present town of Indian Mills, Burlington County. Conditions on the reservation apparently became intolerable and the group followed the other survivors westward. By 1801 there was scarcely a Lenape left in the state; their

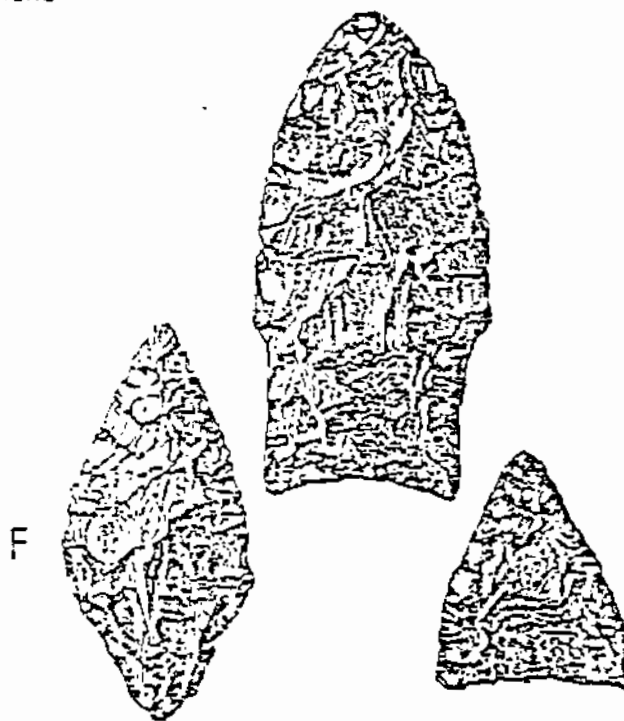
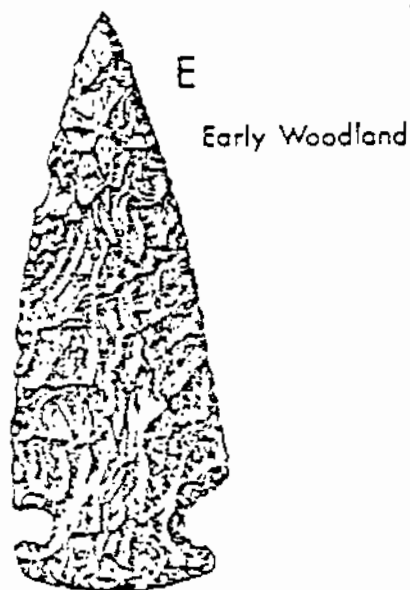
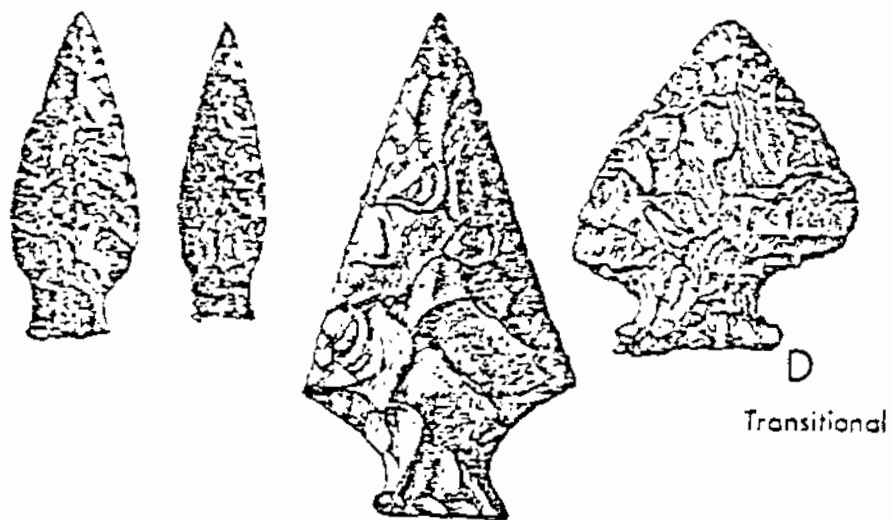
descendants reside in Oklahoma and Canada.



CHARACTERISTIC PROJECTILE POINTS of N.J.

Figure 1

Figures 1,2,and 3, courtesy Mid-Atlantic Archaeological Research, Inc., Newark, Delaware.



(views D.E & F from Ritchie, 1961)

CHARACTERISTIC PROJECTILE POINTS of N.J.

Figure 2



Late Woodland

CHARACTERISTIC ARTIFACTS of N.J.

Figure 3

SETTLEMENT PATTERN STUDIES

For many years archaeologists investigating a region would select one, or several, large sites within it for excavation. The selection process was based on a number of factors and problems related to a particular area or culture but the actual choice of site was intuitive rather than systematic. Through the study of local artifact collections the relative age and cultural affiliations of a site were established. Sites exhibiting a wide range of tool types in sufficient numbers over a fairly large area were preferred to smaller less intensively occupied locations.

Upon completion of the excavation and analysis, a site might be referred to as being "typical" of a particular culture(s) in an area. In reality the concept of the "typical" site is invalid. If the population under study made their living by hunting and gathering, no one site could be said to be typical of them because of the nature of their economic strategies. Hunter/gatherers were dependent upon the seasonal availability of edible plant and animal resources for their survival. These resources are unevenly distributed across the landscape and were not available for exploitation from a single location. In order to insure the efficient exploitation of edible and non-edible resources, these groups engaged in what is referred to as the "seasonal round". Different resources required diverse strategies, groups of people, and tools in

order to acquire and process them. These differences would be reflected in the archaeological record by the location of sites in different environmental zones and the presence of tool types indicative of specific procurement and maintenance activities.

Therefore, the only way one can understand the nature of hunter/gatherer subsistence/settlement systems is through the use of regional research strategies which investigate sites in a wide variety of environmental settings in a particular area.

PINELANDS ENVIRONMENTS

Since the theoretical basis of this study is cultural/ecological, it is essential that consideration be given to the dynamics of Pinelands environments and their relationships to the region's prehistoric native inhabitants.

Geology and Soils

The New Jersey Pinelands as federally defined encompass approximately 1,000,000 acres. However, the region as ecologically defined covers most of New Jersey's Outer Coastal Plain. The unique qualities of this environment are determined by a number of factors such as climate and topography (Figure 4). The soils are largely a result of the Coastal Plain's geological history. The present land surface is underlain by sedimentary deposits of unconsolidated sands and gravels, several hundred feet in thickness (Figure 5).

These include the Tertiary Kirkwood and Cohansey formations, and the Pleistocene Bridgeton, Pennsauken, Beacon Hill and Cape May formations, in order of deposition. Although the New Jersey Coastal Plain was never glaciated, its present landforms resulted from recurrent cycles of glacial outwash deposition, erosion, and redeposition.

Modern river systems in the Outer Coastal Plain include the Metedeconk, Toms, Cedar Creek, Wading-Oswego, Mullica, Great Egg Harbor, and Tuckahoe, which drain into Delaware Bay, and the headwaters of various streams, such as Crosswicks Creek and the Rancocas, which drain west into the Delaware River. Southern New Jersey rivers and streams show evidence of much greater water flow and volume in the late Pleistocene, as demonstrated by the presence of features such as river terraces, meander scars, ox-

bows, and braided stream channels. No major rivers presently cross the Outer Coastal Plain, though evidence suggests that the Hudson and Delaware river channels have shifted since mid-Pleistocene times, and the Schuylkill River once emptied through what is now the Mullica River/Great Bay channel. (Figure 6).

The topography of the Pinelands is a greatly undulating surface ranging between 15-46 meters (50-150 feet) above sea level. In areas of the cuesta, which form the divide between the Inner and Outer Coastal Plain, altitudes of 107 meters (350 feet) occur near Clarksburg in Monmouth County (Rhodehamel 1979:39).

Soils are a critical factor in determining plant and animal communities on the Outer Coastal Plain. Parent materials are represented by heavily weathered Pleistocene quartz sands and gravels, with occasional lenses of clay or patches of iron oxide. Water and drainage influence soil development of the thirteen recognized soil types, which range from excessively drained and leached uplands, to very poorly drained muck. All soils in the Pinelands are acid to very acid (pH 3.6-4.5). The majority of these soil types have low cation exchange capacities, or ability to hold nutrients, and are, therefore, low in fertility. In addition, the excessively drained upland soils tend to be very dry, despite abundant rainfall, and are highly susceptible to periodic forest fires (Hartzog 1979), (Figure 7).

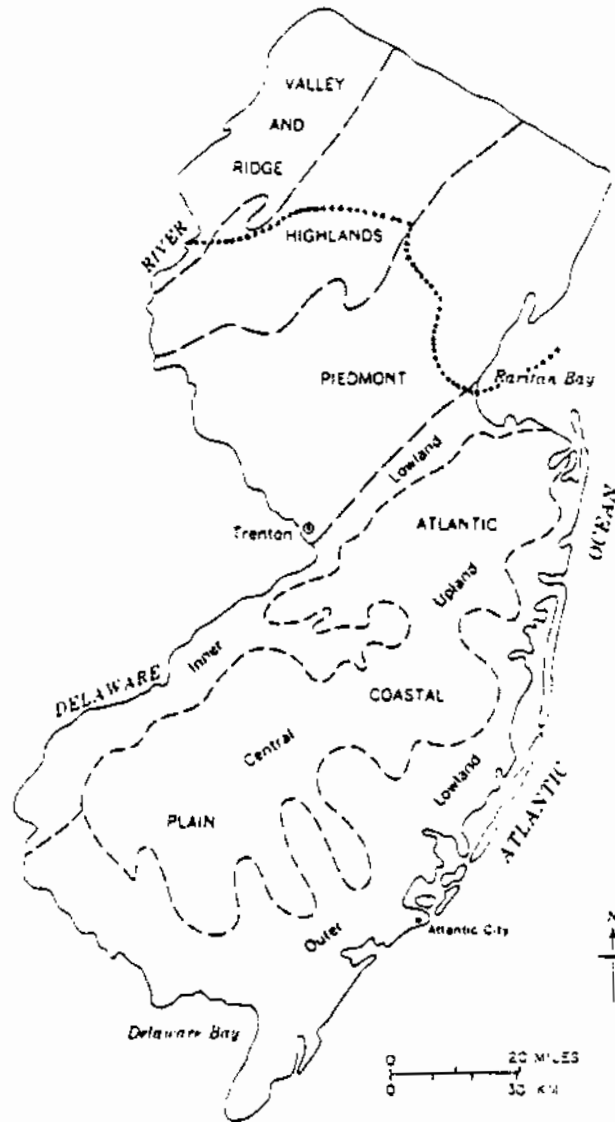
Late Pleistocene/Holocene Environments

Like its prehistoric human inhabitants, the origins of the

Pineland's faunal, floral, and vegetational communities have been the subject of speculation by such researchers as Stone (1911), Harshberger (1916), Potzger (1945), and Kraft (1977). Since little detailed evidence is available for the region, we must rely for the most part on inferences derived from this information and data from other areas.

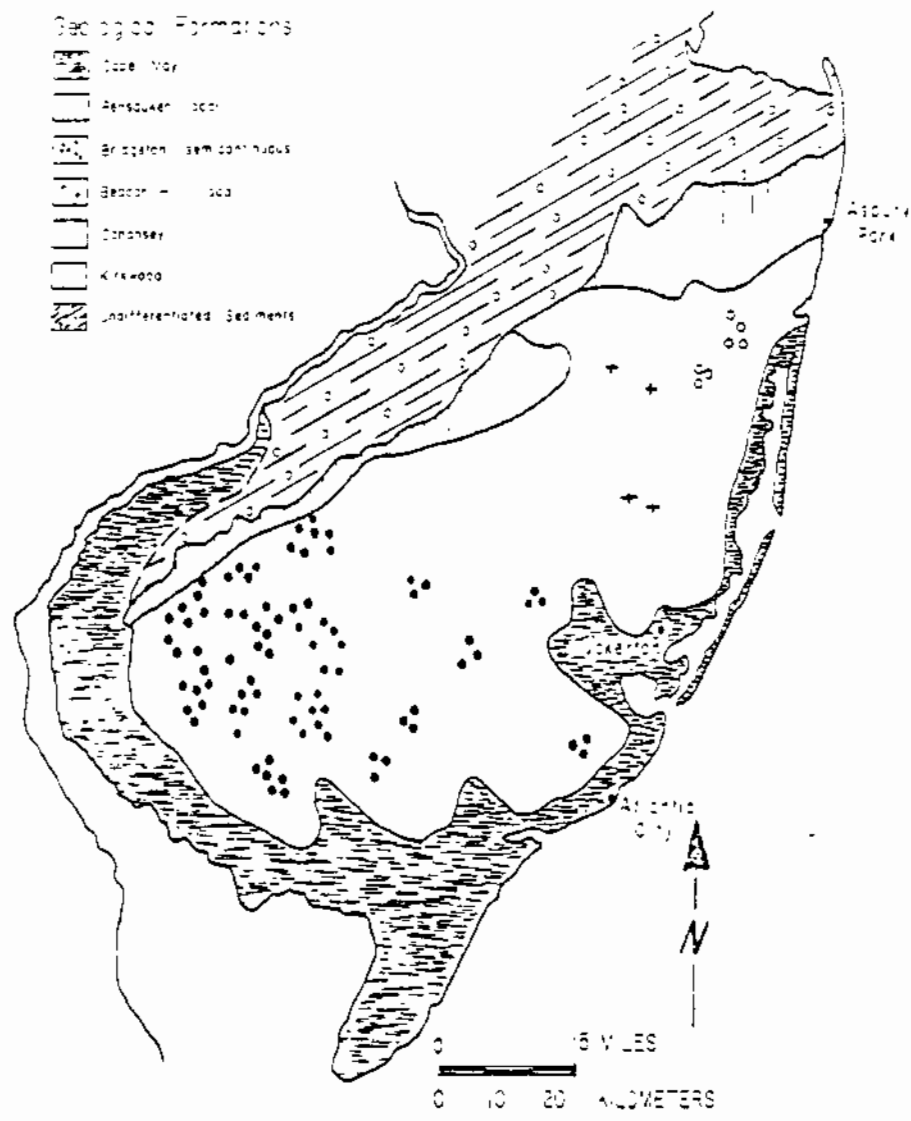
The most useful of these data were drawn from the analysis of fossil pollens collected in bog sediment cores in the Pinelands, Outer Coastal Plain, and elsewhere. A series of pollen spectra from deposits west of the Pinelands in the Delaware River Valley were described by Sirkin et al. (1970) and radiocarbon dated at $26,800 \pm 1000$, $16,700 \pm 421$, $13,200 \pm 400$, $13,680 \pm 300$, $12,330 \pm 300$ and $10,770 \pm 331$ years B.P. The major types represented throughout the spectra were pine, spruce, and birch. During the most recent interval, pine was the dominant type. "Lacking direct evidence, Sirkin et al. (1970) and Whitehead (1973) interpret the vegetation in New Jersey to have been tundra and taiga during full-glacial conditions some 20,000 years ago" (Heusser 1979:219). Late Pleistocene mammal remains associated with this period include mammoth, mastodon, musk-ox, walrus, giant sloth, caribou, moose-elk, giant beaver, and aurochs (Kraft 1977:1; Hartzog 1979).

The glacial front had reached New Jersey during this time but the ice itself was probably covered with soil and scattered trees as are many glaciers today (Stewart Ferrell, personal communication in Hartzog 1979). The moderating effects of the Gulf Stream, which was present off our coast,



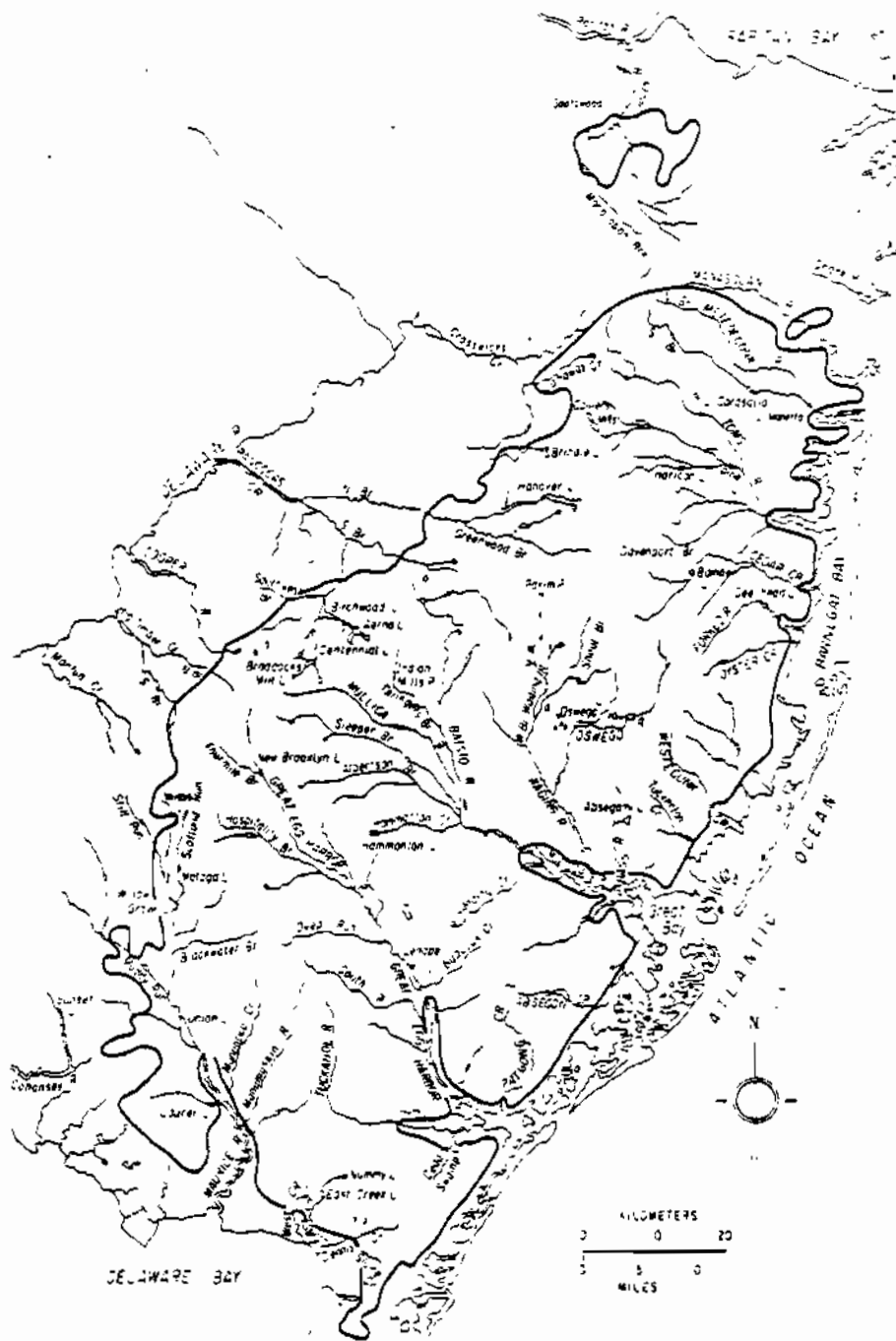
Physiographic provinces and terminal moraine in New Jersey. Dotted line is the southernmost limit or terminal moraine of the Pleistocene glaciation (Wisconsin age). Three subprovinces are indicated for the Atlantic Coastal Plain. The Pine Barrens are restricted mainly to the central upland and outer lowland subprovinces. Modified from Minard and Rhodenamel (1969).

Figure 4



Geological map of the Pine Barrens of New Jersey. Adapted from Lewis and Kummer (1910-1912) and other sources.

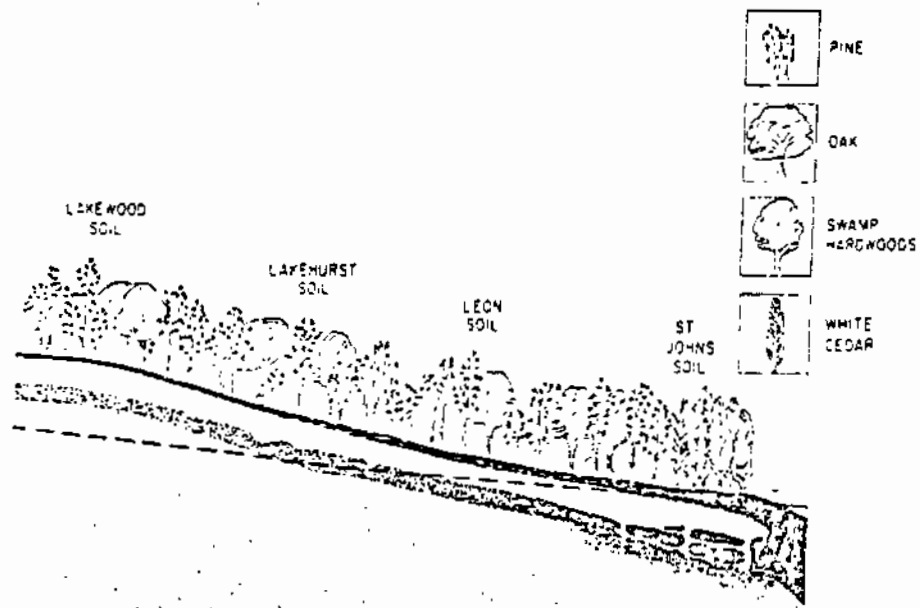
Figure 5



Major rivers, streams, lakes, and ponds of the New Jersey Pine Barrens. R, river; Cr, creek; Br, branch; Brk, brook; L, lake; P, pond.

Figure 6

Development of Pine Barrens Soils



Drainage catena of the Lakewood soil area. On the left (Lakewood soil) are shown xeric uplands and, as one progresses to the right, the water table is seen to occur at higher levels, with the site becoming more hydric in character. In addition to the Lakewood, the Lakenhurst, Leon, St. Johns, and Bog soils are present along this moisture gradient.

Figure 7

produced a more favorable climate including brief but warm summers (Hartzog 1979).

As the glaciers retreated between 18,000 and 12,000 years B.P., South Jersey was cold and wet, with dense forests of spruce, fir, birch and alder. Mastodons and mammoths were still present but caribou were probably more abundant. Oaks returned during a brief warm spell around 11,500 B.P., followed by the last glacial advance (Hartzog 1979).

A pollen core was removed from a peat bog formed in a meander scar of the Oswego River in the Pinelands by Buell (1970). The basal peat was radiocarbon dated as $10,485 \pm 240$ B.P. (Buell 1970). The core was later analyzed and described by Florer (1972). The pollen diagram generated from this core indicates that pine and oak were dominant, forming what is essentially a pine-oak assemblage with a small percentage of spruce throughout (Florer 1972:137).

Potzger (1945) interpreted pollen from eight cores in the Pinelands as representing full glacial boreal (northern) and southern broadleaf forests. Potzger concluded that the Pinelands was a glacial refugium; an area of relatively unaltered climate that is inhabited by plants and animals during a period of continental climatic change and remains as a center of relict forms from which a new dispersion and speciation may take place after climatic readjustment. Whitehead (1965) and Buell (1970) contend that the bogs analyzed by Potzger are probably post-glacial in age.

One fact that is evident in both Florer's and Potzger's cores is that the effect of climatic change on the region's

plant communities is not readily observable in the pollen diagrams. Florer states that, "It would appear that in the Pine Barrens the local environment remained relatively stable during post-glacial time, despite climatic change. The lengthy history of the pine-oak communities in the Pine Barrens also suggests that the ecological characteristics of the Pine Barrens--a podzol developed on coarse sand and gravel, acid water, and susceptibility to fire--may have existed a similar length of time. Little evidence is seen in the last 10,000 years in the Oswego River section of the Pine Barrens of the presence of boreal or southern broadleaf plant communities. Plant communities different from the existing communities may, however, have been present in the Pine Barrens prior to this period (Buell 1970)" (Florer 1972:138).

This pattern is quite similar to the vegetational history of the Delmarve Peninsula to the south (Sirkin 1977) but in sharp contrast to the pattern of succession of forest types identified for post-Pleistocene northern New Jersey, New York, and New England. The sequence of succession for these northern areas had three distinct stages: spruce-fir replaced by pine and followed by hemlock-northern hardwoods (Hartzog 1979).

With the final retreat of the glaciers, the cold-adapted animals of the Pleistocene, such as the mammoth, mastodon and musk-ox, were gradually replaced by species better adapted to temperate forest conditions. Marshberger (1916) mentions an historic source which describes a variety of fauna encountered during the construction of roads linking early settlements on

the Delaware River and those on the coast. "Roads designed to connect these early settlements were early constructed across the Pine Barrens wilderness, where abounded red deer, bears, wolves, panthers, wild-cats, foxes, rabbits, opossums, pole cats, hedgehogs, wild turkey, pheasants, grouse and quails. Wolves were so abundant that a bounty of ten shillings was offered in 1682 for every head of that animal killed in West Jersey" (p.13).

While the majority of the aforementioned fauna were hunted to extinction, thirty-four species of mammals reside in the Pinelands today. These include the large mammals, the white-tailed deer (reintroduced), 11 intermediate-sized mammals including red and grey fox, raccoon, beaver (reintroduced), and river otter (Wolgast 1979:443).

A wide variety of edible plants from the region were, and are, available within the mosaic environment of the Pinelands (Regensburg 1979). These include water lily, wake robin, huckleberries, blueberries, cranberries, acorns, and various seed plants. The bays, tidal marshes, and barrier island complexes provide habitats for shellfish, fish, and waterfowl. The rivers, streams, and freshwater marshes support a wide variety of waterfowl, edible plants, and characteristic fish species.

In the spring, anadromous marine fish move into Pinelands rivers to spawn. Blueback herring, alewife, American shad and striped bass are examples. The majority of these migratory species are confined to the tidal portions of larger rivers and seldom enter the higher acid streams. Dam construction has, no doubt, played a major role in restricting the upstream movement of these

populations. An exception to this condition is the confirmed runs of alewife in the Maurice, Tuckahoe, Great Egg Harbor, Mullica, Toms, Manasquan and Metedeconk River drainages.

Modern Pine Barrens vegetation consists of several plant communities which are controlled by elevation and drainage. Despite the abundant rainfall -- up to 48 inches annually--dry upland sites occur. These may contain oak, oak-pine, or pine-oak dominated communities. The dominant species depends largely upon the incidence and severity of fires on such sites, which kill off oaks but not pitch pine. The most extreme example of this condition is the Pine Plains area, or PLAINS consisting of dwarfed pitch pine, blackjack and bear oak, most of which are under 5 feet in height. More favorable upland sites have white, black, scarlet, and chestnut oaks, and an underbrush of lowbush blueberry and other heaths.

At lower elevations and moister sites, pitch pine, sassafras, black gum, holly and dense underbrush are found in areas designated "pitch pine lowlands". Sites with flowing water may contain predominantly Atlantic white cedar--cedar swamps--or swamp hardwoods such as red maple, sweetbay magnolia and black gum. Stagnant waters produce acid sphagnum bogs. Freshwater marshes are found along rivers and streams.

Prior to 1750, the Pinelands were undoubtedly a richer, more productive region. Heavy cuttings of the forests began in the 17th century and by 1749 threatened to deplete such species as white cedar (Little 1979:107). Pinelands lumber was used for a variety of purposes including local building, shipbuilding, fuel, charcoal, and export to nearby cities (Little 1946).

"In 1957 Cook stated that many forested swamps of Cape May County had been cut over twice, and some three times, since settlement. By now, many upland and swamp sites have been subjected to at least five clearcuttings"(Little 1979:107). A number of severe fires resulting in the destruction of thousands of acres of forested land are recorded shortly after settlement. This pattern of periodic fires has continued to this day and, along with succession, past use, and abuse, has shaped the present configuration of Pinelands forests(Little 1979:113).

To the ecologist, the New Jersey Pinelands represent a combination of species and ecosystems found nowhere else in the world (Forman 1979:570). One of the major problems confronting ecological researchers is the lack of sufficient data regarding the origin and development of faunal and floral aggregations and interrelationships in the region. This is particularly true of the period between the early Holocene and initial settlement by Europeans. Within the framework of a systematic interdisciplinary program of research, archaeologists could provide a variety of data related to ecological problems.

For example, the flotation of soils from prehistoric aboriginal refuse or storage pits could yield carbonized seeds, wood charcoal, and faunal remains. Analysis of these remains would facilitate species identification. If a sufficient number of sites of the various cultural traditions were sampled in areas representing the full array of environmental settings in the Pinelands, the ecofactual data from them would provide a fairly accurate picture of the configuration of regional environments through time. This, of course, would be dependent upon the degree to which the

sample approximated the full range of functional and seasonal variability of sites within a particular setting.

Data derived from the analysis of pollen cores collected in peat bogs, archaeological sites, and relict pingos (Jack Cresson-personal communication) would supplement those obtained from ethnobotanical remains. The use of more precise analytical techniques in the identification of fossil pollens would aid in the determination of species rather than genera as is the case with the diagrams previously discussed (Sandra Hartzog-personal communication).

The integration of ethnobotanical, palynological, and geological data would form the basis for paleoenvironmental reconstruction. It will then be possible to explicate the effects of climatic change on the Pinelands; to approximate more precisely, the configuration of plant and animal populations; to measure their effects on cultural dynamics through the employment of subsistence/settlement models; and to ascertain the extent to which historical factors modified present-day ecosystems.

PAST ARCHAEOLOGICAL RESEARCH IN THE PINELANDS

The project which comprises the subject of the present report is the first to attempt a systematic and thorough investigation of prehistoric cultural resources in the Pinelands. Earlier site surveys had been undertaken in New Jersey, but for a variety of reasons, the Pinelands have received very little serious investigation.

The New Jersey legislature sponsored the first state-wide survey of archaeological sites beginning in 1912. Although the survey was authorized for the next few years, it should be noted that the actual investigations were confined to a period of only a few months duration (Skinner and Schrabisch 1913:41). The survey was concerned only with surficial representations; no excavations were undertaken.

During the depression era New Jersey archaeology became the focus of a Work Projects Administration (W.P.A.) undertaking which again lasted but a few years. This effort was as much concerned with creating work for the unemployed as it was with understanding New Jersey prehistory (Cross 1941). The survey involved superficial site inspections and excavations, using local labor under loose supervision of the archaeological staff.

While these surveys did prove useful in achieving a preliminary characterization of archaeological remains in the state, neither effort resulted in much activity within the Pinelands. The survey of 1912 resulted in the recording of about 1000 sites of which only about a dozen occurred in

the Pinelands. The W.P.A. survey located about 50 Pinelands sites out of a total of nearly 600 investigated locations.

These surveys scarcely penetrated the region, largely because extensive forest cover masked site locations and poor roads made access difficult. Because of these problems and other logistical constraints, the early surveys in South Jersey concentrated upon the intensively farmed and highly accessible lands of the Delaware Valley.

On the basis of the findings of the preliminary archaeological survey, Skinner observed that:

The great mass of villages and cemeteries... are along the Delaware River and its tributaries... It will be observed that the interior is practically devoid of sites, except on the headwaters of the more important creeks and rivers. This lends support to the tradition that the sandy interior of South Jersey was more of a hunting ground than anything else. (Skinner and Schrabisch 1913:16;41).

Despite the apparent unevenness of regional coverage, the results of the preliminary survey efforts have generally been taken as prima facie evidence that the Pinelands were unoccupied or, at best, sparsely settled in prehistoric times. For example, Harshberger (1916:13), after reciting the inhospitable and forbidding qualities of the pine forest, went on to say that:

Even the Indians... rarely penetrated these pine-barrens except for hunting and fishing...

This notion of aboriginal settlement has proven to have wide popular appeal and has persisted down to the present day despite the frailty of the evidence upon which it is

based.

Most of the archaeological inquiry in the Pinelands region has been undertaken not through government sponsored surveys but through the efforts of a few interested individuals. In 1955 Charles F. Kier, Jr. conducted a survey of prehistoric sites in the drainages of the Nescochaque Creek, the Mullica River and the Batsto River. Through a combination of surface inspection and subsurface testing Kier located a total of nineteen site locations.

Beginning in the late 1960's Richard Regensburg investigated numerous sites within the Pinelands in the vicinity of Marlton, Burlington County. The most prominent of these sites is the Savich Farm which contained more than 50 cremated human skeletons with associated grave goods in a Late Archaic cemetery. The site also yielded evidence of numerous components dating from Early Archaic to Late Woodland times. At least some of the components have been dated by means of radiocarbon assays. The Savich Farm is currently the only prehistoric site in the Pinelands to be listed upon the State and National Registers of Historic Places.

Also in the late 60's and early 70's R. Alan Mounier conducted extensive surveys and excavations in the Maurice River drainage, and to a lesser extent in the watershed of the Great Egg Harbor River. The numerous sites along the Maurice River - representing the entire span of prehistory in southern New Jersey - appeared to cluster along the margins of the watercourse and to form a graded series

ranging from very substantial habitations along the main trunk to small campsites at the river mouth and in the headwaters. The extent to which this pattern can be reasonably projected to other drainage networks remains to be determined.

This research, and most other investigations dealing with the prehistory of South Jersey, focused on aboriginal settlements in the context of extant river systems. However, as a result of extensive fieldwork, Anthony Bonfiglio and John A. Cresson began to recognize a consistent association of early cultural materials with certain geomorphic features in other settings (Bonfiglio and Cresson 1978, Cresson 1976). These features are referred to as thermokarst basins or "pingos."

Pingos represent relict structures of a periglacial environment dating to Pleistocene times and, therefore, bear no particular association with present riverine drainages. Resulting from the collapse of ice cones as a result of late- and post-glacial warming, pingos comprise circular or oval depressions which tended to collect water and to support a variety of floral and faunal resources. These resources in turn proved to be attractive to human populations, for the most part represented by artifacts characteristic of Paleo-Indian and Archaic traditions. Of the 94 relict pingos thus far examined by Bonfiglio and Cresson, 89 (c.95%) have yielded evidence of cultural utilization (see Figures 8-12).

EVOLUTIONARY MORPHOLOGICAL SEQUENCES OF SOME PERIGLACIAL RELICT STRUCTURES

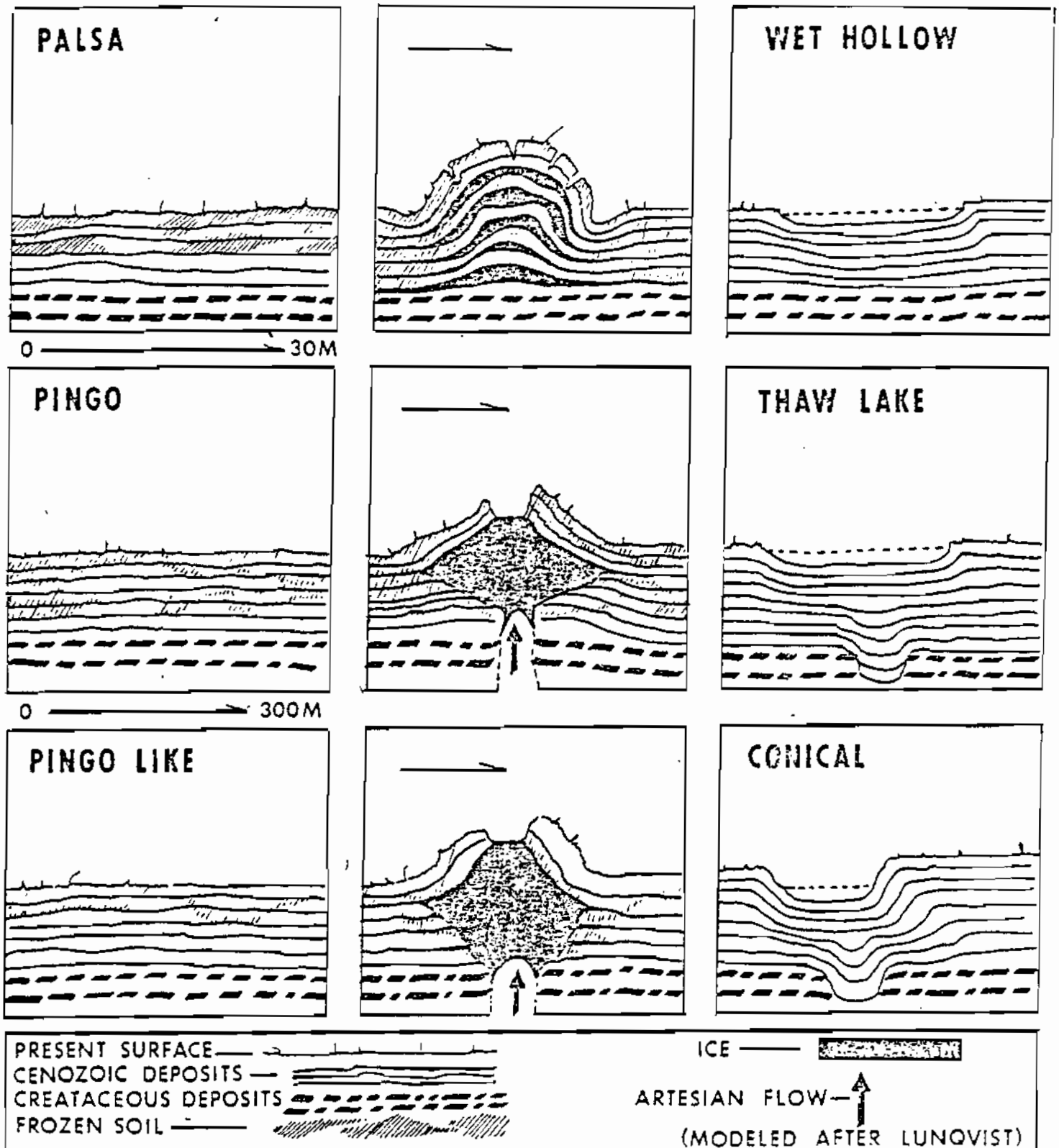
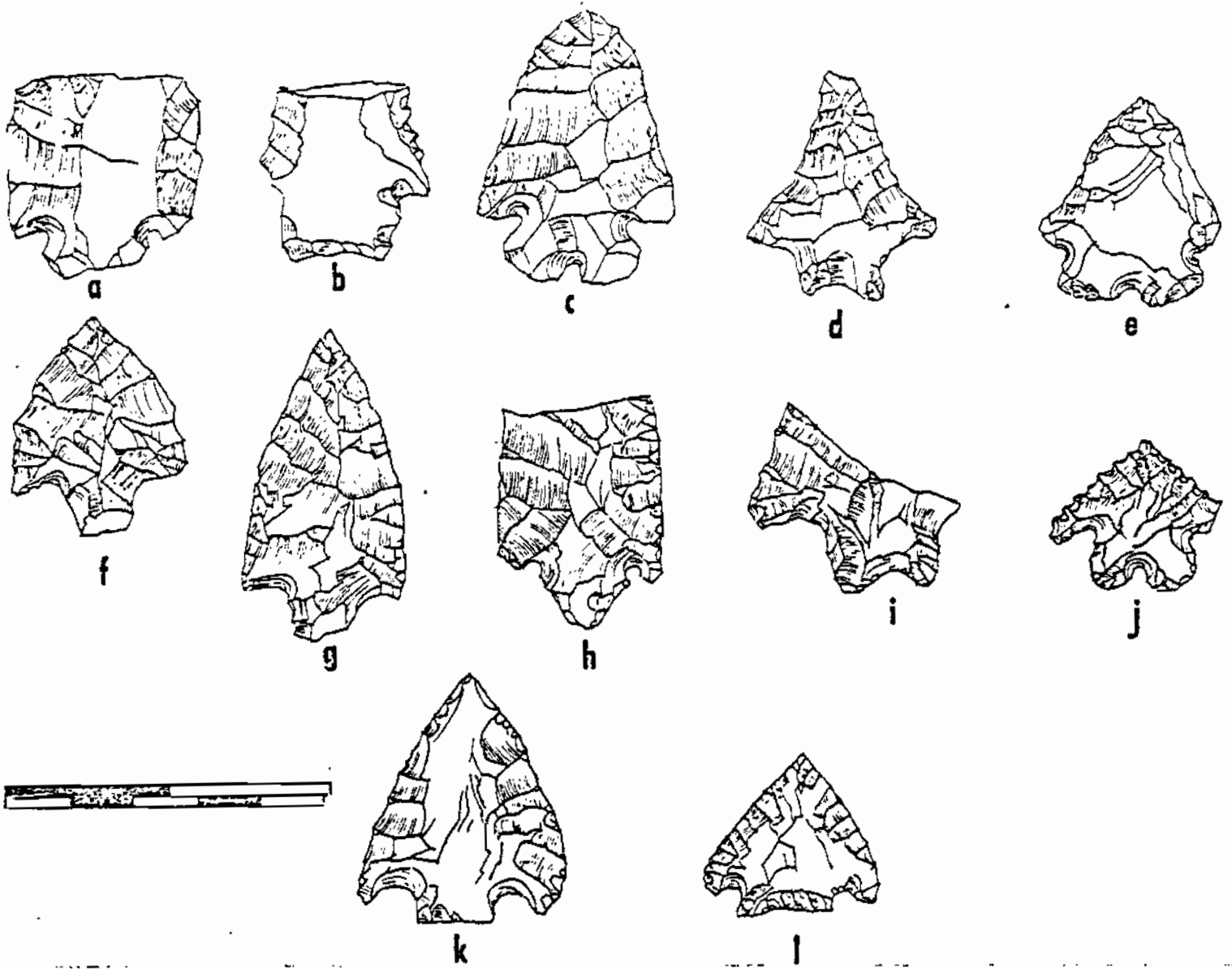


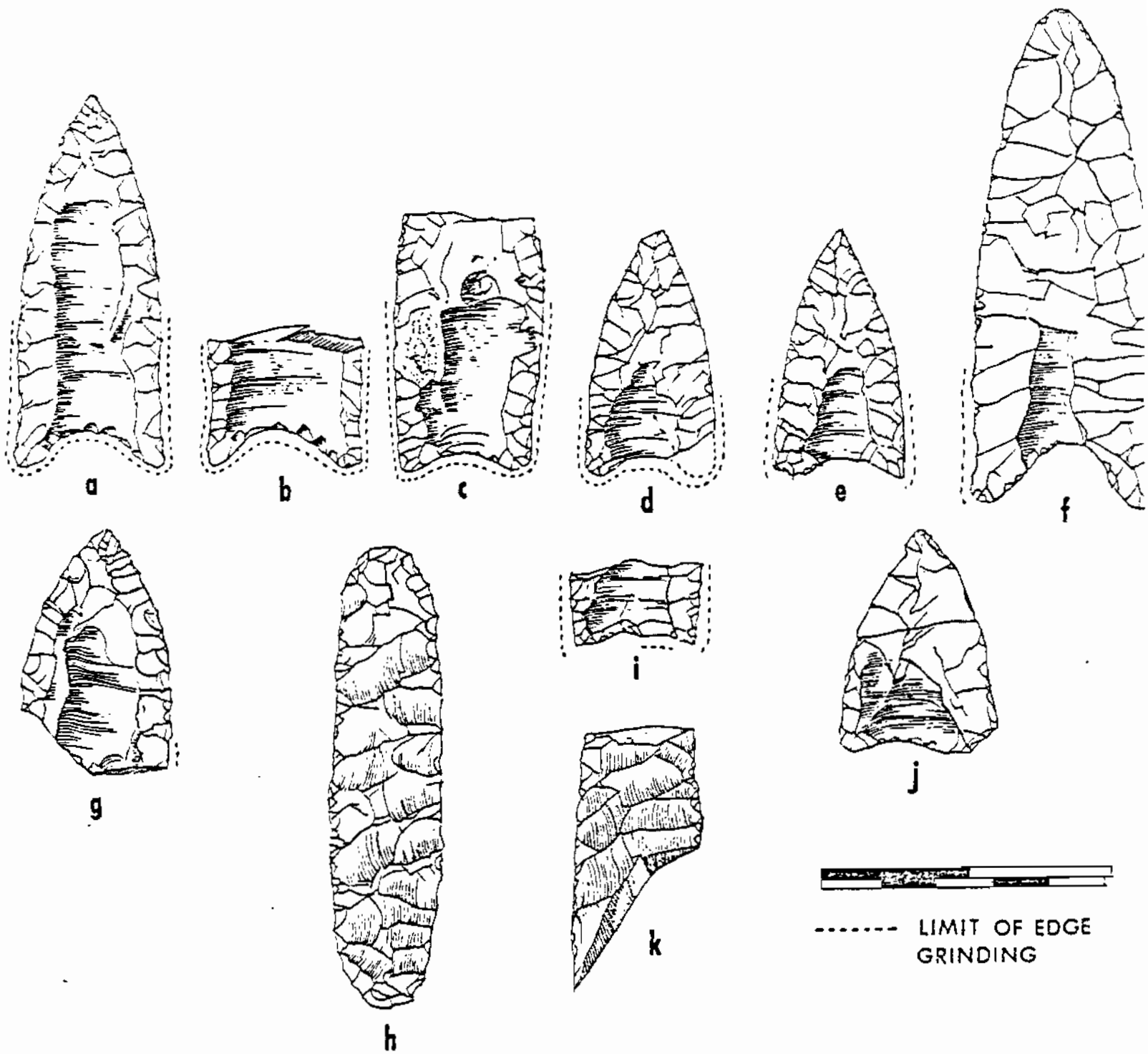
Illustration by J. Cresson
Figure 8



- | | | |
|------------------------|---------------------------|------------------------------|
| A. BROWN JASPER | E. BLACK FLINT | I. PINK/CREAM CHERT (EXOTIC) |
| B. RHYOLITE | F. BROWN JASPER (T.A.) | J. BROWN JASPER (T.A.) |
| C. GREY CHERT | G. BLACK FLINT (EXOTIC) | K. QUARTZ |
| D. DEHYD. YELL. JASPER | H. BROWN JASPER | L. QUARTZ |
| | (T.A.) THERMAL ALTERATION | |

Projectile points and point fragments of the Archaic Tradition (Early and Middle Periods) found associated with relict-pingo or frost thaw basins.

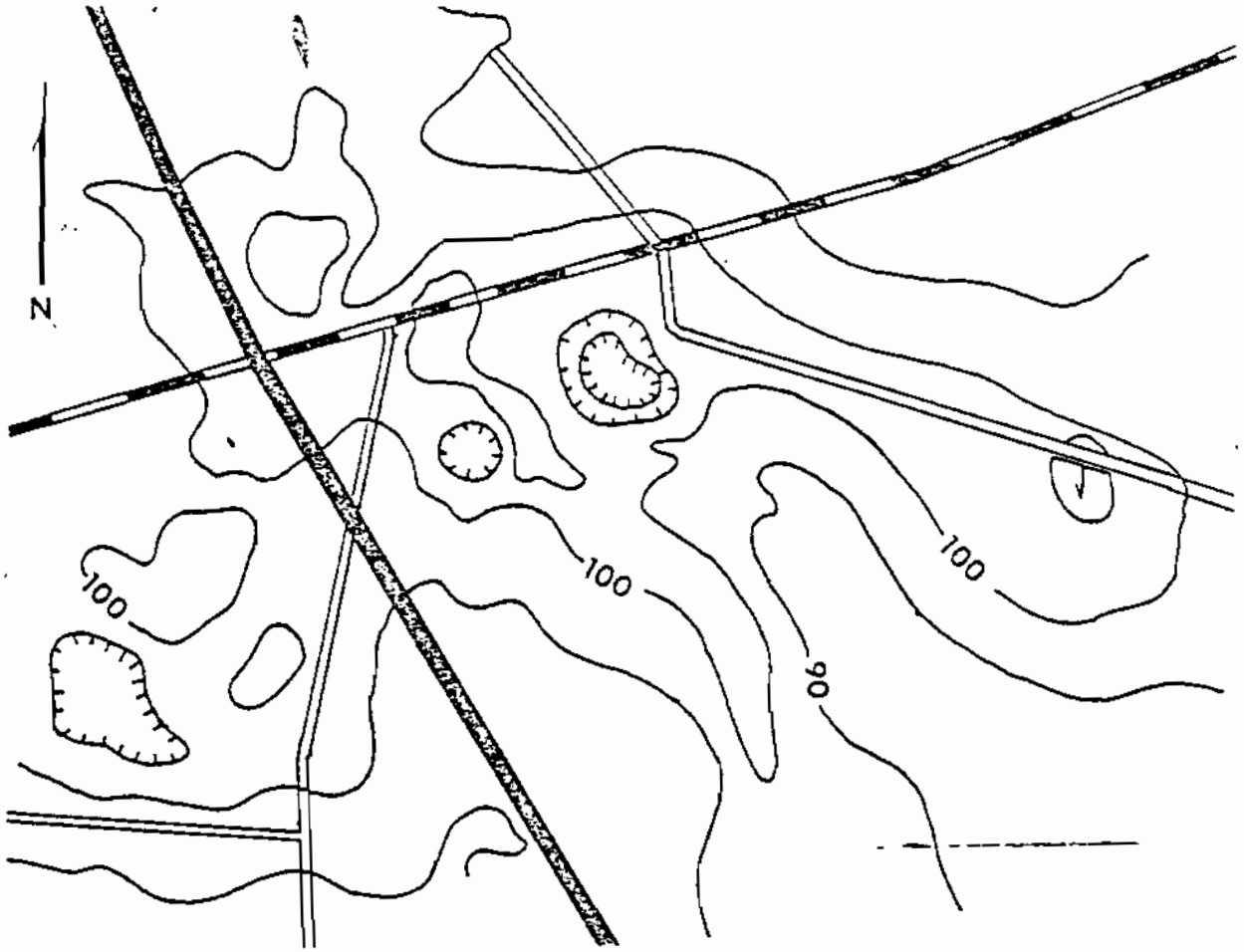
Illustration by J. Cresson
Figure 9



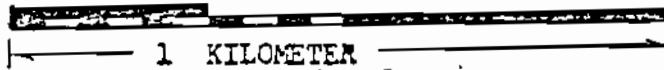
- | | | |
|--------------------------------|----------------------|------------------------|
| A. RED JASPER | E. BROWN JASPER | I. BROWN JASPER |
| B. YELLOW JASPER (T.A.) | F. BROWN JASPER | J. DEHYD. SILTSTONE |
| C. RED JASPER (T.P.) | G. GREY CHERT | K. DEHYD. GREY CHERT |
| D. MOTTLED GREY CHERT (EXOTIC) | H. DEHYD. GREY CHERT | LA. THERMAL ALTERATION |

Projectile points and point fragments of the Paleoindian Tradition found associated with relict-pingo or frost thaw basins.

Illustration by J. Cresson
Figure 10



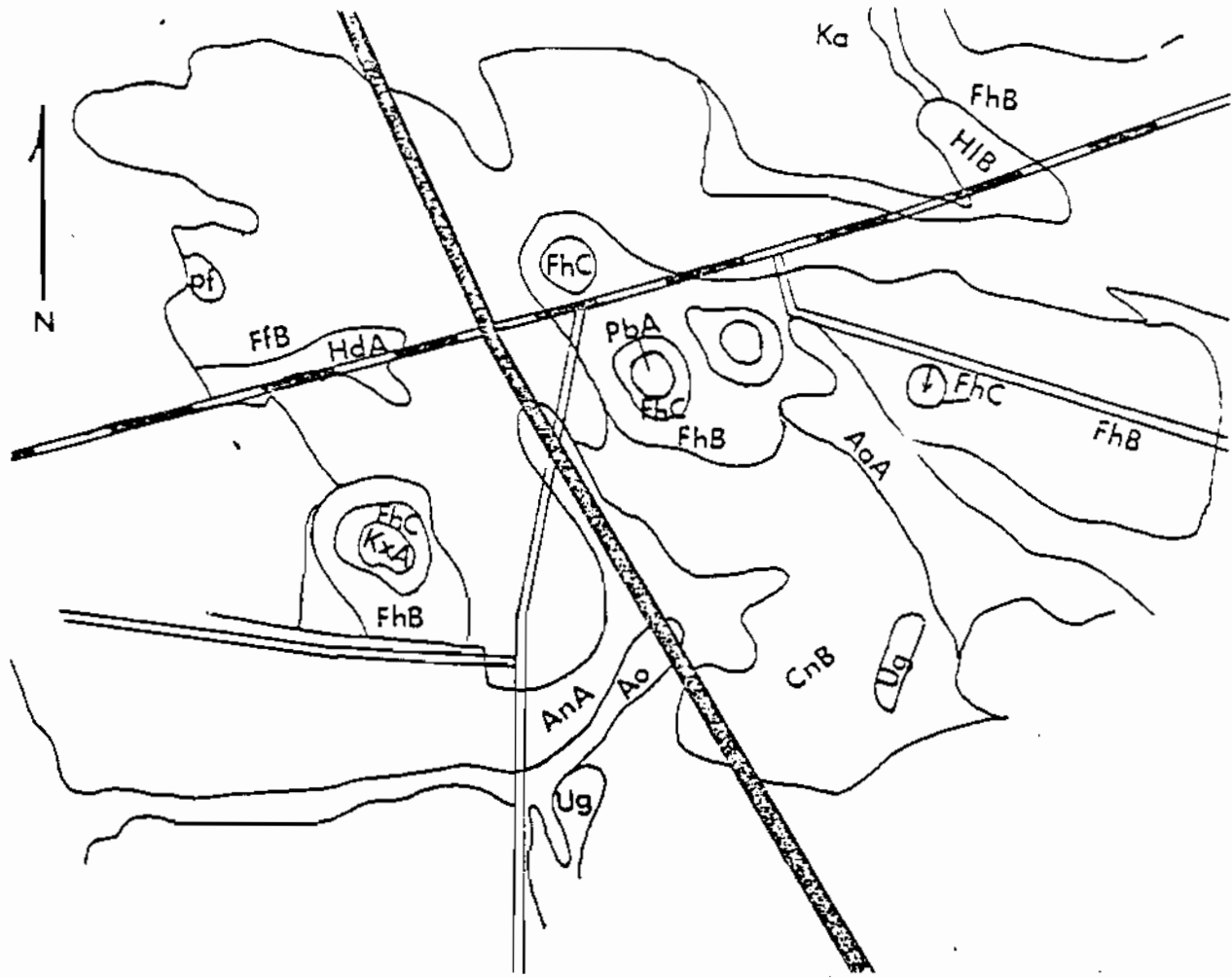
1" = 1000'



TAKEN FROM U.S.G.S. MAPS.
 MOORESTOWN, N.J. QUAD.
 7.5 MIN. SERIES 1966

Illustration of relict landform features (pingos, frost thaw basins, palsas etc.) as they appear on U.S.G.S. maps.

Illustration by J. Cresson
 Figure 11

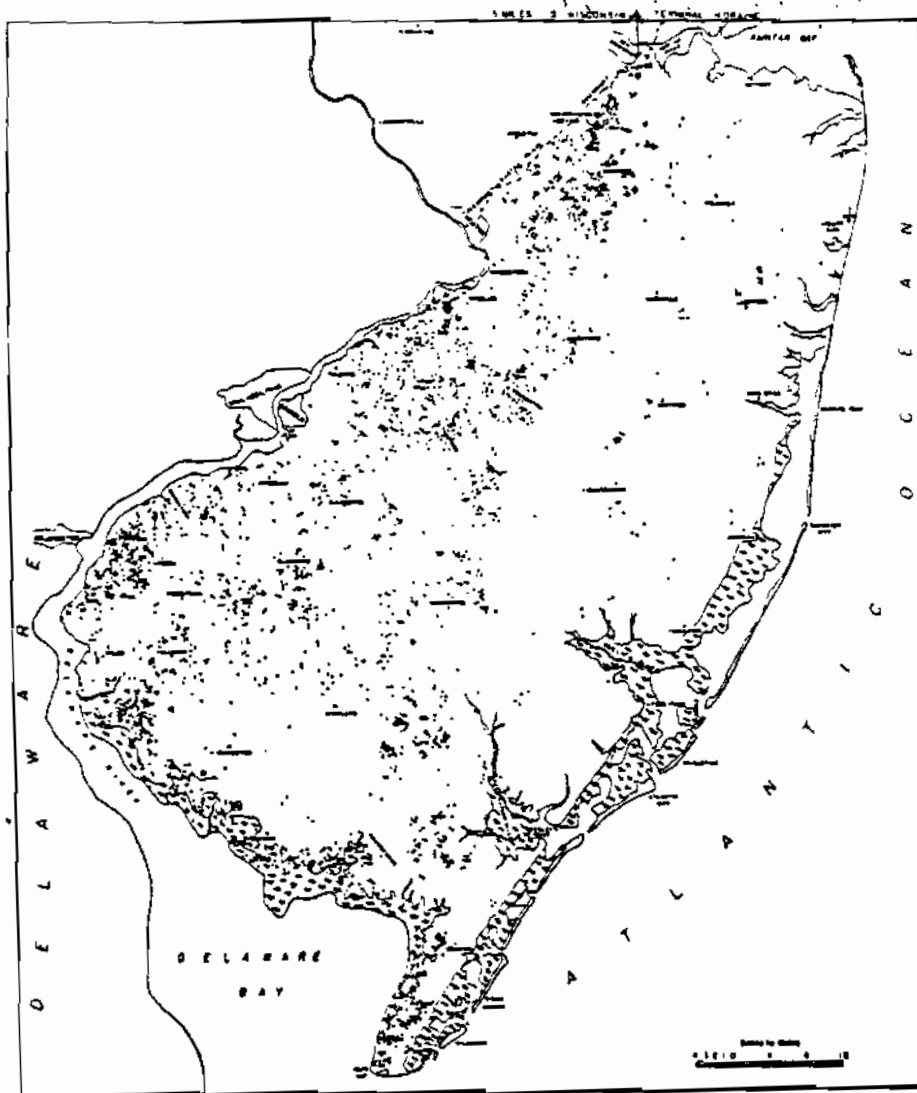


$\frac{3}{4}'' = 1000'$
 1 KILOMETER

TAKEN FROM BURLINGTON CO.
 SOIL SURVEY 1971 SHEET 44

Illustration of relict landform features (pingos, frost thaw basins, palsas etc.) as they appear on USDA soil survey sheets.

Illustration by J. Cresson
 Figure 12



Distribution of frost-thaw features on the New Jersey Coastal Plain. Each dot (.) represents a basin or group of basins as determined by Peter Wolfe (1952) from aerial photographs. Note that the absence of these features in the eastern sector is due, in part, to the presence of heavy forestation which obscured basin relief.

Illustration from P. Wolfe
Figure 13

This research is of considerable importance to the present study because pingos occur quite commonly across the Pinelands in settings which are difficult to predict. Rhodehamel (1979:160) estimates that "approximately 2% of the Pine Barrens region is covered by relatively small, shallow, undrained depressions that have highly impermeable clayey layers beneath them." Since these features have been routinely ignored in previous archaeological research, if even a small percentage of them bear cultural representation, it is clear that a major aboriginal settlement niche has been overlooked (Figure 13).

Other settings, such as the headlands between drainage systems, have also recently proven to yield remnants of aboriginal occupation, and as research proliferates additional ecological situations once exploited by aboriginal populations may yet come to light.

In a recent review of prehistoric cultural resources in the Pinelands Richard Regensburg (1979) estimated the number of archaeological sites in the region at 1200, an estimate far exceeding the number of sites reported or generally anticipated at the time.

It is clear that the formerly prevailing concepts of aboriginal settlement in the Pinelands seriously underestimated not only the frequency of site occurrences but also the range of habitats utilized by the native inhabitants of the region. The extent to which the perceived patterns of aboriginal occupation of the Pinelands relate to

environmental factors or sampling biases remains to be analyzed in detail. It is obvious that renewed archaeological research and a serious conservation effort are urgently needed.

ARCHAEOLOGICAL SITES IN THE N.J. PINELANDS

The following photographs and their accompanying texts are designed to introduce the reader to a sampling of prehistoric artifacts from actual sites in the New Jersey Pinelands. While they do not cover all cultural traditions within the region, they provide a range of artifact types, variations within specific types, **and a variety of functional types**, as well as above-and below-ground finds of artifacts and features.



Fig.14 This photograph shows one of many methods utilized by archaeologists to recover information concerning aboriginal settlement in the Pinelands. It illustrates the carefully controlled excavation of a Terminal Archaic (2000 B.C.) refuse pit found on a living floor of the now well known Savich Farm Site. The perimeter of the pit or feature is dotted for clarity. The soil column in the center reveals artifacts insitu. The soils of such features also contain microscopic charred seeds which, when identified, provide information on prehistoric diet and environments.

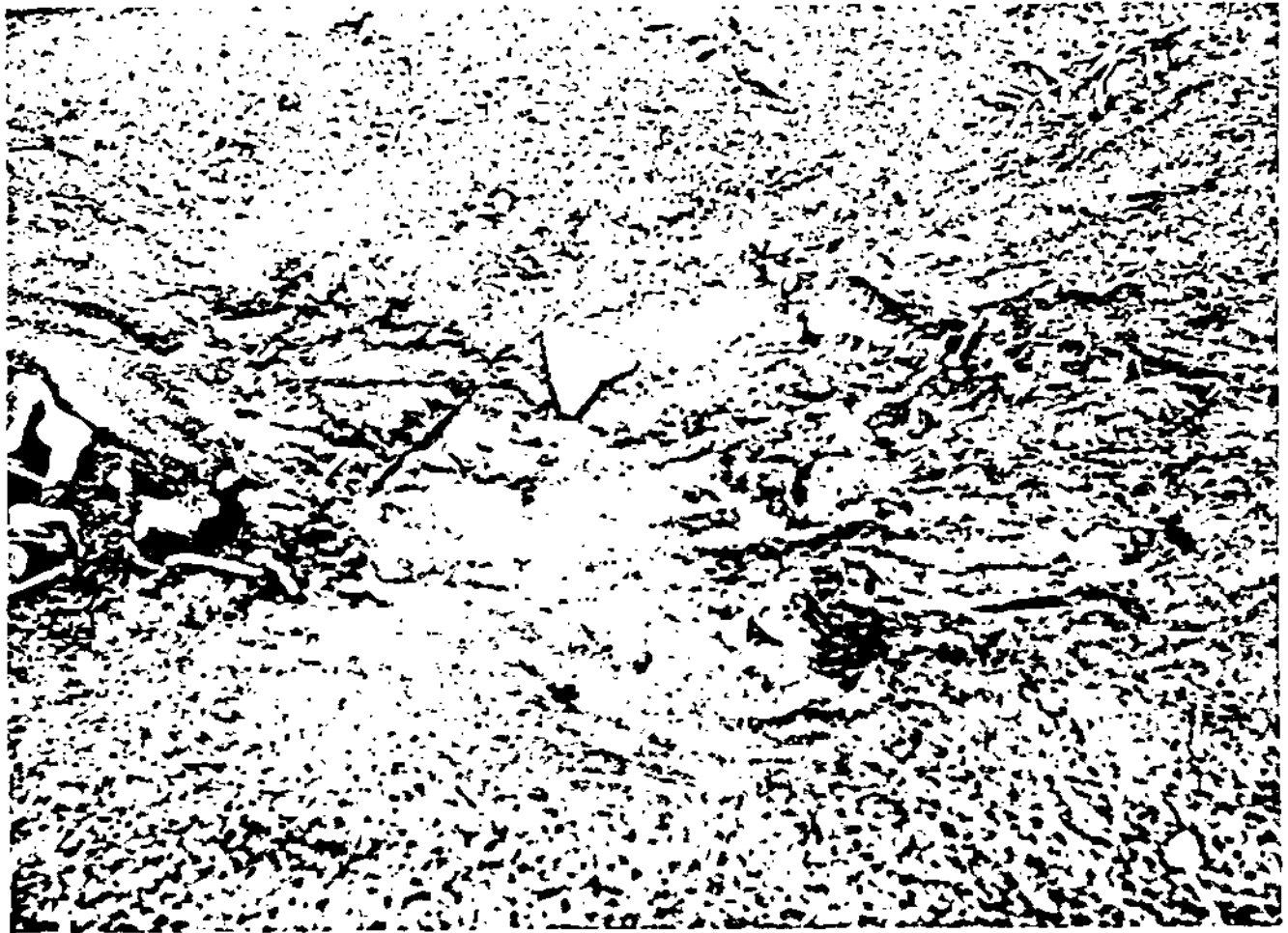


Fig.15 This photograph illustrates a method that is employed by archaeologists to determine areas of prehistoric occupancy. Surface reconnaissance of project areas often leads to recovery of artifacts on open, exposed surfaces such as plowed fields, road shoulders and eroded banks and knolls near predicted areas of prehistoric settlement. The above is an artifact (chipped stone projectile point) of the Woodland Tradition that was found lying exposed in a run-off gully near an undisturbed, wooded site in the PNR.

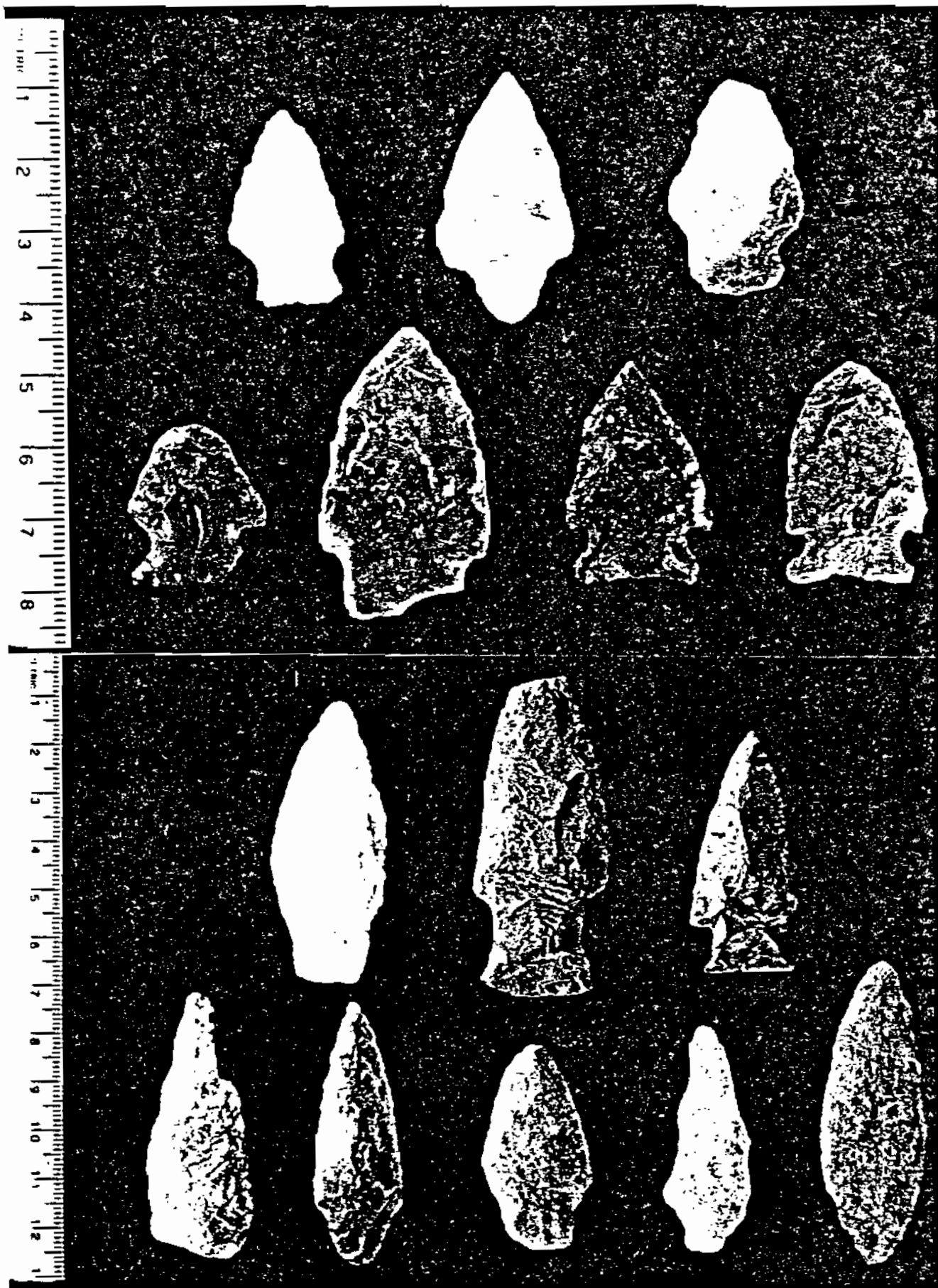


Fig.16 Various types of chipped stone projectile points and knives of the Archaic Tradition recovered from several known sites within the PNR.

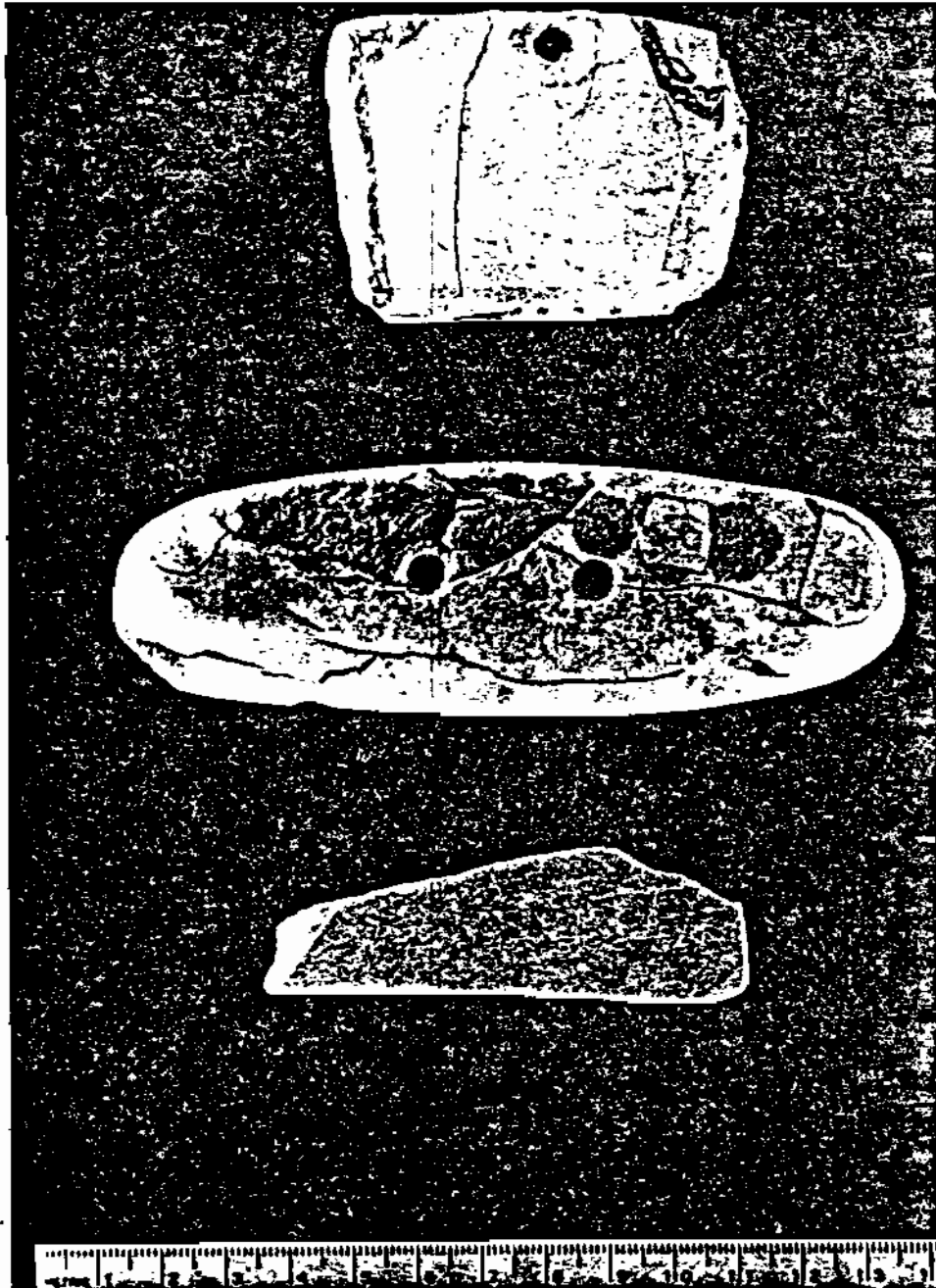


Fig.17 Polished and drilled stone artifacts of the Archaic and Woodland Traditions found within the project area.

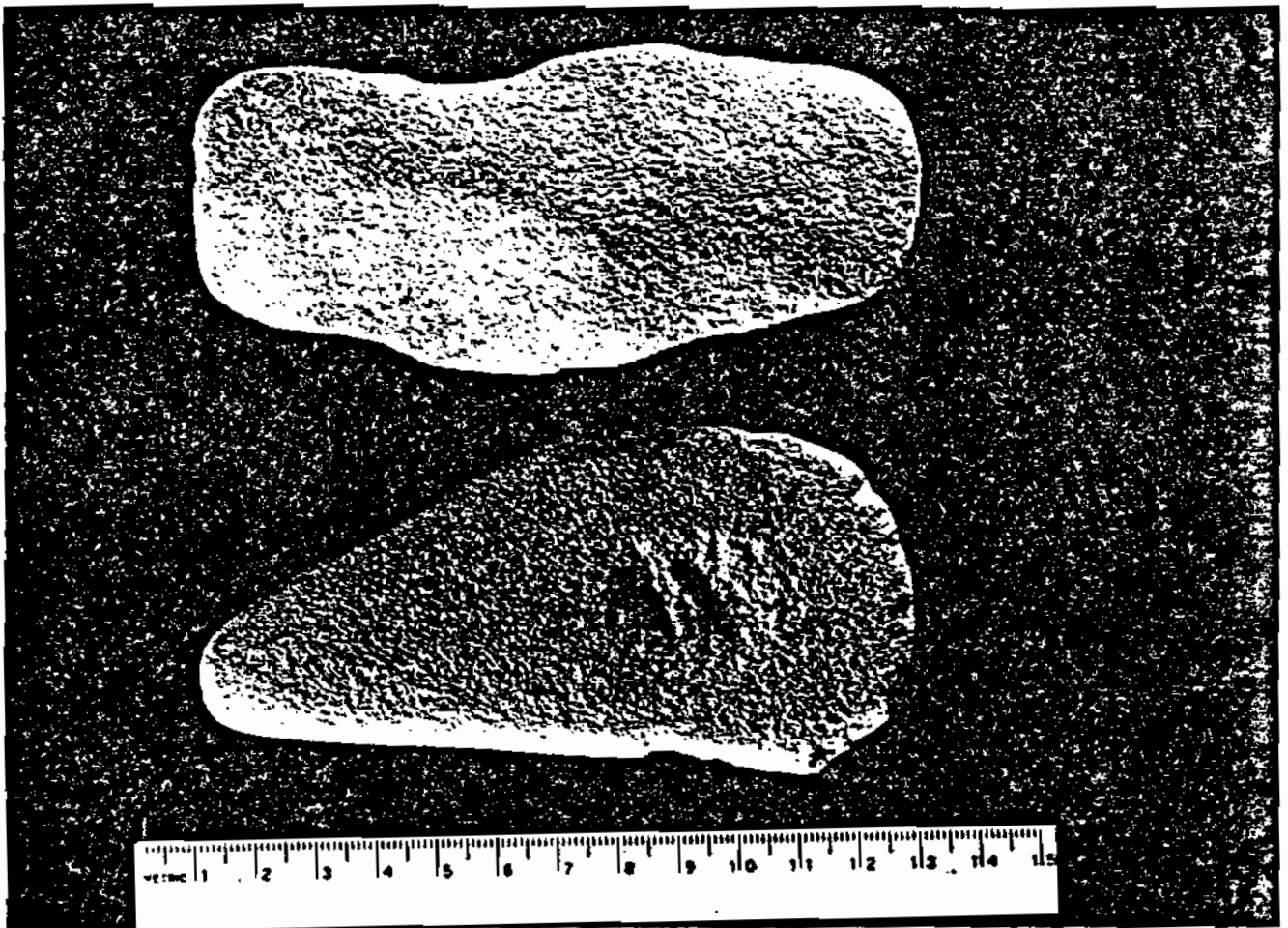


Fig.18 This plate illustrates two distinct tool types of the Archaic Tradition found in the region. Wear patterns on their surfaces indicate that they were used for a variety of purposes. The tool at the top of the photograph is a worn chipped celt (woodworking tool) of argillite, while the lower form is a utilized stream cobble that exhibits a multiple functions (combination hammerstone/anvil--tool making and food (nut) processing). From the uses ascribed to these stone implements, inferences are drawn concerning activities and economies of prehistoric peoples.

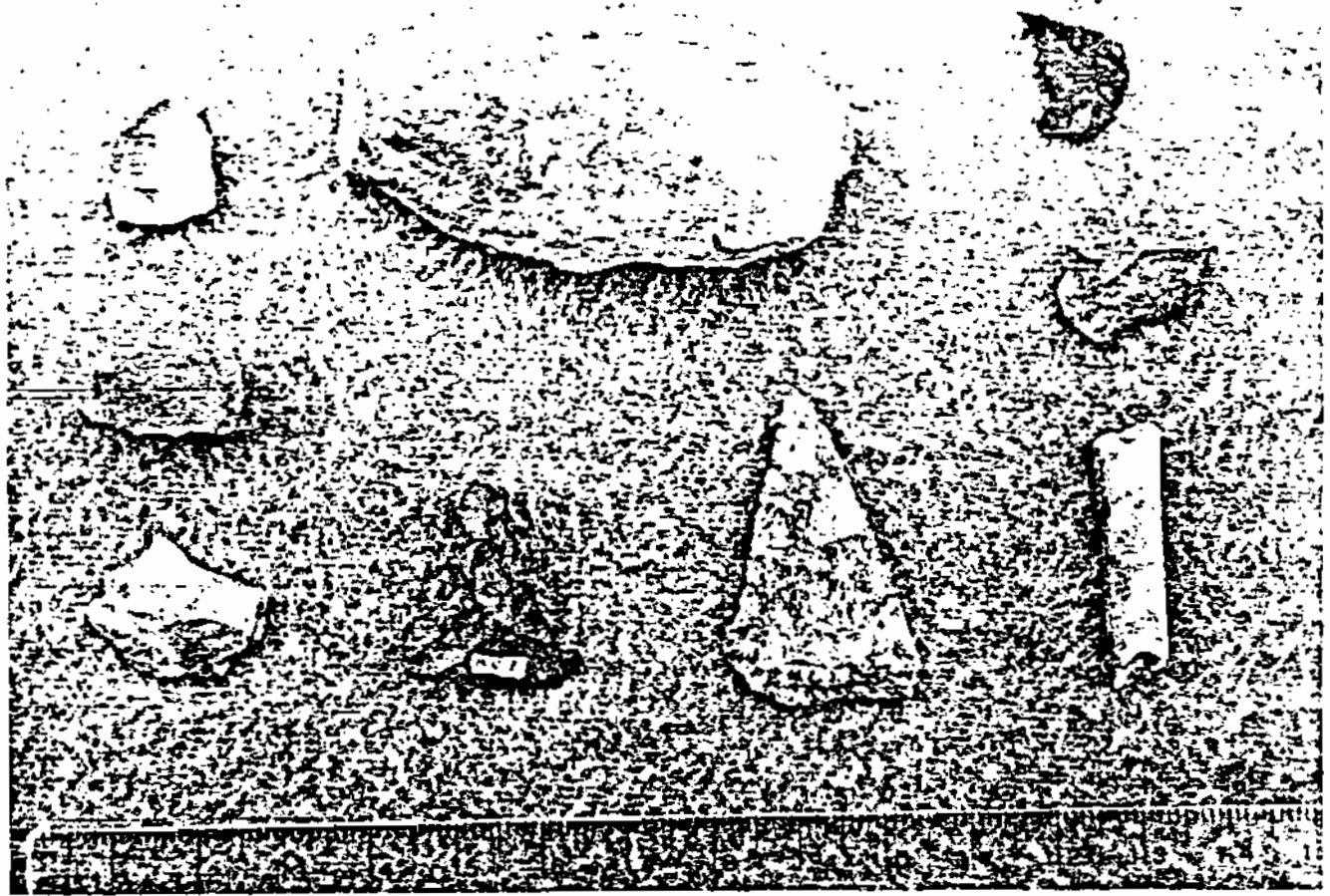


Fig.19 This photograph shows a range of different kinds of artifact types recovered from a surface reconnaissance of an area on the north bank of the Hammonton Creek in Atlantic County. The waste flakes (smaller objects) and preform (top middle) indicate tool making activities, while the two fragmentary projectile points may represent hunting related activities at this prehistoric site. The object in the lower right corner (kaolin pipe stem fragment) is indicative of Colonial or 19th Century utilization of the site as well.

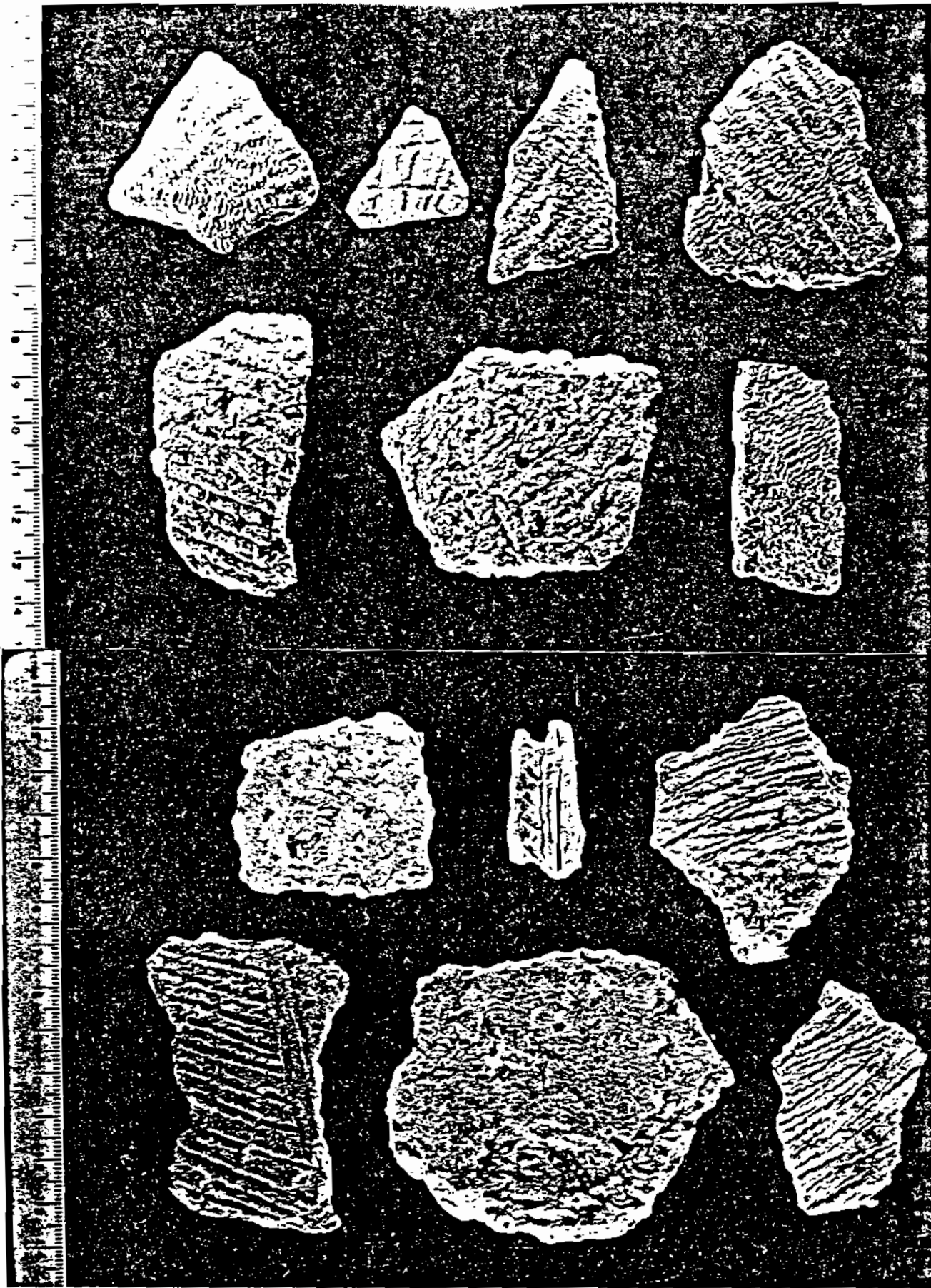


Fig.20 Prehistoric ceramic sherds from vessels utilized by the Woodland Tradition peoples who exploited the Pine-lands.

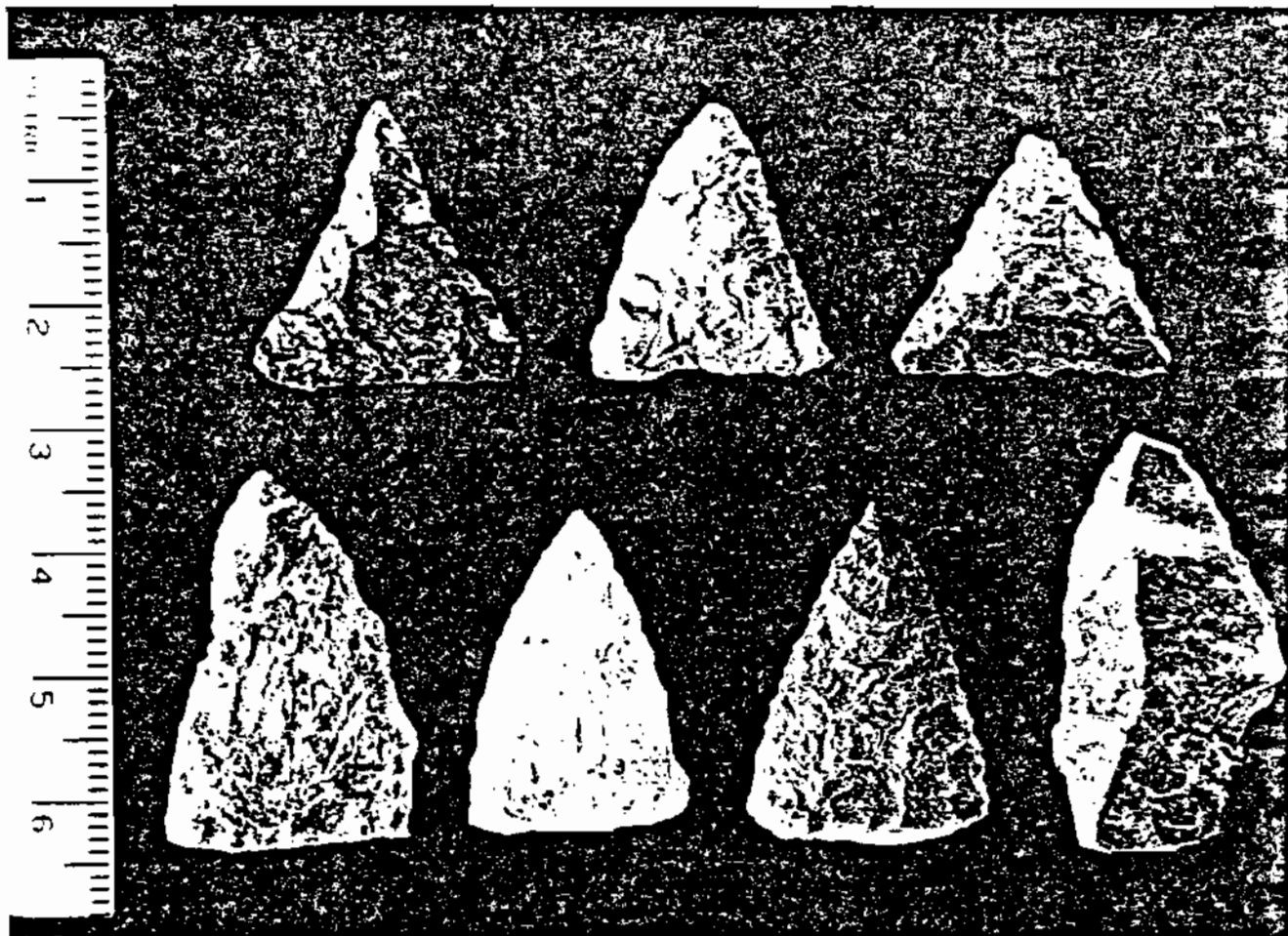


Fig.21 An assortment of miscellaneous chipped stone projectile points and knives of the Woodland Tradition from various locations in the PNR.

PROJECT OVERVIEW

This project was undertaken with three goals in mind;

- (1) to provide an inventory and assessment of known prehistoric archaeological sites in the New Jersey Pinelands
- (2) to make recommendations as to how these resources should be managed and protected
- (3) to use data derived from the analysis of the cultural and environmental attributes of these sites to construct a model capable of predicting site locations in unsurveyed areas of the Pinelands.

What follows is an abstract of the scope of work, the methodologies employed, the findings of the research team, and some general recommendations. Each of these topics will be discussed at length in the following sections.

The inventory of archaeological resources in the Pinelands was completed from an intensive search of published, archival, and unpublished information. In addition to the site files of state agencies and institutions, knowledgeable groups and individuals were also consulted.

Site locations were plotted using U.S.G. topographic quadrangles and U.S.D.A. soil maps. The locational, environmental, and cultural attributes of each site were individually recorded on specially designed site survey forms. The form number and other pertinent information was also recorded on a site index form in order to facilitate the rapid location of sites within a particular area. The inventory or data collection phase was conducted over a period of approximately 6 weeks, and resulted in the documentation of over 1,000

sites in the Pinelands.

The sites identified during this phase of the research represent every cultural grouping currently recognized by archaeologists in the Northeast. Their temporal distribution ranges from approximately 10,500 B.C. to A.D. 1650. Spatially, the sites occur in a variety of microenvironmental settings within larger environmental zones. These larger zones are wetlands, riverine settings, and drainage divides. A substantial number of known sites are also associated with certain periglacial features known as pingos or thermokarst basins. The greatest densities of sites occur in association with riverine settings and wetlands. These associations will be discussed in detail in the following sections.

A number of sites identified during the initial phase of this study appear to meet the criteria for nomination to the State and National Registers of Historic Places. However, for the vast majority of sites in the sample insufficient information is available at this time to support National or State Register Nomination.

Earlier archaeological research and historic documentation have both contributed to the belief that the Pinelands were unoccupied, or at best, sparsely settled in prehistoric times. The results of this current survey clearly point out that the formerly prevailing concepts of aboriginal settlement in the Pinelands seriously underestimate not only the frequency of site occurrence but also range of habitats utilized by the native populations of the region. The extent to which the perceived patterns of aboriginal occupation of

the Pinelands relate to environmental factors or to sampling biases remains to be analyzed in detail. It is obvious that renewed archaeological research and a serious **conservation** effort are urgently needed.

THEORETICAL BASIS OF STUDY

Based on ethnohistorical information and archaeological evidence, New Jersey's prehistoric Native Americans can be generally classified as hunter/gatherers or, in Late Woodland times, hunter/gatherer/horticulturalists. As such, they were intimately connected to elements in the natural environment such as the distribution of plant and animal **populations** soil types, lithic (stone) raw materials, water resources and landforms. In the past, as now, these resources were distributed somewhat unevenly across the landscape. It is expected that aboriginal subsistence/settlement systems articulated with these distributions. In other words, cultural systems are viewed here as an adaptation to local and regional environments. The corollary of this proposition is that, given a knowledge of the kinds and combinations of natural elements associated with known archaeological sites, one should, with a fair degree of accuracy, be able to predict the presence or absence of archaeological sites in similar, but unsurveyed areas of the same region.

Units of Analysis

For the purposes of this research, the "site" serves as our basic unit of study. Sites appear on the surface as scatters of flakes resulting from the manufacture of stone tools hundreds or thousands of years ago. They may also yield a wide variety of stone tools and/or the remains of animals or shellfish which were consumed by the Indians.

The majority of sites found during the course of this survey were discovered in fields subjected to agricultural activities. Years of constant plowing have brought the artifacts to the surface where they have been then picked up by archaeologists and collectors. However, many areas of the Pinelands have never been subjected to this kind of activity and archaeological sites within them lie in an undisturbed pristine state below the ground surface.

A site is here defined as any location which once served as the locus of human activity. Sites are composed of aggregates or clusters of associated cultural remains (artifacts) and culturally related non-artifactual remains (ecofacts). While the association of these materials are for the most part constant, their numbers and kinds will vary according to age, function, environmental setting, and differential preservation.

Over the years archaeologists have changed the way they view prehistoric cultures and the sites created by them. They have also changed their thinking about how sites should be excavated and for what purposes. In the past archaeologists concerned themselves with ordering artifacts, sites, and prehistoric cultures in time and space. This is referred to as the "cultural-historical approach". Essentially, culture-historians sought answers to such questions as:

- (1) What was the temporal location of a particular artifact, set of artifacts, site(s), or prehistoric culture(s) under study?
- (2) When was a particular technology or human population functional?
- (3) What was their spatial or geographical distribution?

- (4) How could aspects of their ancient lifeways be inferred through the description and study of their archaeological remains?

More recently, archaeologists have sought to align the discipline more closely with the goals of cultural anthropology. While still maintaining many cultural-historical objectives, they utilize anthropological theory, ethnographic documentation, theoretical models and statistical techniques. They not only seek to describe the archaeological record but to offer explanations on the natural and cultural processes that shaped the cultures who produced these remains. Archaeological sites are places in which the archaeologist tests propositions regarding cultural evolution and attempts to study and explain the changing relationships between prehistoric cultures and their environments.

METHODOLOGY

The study universe of this research project is the New Jersey Pinelands as defined politically by the Pinelands National Reserve Boundary. However, since the major objective of this project is to develop a method of predicting prehistoric archaeological site locations in unsurveyed areas of the region, it was important to collect locational information on sites within the Pinelands as ecologically defined. The study of sites was restricted to the federal boundaries and the contiguous areas immediately outside of these boundaries. All sites included in the sample fall within the 50 U.S.G.S. topographic quadrangle maps designated on the Pinelands Index (see Appendix B).

Data Collection Procedures

All of the data collected in this project have been recorded on a set of forms and on maps so as to minimize the loss of information and to facilitate its retrieval for purposes of analysis.

Site locations were plotted on U.S. Geological Survey topographic maps of the 7.5 minute series. The maps were then numbered 1 through 50 according to the Pinelands Index system, and the federally defined boundaries were indicated on them in magic marker. Sites were recorded as red dots when the specific locations were known. When the approximate extent of a site was known it was indicated by red diagonal lines. Rectangles were used to delimit areas with very general or vague site provenience.

Apart from serving as the basis for locational information

the U.S.G.S. topographic quadrangles allowed for the observation and documentation of associated landform types, site altitude, and various hydrological resources such as rivers, streams, and ponds. These maps also indicate the presence of forested or agricultural lands, buildings, proposed and extant developments, and roadways.

Site locations were also plotted on U.S. Department of Agriculture soil maps. The use of these maps allow for the determination of several kinds of environmental data relating to site placement, such as drainage characteristics, slope, lithic resources, suitability of soils for the support of various types of flora and fauna, and the premanence of hydrological features. As sites were plotted, their locational, environmental, and cultural attributes were recorded on a specially designed Site Survey Form. A sample of this form appears in the appendix of this report (See Appendix C).

Site Index Forms were designed to allow easy retrieval of specific site locations of a particular researcher in any area of the Pinelands. These forms include the Monmouth College Site Designation Number (MCSD), the Researcher's Site Designation or site name (RSD), the County in which the site is located (Co.), the USDA soil sheet on which the site is located (USDA#), the Pinelands Index Number of the USGS quadrangle on which the site is located (PI#), and the Site Survey Form Number of each site (FORM#). A sample of the Site Index Form appears in the appendix of this report (See Appendix D).

The locational, ecological, and cultural information and data recorded on the Site Survey Forms were further codified in order to facilitate their transferral to computer input forms. These data were subsequently key-punched, and the numerical tabulations for each site were printed out by quadrangle. The computerization of site data will, among other things, allow for the analysis of the predictive value of site variables within a number of environmental settings. Furthermore, the use of a data retrieval system will provide researchers in the region with access to invaluable information which they can draw upon as work progresses. Computerization will, therefore, have both immediate utility and long term practicality.

COMPUTER ANALYSIS OF DATA

Given the large number of sites collected in this survey and the number of variables per site, analysis by computer becomes appropriate and necessary. The first step in computer analysis is to develop a numerical code, including an index number for each site, Pinelands Index Quadrangle number, and codes for selected variables such as name and type of nearest water source; distance of site from, and orientation of site to, the nearest water source; relict features (pingos, ox bows, etc.); soil type, slope, and drainage; plant community type and suitability for wildlife; and cultural remains. Processing of data includes keypunching of data and tabulation and cross-tabulation of data by one or a combination of variables. Correlations or nonrandom associations of sites with specific variables will be sought. Since most of the environmental variables are nonlinear (except distances), nonparametric statistical methods must be employed, such as 2-dimensional R x C Chi-square analysis or N-dimensional Factor analysis. These can be run using existing statistical programs such as SPSS. Hopefully, variables may be shown to have a high, medium or low probability of association with prehistoric Indian sites in the New Jersey Pinelands. Also, density of sites by subprovinces of the region can be ascertained.

In addition to analysis of environmental factors correlated with site location, further analysis for cultural factors may indicate patterns of site distribution by

human use--hill sites, temporary or seasonal camp sites,
permanent habitation; and by cultural period-- Paleo- Indian
to Late Woodland.

BACKGROUND RESEARCH

Background research was undertaken in order to inventory, classify, and evaluate prehistoric archaeological sites in the Pinelands, specifically with respect to their distributions within a variety of ecological settings. This research included a documentary study of both published and archival sources as well as numerous interviews with knowledgeable informants.

A broad range of source material was reviewed, including not only archaeological publications but also the varied literature concerning local and regional history, geology, geography, and ecology. Expansive research was conducted in an effort to understand the role of environmental, social, and historical factors in structuring or conditioning the size, complexity, distribution and density of sites in the region.

Site records, files and pertinent reports maintained by a variety of state, county, and local governmental agencies were reviewed. The following is a partial listing of the agencies contacted during this research: New Jersey State Museum (Bureau of Archaeology), New Jersey State Library and Archives, New Jersey Department of Environmental Production (Offices of Historic Preservation and Environmental Review), New Jersey Department of Transportation (Bureau of Environmental Analysis), and Burlington County Heritage Commission.

The publications and unpublished records of private institutions such as the Archaeological Society of New Jersey, the Ocean County Historical Society Museum and various other county historical societies were also examined.

Background research also involved the inspection of the site files, maps, and unpublished researches of professional, avocational, and amateur archaeologists with an interest in or knowledge of regional prehistory. Members of the Southern New Jersey and Monmouth County Chapters of the Archaeological Society contributed information and the vast majority of site locations which, for the most part, were previously undocumented. Finally a member of private landowners with artifact collections and/or sites on their properties were also interviewed.

Although every effort was made to contact as many authorities and knowledgeable persons as possible, a number of potential informants could not be interviewed because of scheduling conflicts or other problems.

Even though considerably more research will be necessary to achieve an exhaustive listing of prehistoric archaeological sites in the Pinelands, the present study has resulted in the most comprehensive inventory of such resources compiled to date. The analysis of the data presently at hand will form the basis upon which the predictive model will be constructed.

RELIABILITY OF DATA SOURCES

Since no accurate settlement pattern data exist at this time for the New Jersey Pinelands, it is necessary to rely primarily upon data concerning known prehistoric archaeological site locations as derived from background research. While this method has been used successfully elsewhere (Dincauze and Meyer 1977; Brown 1978), some of the biases and limitations of this approach should be pointed out.

As King *et, al.* (1977: 150) have aptly observed, "Predictions derived from background research can be only as reliable as the data upon which they are based". The distribution of known or reported sites in a particular area may not accurately reflect the total range, number, or distribution of actual sites in the area. Factors such as ease of access, the ratio of cleared to forested land, the extent of modern development, prevailing theoretical concepts, and the specific research interests of investigators all may affect the discovery and study of archaeological sites in a particular region. These factors, combined with the results of prior research, may also lead to inaccurate perceptions about the structure and operation of past settlement systems.

With regard to the Pinelands, there is a direct correlation between an observed increase in site densities and the occurrence of roadways and cleared farmland. Conversely, there is a dramatic decrease in site densities in areas having fewer roads and large tracts of inaccessible forested areas. It is also likely that, to some extent, archaeologists have avoided

the region in response to the widely held notion that few archaeological sites of any significance are to be found there.

The data collection which forms the core of the present research has been conducted so as to identify as fully as possible any biases and other factors that may have influenced the quality of existing information about site placement and content in the Pinelands. The accuracy of plotted site locations and the reliability of negative evidence (in areas where no sites have been recorded) have been a matter of concern throughout this project. Since the data acquired thus far are mainly locational, questions dealing with site context, composition, complexity, cultural affiliations and chronology remain to be completely evaluated.

Several biases and limitations have been recognized in the past research upon which this present study is based.

A few examples follow:

- (1) avoidance of the Pinelands as an area for study.
- (2) focus of activity on sites predominantly in riverine settings.
- (3) focus of activity upon sites in intensively farmed land.
- (4) selective artifact collection.
- (5) adherence to the site rather than the region as a unit of study and inference.
- (6) lack of good excavation technique, provenience control and adequate record keeping, etc.

Because of these and other shortcomings not all the information reported to the research team can be regarded as entirely accurate and reliable. Some site locations, for example,

have necessarily been omitted from detailed consideration because the vagueness of their placement has made analysis of their ecological associations overly general or impossible.

On the strength of the evidence now available, it is clear that existing inventories of prehistoric sites in the Pinelands have grossly underrepresented not only the frequency but also the ecological diversity of site locations in the region. Obviously, a great deal more critical research will be required before patterns of aboriginal settlement in the Pinelands can be well understood.

MANAGEMENT OF PREHISTORIC CULTURAL RESOURCES

The Pinelands Commission should assume the responsibility and initiative for the identification, evaluation, and conservation of prehistoric cultural resources within its jurisdiction. The first step toward developing responsible management policies to these ends is the compilation of a comprehensive site inventory. This step has already been initiated with encouraging results in the research that forms the nucleus of the present undertaking. However, much remains to be done, not only with respect to data acquisition but also in the realms of assessment, interpretation, and synthesis.

Considering the immense size of the Pinelands region, the lack of adequate archaeological inquiry in the past, and the pressures brought to bear against cultural resources by developers, relic collectors and others, it is clear that the study of Pinelands archaeology is not only a task of tremendous proportions but also one of great urgency. A sustained effort to identify, locate, sample, evaluate and conserve the archaeological resources of the region will be required.

Because the study of Pinelands archaeology has not kept pace with development in the region, data acquisition, analysis and interpretation must be continued if not intensified while conservation measures are being formulated. In developing resource management priorities and policies, it is necessary to consider the values of the existing resources in terms of research, conservation, and interpretation. Furthermore, the nature of the environmental settings in which the resources occur must be taken into account along with the kinds of pressures which jeopardize or may be expected to jeopardize the values of the resources.

In light of this requirement, the prehistoric archaeological resources of the region will be examined in the context of study units which provide a conceptual framework for ordering technical data. The study unit concept has been developed by the U.S. Heritage Conservation and Recreation Service (H.C.R.S.) as the means of translating technical data unto useful management information.

In this survey the study units have been defined on the basis of the observed occurrence of archaeological remains in association with recognizable elements of the natural environment such as hydrological features and landforms. Using the finest discriminations presently available, current data were cast into a two-dimensional matrix which arrays cultural representations against gross environmental settings (Figure 22, p. 100). The zones of intersection between the cultural/temporal associations on the one hand, and the ecological situations on the other, embody the study units to be employed in this analysis.

Following the prevailing cultural/temporal model for the Mid-Atlantic region, the cultural associations used in this study include: 1) Paleo-Indian, 2) Archaic, and 3) Woodland. However, since more than half of the archaeological components thus far recorded in the Pinelands could not be identified as to cultural affiliation, a fourth category-Unspecified Prehistoric-was added.

For the purpose of this discussion, the environment has been divided into four categories which together cover all of the site locations currently reported in the Pinelands. These categories include: 1) Tidal wetlands, 2) Riverine Settings, 3) Drainage Divides, and 4) Pingos (thermo-karst basins and similar areas with internal drainage).

It should be stressed that the cultural identifications reported to the investigators so far have not been screened for accuracy. Given the generally conservative nature of aboriginal cultures in southern New Jersey (at least as represented in the surviving material remains) and the ambiguities inherent in the existing cultural/temporal model, it is not entirely clear that this scheme ultimately represents the best possible framework for organizing archaeological data in the Pinelands. Also, since no major portion of the region has yet been adequately surveyed, certain presently unrecognized archaeological expressions may still come to light in ecological settings not included in the current format. Consequently, the form and composition of the study unit matrix used in this report must be regarded as tentative and subject to future modification.

Nevertheless, even in light of the limitations of the presently available data, the framework proposed above should prove useful in identifying and evaluating the known prehistoric cultural resources in the Pinelands and in developing a set of management procedures to insure their conservation. Before reviewing each of the study units individually, a few general observations should be made about the distribution of archaeological sites as tabulated in Figure 22 .

First, it is important to recognize that the entries in the matrix represent only those sites found to occur within the limits of the Pinelands National Reserve. Of the 1,046 sites so far identified in this study, only about one-half are represented in the table. Also, it should be noted that many of the site locations within the study area contain multiple components which reflect

repeated occupation of the same sites over time. The tabled values, therefore, represent the archaeological components which have been identified so far as well as site locations of uncertain cultural affiliations.

As previously noted, nearly half of the recognized archaeological representations in the Pinelands have been identified without reference to cultural affiliations or chronology. Of the components with known or suspected cultural associations, Woodland and Archaic expressions occur with nearly equal frequency though with rather different distributions across the landscape. Very few Paleo-Indian remains have thus far been recognized. Although diverse cultural remains have been observed in a variety of Pinelands habitats, no detailed characterizations of these expressions are currently available. Much more research will be needed across the region before the cultural affiliations, chronology, and function of sites in various environmental contexts can be well understood.

Even considering only the rather limited data presently available it is clear that the frequency of cultural exploitation varies considerably from one gross environmental zone to another through time. For example, many more Woodland than Archaic remains have been reported from drainage divides and from the periphery of relict pingos within the confines of the study area. The observed patterns of archaeological site distribution strongly suggest that cultural activity may have been structured in response to changing environmental conditions throughout the span of prehistory. Therefore, more data concerning paleo-environments in the region and the nature of cultural adaptations to these environments, will be required before an adequate assessment of prehistoric cultural de-

velopments in the Pinelands can be rendered.

The recorded frequencies of cultural remains in the Pinelands suggests a preferential orientation toward riverine settings with much less extensive representation in other ecological zones. Whether this observed distribution truly reflects patterns of aboriginal settlement or sampling biases among researchers, or both, is a matter requiring careful consideration in the future.

The cultural remains presently recognized on drainage divides and in association with relict pingos comprise only a small fraction of the total site sample. In light of the suspected frequency of pingos (and other relict geomorphological features) and the rather extensive area covered by divides, the observed numbers of sites in these situations seems inordinately low. Since archaeological vestiges are more commonly found in such settings in better surveyed portions of southern New Jersey, it is likely that a thorough investigation of these kinds of settings would reveal a greater actual representation than is presently indicated by the data at hand.

As a final note, it should be mentioned that the observed distribution of all sites across the four environmental zones is not one that might reasonably be expected to occur on the basis of chance alone. A chi-square test of the data revealed a probability of a chance occurrence for this distribution of far less than 1/1000 (0.001)(See Appendix A).

Each of the 16 study units will be reviewed below with respect to the identification and evaluation of the represented resources. Comments concerning the conservation of these resources will also be given here and in a following section of the report.

1. Woodland-Wetlands Study Unit

This unit includes components of the Woodland Stage or Period identified in tidal wetlands or on the immediately adjacent fastground. Chronologically, these components may range from about 1000 B.C. to about A.D. 1650. Early, Middle, and Late Woodland expressions are either known or suspected on sites of this kind. These components seem to represent areas of hunting and collecting activity which formed part of a broad spectrum subsistence system. Frequently, wetlands sites contain small, discrete, temporally specific assemblages with well preserved faunal materials and, occasionally, human skeletal remains as well. Archaeological evidence indicates the extensive exploitation of locally available shellfish, mammals, reptiles, birds, and fish. The exploitation of floral resources for fibers useful in the manufacture of cordage and basketry is also suspected and partially substantiated by mat impressions on basal sherds of Early Woodland flat-bottomed ceramic vessels.

Generally, Woodland sites occur in two kinds of settings in wetlands environments; either on slight eminences (so-called "islands") on the salt meadow itself, or on the fastground at the edge of the meadow. The former are frequently indicated by stands of red cedar trees and other vegetation distinct from typical salt marsh species. These locations most often have sandy substrata that support woody and herbaceous growth. Many of the islands are less extensive now than formerly owing to rising sea levels. In many cases, even later cultural deposits at these locations may be inundated, at least intermittently during periods of extreme tides. Upland sites bordering on the salt meadow have vegetational com-

munities which typify the transition from terrestrial to wetlands habitats (Robichaud and Buehl 1973).

Woodland sites in wetlands do not generally appear to represent permanent base-camps per se but rather seasonally occupied procurement and processing stations. However, there are several exceptions to this condition, one being a large Late Woodland site near Brigantine thought to be a base-camp settlement (Regensburg personal communication). The exploitation and utilization of shellfish and other faunal resources in particular can be inferred from the composition of Woodland refuse deposits in wetland areas.

Components of the kind considered here do not, for the most part, produce either a great abundance or variety of artifacts. Usually, only a few utilitarian specimens such as projectile points, scrapers, hammerstones, and potsherds, are recovered from archaeological excavations at these sites. The most common type of feature associated with wetland sites are refuse deposits which may assume a number of forms. Generally, scatters of discarded shells and bones occur either on the surface of the ground or buried beneath it. True shell mounds are rare, having been mined in historic times for lime or fill. Refuse accumulations occasionally will be encountered in subterranean pits which seem to be more common upon the fast ground at the meadow's edge than upon the islands.

The preservation of organic material such as bone and antler is often far better on wetlands sites than elsewhere due, for the mostpart, to neutralization of soil acids by the presence of mollusc shells. Good organic preservation on these sites provides rare insight into patterns of environmental exploitation; through the analysis of faunal remains economically important species

can be identified and environmental reconstructions can be obtained. The survival of artifacts of perishable materials-such as bone needles and awls-allows a fuller understanding of Woodland material culture than would otherwise be possible. Since well preserved human skeletal remains sometimes occur on these sites, they are valuable as sources of information necessary and important to osteological analysis and to paleo-demographic reconstructions. Furthermore, the presence of organic matter in the form of bones and shells provides a means of securing a chronological framework through radiocarbon assay. Woodland sites in wetlands, then, are extremely valuable resources with respect to the integration of data concerning culture history, cultural/ecological adaptations, paleo-demographics and paleo-environmental reconstructions.

In the present study a total of 24 Woodland components in wetland habitats have been identified. These components comprise 20% of all presently recognized Woodland occupations within the Pinelands National Reserve and 24.2% of all components and sites in tidal wetlands situations. Because of a general lack of archaeological activity in this realm, it may be expected that many more representations of this sort remain to be identified. An unspecified number of these sites, particularly ones with large accumulations of mollusc shells, have been destroyed by the removal of shells for use as lime, road fill, etc. Others have been excavated by relic collectors or curio seekers without regard to theoretical research questions or the destructive consequences of their actions.

Past archaeological research into Woodland sites in wetlands has been meager. Generally sites of these periods have been avoided because of the relatively low yields of artifacts realized from their excavation. In light of the neglect of these sites from the standpoint of contemporary archaeology, it can be unequivocally stated that serious deficiencies exist in the amount and quality of data thus far derived from sites in this study unit. Data relevant to patterns of settlement and subsistence, technological development, cultural ecology, paleo-demographics, culture history, chronology and paleo-environmental reconstruction are needed and await collection at these locations.

In order to secure data of these kinds, systematic regional sampling surveys of Woodland sites on tidal wetlands are in order. Stratified random samplings covering, perhaps, 2-5% of the total environmental zone within the Pinelands should be sufficient to provide adequate coverage in order to secure the kinds of information required to address research concerns and allow for the refinement of management procedures.

The stratification of wetland zones into three sub-areas--meadows, islands, and uplands--should prove appropriate. This research should attempt to identify site locations, to determine the qualitative similarity and differences between sites, to examine environmental variability, and to test predictions about site frequency within wetlands habitats.

Research of this sort should be implemented in areas where there is a high risk of habitat destruction through commercial development, public works projects, or natural agencies.

Because little qualitative data are presently available it is not possible to advance National or State Register Nominations for any of the sites in this unit. However, there can be little question that at least some of these sites would ultimately prove to have some significance in terms of National Register Criteria. Any sites with archaeological remains undisturbed in situ should be considered as suitable candidates for listing upon the registers as sources of important information concerning the research topics previously mentioned.

Woodland sites in wetlands situations are chiefly valuable for their potential research values. However, those sites with particularly distinctive features, which lend themselves to the visualization of archaeological stratigraphy, aboriginal subsistence pursuits or cultural/ecological interpretation, might serve as educational centers for the general public. Because relatively few Woodland sites are currently recognized in wetlands environments, the preservation of as many as possible must be encouraged. Conservation of this class of resource is particularly important since these sites possess unusual potential for yielding information with respect to a broad range of questions of theoretical significance. Given the small sample of these sites presently on record, at least 50% (including sites in all micro-habitats) should be preserved for future research and interpretation.

Any land uses which do not appreciably alter the surface of the ground could be considered potentially compatible with the goals of resource conservation. Ground disturbing activities such as dredging, building construction, etc., should be minimized in wetlands areas or on the uplands within 300 meters of

wetlands. Applications for all projects in this environmental zone should be screened by the Staff archaeologist or consulting archaeologist before construction permits are granted. If and when compatible land uses conflict with known or suspected resources, the affected resources should be thoroughly explored by a qualified professional archaeologist operating under a theoretically sound and anthropologically oriented research design. The execution of fieldwork, laboratory analysis and report preparation should provide the greatest possible recovery of significant data. Ample time for this work and the necessary financial support should be provided so that data recovery and construction schedules do not conflict.

2. Woodland-Riverine Study Unit

This unit comprises Woodland components which have been recognized in a variety of settings associated with networks of riverine drainage. Sites which represent the entire duration of Woodland cultural development from 1000 B.C. to A.D. 1650 frequently occur on well-drained uplands abutting directly upon the margins of the stream in riverine settings. In some areas, such as the Maurice River drainage, Woodland sites appear to cluster along river systems and to form graded series, ranging from very substantial habitations (perhaps semi-permanent base camps) along the main trunk to smaller campsites at the mouth and headwater areas of the river. However, since comparative studies are lacking, it is unclear at this time whether this pattern may be securely projected to riverine settings elsewhere in the Pine-lands. There is suggestive evidence, for example, of very large sites well upstream in the headwaters of Rancocas Creek. It may well be that regional or even local diversity in resource distribution through time has resulted in a variety of Woodland settlement systems.

Woodland components in riverine settings appear to represent a wide range of functionally related activities having to do with patterns of settlement and subsistence. Usually the material content of these sites occurs in unstratified contexts and often reflects a long occupational history by a series of cultural groups of diverse age and origin. Although some riverine sites in particularly favorable ecological settings may have been occupied for extended periods of time, it is likely that most were occupied intermittently in season as local resources became available.

Some riverine sites have produced large quantities of arti-

facts and an abundance of features such as hearths and storage/refuse pits, while the content of others is much more attenuated. The character of the site is likely structured to some extent by circumstances of location, proximity to resources, site function, etc. The range of site types and their relative abundance or the variety of anticipated archaeological remains on each are matters of speculation since thorough analytical studies have not been undertaken to date. Generally, organic preservation is poor on most riverine sites owing to adverse soil conditions; consequently, the majority of surviving materials represent items of an imperishable nature such as lithic and ceramic artifacts. Occasionally, incinerated refuse bone, charcoal, and botanical remains such as charred nuts and seeds survive. The occurrence of human skeletons is not very common.

In the absence of complete inventories of material items, the culture of Woodland peoples as represented on riverine sites is usually inferred from typological and functional analysis of the surviving specimens. Cultural reconstructions based upon such limited observations are likely to prove rather shortsighted and such interpretations must be viewed with a certain amount of circumspection.

Woodland components in riverine settings comprise 80% of all Woodland occupations so far recognized in the Pinelands. About 24% of all riverine components have been identified as having some Woodland affiliation. The total number of Woodland riverine sites is 96. The little organized archaeological research undertaken in the Pinelands has concentrated on sites in riverine settings. Collectors, too, have shown a selective bias toward these sites.

Although these sites dominate the present inventory, the known distribution shows a preponderance of sites in highly accessible farmland and a concomitant lack in presently forested terrain. Many more site locations may be expected to emerge from systematic surveys of previously neglected areas.

Riverine sites in woodlots or forest may ultimately prove to be of great value since they have not been disturbed unduly by years of intense farming and selective artifact collection. For example, in one pristine site (outside but contiguous to the present study area) ceramics, chips, and other artifacts were found directly beneath the leaf mold in a forested site (Mounier n.d.). The same situation occurs at the Turkey Sump Site located in the oak-pine fringe area of the Pinelands where a complex cultural sequence was discovered in a forested area. Radiocarbon dates on the Woodland component range between A.D. 1240 and A.D. 840 and an earlier occupation was dated between 6000 B.C. and 7042 B.C. In both cases the entire sequence thus lay undisturbed beneath the mat of forest duff. Similar discoveries in the study area are not beyond expectation.

A great many riverine sites have been altered or destroyed by agricultural practices, real estate, commercial and industrial developments, by public works and by unsystematic excavation at the hands of relic collectors. The percentage of the presently known sites modified by such activities is quite high. The fraction of all Woodland riverine sites similarly affected is unknown.

Even though most of the early surveys and collecting activity concentrated on sites in riverine settings, past research

into questions relating to Woodland cultural development has been extremely limited both in intensity and scope. Data categories requiring renewed analysis include: subsistence and settlement systems, functional analysis of sites and artifacts, cultural/ecological adaptations, paleo-demographics, cultural sequence and chronology, and paleo-environmental reconstruction among others.

Regional surveys which explore the full range of Woodland sites in riverine habitats are needed. Renewed regional surveys are required because the limited amount of earlier research does not satisfy the need for information vital to the understanding, interpretation and conservation of Woodland cultural systems and their archaeological expressions.

Considering the rather extensive areas occupied by the margins of drainage networks, a random sample of, perhaps, 1 to 5% of all riverine habitats should be examined. The sampling designs developed for this kind of analysis should call for the stratification of drainage systems into a number of sub-units which represent different environmental qualities, e.g. river mouths, main trunks, principal tributaries, headwater areas, etc. Regional surveys should be undertaken with certain aims in mind, such as:

- 1) detecting the presence or absence of sites in certain settings;
- 2) determining the qualitative characteristics of sites within those settings; and
- 3) assessing the predictive value of environmental factors in determining site location, size, complexity and function.

Although this kind of research is needed throughout the region, it is important to begin surveying in areas where there is a high probability of site loss due to development pressures.

Eastern Ocean, Atlantic and Cape May Counties; Southwestern Burlington County and the Camden-Atlantic City corridor are areas with highly visible development activity. Similar development pressures might presently exist or might be anticipated in other areas as well. Such areas should be surveyed as soon as possible.

Given the information presently available, it is not possible to nominate any of the Woodland Riverine sites to the National or State Registers of Historic Places. At this point, it would seem likely that many of these sites possess the qualities of integrity and content that would make them eligible for National Register listing. Any Woodland riverine components which have not lost integrity through disruptive land use, natural erosion, collecting activities, etc., should be considered as potentially eligible resources.

Most Woodland sites in this unit are probably important as sources of information about past lifeways and cultural systems. Some may possess values of environmental setting or archaeological context that would make them suitable for public interpretation.

Since very little serious research has been conducted on Woodland riverine sites in the Pinelands per se, as many of these sites as possible should be preserved for future study. Even though riverine sites predominate in the present sample, qualities of and variations in site relatedness, cultural association and chronology are very poorly understood. Additional research into these topics, among others, must be undertaken before the claim can be made that cultural representations in this unit have been adequately examined. In light of the current data gaps, at least 50% of Woodland riverine site (including locations in all por-

tions of drainage systems) should be preserved for future research and interpretation.

Compatible land uses would include any activities or undertakings which do not lead to subsurface disturbance or increase the extent of disruption already existing as a result of previous uses such as farming. Whenever possible, construction projects and other ground altering activities should not be placed within 300 meters of active or relict stream channels, since it is within this zone that most riverine sites are likely to occur. Applications for all proposed undertakings within the riverine settings should be reviewed by the Staff archaeologist of Consulting archaeologist and determination of appropriate levels of survey made in accordance with the recommendations given elsewhere in this report. Conflicts between cultural resources and proposed projects should be avoided by design alterations, data recovery or other appropriate actions depending upon immediate circumstances. Adequate time and funding should be allowed to insure reasonable data recovery when salvage excavations are required.

3. Woodland-Divides Study Unit

Currently no Woodland components are recognized in drainage divides. This lack may well reflect the inactivity of archaeologists within this environmental zone. Additional sampling on perhaps as much as 20% of divide situations should be undertaken to locate and assess cultural resources of all periods.

4. Woodland-Pingo Study Unit

Presently no Woodland components are known to occur in association with relict pingos or similar geomorphic features in the Pinelands. The apparent absence of Woodland components on the

periphery of pingos in the present sample probably reflects at least two factors; viz., 1) environmental changes making these features generally less attractive to later prehistoric populations; and 2) a lack of regional surveys aimed at identifying pingo locations and at quantifying cultural remains in association with these features.

5. Archaic-Wetlands Study Unit

This unit comprises a total of five presently recognized Archaic components in tidal Wetlands habitats. These components account for 4.2% of all Archaic representations in the sample and 5.1% of all archaeological sites presently known in wetlands within the Pinelands borders. The data at hand are insufficient to allow firm discriminations with respect to cultural affiliation or chronology; however, it is suspected that the surviving remains represent rather late Archaic (possibly in the period of 1000 B.C. to 3000 B.C.) manifestation inasmuch as rising sea levels have inundated many earlier coastal sites (Salwen 1965).

The general character of the sites is expected to conform to the description given above with respect to Woodland-Wetlands components. Observations and recommendations concerning the research values and needs, conservation threats and requirements, and management suggestions discussed above also apply.

6. Archaic-Riverine Study Unit

The present study has identified a total of 101 Archaic components in riverine settings. These components account for nearly 85% of all Archaic cultural expressions and about 25% of all known components in riverine environments. The available data do not allow for an understanding of the nature of Archaic settlement

systems or of their distribution across the landscape. Generally, the sites occupied by Archaic groups also show evidence of repeated occupation by later and sometimes earlier cultural groups. The limited evidence currently at hand indicates that Archaic occupations themselves span a broad time range (7000 B.C. to 1000 B.C.) during which changes in material culture (and presumably in life-ways) took place.

Since the same sites were repeatedly occupied through time, present day settings of Archaic sites in riverine habitats do not differ from those already mentioned above in connection with the Woodland-Riverine study unit. Environmental changes through time may have resulted in rather different patterns of settlement and subsistence, however, and more critical research into the question of cultural/ecological changes are needed. Generally, the considerations and comments regarding research issues, survey requirements, conservation aims and management recommendations given above in connection with the Woodland-Riverine Study Unit also pertain to this case.

7. Archaic-Divides Study Unit

Two Archaic components have been recognized upon drainage divides as a result of the present survey. These sites represent about 2% of all Archaic components and about 13% of all sites present presently recorded on divides.

These sites are represented by very sparse surface scatters of artifacts or by isolated finds. So far, only Middle and Late Archaic specimens, dating perhaps from 4000 B.C. to 1200 B.C., have been found. The artifacts themselves are mostly projectile points; occasionally scrapers and chips are found. One site outside, but

contiguous to, the federally defined boundaries, yielded Kirk-like projectile points of the Early Archaic period. The characteristics of these sites suggests that hunting was their principal function. It should be stressed that since most of the related finds have been made by chance, a comprehensive interpretation of the cultural content of this study unit cannot be offered. Sites on divides are better represented in areas beyond the Pinelands boundaries, and when serious archaeological surveys of divide environments in the Pinelands are undertaken, it is likely that both the number of sites and the diversity of cultural representations will increase. It is possible that some of the presently recognized site locations will, upon further analysis, prove to relate to extinct environmental settings which are not immediately obvious given the superficial information available at this time.

Surveys of divide areas are needed to develop an understanding of their frequency, distribution, cultural affiliation and functional context. Random samples of divide habitats, covering perhaps 5-10% of their total proportion, should reveal the characteristics of sites in these settings. Surveys are needed now because none have ever considered sites in this context previously.

The only known sites on divides are limited to superficial surface scatters and isolated finds. The areal extent and depositional context of these sites are not known. Therefore, no statements can be made regarding their eligibility for nomination to the National Register. It must be emphasized that the possibility of the future discovery of Archaic-Divide sites in undisturbed condition and with grossly different archaeological contents can-

not be ruled out. A screening process is needed for projects which might detrimentally affect these kinds of sites. The procedures set forth with respect to applications and project review should be consulted.

8. Archaic-Pingo Study Unit

This study unit includes all Archaic components found within the Pinelands boundaries in association with relict pingos (thermo-karst basins), bogs, spongs or other basin-like areas with internal drainage. Preliminary analysis of paleocultural associations with pingos (for the most part, outside, but contiguous to the Pineland boundaries) reveals a very high frequency of occurrence, i.e., about 95% of the basins had associated archaeological material (Bonfiglio and Cresson 1978). Commonly the artifacts found on the margins of pingos reflect hunting or some limited use activities directly related to subsistence.

Pingos themselves represent elements of periglacial environments and their distribution bears no necessary correspondence to presently existing environmental features. For this reason their distribution and frequency are not easily predicted. Geological studies suggest that a great many of these basins occur on the Coastal Plain and in the Pinelands. However, very few have been studied or mapped, partly because their locations, especially in the Pinelands, are hidden from aerial observation by dense vegetation.

Although but a few Archaic related pingo sites are presently recorded, it is certain that the sample size would be dramatically increased given adequate survey. At the moment, 11 components of this sort are recognized in the Pinelands. These components represent 9.2% of all Archaic representations and 55% of all pingo

sites in the present sample.

Those pingos in farmland have obviously been disturbed to some extent by agricultural practices. The numerous suspected sites yet to be discovered in forested areas may well remain essentially undisturbed.

It is only within the past few years (primarily as a result of Bonfiglio and Cresson's research) that archaeologists have paid any attention to sites on the periphery of pingos. The resource is one that is newly recognized and generally undefined. Continued research on a regional basis should yield a great deal of information about these sites in relation to subsistence/settlement systems, technology, cultural ecology, culture history and paleoenvironments.

This research should be embodied in regional random sampling in 5-10% of the upland areas. This sampling should cover the entire region but should be undertaken first in areas where there is a threat of rapid development.

Since the data at hand are locational rather than qualitative, National Register Nominations cannot be prepared for any of the components thus far recorded in this unit. The potential eligibility of a number of resources in this category, however, cannot be doubted. Any sites with surviving cultural traces in association with relict pingos and related features should be considered as potentially eligible for listing in the register.

Pingo-related sites are valuable, not only as sources of information about subsistence and settlement but about past environments and cultural adaptations to them as well. Because these sites represent a class of phenomena only recently recognized,

Archaic pingo sites should be preserved for future study and others, yet to be discovered, conserved for posterity. Overall, at least 50% of these last should be kept intact until adequate investigation can be undertaken.

Land uses which result in subsurface modifications to the earth should be considered to be incompatible with the conservation of these cultural resources. Those uses which do not lead to altered ground conditions are probably consistent with the aims of historic preservation, provided that cultural resources are not adversely affected by secondary or indirect impacts (such as increased relic collecting as a result of increased site access). All projects should be reviewed by the Staff Archaeologist or a consulting professional archaeologist to insure the protection of these resources. If unavoidable conflicts exist, data recovery is in order and should follow procedures outlined elsewhere in this report.

9. Paleo-Indian-Wetlands Study Unit

Presently no Paleo-Indian components are recognized in wetland habitats in the Pinelands. The probabilities of recovering Paleo-Indian materials from this zone are somewhat lessened due to the rise of relative sea levels. However, two wetland sites in areas outside, but contiguous to, the Pinelands boundaries have yielded fluted points diagnostic of this tradition. While most Paleo-Indian sites on the coast are expected to lie beneath present sea levels, the two sites previously mentioned support our contention that the possibility of encountering Paleo-Indian sites in Pinelands wetlands cannot be ignored. Recommendations for research given in connection with Woodland and Archaic com-

ponents in wetlands should be sufficient to identify and evaluate remains of Paleo-Indian occupations as well. Comments concerning research values, significance, and the need for conservation also apply.

10. Paleo-Indian-Riverine Study Unit

Two Paleo-Indian components have been recognized in riverine habitats in the Pinelands. These components represent the earliest occupation of the sites on which they were found. Even though there may have been significant changes in the environmental settings of these locations through time, the locations can be recognized as parts of riverine systems with long and complex occupational and depositional histories. The study of these locations and their diverse cultural contents should lead to a better understanding of past environments and past systems of cultural/ecological adaptation.

The present sample of Paleo-Indian components represents 100% of all such expressions now known in the Pinelands, but only 0.5% of all components in riverine habitats.

The known sites are represented by a few artifacts, chiefly fluted bifaces, which occur as surface finds. Paleo-Indian materials have been collected with greater frequency from sites beyond the immediate limits of the Pinelands boundaries. As explained earlier, the recognition of Paleo-Indian components in this region has been hampered to a degree by the belief that no such remains were to be found here. It is likely that more vigorous research, including examinations of existing collections and carefully controlled excavation would result in a greater representation of sites within this unit.

Recommendations for research and management given above in other categories of this matrix apply.

11. Paleo-Indian-Divides Study Unit

Presently no Paleo-Indian components are recorded within the sample of Pinelands sites on drainage divides. This lack may reflect the absence of research activities in this setting rather than an actual paucity of early cultural remains. Additional research along the lines indicated above in connection with the Archaic-Divides Study Unit will be required before confidence in the observed distributions can be established. Comments regarding potential research values, conservation needs, and management procedures have already been cited with regard to other study units.

12. Paleo-Indian-Pingo Study Unit

No Paleo-Indian components have been listed for pingos in the Pinelands as federally defined. However, such material has been found in association with a number of these features elsewhere, and it is likely that more will still come to light with further research. The need for additional research is clear since virtually nothing has been done to investigate pingos for cultural remains in this region. Suggestions for regional sampling, conservation and management have been advanced in connection with the Archaic-Pingos Study Unit. These apply equally well here.

13. Unspecified Prehistoric-Wetlands Study Unit

Seventy unspecified prehistoric components occur in wetlands habitats in the Pinelands according to the results of the present study. These components represent nearly 71% of all cultural expressions in wetlands and about 24% of all unspecified prehistoric components. This distribution accords well with that recorded

for Woodland and Archaic components taken together (a total of 24.2%) and suggests that the unidentified components are made up of both Woodland and Archaic expressions in a ratio of about 5:1 respectively (see Figure 22).

Obviously more research is needed in order to develop an understanding of the nature of these suspected relationships more fully. Recommendations for future research, conservation and management already given apply.

14. Unspecified Prehistoric-Riverine Study Unit

Exactly half of the prehistoric sites recorded in the present study of Pinelands riverine settings lack any cultural identity. As in all of the other cultural categories, riverine settings predominate in this grouping as well (68.3%). The cultural classifications represented in this category probably include a combination of Paleo-Indian, Archaic, and Woodland. If existing frequencies provide an adequate measure of the expected distribution, the presently identified components would comprise roughly equal numbers of Archaic and Woodland expressions as well as a few Paleo-Indian remains (see Figure 22).

The need for further investigation is clear. Recommendations given above with respect to research values, conservation needs, and management pertain equally well here.

15. Unspecified Prehistoric-Divides Study Unit

The present sample includes 13 unidentified sites or components on drainage divides. These components account for nearly 87% of all sites so situated and only 4.5% of all unspecified prehistoric representations. Because of the general paucity of

reported components in this environmental zone, it is not possible to estimate the composition of the unidentified components. With rigorous sampling, the numbers of sites represented in this zone is likely to increase greatly. Recommendations about research, conservation, and management needs and procedures have been offered above and should be followed here as well.

16. Unspecified Prehistoric-Pingo Study Unit

This unit includes 9 components of unidentified cultural affiliation in association with pingos or similar geomorphic structures. The remains at these locations represent 45% of the known sample of pingo-related sites in the Pinelands and 3.1% of all unspecified prehistoric components. Based upon the work of Bonfiglio and Cresson (1978), these expressions are probably limited culturally to Paleo-Indian, Archaic, and possibly Early Woodland components.

Additional research into this environmental setting is needed. Suggestions for further investigation and preservation are indicated above.

Summary of Study Units

By casting the available data into a study unit matrix it has been possible to provide a preliminary characterization of archaeological remains as thus far recognized in the Pinelands. Cultural representations spanning the whole of prehistory have been recorded. Even given the very weak available data, certain gross cultural and environmental discriminations can be made. This division shows what is known about prehistoric settlement or population distribution in the Pinelands. Significantly, it

also shows to a certain extent what is not known about the study area. The recognition of the disparities between the two allows for general recommendations about future research, conservation and management. Suggestions along these lines have already been given above, and more formal recommendations follow in the subsequent section of this report.

Figure 22

ENVIRONMENTAL SETTINGS

		Wetlands	Riverine	Divides	Pingos	Totals	% N
		→	→	→	→	→	
CULTURAL ASSOCIATIONS	WDL D 1000 BC- 1650 AD	20% 24.2% 24	80% 24.1% 96	0% 0% 0	0% 0% 0	100% 120	22.56
	ARCH. 7000 BC- 1000 BC	4.2% 5.1% 5	84.9% 25.4% 101	1.7% 13.3% 2	9.2% 55% 11	100% 119	22.37
	P.I. 10,500 BC- 7000 BC	0% 0% 0	100% 0.5% 2	0% 0% 0	0% 0% 0	100% 2	0.37
	U.P.	24.1% 70.7% 70	68.3% 50% 199	4.5% 86.7% 13	3.1% 45% 9	100% 291	54.70
	TOTALS	100% 99	100% 398	100% 15	100% 20	532	100.00
	% N	18.61	74.81	2.82	3.76	100.00	100.00

U.P.= Unspecified Prehistoric

P.I.= Paleo-Indian

ARCH.= Archaic

WDL D.= Woodland

DEFINITION OF CRITICAL AND SENSITIVE AREAS

Critical Areas

- 1) Criteria
 - a) Known presence of cultural remains.
 - b) Probable presence of cultural remains based upon projection of known distributions to the unknown, and/or
 - c) documented densities of sites.
- 2) Rationale: Critical areas are ones with demonstrably high densities of sites or with recurrent site distribution in certain ecological zones. The repetitive occurrence of sites in these settings gives a certain measure of predictability to site locations. Development in these areas may be expected to conflict with known or predictable site locations and an interest in resource preservation. Certain localized areas with deep and/or extensive ground disturbance (e.g., gravel mines, etc.) may have lost their potential for yielding archaeological information.

Sensitive Areas *

- 1) Criteria
 - a) Known presence of cultural remains (a documented presence not as dense as in critical area).
 - b) Probable or possible site locations based upon projection of known distribution.
- 2) Rationale: Sensitive areas are ones in which sites have been reported but in which the site frequencies and densities are not as great as in the critical areas.

The apparently diminished site frequencies and densities in the sensitive areas may reflect sampling biases in previous research rather than actual patterns of aboriginal settlement. Site occurrences in sensitive areas cannot be assumed to be without predictive value. Development in these areas may lead, in certain cases, to conflicts between project completion and resource preservation. Certain localized areas with deep and/or extensive ground disturbances (e.g., gravel mines, etc.) may have lost the potential for yielding archaeological information.

* This category may be limited by the extent to which such areas can be identified and mapped.

3) Identification of Sensitive Areas

- a) All lands within the Pinelands boundaries not specified as critical areas.

RECOMMENDATIONS

Recommendations concerning further research, conservation and management are provided below. These recommendations follow from the study unit analysis and are designed to maximize the potential values of currently recognized cultural resources in the Pinelands and at the same time to minimize the effects of and on future development within the region.

General Recommendations

- 1) The Commission should hire a staff archaeologist or retain the services of a qualified consulting archaeologist (as per Federal/SOPA guidelines) in order to develop, implement and/or oversee required research and project review. The Commission must hire and/or maintain a sufficient staff or support personnel to allow the staff or consulting archaeologist the freedom to function as an archaeologist.
- 2) Perform continued archaeological data gathering and assessment as indicated above and under Research Recommendations below.
- 3) Develop, implement and revise as necessary to the adequate protection of cultural resources, procedures for application and project review as noted above and under Recommendations for Application and Project Review below.
- 4) Develop a program of public education with respect to cultural resources, the need for preservation, conservation, and management, etc.
- 5) Protect recognized and suspected cultural resources from intentional or inadvertent loss or degradation from all

public, private, or natural agencies.

- 6) Prioritize research and management policies according to development pressures; areas with high risk of resource loss should be examined first. Such areas include the eastern margin of the Pinelands, the Medford-Marlton area, and the Camden-Atlantic City corridor.

Research Recommendations

- 1) Conduct regional survey(s) to test and refine a predictive model of site location.
- 2) Conduct regional site surveys to complete the inventory of presently known sites in the Pinelands.
- 3) Conduct survey(s) of Wetlands, Riverine, Divides, and Pingo habitats using systematic sampling procedures and covering sufficient territory to insure reliability of the resulting data.
- 4) Encourage responsible academic research into questions of theoretical significance, e.g., settlement/subsistence systems, paleodemography, etc.

Preservation Recommendations

- 1) The known or predictable cultural resources in the Pinelands must be preserved to the fullest extent possible.
- 2) Proposed undertakings which may conflict with resource preservation must be screened through the process of application and project review.
- 3) Conflicts between proposed projects and resource preservation should be resolved through mitigation, avoidance, or data recovery (see recommendations under Management Recommendations).

MANAGEMENT RECOMMENDATIONS

Critical Areas-Private Undertakings

- A) Actions to pursue when known sites exist in project area:
- 1) Staff/consulting archaeologist should determine the nature of the site and extent of conflict, if any, between site preservation and project completion.
 - a) Appropriate activities:
 - 1) Review project application.
 - 2) Review site surveys, interview informants, etc.
 - 3) Inspect site area.
 - 4) Perform limited sampling.
 - b) Possible outcomes:
 - 1) Conflict exists between site preservation and project completion.
 - 2) No conflict exists:
 - a) because of design compatibility
 - b) previous alteration of site.
 - 2) If no conflict exists:
 - a) archaeologist should document pertinent facts for file with copies to SHPO and State Museum.
 - b) project should proceed to next review step, etc.
 - 3) If a recognized conflict exists:
 - a) Site should be avoided if and when possible by:
 - 1) redesign
 - 2) relocation
 - 3) abandonment of the proposed project.
 - b) If site cannot be avoided:
 - 1) applicant must show cause.

- 2) Staff/consulting archaeologist should determine need for data recovery and appropriate level of activity:
 - a) in consultation with SHPO and State Museum.
 - b) by considering characteristics of the site and the nature of the proposed undertaking.
 - c) Possible outcomes:
 - 1) data recovery program not needed.
 - 2) data recovery program needed.
- 3) If no data recovery is needed:
 - a) the archaeologist should document the basis for this determination and forward copies of same to the SHPO and the State Museum.
- 4) If data recovery program is needed:
 - a) the archaeologist should develop a scope of work specifying classes and required level of inquiry, report format, qualifications, etc., with copies to the SHPO and the State Museum.
 - b) assist the applicant in securing the services of a qualified consulting archaeologist.
 - c) assist the applicant in securing any available funding in order to offset any hardships imposed by the costs of data recovery.

MANAGEMENT RECOMMENDATIONS

Critical Areas-Private Undertakings

B) Actions to pursue when no known sites are present in the project area:

- 1) Staff/consulting archaeologist should call for survey of project area to determine whether or not any cultural resources are present.
- 2) Archaeologist should review project and application and possibly visit project area to determine whether potential for archaeological recovery has been lost to natural processes or human agencies (e.g. erosion, sand-mining, etc.).
- 3) Possible outcomes:
 - a) Potential for recovery exists.
 - b) Potential for recovery does not exist.
- 4) If potential for recovery does not exist, archaeologist should:
 - a) document pertinent facts for file with copies to SHPO and State Museum.
 - b) project should proceed to next review step, etc.
- 5) If potential for archaeological recovery does exist, archaeologist should call for survey of the project area giving documentation with copies to SHPO and the State Museum.
 - a) Goals of survey:
 - 1) establish inventory of cultural resources.

- 2) establish qualities of cultural resources:
 - a) size
 - b) boundaries
 - c) cultural content and context
 - d) chronological framework (relative or absolute)
 - e) quantities and types of artifacts, etc.
- 3) determine the probable effects on cultural resources of project completion.
- 4) determine appropriate means of avoiding or mitigating adverse effects.
- 5) determine the need, if any, for additional research.
- b) Survey format. Survey should incorporate the following elements:
 - 1) documentary research
 - 2) fieldwork including systematic surface inspection where applicable.
 - 3) laboratory analysis.
 - 4) competent, professional quality report.
- c) Qualifications for archaeologists:
 - 1) minimum professional qualifications as per Federal Register Vol. 43, No. 210, p. 50659, 10/30/78.
- d) Staff/consulting archaeologist should:
 - 1) assist applicant in securing services of qualified archaeologists as needed.
 - 2) develop scope of work for survey.
 - 3) review survey proposals for adequacy.
 - 4) review survey reports.
 - 5) make recommendations for additional work if needed.

- 6) implement recommendations as per No.5 above.
- 7) release project for progress to next step in official review, etc.

MANAGEMENT RECOMMENDATIONS

Critical and Sensitive Areas-Public Undertakings

- 1) Staff archaeologist should determine the nature and extent of public involvement by Federal, State, or local governments through:
 - a) direct funding.
 - b) requirements for licenses, permits, etc.
 - c) rent subsidies.
 - d) loans and/or loan guarantees.
 - e) community development funds, etc.
- 2) Identify government agencies involved:
 - a) EPA
 - b) HUD
 - c) FHA
 - d) FHWA
 - e) Coast Guard
 - f) EDA, etc.
- 3) Archaeologist should determine appropriate levels of activity necessary to satisfy existing Federal and State laws:
 - a) Section 106, National Historic Preservation Act, 1966
 - b) Section 102, National Environmental Policy Act, 1970
 - c) Executive Order 11593, 1971
 - d) CAFRA (NJ P.L. 1973, Chapter 185, 1973).
- 4) Archaeologist should implement procedures and policies as specified in the Federal Register and codified in 36 CFR 60.6, 36 CFR 63, 36 CFR 800, etc.

- 5) Archaeologist should advise and assist sponsoring agency and the Commission in discharging responsibilities under the law and in consultation with SHPO.
- 6) Archaeologist should assist sponsoring agency and the Commission in securing the services of qualified consulting archaeologist(s).
- 7) Archaeologist should develop scopes of work for required levels of survey in consultation with SHPO.
- 8) Archaeologist should review proposals for required surveys for adequacy.
- 9) Archaeologist should review survey reports and comment on adequacy of research, findings, and recommendations.

Sensitive Areas-Private Undertakings

- 1) Procedures for reviewing private undertakings in Sensitive areas should parallel those for critical areas. The known or suspected site density in the sensitive area is much lower than in the Critical Area and relatively few conflicts between proposed projects and archaeological resources are expected to occur. The sensitive area is not without archaeological potential and procedures for dealing with contingencies are therefore necessary.

APPLICATIONS

1. All applications for permits must include the following elements:
 - A. A clear, concise and accurate narrative description of the proposed project including:
 1. A statement of the general location in terms of geographic features (roads, rivers, etc.)
 2. A statement of the project boundaries.
 3. A statement of the physical extent of the project within the project boundaries.
 4. A statement of the kind and size of the project (dwelling units; 25 units etc.)
 5. A statement of the ancillary features serving the main development (parking lots, sewers, sidewalks etc.)
 - B. Clear sharp copies of U.S.G.S. Quadrangle with project boundaries clearly indicated.
 - C. Required background data.
 1. A summary statement of the existing physical setting.
 - a. Identify characteristics of the terrain.
 - b. Identify predominant landforms (hills ridges, depressions etc.)
 - c. Identify characteristics of drainage.
 1. Surface drainage through streams, etc.
 2. Internal drainage in bogs, springs, swamps, pingos, etc.)

- D. Describe present vegetation
 - 1. Trees
 - 2. Brush
 - 3. Grass
 - 4. Crops, etc.
- E. Identify and/or describe predominant soils
 - 1. USDA soil classification
 - 2. General verbal description
 - a. Sandy
 - b. Gravelly
 - c. Clayey, etc.
- F. Describe modifications to the landscape resulting from natural processes and human activities.
 - 1. Natural processes
 - a. Erosion
 - b. Sedimentation, etc.
 - 2. Human activities
 - a. Previous construction
 - b. Modifying land uses
 - 1. Farming
 - 2. Timbering
 - 3. Sand/gravel mining
 - 4. Industrial development
 - 5. Dumping/filling etc.
- G. Black and white photographs showing various views of project area.
 - 1. Include photos sufficient to allow accurate visualization of project area.

2. Photos should be no smaller than 5 by 7 inches
3. Indicate location and orientation of camera
for each photograph.

2. Summary statement of cultural setting.

A. Provide a brief summary of known history.

B. Identify any known archaeological finds

1. Arrowheads
2. Pottery
3. Other implements or objects
4. Skeletons
5. Shell deposits, etc.

C. Identify sites listed on the State, local or National
Registers

3. Summary statement concerning federal or state sponsorship,
support, regulation or assistance to the project.

A. Identify the nature of government involvement through:

1. Direct funding
2. Requirements for licenses and permits (e.g. Coast
Guard permits)
3. Rent subsidies (e.g. HUD sect. 8)
4. Loans or loan guarantees (FHA)
5. Community development funds, etc.

B. Identify government agencies supporting funding assisting
or regulating project.

1. EPA
2. HUD
3. FHA
4. Coast Guard
5. EDA, etc.

RESPONSIBILITIES OF STAFF/CONSULTING ARCHAEOLOGIST

1. Review all applications for permits
2. Make appropriate field inspections of project areas as deemed necessary.
3. Make archaeological surveys as appropriate.
4. In consultation with Commission staff and SHPO, determine level of survey required for all projects.
5. Determine extent of State and Federal involvement in all projects and execute requirements of existing laws and regulations (e.g. Section 108 NHPA, 1966).
6. Develop scopes of work for projects as required.
7. Act as liaison with SHPO, State Museum, the professional community, and with the Commission.
8. Review management plan, suggest modifications, coordinate revision process with government agencies, and implement changes in the plan.

THE PREDICTIVE MODEL

This section is the result of research conducted by the principal investigators together with conceptual and methodological procedures suggested by project consultant, Dr. Michael Ester, Department of Archaeology, Douglass College, New Brunswick. The purpose of this collaboration was to review the nature and quality of the data collected during the inventory phase of this study; to clarify the objectives of the predictive model; to identify the independent predictor variables; to ascertain how these variables should be measured and recorded; to decide on the basic unit of analysis, sample size, and sampling strategies to be employed in the testing phase; to establish a routine for data input; and to discuss the use of computer graphics.

Model Objectives

Since it is not economically feasible to survey every square foot of the New Jersey Pinelands, for the purposes of planning the most cost-effective means of assessing and managing its archaeological resources is through the development, testing, and application of a predictive survey. "In a predictive survey one physically inspects only a fraction of the actual area of concern, and from this inspection--in the context of good background research--extrapolates to the entire area"(King 1978:74).

Predictive surveys have been used throughout the country by state and federal agencies. They are particularly useful when dealing with large regions such as the Pinelands, although they have been used successfully on a smaller scale. The structure of these surveys will vary according to the proposed scope of work,

the size and environmental complexity of the region under investigation, research considerations, economic limitations, sampling strategies, and the quality of existing regional data. Using data derived from the inventory phase of this current study together with the additional strategies described below, a series of projections will be made to the region as a whole. The proposed distributions of sites will then be subjected to a series of systematic field tests within a variety of representative environmental zones in the Pinelands. These tests will ascertain the accuracy of the model and facilitate its further refinement.

Once the refinement process has been completed, the resulting model will be used to generate a series of sensitivity maps for unsurveyed sectors of the study area. These maps will rank areas in terms of high, medium, or low probability with respect to anticipated levels of site frequency. They can then be used as a means of isolating areas where management and preservation needs may come into conflict. Essentially, the sensitivity maps will allow both planners and preservationists to identify the appropriate levels of survey needed or to suggest available mechanisms to minimize the loss or degradation of significant resources.

Inherent Limitations and Reliability of Data Sources

Whatever the intended purpose of a model of site prediction, a few inherent limitations of such a tool should be recognized. Generally, a model cannot replace archaeological fieldwork. At best, a model can help anticipate the scope of archaeological inquiry and aid decision making at crucial junctures of a survey project. The status of a model must be kept constantly in focus; results should not be followed slavishly just because they are quantitatively determined. Any model of this sort entails state-

ments about global trends within the study area. As a simple analogy, consider the relationship between a statistical mean and the individual observations on which it is based; single values may be close or very far away from this summary of central tendency. Another limitation is the reliability of existing data.

As King has aptly observed, "Predictions derived from background research can be only as reliable as the data upon which they are based". The distribution of known or reported sites in a particular area may not totally reflect the actual range, number, or distribution of sites within it. Factors such as ease of access, the ratio of cleared to forested land, the extent of modern development, prevailing theoretical concepts, and the specific research interests of investigators all may affect the discovery and study of archaeological sites in a particular region. These factors, combined with the results of prior research, may also lead to inaccurate perceptions about the structure and operation of past settlement systems.

With regard to the Pinelands data, there is a direct correlation between an observed increase in site densities and the occurrence of roadways and cleared farmland. Conversely, there is a dramatic decrease in site densities in areas having fewer roads and large tracts of inaccessible forested areas. It is also likely that, to some extent, archaeologists have avoided the region in response to the widely held notion that few archaeological sites of any significance are to be found there.

The data collection which forms the core of the present research has been conducted so as to identify as fully as possible any biases and other factors that may have influenced the quality of existing information about site placement and content in

the Pinelands. The accuracy of plotted site locations and the reliability of negative evidence (in areas where no sites have been recorded) have been a matter of concern throughout this project. Since the data acquired thus far are mainly locational and environmental, questions dealing with site context, composition, complexity, cultural affiliations and relative chronology remain to be completely evaluated.

Several biases and limitations have been recognized in the past research upon which this present study is based. A few examples follow:

- (1) avoidance of the Pinelands as an area of study.
- (2) focus of archaeological activity on sites predominantly in riverine settings.
- (3) focus of archaeological activity upon sites in intensively farmed land.
- (4) selective artifact collection.
- (5) adherence to the site rather than the region as the unit of analysis and inference.
- (6) lack of good excavation technique, provenience control and accurate record keeping, etc.

Because of these and other shortcomings not all the information reported to the research team can be regarded as entirely accurate and reliable. Some site locations, for example, have necessarily been omitted from detailed consideration because the vagueness of their placement has made analysis of their ecological associations overly general or impossible.

Apart from its limitations, the current inventory has demonstrated that earlier surveys have grossly underestimated not only the frequency but the ecological diversity of site locations in the Pinelands. In this light it is imperative that site prediction be viewed as a dynamic process if the model is to be of contin-

ued usefulness. The data which underlies the model will change gradually over time, and comparison between predicted and actual remains should be incorporated as self-correcting and self-improving features of model performance.

The Logic of Prediction

As previously mentioned, a predictive model should simulate what archaeologists would recover if the Pinelands were subjected to a 100% full-coverage survey. In keeping with this idea, it is the areal unit which is the unit of analysis. This differs from the common archaeological situation where a site is given, and we look into the natural and cultural environment in order to make sense of its prehistoric significance. The present interests demand the opposite perspective, where cultural and natural features are attributes of an area. Observed sites are likewise an attribute of an area, with the important distinction that sites are the dependent variable we are trying to predict.

There are a few possible forms a predictive statement might take. One simple construction is:

Given an area's observed values on natural and cultural features, what is the probability of site occurrence in the area?

Although this seems a natural expression of the model's objectives, it is unsatisfactory for early stages of research. Since there has been no continuous or systematic survey work over the study area, the empirical base for the model consists of areas where the probability of site occurrence is inevitably 1.00; every reported area contains sites.

A different question avoids this problem:

Given an area's observed values on natural and cultural features, what is the expected site frequency in the area?

To allow the model to express the continuous, spatial distribution of sites, one other reformulation is useful:

Given an area's internal distribution of natural and cultural features, what is the varying site frequency over the area?

It should be noted that, given the fundamental limitations of the existing survey data, even this phrasing of the problem may be impractical. However, this conception of site prediction is still useful if for no other reason than that it leads to what should be the tangible product of the model.

Expected site frequency can be envisioned as a surface over the Pinelands, akin to a surface of topographic altitude. An obvious vehicle for displaying the model's results is a contour map in which any target area could be isolated and examined. This physical format for site prediction should suit any of the applications discussed under Model Objectives, and has the important advantage of being immediately and intuitively understandable.

Variables

Going back to the purpose of the model, the aim is to recognize sites that might be impacted by modern development. It should be stressed that this is different from strict archaeological interests, and should therefore include variables which might enhance or inhibit the preservation of material remains. Variables will pertain to three agents of site location:

- (1) Magnet or repelling attributes distinguished by aboriginal populations.
- (2) Indicators of natural processes which alter the archaeo-

logical record such as fluvial erosion (Handsman 1978).

- (3) Modern land use practices which promote (plowing) or detract (modern construction) from the discovery of sites.

The majority of predictive surveys rely primarily on the isolation of specific combinations of environmental factors, or variables, thought to have played a significant role in structuring the distribution of prehistoric Indian sites in particular. Researchers such as Ray et, al. (1975) claimed that the three most important variables for site prediction are slope gradient, distance from water, and site altitude. Lee (1976) considers distance to water (up to 300 meters), landform, and soil types as essential to validity in site prediction.

Schneider and Frantz (1977) list ten variables:

- (1) Landform
- (2) Source of materials
- (3) Soil moisture
- (4) Slope
- (5) Modifiers such as prevailing winds, insects, etc.
- (6) Aspect (orientation)
- (7) Elevation
- (8) Vegetation
- (9) Stream distance
- (10) Stream order

Swigert (1977:61) reports that in western Connecticut, "a primary requirement for prehistoric site location would appear to be close proximity to water. In addition, the location would

suggest a strong preference toward the lee shores adjacent to potable water, particularly on lakes and streams where sites are most often located at the confluence of a small stream".

The preliminary model originally proposed for the New Jersey Pinelands emanated from an experiment conducted by two graduate students as part of their research requirements for the 1978 Monmouth College Archaeological Field School under the direction of John Cavallo. Dr. Sandra Hartzog and Daniel Sorkowitz were provided with locational and cultural information on 14 surficial prehistoric archaeological sites. The majority of these sites are located in the oak-pine fringe area of the Pinelands. Each of them had yielded diagnostic artifacts of Paleo-Indian and/or Early Archaic through Late Woodland occupations.

Using U.S.G.S. topographic quadrangles, U.S.D.A. soil maps, and aerial photographs, the students were asked to examine the sites for the number and kinds of environmental variables they exhibited individually and shared collectively. The collective variables shared by the majority of sites in the sample were:

- (1) Elevation
- (2) Slope at site
- (3) Slope in contiguous areas
- (4) Aspect (orientation)
- (5) Distance to stream
- (6) Elevation above stream
- (7) Water resources beyond immediate stream
- (8) Stream order
- (9) Relation of site to stream confluence

(10) Drainage at site

(11) Drainage in contiguous areas

Through further analysis of a larger number of Coastal Plain sites and data from the researches of Gardner, Bonfiglio and Cresson and others, several variables were combined while others were removed or added. Prior to the initiation of the Pinelands Predictive Survey, the following variables were listed as having the greatest predictive value for general use in Coastal Plain environments:

- (1) Elevation above mean sea level
- (2) Slope at site
- (3) Slope in contiguous areas
- (4) Aspect or orientation
- (5) Soil moisture or drainage at site
- (6) Drainage in contiguous areas
- (7) Areas of maximum habitat overlap
- (8) Areas of geological formation overlap
- (9) Distance to primary hydrological source
- (10) Presence of low order streams
- (11) Presence of stream or stream/river confluences
- (12) Presence of stream bisecting floodplains
- (13) Presence of swamps and bogs
- (14) Presence of secondary lithic sources (flints, cherts, etc.)
- (15) Presence of knolls and ridges
- (16) Presence of extant oxbows
- (17) Presence of relict features (river/stream meander scars, ancient oxbows, oxbow lakes, relict periglacial features).

Of course, no one prehistoric archaeological site will exhibit all of the variables listed above. Combinations of variables will change in relation to environmental settings. A problem with the aforementioned lists of variables is that some of these may belong to more than one category and work in opposite directions. For example, areas near a stream may have been choice spots for prehistoric peoples, but this location might also mean that sites are buried under silt or have been destroyed as a result of fluvial meander. On closer inspection, it may be that some variables are equivocal in their contribution to site occurrence.

Besides being sensitive to the above agents, good predictive variables should have three other characteristics. First, they should be observable without going into the field. All information should be available in either map or tabular form. Second, variables should be sufficiently common to be of wide predictive utility. For instance, it may be that springs are un-failing predictors of sites. Yet, if there are very few known springs, this variable will not be very helpful. Third, variables should exhibit significant spatial variation. For example, if the Pinelands were largely flat, one would not get very far using topography or site orientation as predictor variables. This would likewise hold true for any other natural or cultural trait which is ostensibly constant over the study region.

Since the tabulations of locational, environmental, and cultural attributes of sites identified during this study have not been completed, it is not yet possible to examine them with re-

gard to correlations between them. As a preliminary exercise, we examined in detail all of the environmental data recording categories on the site survey forms. This was undertaken in an attempt to establish, intuitively, which of the variables belong to more than one category and which were thought to be equivocal or of doubtful advantage. The resulting product is a more manageable grouping of what are considered, at this time, to be the crucial predictor variables:

- (1) Present land use. Percentage of the grid area exhibiting no evidence of human activity such as farming, industrial or urban development, etc.
- (2) Proximity to fresh water. Distance in meters from grid mid-point.
- (3) Proximity to salt water. Distance in meters from grid mid-point.
- (4) Number of hydrological types in grid area. Rivers, bays, stream confluences, etc.
- (5) Altitude. Highest elevation in meters.
- (6) Altitude. Lowest elevation in meters.
- (7) Soil type. Percentage of grid area suitable for Woodland.
- (8) Soil type. Percentage of grid area suitable for Openland.
- (9) Soil type. Percentage of grid area suitable for Wetland.
- (10) Percentage of grid area exhibiting soils with 0-5% slope.
- (11) Ratio of eroded to deposited soils. This variable considers the effect of natural processes in the grid area.

These baseline variables are to be used as preliminary tools in the construction of the model. More precise statistical analysis of their relative contributions will allow for the determin-

ation of interrelationships and the identification of equivocal variables. At first glance the list of crucial variables may appear to be oversimplified. However, upon closer examination it will become apparent that each one carries with it a number of specific implications or subsets.

Toward Model Development

Consider a grid system superimposed over the Pinelands. Each grid square is a recording tract; observations are taken on all independent variables, and on site frequency where a tract has been surveyed. This collection of information is the raw data for generating the model. An important consideration at this stage will be the size of the grid unit relative to the study area. If grid units are too small, observations will be increasingly time consuming and redundant. If the grid units are too big, grid observations may smooth out or mask important variation.

Observed from another perspective, a smaller grid will increase the unit sample size, but at the same time, small grid size will probably reduce the reliability and variability of observation. The proper grid size must strike some kind of balance between these considerations. At this time, we have decided to use squares which are 1,000 meters per side. A grid will then be superimposed over the 50 U.S.G.S. topographic quadrangles included in the Pinelands Index. There are approximately 147 grid units per quadrangle or 7,350 total units of analysis for the Pinelands. The approximate total area of each quadrangle is 6.6 X 8.6 miles or 36,326.4 acres. Multiplied by 50, this totals to 1,816,320 acres for the entire study area.

Initially, two significantly different strategies were seen for moving from the existing data base to a model of site prediction. The first tactic rests exclusively on those grid squares in which known sites have been located. These will serve as units of observation for both independent variables and site frequency. The model would consist of a linear equation which expresses the empirical relation between the independent predictor variables (soil type, slope, etc.) and the dependent variable of site frequency. Conventional multiple regression will establish beta weights for each independent variable; the coefficients describe the contribution of variables to explaining site variance, and they can be used to predict site frequency in grid squares which have not been subjected to survey.

This approach poses some challenging problems, i.e. whether independent variables should be linear (e.g., distance) or sometimes curvilinear; whether independent variables should be strictly additive or, in some cases, multiplicative; and whether some variables involve multicollineality.

However, the most severe problem related to this strategy is the nature of the existing data base. To use grid squares containing known sites to predict site frequency in unsurveyed squares, presupposes that 1) the empirical foundation is broadly representative, and 2) that previously surveyed grid squares have received complete coverage.

A second approach to deriving a regional model does not require these assumptions. As a tradeoff, there is no empirical relationship to sites. Instead, the qualities that will yield site

potential and the way these variables are mathematically combined and defined a priori. The model becomes a descriptive tool which presents the continuous distribution of a composite index variable over the Pinelands. The advantage to this approach is that the model's domain includes the entire study area; unlike the presence of sites, all variables are potentially observable for every grid square. The decided limitation is that the resulting "topography" of site potential is entirely hypothetical; whether the variables themselves or the way they are combined says anything about sites, remains unsubstantiated by a knowledge of actual site data.

A more reasonable approach is to use both methods in tandem. Analysis of the independent variables can be conducted at the global, regional level. We would want to know how different natural and cultural qualities vary over space and how they are related to one another. The existing site inventory can then be used in one of two ways; either to project best-guess estimates about how variables should be combined, or as an initial check to insure that the descriptive index variable is not grossly out of line with site occurrence. In the latter use of known sites, although they may not be characteristic of the entire Pinelands, they are not, therefore, uncharacteristic. It is reasonable to expect substantial congruence or agreement between postulated trends of high site potential and the actual site locations. Such a comparison is primarily of negative significance; something has gone seriously wrong if fundamental inconsistencies are apparent.

Appendix A

Chi Square Test of Presently Recognized Site Frequency Distribution

The observed frequency distribution for all sites presently recognized in the Pinelands was cast into the following matrix and compared against

	Wetlands	Riverine	Divides	Pingos	Total
Sites	E 133 0 99	E 133 0 398	E 133 0 15	E 133 0 20	532

the distribution for χ^2 at $df = 3$

H_0 = No difference in the distribution between cells is expected on the basis of chance alone.

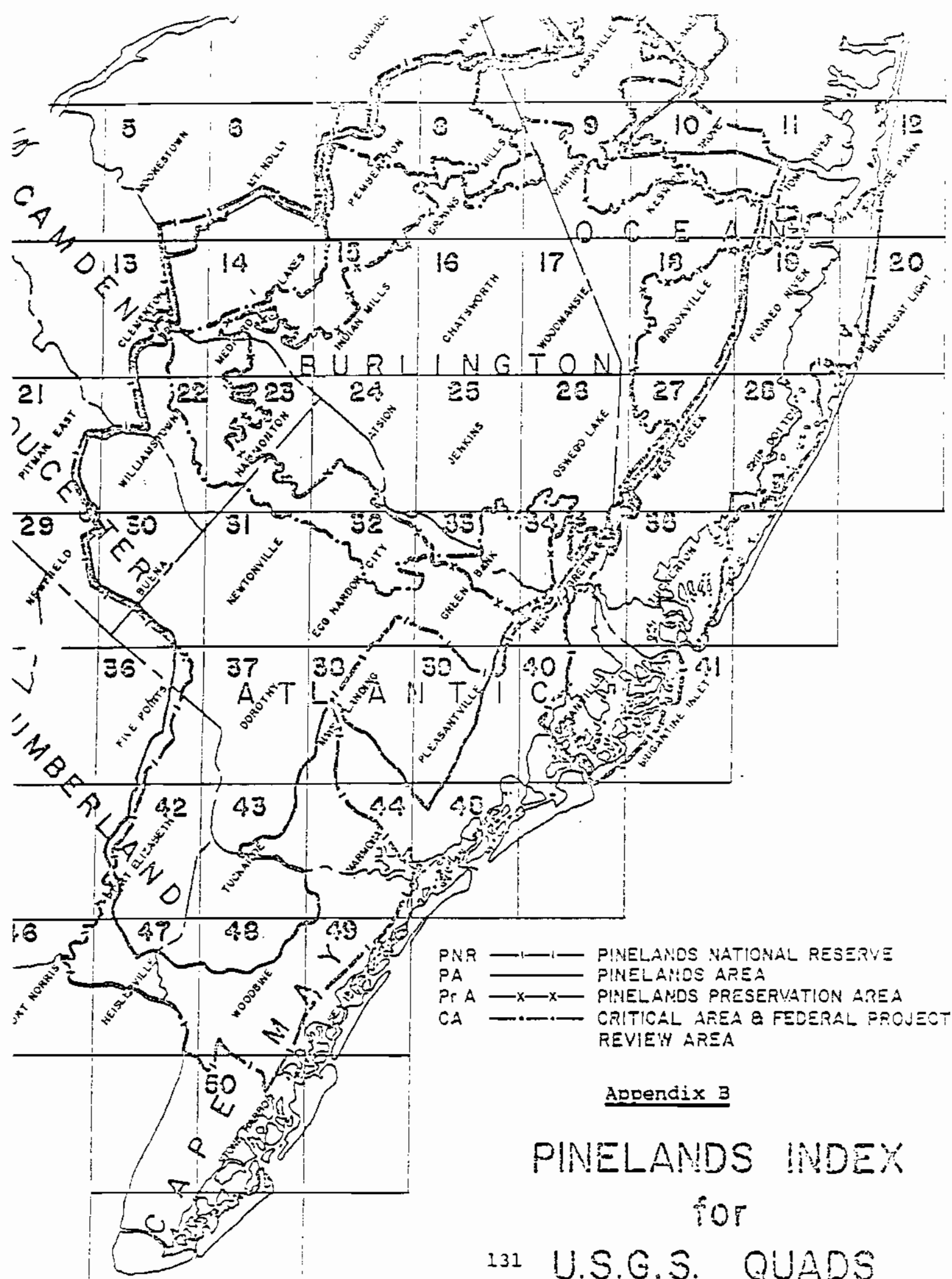
H_1 The observed distributions show differences between cells which do not reflect random occurrences

$$\alpha = 0.01$$

$$\chi^2 = \frac{1156}{133} + \frac{70225}{133} + \frac{13924}{133} + \frac{12769}{133} = 737.38$$

Decision: Reject H_0 if values of χ^2 at $df=3 \leq \alpha : 0.01$

Conclusion: Reject H_0 . Observed distributions probably not due to operation of chance alone.



MONMOUTH COLLEGE ARCHAEOLOGICAL RESEARCH LABORATORY-NEW JERSEY
PINELANDS PREHISTORIC SITE SURVEY FORM

LOCATION: USGS QUAD _____/PI MAP# _____/CO. _____/USDA SHEET# _____/

UTM: I I I ; I I I I I I I I ; I I I I I I I I I I /MCS D _____/RSD _____/
zone easting northing

RCD _____/NJSM# _____/ELEVATION _____ m; _____ ft/

ACCURACY OF LOCATIONAL DATA: ACCURATE _____/ADEQUATE _____/QUESTIONABLE _____/FIELD-
CHECKED? YES _____/NO _____/IF SO, BY WHOM _____/METHOD _____

SELECTIVE CRITERIA _____

CONDITION OF SITE: PRESERVED _____/DESTROYED _____/OTHER _____

PRESENT USE: AGRICULTURAL _____/URBAN _____/FORESTED _____/UNKNOWN _____/OTHER _____

SITE IS IN PINELANDS AS: FEDERALLY DEFINED _____/ECOLOGICALLY DEFINED _____/LO-
CATION IS IN THE FOLLOWING ZONE(S): PNR _____/PA _____/PrA _____/CA _____/CAFRA _____/OUTSID
BUT CONTIGUOUS TO _____

CLOSEST HYDROLOGICAL SOURCE(S): NAME OF SOURCE(S) 1) _____ ;
2) _____ ; 3) _____ ; 4) _____

TYPE: RIVER _____/STREAM _____/SPRING _____/POND _____/LAKE _____/BOG _____/CRANBERRY BOG _____/
SWAMP _____/EMBAYED SWAMP _____/MARSH (FRESH _____/TIDAL _____)/BACK BAY _____/OPEN BAY _____/
SEMI-ENCLOSED BAY _____/INLET _____/OCEAN _____/DISTANCE TO SOURCE: 1) _____ m;

2) _____ m; 3) _____ m; 4) _____ m/ORIENTATION OF SITE TO
SOURCE: 1) N/S/E/W/NE/NW/SE/SW/2) N/S/E/W/NE/NW/SE/SW/3)
N/S/E/W/NE/NW/SE/SW/4) N/S/E/W/NE/NW/SE/SW/PERMANENCE OF
SOURCE: PERMANENT _____/SEMI-PERMANENT _____/INTERMITTENT _____/RELICT FEATURES: RIVER
MEANDER SCAR _____/STREAM MEANDER SCAR _____/OXBOW _____/OXBOW LAKE _____/PLUVIAL LAKE _____/
PINGO OR THERMOKARST BASIN _____/OTHER _____/DISTANCE TO FEATURE:

1) _____ m; 2) _____ m; 3) _____ m; 4) _____ m/ORIENTATION OF
SITE TO FEATURE(S): 1) N/S/E/W/NE/NW/SE/SW/2) N/S/E/W/NE/NW/
SE/SW/3) N/S/E/W/NE/NW/SE/SW/4) N/S/E/W/NE/NW/SE/SW/

STREAM ORDER: 1 _____/2 _____/3 _____/4 _____/5 _____

HYDROLOGICAL ASSEMBLAGES: RIVER/STREAM CONFLUENCE _____/STREAM CONFLUENCE _____/
STREAM BISECTING FLOODPLAIN _____/POND FEEDER _____/LAKE FEEDER _____/MARSH FEEDER _____/
OTHER _____/CLOSEST DISTANCE TO SOURCE(S): 1) _____ m; 2)

_____ m; 3) _____ m; 4) _____ m/ORIENTATION OF SITE TO SOURCE(S): 1)
N/S/E/W/NE/NW/SE/SW/2) N/S/E/W/NE/NW/SE/SW/3) N/S/E/
W/NE/NW/SE/SW/4) N/S/E/W/NE/NW/SE/SW/

SITE IS LOCATED NEAR RIVER _____/STREAM _____/: MOUTH _____/TIDAL LIMIT _____/HEADWATERS _____/

LANDFORM: SITE IS LOCATED ON: KNOLL / HILL / DUNE / OXBOW / SADDLE / RIDGE / CUESTA / POINT BAR / ALLUVIAL FAN / FLOODPLAIN / RIVERINE TERRACE / COASTAL TERRACE / PENINSULAR TERRACE / ESCARPMENT / DELTA LOBE / DELTA / ISLAND / BARRIER ISLAND (LEE / SEA /) / PENINSULA (LAKE / BAY / OCEAN /) / BARRIER BEACH / BAY BEACH / BARRIER SPIT / POINT (LAKE / BAY / OCEAN /) / LEVEE / BAY BEACH DELTA / DEPRESSION / FLAT / COMPLEX /

ON-SITE SOILS: SOIL SERIES _____ / MAP SYMBOLS _____ /

MINORITY TYPE(S) (ABBR.) _____ /

SLOPE: 0-2% / 2-5% / 5-10% / 10-15% / 15-30% /

DRAINAGE CHARACTERISTICS: EXCESSIVELY DRAINED / WELL DRAINED / MODERATELY WELL DRAINED / SOMEWHAT POORLY DRAINED / POORLY DRAINED / VERY POORLY DRAINED /

WILDLIFE SUITABILITY OF SITE SOILS: OPENLAND 1 2 3 4 / WOODLAND 1 2 3 4 /

WETLAND 1 2 3 4 /

SUITABILITY OF SITE SOILS: GRAIN & SEED CROPS 1 2 3 4 / GRASSES & LEGUMES 1 2 3 4 / WILD HERBACEOUS UPLAND PLANTS 1 2 3 4 / HARDWOOD WOODY PLANTS 1 2 3 4 / CONIFEROUS WOODY PLANTS 1 2 3 4 / WETLAND FOOD & COVER PLANTS 1 2 3 4 /

LITHIC RESOURCES WITHIN 100m OF SITE: GRAVELS / CHERT / OTHER _____ /

NUMBER OF LOCATIONS: 1 2 3 4 5 MORE _____ /

SUBPROVINCE OF SITE: CENTRAL UPLAND / OUTER LOWLAND / TRANSITIONAL _____ /

ASSOCIATED VEGETATION TYPES (AFTER McMORMICK & JONES):

UPLAND FOREST COMPLEX: PINE-OAK FOREST TYPE / OAK-PINE FOREST TYPE / NON-PINE BARRENS FOREST TYPE / EDGE AREA (EXPLAIN) _____ /

LOWLAND FOREST COMPLEX: CEDAR SWAMP FOREST TYPE / HARDWOOD SWAMP FOREST TYPE / PITCH PINE LOWLAND FOREST / EDGE (EXPLAIN) _____ /

NON-FOREST AREAS: INLAND MARSHES / INTERTIDAL WETLANDS / EDGE (EXPLAIN) _____ /

CULTURAL ATTRIBUTES OF SITE:

DIAGNOSTIC ARTIFACT TYPES PRESENT: PROJECTILE POINTS _____ / CERAMICS _____ /

OTHER _____ /

CULTURAL PERIODS REPRESENTED: P. INDIAN / E. ARCHAIC / M. ARCHAIC / L. ARCHAIC / T. ARCHAIC / E. WOODLAND / M. WOODLAND / L. WOODLAND / CONTACT /

ACTIVITY INDICATORS:

HUNTING IMPLEMENTS: POINTS / ATLATL WEIGHTS / NETSINKERS / OTHER _____ /

VESSELS: CERAMIC SHERDS / STEATITE SHERDS / STONE BOWL FRAGMENTS _____ /

Appendix D

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