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Archaeology in the Connecticut College Arboretum

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Front cover: Archaeological research at the Mamacoke Cove site showing some of the units in the process of excavation.

ARCHAEOLOGY IN THE CONNECTICUT COLLEGE ARBORETUM

Harold D. Juli

edited by

Glenn D. Dreyer
and
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THE CONNECTICUT COLLEGE ARBORETUM
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THE CONNECTICUT COLLEGE ARBORETUM

Mission Statement
January 1, 1990

The Connecticut College Arboretum is owned by Connecticut College and operated for the benefit of the college and the community. The Arboretum functions in support of the college's mission by helping to prepare men and women for a lifetime of learning about and interacting with the natural world. The mission of the Connecticut College Arboretum is:

- **Teaching**—To provide an outdoor laboratory for use by faculty and students in Botany, Zoology, Biology, Human Ecology and other departments. In both teaching and research, the Arboretum is a unique and valuable academic resource and support facility.

- **Research**—To support and conduct research in a broad range of topics including ecology, field biology, conservation and natural history. Arboretum research emphasizes long-term studies.

- **Conservation**—To provide stewardship of college lands by protecting, sustaining and enhancing biological diversity of large tracts of open space. The Arboretum also provides leadership statewide and beyond in conservation matters.

- **Collections**—To maintain, develop and interpret well-documented plant collections for teaching, research, public education and enjoyment.

- **Recreation**—To provide a place where people from the college and the community may enjoy passive recreation and where they may come to learn, reflect and renew themselves through contact with the natural world. The Arboretum enhances the quality of life for the college and the citizens of southeastern Connecticut.

- **Public Education**—To provide programs and publications about conservation, horticulture, gardening, botany and natural history which enhance people's understanding of the natural world and foster an understanding of the Arboretum's mission.

FOREWORD

After rereading this bulletin I am once again impressed by the many faces of the Arboretum. To most students, staff, faculty and the local citizenry, the Connecticut College Arboretum is a particularly lovely setting to walk and relax in while getting "closer" to nature. To a smaller group of faculty and students, it is a truly diverse living laboratory used to examine natural processes in great detail. Among college and university "gardens" nationwide, our Arboretum has an unusually strong emphasis on undergraduate teaching and research opportunities in the environmental sciences. In such a context we often think of "preserved" lands, like the Arboretum's 440 acres, as most important for the protection of biological diversity.

Professor Juli shows herein that land spared from destructive alteration for human uses also preserves *cultural diversity*. The Arboretum will now be recognized as a very important source of physical documentation revealing continuous human habitation *of this very land* for at least the past 4,000 years. The rich array of clues left behind by Native Americans, painstakingly recovered and cataloged by scientists like Dr. Juli, are a small but enlarging window through which we may glimpse the lifestyles of the previous occupants of this land. When the landscape is covered with houses, shopping malls, roads and athletic fields, such clues vanish forever.

During the process of accumulating the information on prehistoric cultures that is the subject of this bulletin, Connecticut College students were offered a very exciting opportunity to learn outside the classroom. From 1975 to 1985 over one hundred undergraduates had the chance to participate in a series of scientifically organized archaeological digs within a short walk of the lecture hall. For them the Arboretum is much more than a pretty place with interesting plant collections and biological communities.

It is my hope that this bulletin will inspire others in our academic community to discover new and exciting ways to integrate the Arboretum into their programs of teaching and research. Perhaps even more important, *Archaeology in the Connecticut College Arboretum* will also increase the public awareness of yet another important reason to actively support natural areas preservation at the local, regional, national and international levels.

Glenn D. Dreyer
Director

ACKNOWLEDGMENTS

I am grateful to Richard Goodwin, William Niering and Glenn Dreyer of the Connecticut College Arboretum for allowing the research and supporting these efforts over several years. I also wish to thank numerous students for their dedicated work in the Arboretum. I am especially grateful to Amy Felmley, Karla Evans, Roxanne Littlefield, Wendy Stark, Melissa Juhas and Philip Hayden. Gina Foster and Anita Allen deserve special thanks for their help in manuscript preparation.

Harold D. Juli

INTRODUCTION

For many years the Connecticut College Arboretum has functioned primarily as an institution sponsoring botanical research, environmental studies, and public education, with its focus emphasizing the natural environment. In addition to providing an outdoor laboratory for the study of local botany, zoology and ecology, the Connecticut College Arboretum also contains archaeological remains associated with the region's prehistoric Native American inhabitants, as well as early colonial farmers. Six archaeological sites representing approximately 4,000 years of human occupation have been discovered and studied within several Arboretum tracts. Five of these sites comprise an interesting group of surviving prehistoric Native American cultural resources along the heavily developed shore zone of the Thames estuary (Figure 1). One of the sites is an eighteenth and nineteenth century colonial farm. It is indeed remarkable that archaeological sites have survived in our region at all. Within southeastern Connecticut, as in many other areas of the northeast, once abundant and varied sites are being destroyed at alarming rates as development alters the environment. While we have always tended to think of the Arboretum as a resource whose major benefit is study and protection of the natural landscape and biota, its protective covenants also have functioned to preserve a complex of rare material remains reflecting the area's long term occupation, primarily by native peoples, whose lifeways and use of the land predate the European presence.

In the early 1970s the Anthropology Department at Connecticut College began to use the Arboretum as a location for archaeological field studies, primarily in the context of a semester course in archaeological methods. The Arboretum seemed an ideal field laboratory because of its proximity to the College and the presence of prehistoric and colonial sites. The Arboretum staff saw the archaeological activity as an opportunity to expand the preserve's use for scientific research and very kindly granted permission for the archaeological work described in this bulletin.

Initial testing and subsequent excavation began to yield information about Arboretum sites, but it also became increasing clear, particularly after a 1980 archaeological survey of the Thames River shore zone from its mouth to Norwich, that the Arboretum was a unique enclave with respect to the number, state of preservation, and diversity of its prehistoric resources. These sites are near one another and probably represent the activities of related cultural groups. As a unit these sites are an excellent yardstick by which we may begin to appreciate the density and patterning of prehistoric resources along the Thames River shore zone. This Arboretum Bulletin reports on efforts to study and preserve the record of these local Native American cultures and colonial remains in southeastern Connecticut.

Figure 1. Approximate Locations of Archaeological Sites in the Connecticut College Arboretum.

THE ARCHAEOLOGICAL SITES

The archaeological sites studied in the Arboretum are discussed below. Descriptions focus on site location, form, manner of study, recovered artifacts, interpretations, and implications for the area's prehistory. The presentation is designed so that the reader may learn specific information about each site, as well as understand these data within regional and chronological contexts.[1]

HARRISON'S LANDING

The Harrison's Landing site is located at the head of the cove forming the southern boundary of Mamacoke Island, within the Arboretum's George S. Avery Tract (Figure 1). A stream empties into the cove at this location forming the southern boundary of the site. This was the first Arboretum site systematically studied, although another nearby at the Arboretum athletic field had been collected intermittently by a College employee for some years.[2] Harrison's Landing was excavated initially by Professor B. June Macklin of Connecticut College's Anthropology Department in the early 1970s to give students firsthand exposure to archaeological field methods. The site represents a type known to archaeologists as a shell midden. Middens are found quite frequently within coastal zones throughout the world since they are composed of dense shell refuse and other food remains such as bone and artifacts, resulting largely from the consumption of countless prehistoric meals. These sites, often termed kitchen middens in Europe, may reflect either a long-term or brief occupation, with density, abundance of shell, and artifact content as the main indicators of settlement history. At Harrison's Landing, the common eastern oyster (*Crassostrea virginica*) is the dominant shellfish species, representing about 95% of the midden deposit. Several varieties of clam, scallop, and mussel are also present in small amounts. The midden covers an area of some 500 square meters consisting of a deposit which is no more than 25 centimeters thick in some areas.

Archaeological studies of shell middens and the ways of life represented by such sites have seen much change in the last one hundred years. Initially, vast coastal middens were taken as evidence of ancient shellfish dependent cultures, whose major nutritional requirements were furnished by the meat yields of oysters, clams, mussels, etc. Today, archaeologists feel that early investigators probably attached too much importance to the nutritional contribution of shellfish and neglected evidence of other foods, particularly fish, mammals, and plant foods, whose remains are also important constituents of many midden sites. Detailed analyses of midden contents have indicated that these sites usually represent complex economic activities practiced by people engaged in diversified, seasonally based gathering and hunting, utilizing a wide spectrum of food resources.[3]

At Harrison's Landing, the archaeological testing consisted of two parts. First, several 2-meter-square test units positioned in a checkerboard pattern in

the densest area of the midden, adjacent to the stream and the cove, were excavated. Six units were excavated to a depth of 25 centimeters or to the point where archaeologically sterile soil was reached. Such an excavation plan usually produces artifacts, food remains, and environmental information, as well as stratigraphic data on the length of occupation. Generally, at an undisturbed site, artifacts of earlier periods are uncovered as one digs deeper into the deposit, and this was the case at Harrison's Landing. The second testing strategy consisted of excavating a transect in the open field adjacent to the midden deposit, which was divided into ten 2-meter-square units. This method permitted intensive exploration of one area of the site previously untested and undisturbed, because it appeared that stream and slope erosion at the southern boundary of the midden grid had probably altered that deposit. The transect units produced artifacts as well as shell and animal bone. After two autumn excavation seasons the site's testing was completed, leaving much of the site undisturbed and thus preserved, one of the goals at all the Arboretum sites.

The artifacts from Harrison's Landing were quite instructive. Among the earliest materials stratigraphically were small stemmed quartz projectile points of the Wading River type (Figures 2 and 3).[4] For many years these artifacts were assigned typologically to the late Archaic period ca. 4000 B.C. - 1000 B.C., although recent evidence suggests that similar forms were produced in subsequent prehistoric periods and are found in Woodland and seventeenth century contexts (Snow 1980). Climatically, the Late Archaic had temperatures warmer than those in southern New England today. Archaeologists have suggested that populations larger than those in the region just before European contact may have been present during Late Archaic times.

Figure 2. Projectile Points Excavated at the Harrison's Landing Site. 1, 2. Squibnocket Triangle Points; Narrow point tradition, Late Archaic stage. 3, 4, 5. Wading River Points; Narrow point tradition, Archaic and Woodland stages. 6. Orient Fishtail Point; Terminal Archaic stage. 7. Madison Point; Late Woodland Stage.

Estimates of aboriginal North American populations at the time of European

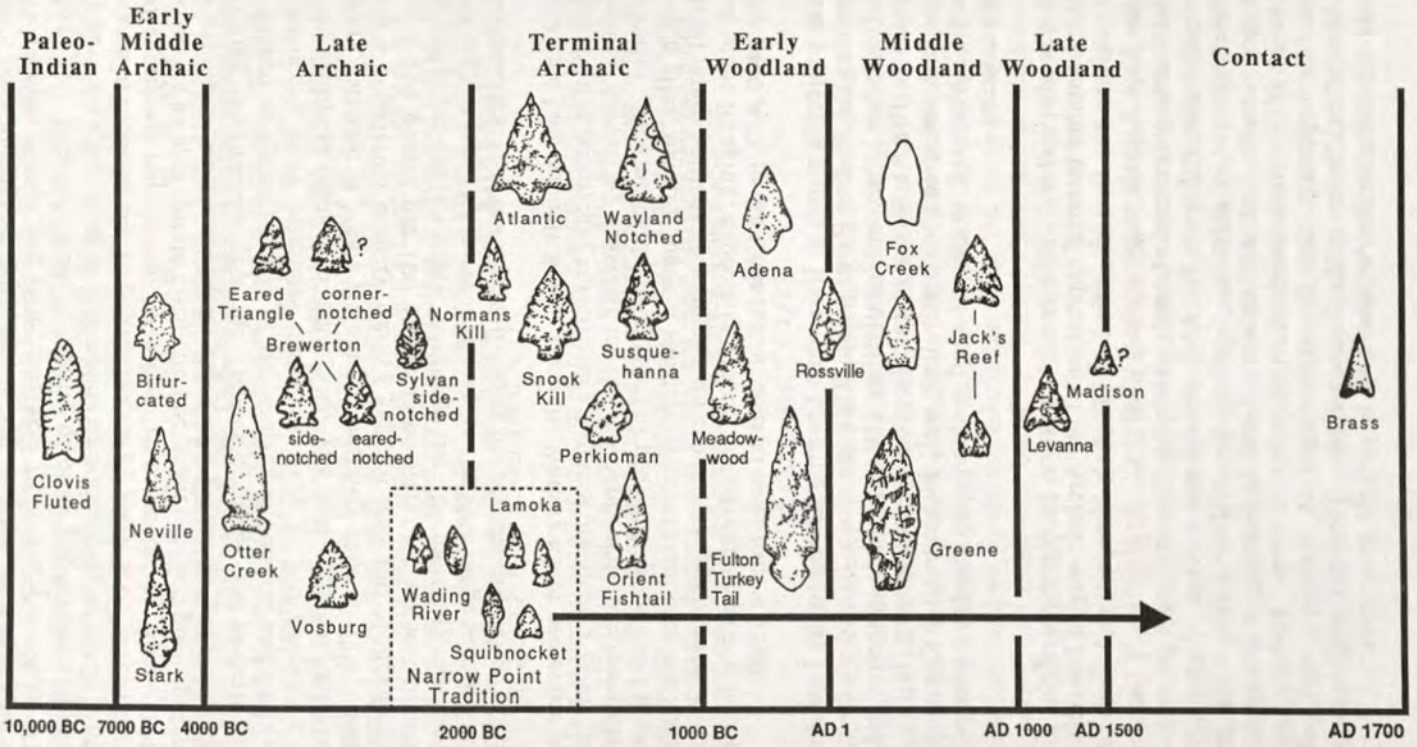


Figure 3. Major Connecticut Prehistoric Projectile Points (after Lavin 1985). Points present in the Arboretum include Brewerton, Squibnocket, Wading River, Orient Fishtail, Levanna, and Madison. (Reproduced courtesy of the Peabody Museum of Natural History, Yale University.)

contact have undergone much debate and revision in recent years (Kroeber 1939; Dobyns 1966; Cook 1976; Ubelaker 1976; Dobyns 1983). The controversies have focused on the reliability of older population estimates, which may have been based on an incomplete understanding of the role of epidemic diseases in reducing native populations after 1600 A.D. Recently, New England aboriginal populations have been re-estimated by Snow (1980:33-34), who makes an appropriate distinction between pre- and post-epidemic levels. His estimates seem reasonable, especially given the uneven quality of the surviving information. For the Thames drainage and eastern Long Island (combined as a unit because of the aboriginal cultural and linguistic correspondences), Snow estimates that there were 13,300 people in the region before European contact ca. 1600 A.D. His post-epidemic, mid-seventeenth century estimate is 3000, yielding a mortality rate of 77%. Interestingly, Snow's population density figures suggest that the Mohegan-Pequot had around 266 people per 100 square kilometers, the highest density in New England in pre-contact times. Although the 77% mortality rate seems exceedingly high, it is in fact lower than rates in the 90% range seen in other regions of Connecticut and New England during the seventeenth century (Snow 1980).

During the Late Archaic Stage, when the Wading River projectile points were in use, Native Americans at Harrison's Landing practiced a mobile subsistence economy marked by seasonal moves, probably within circumscribed group territories. Judging by the abundance of projectile points and faunal remains in such sites, hunting made a substantial contribution to the diet, although current interpretations also suggest an economy supplemented by broad spectrum plant foraging, especially before the advent of native horticulture ca. 1200-1400 A.D. in the Connecticut coastal zone (Snow 1980).

Three projectile points at Harrison's Landing belong to the Late Archaic type known as the Wading River point. They are characterized by their small size (¾-1¼ inches long), and locally they often are made of quartz and sandstone (Figure 2). These tools are extremely common on southern New England sites in general, and have been particularly well documented in Connecticut and on Martha's Vineyard, in coastal shell midden sites similar to the one at Harrison's Landing.[5]

The site also yielded evidence of habitation by members of the Squibnocket culture, another material expression of the Archaic way of life (Ritchie 1969). This culture was first identified on Martha's Vineyard and dates to the phase of the Late Archaic stage around 1000 B.C. At Harrison's Landing, characteristic artifacts consist of small quartz Squibnocket style projectile points of triangular shape (Figure 2). Also present was a piece of graphite, probably used as a source of pigment. Squibnocket artifacts suggest that hunting was a major activity, and at Harrison's Landing hunting is documented by the recovery of deer and numerous small mammal bones. Fishing seems to have been less important than the exploitation of shellfish, with only a small number of fish bones in the faunal sample. The Squibnocket people did not produce pottery, as the Archaic stage is entirely preceramic.

A prehistoric culture transitional between Archaic and Early Woodland times ca. 1000 B.C. is represented at Harrison's Landing by one example of an Orient Fishtail projectile point. This type was originally identified in a coastal context on Long Island (Ritchie 1959) and continues the earlier coastal-based economic patterns marked by hunting, gathering and shellfishing.

In addition to the Archaic stage artifacts, several projectile points of the Madison type found at Harrison's Landing document a later prehistoric occupation (Figure 2). This period, the Late Woodland, is dated approximately 1000 - 1500 A.D. in southern New England. Madison points are generally small triangular artifacts and were the dominant arrowhead type in use on the eve of European contact. If this site was used during late prehistoric times, there is very little evidence beyond these few projectile points. The artifacts may be intrusive or they may indicate a limited Late Woodland occupation. Clearly, they are not very abundant at Harrison's Landing and are not supported by the presence of native ceramics, another typological marker of the Woodland Stage. Chronologically, the Harrison's Landing prehistoric artifacts, when seen as a group, indicate that the site may have been the focus of activities from 2000 B.C. to about 1600 A.D.

The youngest material recovered from Harrison's Landing consists of a scatter of colonial artifacts such as redware and combed slipware ceramics, clay pipestems, and nails. These artifacts can be assigned to the eighteenth century, with the pipestems dating to the period 1700-1750. During this time the area was used by colonial farmers; it is likely that these artifacts represent domestic waste discarded on top of the prehistoric Native American site.

MAMACOKE COVE

The Mamacoke Cove prehistoric site is situated on a gently sloping hill along the south cove of Mamacoke Island, a small peninsula jutting into the Thames River opposite the United States Naval Submarine Base in Groton. The Mamacoke Island Tract in the Connecticut College Arboretum is a bedrock promontory with evidence of glacial activity visible on the outcrops. During the last several hundred years the island has been the scene of agricultural activity, grazing, and small boat building. Today, access and public activities are limited as the island is used as a natural area, wildlife refuge, and scientific study zone.

The prehistoric site was discovered by a Connecticut College undergraduate in 1975. Initially, the surrounding environmental context suggested that the area had not been subject to major development or modification other than forest clearance, probably to create grazing pasture during the last century. The site seemed to be extremely well preserved. Such situations are unusual in the highly developed Thames estuary, and the site was judged to be an excellent candidate for archaeological testing. A small ½ x ½ meter test unit was opened initially, and this probe produced abundant remains of shell, bone, a stone tool, and prehistoric ceramics. The remains indicated that the site had

good archaeological potential to yield cultural information relating to at least one period within the long occupational history of the region. The ceramics were particularly noteworthy because the design motifs suggested that the site had been occupied during the Middle to Late Woodland stage ca. 1 - 1600 A.D. These dates fell within a period consistent with the focus of other archaeological research being planned by Connecticut College, and a decision was made to study the site. The excavations were conducted during several autumn semesters as part of an undergraduate course in Archaeological Field Methods. This program was supplemented by a six-week summer session in 1980.

Figure 4. Mamacoke Cove Site. Located on a sloped clearing along the south shore of Mamacoke Island, the Mamacoke Cove site yielded important evidence on the people living during the Middle to Late Woodland cultural stages.

The Mamacoke Cove excavation was designed with two aims in mind. First, the site was considered an example of a seasonal occupation that was part of a more complex yearly cycle exhibiting multiple economic and settlement forms. As such, it was important to recover evidence of the economic activities practiced at the site so that the specific form of seasonal adaptation could be reconstructed. Methodologically, several techniques were used to recover a broad spectrum of archaeological remains. These techniques included controlled stratigraphic excavation, systematic sampling of shell refuse, and the water separation procedure termed flotation, useful in recovering small organic remains such as nuts, charcoal, and bird and fish bones. The second goal was to uncover evidence of internal site features such as hearths, roasting pits, storage facilities, and architecture. Such information would help in the reconstruction of economic as well as social activities. Methodologically, these goals were pursued through the excavation of broad horizontal exposures, rather than focusing solely on the more traditional method of midden excavation which stresses the use of vertical soundings and long trenches.

The site encompasses 200 square meters within a wooded area, bounded by a

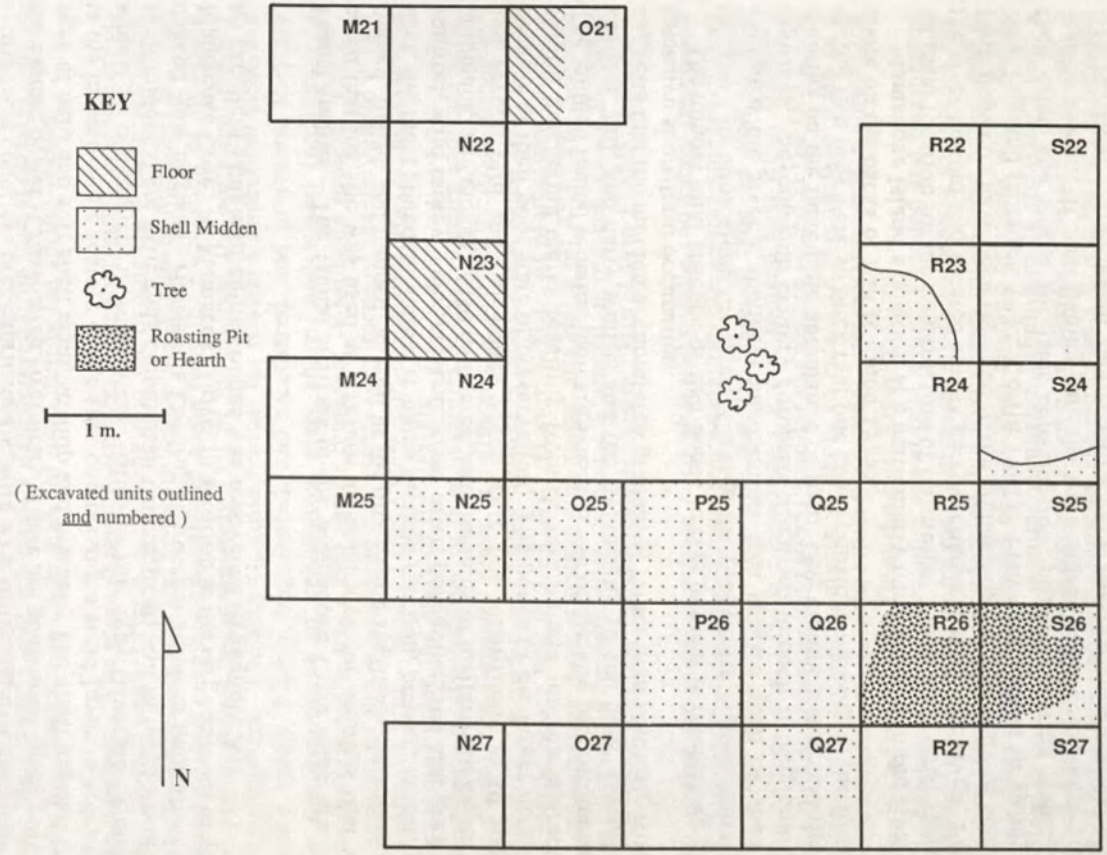


Figure 5. Archaeological Excavation Units at Mamacoke Cove.

cliff on the north and a salt marsh to the south, along a cove on the south side of the island (Figure 4). Within this site the excavation plan encompassed a 70-square-meter grid pattern of which some 30 square meters were excavated (Figure 5). The most distinctive feature of the site is the dense sub-surface midden, or concentration of shells. Like Harrison's Landing, the shells are refuse from countless prehistoric meals, with 95% of the deposit consisting of the eastern oyster (*Crassostrea virginica*). There are additional small percentages of hard and soft shell clam, scallop and mussel. The shell deposit itself is the largest single feature of the site, comprising a solid layer to a depth of almost 30 centimeters in some areas. Sites of this type (riverine or coastal shell middens) are extremely common in Connecticut, and in fact throughout coastal New England. Harrison's Landing represents an older habitation than Mamacoke Cove. At Mamacoke Cove, in addition to the large amount of shell, an excellent sample of animal bones was recovered (Appendix A).

Faunal Analysis – The faunal analysis of the Mamacoke Cove materials indicated that the site was used as a refuse disposal area for animals that were hunted, fished, and trapped, as well as for processing shellfish. In addition to deer, the most abundant animal remains include raccoon, beaver, rabbit, gray squirrel, wild turkey, vole, muskrat, river otter, porcupine, red and gray fox, chipmunk, and mouse. Also recovered were remains of mallard ducks, turtles, and several bird and fish bones which were not identifiable as to species because of their poor state of preservation. The bones of the larger mammals exhibit butchering marks resulting from defleshing and marrow extraction. The midden faunal remains indicate seasonal use of the site predominantly in summer, fall, and early winter, and the weathering of the bone assemblage suggests that the midden accumulated gradually, rather than resulting from an intensive short-term occupation.

The almost total absence of fish bones in this midden is interesting given the site's location along the river. Clearly, the prehistoric Native Americans exploited the river's abundant anadramous fish species such as shad and alewives. Seventeenth century colonists often wrote back to England commenting on the incredible abundance of fish. One commentator said that the spring fish runs were so thick that one could consider walking to the opposite shore on the backs of fish (Cronon 1983).

Mamacoke Island's position at a particularly narrow point in the river was an ideal location for the construction of fishweirs. These were nets, staked to the river bottom and located across narrow channels along the river. Prehistoric fishweirs have been reported in the archaeological literature of southern New England (Johnson 1942; Coffin 1947). Fish were caught in spring and then dried and stored for later consumption, probably during winter, the leanest season. If such fishing patterns were indeed practiced, where are the fish remains? If abundant fish remains have survived, the archaeological research in the Arboretum indicates that they are not to be found on the river's western shore in the Mamacoke Island area. However, during the course of an archaeological survey of the Thames River (Juli 1981), examinations of local artifact collections indicated that an extremely large Woodland village was located on the site of the Naval Submarine Base in Groton, along the

Thames River's eastern shore directly opposite Mamacoke Island. The presence of this site suggests the possibility that it was the locus of fish processing and drying, rather than Mamacoke Cove which functioned in part as a special-purpose shellfishing station. The eastern shore village would have been occupied during spring when large Native populations came together to exploit the river's abundant fish resources. This hypothesis articulates nicely with the Mamacoke Cove seasonality data derived from faunal remains, which suggest that Mamacoke Cove was not used during the spring season.

Artifact Analysis – The most abundant artifacts were aboriginal ceramics representing several vessel types, indicating that the people used these wares for various cooking, storage, and domestic functions (Figure 6; Appendix B). The Mamacoke Cove ceramic assemblage came from the excavation of 30 square meters representing approximately 15% of the midden, the portion of the site that was studied. The sherds, quite typical for coastal Connecticut sites, are generally small, highly fragmented, and weathered, and in general they are poorly representative of decoration, size, shape, and vessel function. At Mamacoke Cove, the site's 200 sherds represent 19 separate vessels. Twenty-eight percent of the assemblage represents specimens of indeterminate vessel size, shape, or type. Most of these were non-diagnostic, that is, undecorated sherds coming from the body of the vessels.

The typological attributes or design motifs of the ceramics indicate occupation during the Sebonac stage, a cultural unit within the Late Woodland Windsor ceramic tradition. This tradition is radiocarbon dated at other sites in the region about 900 to 1500 A.D. (Lavin 1980). At Mamacoke Cove the latest radiocarbon date is within this range at 1260 ± 60 A.D. The Sebonac stage's diagnostic ceramic type, Sebonac Stamped, is present, as are the other Sebonac types Windsor Brushed and Hollister Plain (Lavin 1985:8; Appendix B).

Decorative techniques include cord-wrapped paddle and fabric impressed forms. Supplementing the Sebonac stage ceramics are a small number of later Niantic stage sherds in the form of a Niantic Stamped type, as well as what appears to be a sherd from a Bowman's Brook Incised East River tradition vessel. As Lavin has noted (1985), similar sherds are found at the Old Lyme Shell Heap and further analysis is likely to establish this incised ware as a Windsor tradition type, rather than the current interpretation which views such incising as a "trade" item from the East River tradition.

The Mamacoke Cove ceramics are at best a highly eroded and fragmented assemblage which makes any morphological study extremely difficult. The analysis of the sherds has indicated that four vessel forms were being used at the site. These include a vessel of 8-10 inch opening diameter with Sebonac Stamping; a cup of 4 inch opening diameter, typologically Hollister Plain; a vessel of 8 inch opening diameter; a possible Niantic Stamped type; and a vessel of 8-10 inch opening diameter, the Bowman's Brook Incised decorative form. The materials suggest that the most common types are a small bowl having an opening diameter of 8-10 inches, and a small cup of 4 inch opening diameter. Determination of overall height and other morphological attributes such as midpoint and base dimensions was impossible given the highly weathered and fragmentary nature of this assemblage.

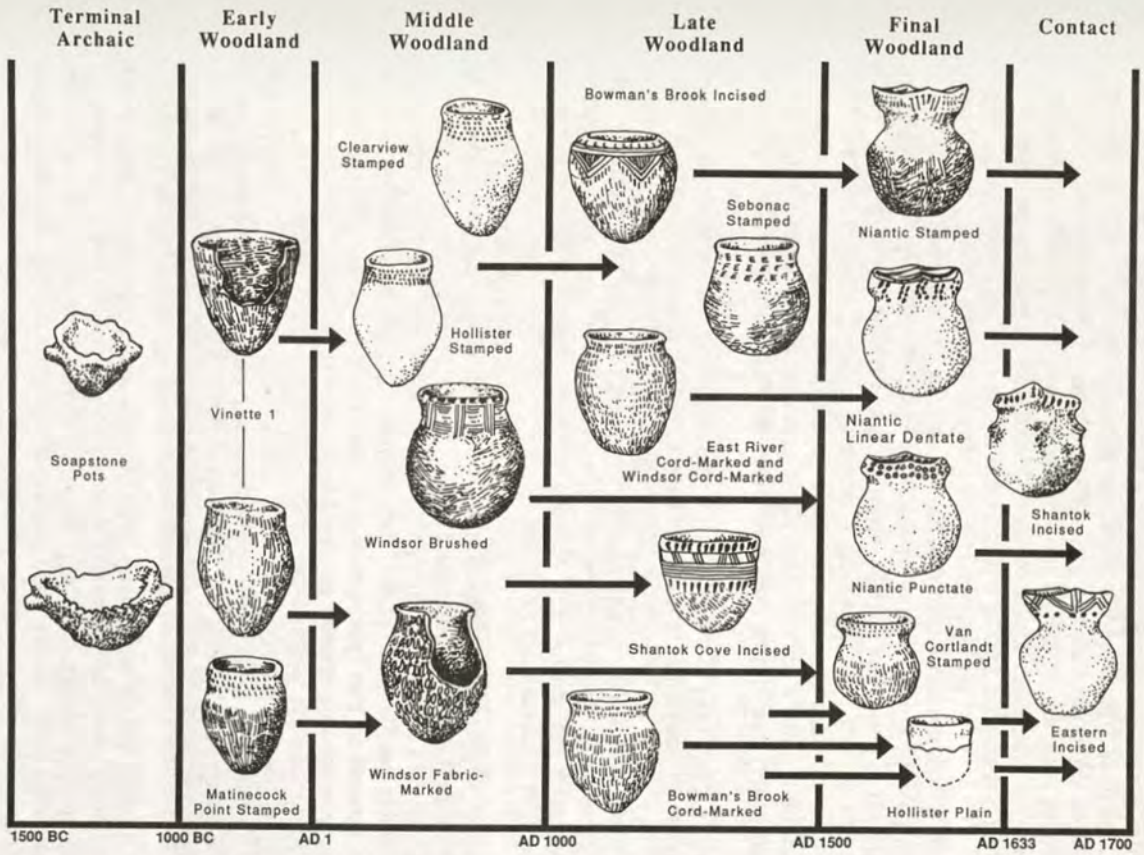


Figure 6. Major Connecticut Prehistoric Ceramic Vessel Types (after Lavin 1985). Types present at Mamacoke Cove include Sebonac Stamped, Windsor Brushed, Hollister Plain, Bowman's Brook Incised, and Niantic Stamped. (Reproduced courtesy of the Peabody Museum of Natural History, Yale University.)

Few stone tools have been recovered at Mamacoke Cove, among them a blade and a pestle. The sparsity of these remains suggest that tool production and use were not carried out at this site, a logical assumption for a shellfish processing and food refuse site. In addition to faunal and artifactual remains, a roasting pit or platform consisting of a "pavement" of small rocks was excavated. Such features have been reported before on coastal New England midden sites (Ritchie 1969).[6] Charcoal and a burned ceramic vessel fragment were recovered from this feature, supporting the interpretation of cooking, pit-roasting, or steaming of oysters, deer meat, etc. A hard packed earthen surface, which may have been a midden floor associated with pit-roasting activities, was also excavated. This feature was probably an open air surface as no evidence of architecture in the form of post-molds has been found. Charred bone, shell, ceramics and charcoal were found on this earthen surface. The charcoal derived radiocarbon date indicated that the feature is 1280 years before present (B.P.). Therefore, it is dated 670 A.D. ± 250. The ± range of 500 years indicates that the occupation is between 420 A.D. and 920 A.D. These dates fall within the lower limits of the Sebonac Stage, identified as the culture at Mamacoke Cove on the basis of ceramic design associations and a second radiocarbon date (1260 A.D. ± 60).

Botanical Analysis– Yet another data recovery technique used at Mamacoke Cove was a water separation procedure to recover soil contents know as flotation.[7] In this process soil samples from stratigraphic levels are water screened to separate organic materials such as seeds and nuts from the soil matrix. As analyses have been refined it has become generally understood that only charred seeds are archaeologically significant, since uncharred seeds are most often modern and intrusive into the archaeological deposit (Keepax 1977).

Of 2,943 seeds recovered, 103, or about 3.5%, were charred. A low percentage of charred seeds in flotation samples is not uncommon (Keepax 1977, McBride 1980: personal communication). Flotation samples were derived from random units, making it difficult to note any strong pattern in the distribution of charred seeds. The zone around the hearth was extensively sampled and yielded charred seeds. The unit on which the hearth is situated yielded 62, or about 60% of the total charred seeds, supporting the idea that the rock feature was indeed a hearth or oyster steaming pit. Quantitatively, level II (11-20 centimeters below the soil surface) had the most charred material, followed by level III (21-30 centimeters). Level IV (31-40 centimeters), level V (41-50 centimeters) and level VI (51-60 centimeters) did not have a large enough sample to permit comparison. The upper layers of the site were more likely to have intrusive modern seeds than the lower stratigraphy.

Sumac (*Rhus* sp.) represents the most common of the charred seeds. Bayberry (*Myrica pensylvanica*), oak (*Quercus* sp.), and possibly holly (*Ilex* sp.) are also present (Appendix C). There is one whole acorn which is either red or scarlet oak (*Quercus rubra* or *Q. coccinea*). Analysis of recovered charcoal samples by a botanist, Dr. Randall Amalee, indicated the presence of several hardwoods (possible oak and willow, cherry or poplar) and white pine (*Pinus strobus*) (Appendix C).

The plants represented by the charred seeds and charcoal have a variety of

historically documented uses by northeastern Native Americans (Kavasch 1979; Russell 1980; Powell 1981) and historic groups known to have inhabited southeastern Connecticut (Tantaquidgeon 1977). Historically known plant uses are relevant to the practices of the site's inhabitants in prehistory, due to the cultural continuity between the region's prehistoric inhabitants and the historic Mohegan-Pequot (Appendix C).

The archaeological value of Mamacoke Cove is that it provides a good example of one type of site representing one element of the complex pattern of Middle to Late Woodland subsistence and settlement in southeastern Connecticut. Judging by its size, morphology, contents, and location, a habitation area was very likely located near the site and occupied during all or part of several seasons, especially summer, fall, and early winter. Economic activities at the site centered on shellfish processing and refuse disposal. Comparative work indicates that a high density of such small midden sites were located along the Thames River and that they were used by multi-family or local lineage units that found dispersal to be an advantageous settlement strategy during several seasons. Aggregation of larger social units occurred during spring and winter, if the seventeenth century European descriptions of aboriginal patterns are accurate indicators of practices before contact (Snow 1980). Thus, by understanding the economy, settlement pattern, seasonality, and artifact variations at Mamacoke Cove, it is possible to begin to reconstruct seasonal components of a more complex yearly pattern representing the way of life of the prehistoric Native Americans who inhabited the region before even the earliest contact with peoples of the Old World.

GRAVES ROCKSHELTER

A second archaeological site on Mamacoke Island was located in 1927 by local children who regularly played in the area. The existence of the site came to light in 1980 when John Graves, a man in his seventies, donated a small collection of projectile points and a complete human cranium to the Indian and Colonial Research Center, Old Mystic, Connecticut. As a child, Graves and a group of friends "dug up" the artifacts and two complete human skeletons from a cliff overhang located on the east side of the island opposite the Naval Submarine Base. The youngsters discovered the small rockshelter quite by accident and their predation, as it were, is actually an example of a common occurrence when such sites are encountered by curious individuals of any age. Archaeologists are continually faced with the challenge of trying to understand prehistoric human and artifactual remains "excavated," that is, literally pulled out of the ground by well meaning amateurs and members of the general public. This type of "dig" usually destroys as much information as it recovers. In a systematic, scientific excavation, the artifacts themselves, their positions and contextual associations are always recorded. However, in chance discoveries or haphazard digs the site is often treated as though it were a mine, the artifacts are seen as treasure, and the only goal is to retrieve the valuables that the site has to offer, whether tools, bones, or other exotic objects. People usually do not understand that an archaeological site itself, including its form, depth, location, dimensions, etc., provides abundant information about the

habits, customs and practices of the people who inhabited it, or used it. The Graves rockshelter is an example: we know it was used as a location for human burial, but it may also have had an occupation component that has been destroyed. The neglect and inadvertent destruction of such sites and the information contained within them is a consistent feature of non-scientific archaeology and an approach which archaeologists try to alter through public educational programs. While we are fortunate to know of the existence of the Graves rockshelter site, we can only guess at the information it might have yielded had it been studied systematically.

The rockshelter is not a true cave but a rock overhang which is quite small, having an opening only about 5 meters wide and 1 ½ meters high at its largest points. An occupation probably could not have taken place inside the shelter, but it may have been used as an overnight campsite. Because of its unfortunate destruction as an archaeological unit, we will never know how it was used. Two main facts are known: it contained two skeletons and yielded numerous tools of which only about a dozen projectile points have survived. The artifacts can be dated typologically, because some of them have shapes which have yielded consistent dates when recovered from other sites with stratigraphic control and associations of datable charcoal. The majority can be assigned to the Late Archaic stage. This is the same stage represented by projectile points at Harrison's Landing. This era witnessed many populations moving into and occupying the region, and the archaeological interpretations of this period are complex and controversial (Snow 1980). It would be speculation to attempt to reconstruct the activities at this destroyed site merely from the presence of such a limited number of artifacts whose stratigraphic relationships and contextual associations are not known. Indeed, Graves remembered that other material was found, and divided among the boys. We are fortunate to have the small sample he saved.

Figure 7. Graves Rockshelter. This site, discovered by three youths in 1927, is an example of what not to do when one finds archaeological remains. Of two skeletons and numerous artifacts found, only about a dozen projectile points and a cranium remain.

The other finds at the rockshelter consisted of the two skeletons. Only one skull minus the mandible has survived, because Graves applied a coat of varnish to it in 1927. While the varnish helped to preserve the cranium, the rest of the skeleton crumbled. Graves reported that the second skeleton, in very brittle condition, also disintegrated. In 1932, Norris Bull, a well known Connecticut excavator and collector, was shown the skull and thought it was that of an aboriginal female in her adolescence (Graves 1980: personal communication). Beyond this minimal identification, not much is known about the people who were buried in the rockshelter. For example, we do not know whether the burials predate, were contemporaneous with, or post-date the deposition of the Late Archaic artifacts also found at the site. Although the rockshelter documents another form of prehistoric site located within the Arboretum, the data and the details have, unfortunately, been lost.

COLLEGE SOCCER FIELD

In March 1981, the College began construction of a soccer field adjacent to the Arboretum's Katherine Matthies Tract along the Thames River. While grading an open field, the bulldozer operator noticed a deer antler protruding from the ground. Upon examination the antler was associated with a large concentration of shell and bone scattered across the area. I was notified by the College's crew coach, Richard Ricci, who happened to be in the area, and I conducted an investigation with a view towards determining whether a prehistoric site had been uncovered accidentally. The next four days spent in the rain and cold weather of mid-March turned out to be both a rewarding and a disappointing archaeological experience. The bulldozer had indeed come upon an archaeological site, but by the time the operator noticed the antler, the site had been almost totally destroyed, yielding no opportunity for systematic study. However, the machinery missed the remains of a Native American burial below the main bulldozed site. The excavation of this individual produced the second source of human remains from the Arboretum, and this time the material consisted of a nearly complete skeleton.

The site is situated approximately 50 meters south of a small stream which empties into the Thames River after flowing down the west side of the estuarian valley from the heights above (Figure 8). Just prior to the discovery of the burial, I had completed an archaeological survey of selected areas along both shores of the Thames River and had learned that in virtually every instance where a stream of almost any size enters the river, a prehistoric site can be found in the vicinity. The actual position of these sites relative to the stream's entry into the river varies as a consequence of local topography, size of the social unit using the site, seasonality and period of occupation. At the Soccer Field site the habitation area was located at a slightly higher elevation than the adjacent stream. Clearly, the general location of stream-related sites had been duplicated here, but within a pattern of variation that marks this estuary and which is difficult to predict.

The location of the site was obviously designed to exploit two contiguous

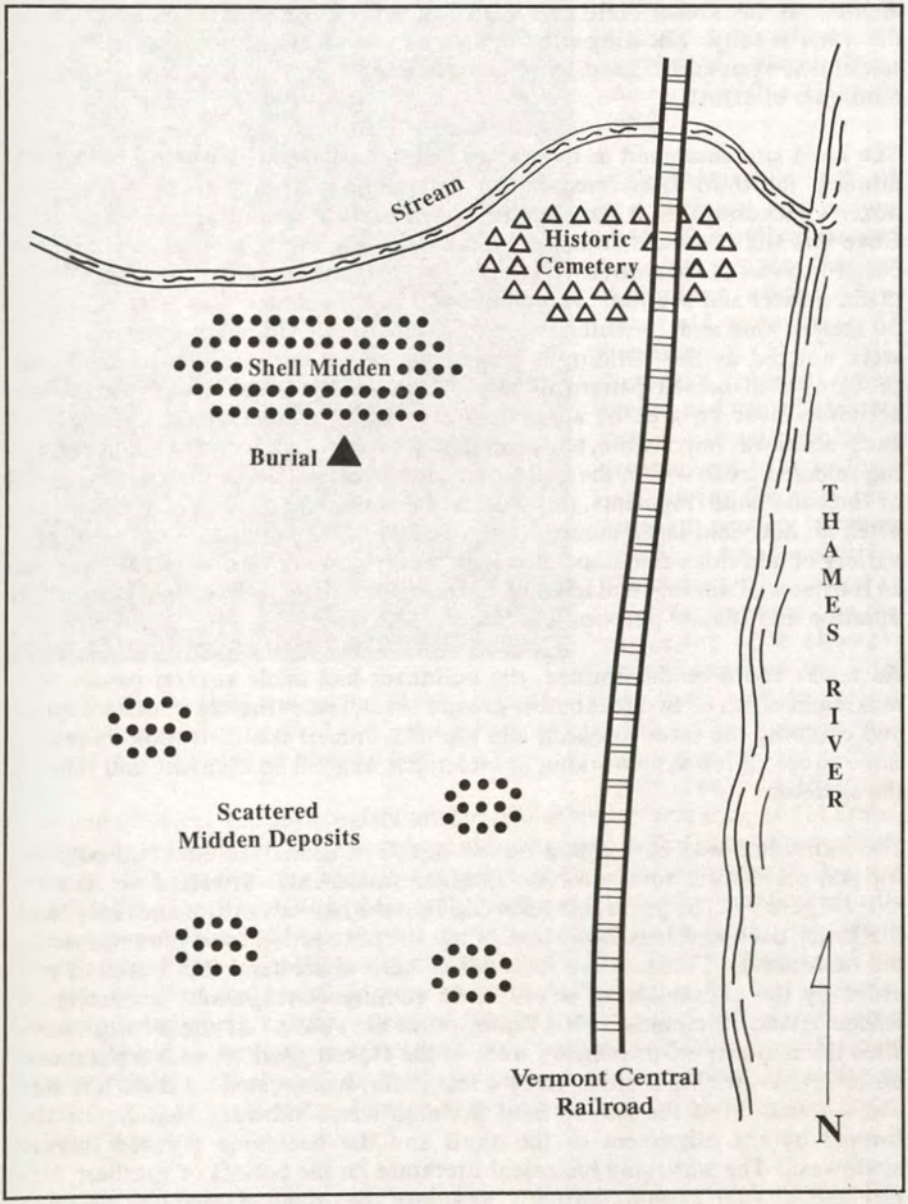


Figure 8. Soccer Field Site Map.

resources, the fresh water supplied by the stream and access to the subsistence resources and transportation possibilities provided by the river. Although technically fresh, Thames River water is not always potable, due to a high salt content, with brackishness decreasing as one moves north from the river's mouth. At the Soccer Field site, which is fairly close to Long Island Sound, the water is salty. Locating sites at streams was an element of the prehistoric settlement system designed to efficiently exploit available resources with a minimum of effort.

The main site destroyed in the soccer field's construction was another shell midden, the third discovered in the Arboretum. After screening the bulldozer's backdirt piles, it was clear that like Harrison's Landing and Mamacoke Cove this site consisted almost exclusively of a dense deposit of the common eastern oyster (*Crassostrea virginica*), with additional small percentages of clam, mussel and scallop. The main body of the midden was approximately 50 meters long and 20 meters wide. Several smaller midden concentrations were noticed as the bulldozer scraped the field, indicating that there was probably a dispersed pattern of refuse accumulation and oyster processing activities over an area of approximately 5000 square meters. Systematic excavation was impossible, but several hours were spent shoveling and screening selected areas within the bulldozed earthen piles. Other than the recovery of shell and bone fragments, this work had disappointing results. Midden sites often do not yield large numbers of artifacts. Those middens representing a variety of activities and associated with recurring long-term occupations such as Harrison's Landing tend to yield more artifacts than those of relatively short duration and special purpose function.

As far as could be determined, the bulldozer had made several passes to a maximum depth of two feet below ground level, removing the midden deposit and crushing the face, forehead and top of a human skull. It took a crew of three people three days working in inclement weather to excavate and remove the skeleton.

The individual was buried in a flexed (fetal) position, the standard position for late prehistoric southern New England interments. It rested on its right side (Figure 9). The grave had been dug into the habitation site unevenly, with the lower back and legs deposited in the deeper section (and thus missed by the bulldozer). Comparative material to help understand this burial is provided by the excavation of seventeenth century Narragansett cemeteries in Rhode Island (Simmons 1970; Robinson et al. 1985). At these large burial sites the majority of interments were in the flexed position with a pattern of placement on the right side. Only a few individuals rested on their left side. The orientation of the soccer field skeleton was southwest, that is, the line formed by the alignment of the skull and the backbone pointed directly southwest. The surviving historical literature on the beliefs of southern New England coastal peoples strongly suggests that their god of the afterlife, Cautantowwit among the Narragansett, was thought to reside beyond the horizon in the southwest. Only one artifact was associated with this burial: a broken sandstone blade fragment placed next to the right knee cap. Grave

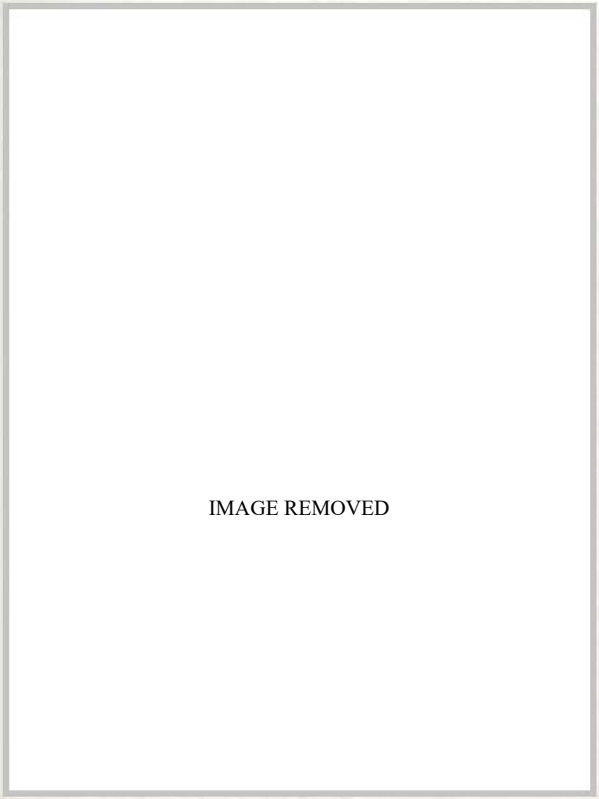


Figure 9. Soccer Field Human Burial. Excavated human burial at the Soccer Field site was a robust male who was in his mid-forties when he died.

goods are often found in Native American burials, and the most common interpretation is that the amount of grave goods is a direct reflection of the individual's status (Simmons 1970; Gibson 1980).

Approximately 90% of the skeleton was recovered. The individual was a robust male Native American about 45 + years old measuring 177 centimeters (5'10") tall. European colonists often mentioned the robust stature of coastal peoples in reports sent back to England during the early seventeenth century (Cronon 1983). Anatomically, skeletons are identified as "Native American" by the presence of a shovel-shaped cusp on the interior surface of the incisor teeth. This feature was present in the soccer field individual. Archaeologists and physical anthropologists always prefer to perform analyses of skeletal remains representing large numbers of individuals rather than solitary finds because such studies can identify anatomical and disease patterns that are statistically significant and thus truly represent the demographics of the ancient population. Although this burial represents one individual, much information emerged in the analysis (Juli and Kelley 1991). Twenty of the individual's teeth had been lost prior to death, indicating an arduous lifestyle. The remaining teeth exhibit attrition due to a coarse diet. There are deep grooves found in the lower canine and lateral incisors indicating modification from activities such as cordage-making. Several of the teeth exhibit caries or dental decay and periodontal disease is present in the form of resorption of the alveolar bone.

The analysis of the bones also revealed the presence of several diseases. The vertebrae exhibit degeneration that is often a consequence of a physically demanding way of life. The maxillary sinus bones show evidence of the disease sinusitis. There was also inflammation of the 7th-9th ribs, a pattern

which has been correlated with chronic pulmonary tuberculosis (Kelley and Micozzi 1984). The tuberculosis in this individual represents a disease common among southern New England Native Americans during the seventeenth century (Gookin 1792), resulting from contact with Europeans who carried the disease to North America. Disruptions in Native diets and exposure to cattle carrying bovine tuberculosis increased tuberculosis in aboriginal populations (Juli and Kelley 1991).

Fragments of unreconstructable bone weighing over 100 grams were submitted for radiocarbon analysis yielding a date 1620 A.D. ± 70. The individual died between 1550 A.D. and 1690 A.D., with the average date of death in 1620 A.D. This individual lived along the Thames River during the first stages of the European contact period in this region during the 1620s and 1630s. Much remains to be learned about southern New England Native American demography, but the skeleton has provided rich information about the area's aboriginal population.

ARBORETUM FIELD

The final prehistoric site described here is located at the field along Benham Avenue adjacent to the Vermont Central Railroad in the Katherine Matthies Tract. The current open area is a former baseball field measuring some 80 x 65 meters. Over the years this field was the scene of intermittent artifact collecting by Frank Malloy, a College employee and amateur archaeologist. The site's artifact collection is small, consisting entirely of seven projectile points. The site has never been tested systematically or excavated because it was used as a baseball field, and because previous agricultural activity also may have damaged the cultural deposits (Goodwin 1991).

The artifacts found by Malloy represent five typological categories from Late Archaic to Late Woodland cultures, indicating an occupational record from ca. 4000 B.C. to the time of European contact. The artifacts do not demonstrate

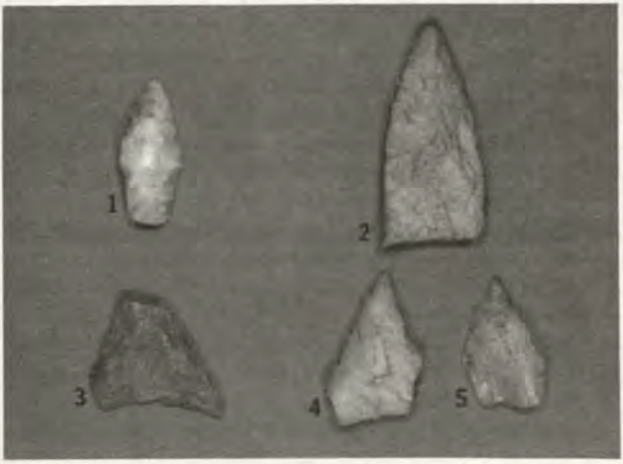


Figure 10. Projectile Points Collected at the Arboretum Field Site. 1. Wading River Point; Narrow point tradition, Archaic and Woodland stages. 2. Brewerton Eared Triangle Point; Late Archaic stage. 3. Levanna Point; Late Woodland stage. Tip and left side of base missing. 4, 5. Squibnocket Triangle Points; Narrow point tradition, Late Archaic stage.

that the occupation was continuous as at least one stage, the Middle Woodland ca. 200 - 1000 A.D., is not represented, although this lack of evidence may result from non-systematic recovery procedures rather than from a true gap in the occupational record. The latter interpretation is supported due to the strong presence of a Middle Woodland occupation at Mamacoke Cove, whose location is very close to the Arboretum Field site. It is likely that these sites are related and were probably part of a unified economic and cultural system. The Arboretum Field site is not a midden, but probably is a habitation site such as a small village. It is impossible, lacking testing and excavation, to suggest any more about site size or form, but it is undoubtedly related by artifact typological affinities and topographic position to both Harrison's Landing and Mamacoke Cove, both of which are in close proximity.

BOLLES FARM

Supplementing the archaeological program on the Arboretum's prehistoric resources, one historic site, the abandoned Bolles Farm, was also briefly studied in 1976 by students enrolled in the College's Field Archaeology course. The site is located in the Hirschfeld Tract, in the Arboretum's northwestern quadrant (Figure 11; Goodwin 1991). Although most people associate archaeology with the study of prehistoric societies, a focus on historic sites and historical archaeology has developed in this country and abroad during the last fifty years. American historical archaeology centers on the material record of the European and African peoples who colonized and were brought to the New World during the last five hundred years. This research focuses on remains more recent than the prehistoric record, representing non-Native American peoples who settled, inhabited, and flourished in North America beginning in the age of exploration. Obviously, the material record of these cultures is much different from the area's prehistoric inhabitants, and many surviving historic site forms are represented on the New England landscape. One of the most common is the historic farm. The Arboretum's Bolles Farm was first inhabited in the eighteenth century, probably as early as several decades before 1750. The site was occupied into the twentieth century when the farmhouse burned after a lightning strike during the 1940s (Goodwin 1976: personal communication).

The site represents a typical southern New England colonial farm. The settlement pattern included a main house with a large surviving stone foundation and chimney base, a series of outbuildings serving various storage, equipment, and animal care functions, as well as a substantial barn, various sheds, pens, corrals, and an extensive field system bordered by stone walls. During its most successful period the farm may have encompassed several hundred acres. Historical archaeologists have turned their attention to research on colonial farms and a number of examples have been excavated. This research has concentrated on several questions, including studies of domestic architecture, colonial artifacts, and the economic and social activities of farm life (Hume 1969).

At the Bolles Farm the goals were to conduct a limited testing program to give

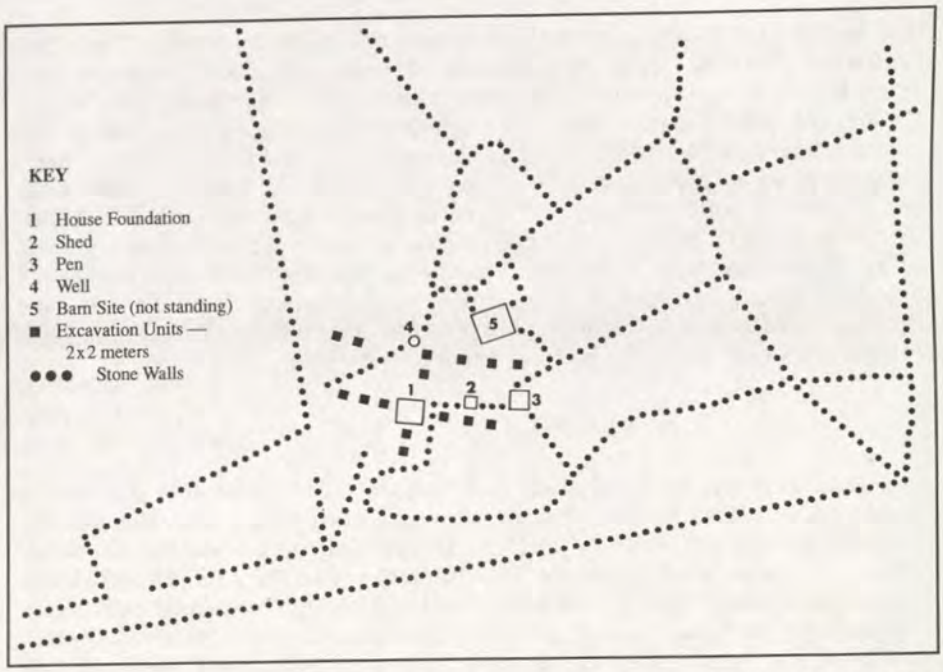


Figure 11. Bolles Farm Site Showing the Position of Archaeological Test Units. The homestead is a concentrated zone surrounded by extensive fields and stone wall boundaries. Archaeological testing was confined to the area of the house, barn, and outbuildings.

students experience in the methods of historical archaeology, as well as to recover a comparative collection of colonial artifacts for teaching and study. To pursue these goals the archaeological approach focused on the concept of the "homelot," that is, the site's primary zone of intense activity surrounding the farmhouse and in the adjacent barn, well, pen, and outbuilding areas. Homelot archaeology tends to yield evidence of domestic and economic activities and has been shown to be more productive on farm sites than broad-based sampling procedures which focus on larger areas such as fields far from the locus of most activities (Keeler 1977; Poinsot 1980). In 1976 fifteen 2 x 2 meter test units were positioned adjacent to the farmhouse in the homelot zone (Figure 11). The students spent a fall semester excavating, recording, and studying these units and recovered a representative artifact collection. The work resulted in an artifact recovery of several hundred specimens which were mostly ceramics. Various types of plates, bowls, cups, pitchers and general domestic wares, dating mostly to the nineteenth century, are represented. They comprise a typical domestic assemblage of this period and have provided a resource for the teaching of historic sites archaeology at Connecticut College. Because the emphasis of the Arboretum archaeological program was the Native American prehistoric record, further work at the historic site was not pursued. Today, the Bolles Farm remains in a preserved if overgrown state and is evidence of the most recent of many occupations within the Arboretum tracts.

NATIVE AMERICAN IMPACT ON THE LAND

In an era of environmental awareness, when many among us lament the destruction and alteration of much of our natural heritage, it is tempting to think of America's prehistoric and aboriginal populations as having lived more harmoniously with nature than we do in the present. Native American cultures have sometimes been used as models of a more balanced relationship between people and environments than that which is the norm in our own society. However, although it is appropriate to conclude that the Native American impact on the land was considerably less devastating than the European, it would be wrong to maintain that prehistoric peoples interacted benignly with nature. Clearly, aboriginal peoples changed their environments in response to their own economic and social needs. In some periods their impact was relatively limited, while in others, they may have helped to advance entire species toward extinction.[8]

The exact nature of the impact of prehistoric people on the land in any period is a complex and controversial question. In large measure this is because the identification and study of the ancient behavior represented at a site yields only limited information on the activities pursued by its inhabitants when they were away from the site practicing other elements of a complex subsistence pattern. Ethnographic observations of analogous hunting, gathering, and horticultural groups, along with historical records of aboriginal economic systems, suggest that the Native Americans in our region often exploited diverse environments within local and regional patterns of social interaction. It is sometimes a very difficult task for archaeologists to gather information necessary to reconstruct such broad ranging settlement, economic, and social behaviors and thus fully understand the complete impact of these societies on the landscape.

Yet another reason why it is difficult to judge the environmental impacts of prehistoric peoples is that we do not, in all cases, possess an accurate understanding of what the landscape itself was like. As is clear from botanical and palynological research within the Arboretum and at other local sites (Beetham and Niering 1961; Davis 1976), environments of the past were not static biological systems, but were constantly changing through time. The environmental sciences help us to understand an ancient culture's use of various floral and faunal species, but it is a formidable task. Far more is known, for example, about environmental change and human adaptations during the last four hundred years than in the preceding four thousand.

A third issue making it difficult to understand the Native American impact on the land derives from our incomplete notions of the size and constitution of the social groups which occupied and produced the surviving archaeological sites. It is often hard to estimate accurately a site's population from the distributions of disturbed, fragmentary, and often intrusive remains that frequently comprise the archaeological record. In addition, evidence of ancient architectural forms are extremely perishable in the New England environment,

making it difficult to reconstruct the sizes of families, local groups, lineage organizations, or the variety of demographic and kinship units using a site at a specific time in its long history. Problems in estimating population size also make it difficult to judge how the group may have had an impact on the local landscape. Given these issues I will briefly discuss what can be inferred about prehistoric Native American impact on the land.

The most common feature found at three of the five Arboretum prehistoric sites is the shell midden. As stated earlier, middens are extremely common in coastal New England, as well as in coastal zones throughout the world. Clearly, the cultural rather than natural morphology of these sites is the most obvious local Native American impact on the land surviving today, but all middens are not identical. When compared to other local examples, those found in the Arboretum are generally smaller and lack the shellfish species diversity seen elsewhere. More extensive middens have been studied in southeastern Connecticut along the immediate shore zone in Old Lyme and at Mago Point in Waterford (Praus 1942; Bellantoni and Dorr 1985; Lavin 1991), and it is thought that these coastal sites may exemplify local economic activities different from those indicated by the Arboretum middens. In a stimulating essay on shellfish midden morphology and diversity in coastal New York, Lightfoot (1985) has developed a typology of midden forms and their associated functions that provides a model useful in interpreting the three Arboretum middens found at Harrison's Landing, Mamacoke Cove, and the College Soccer Field site. This analysis develops a connection between the form and content of midden sites and their relationship to a society's overall settlement strategies along a continuum from very mobile foraging bands to fully sedentary collecting communities. Differing economic strategies along this continuum produce characteristic archaeological patterns reflected in the formation of several types of shell middens. The pattern produced by collectors who are generally sedentary for large portions of the year includes village sites that functioned as residential bases (in the Arboretum, the Arboretum Field

Figure 12. Shell Midden Excavation. Archaeology students excavate a shell midden at the Mamacoke Cove site in October, 1982.

Figure 13. Aerial Photograph of Mamacoke Island and Vicinity. This late 1940's view includes the sites of the Graves Rockshelter (right side of island), Mamacoke Cove (indent at bottom of island), and Harrison's Landing (bottom left corner).

site), as well as special-purpose sites which served as processing stations for local resources such as shellfish. Foods would be brought back to the residential base for consumption or storage. Coastal groups practicing such a pattern would likely produce a special-purpose shellfish processing, or midden deposit characterized by an extremely low diversity of shellfish species, because the economic goal at such a site was intensive harvesting of a single abundant local resource. This is precisely the site form at two of the three Arboretum middens, where the predominant species is the eastern oyster. The model also suggests that such sites should be characterized by low artifact yields and a lack of architectural features, since the sites are formed through the activities of task-specific work parties. The Mamacoke Cove midden conforms to this pattern, while also functioning as general refuse disposal site for the remains of a variety of faunal species.

Other cultural patterns can also be seen when the Harrison's Landing midden is compared to the one at Mamacoke Cove. At Harrison's Landing, two pieces of information hint at the impact of the site within the local landscape. First, the midden produced artifacts indicating a long-term occupation (Table 1). Second, it is adjacent to the Arboretum Field site along Benham Avenue where artifacts have been collected for many years. On the other hand, the Mamacoke Cove midden produced few lithic artifacts and the ceramics were of limited temporal duration (Table 1). Unlike Harrison's Landing, Mamacoke Cove is not associated with an adjacent artifact concentration such as the one present at the Arboretum Field. From these observations it seems reasonable

to infer that the Harrison's Landing midden was a shellfish processing station directly adjacent to a more extensive village-like habitation site at the Arboretum Field. Like Harrison's Landing, artifacts from the Arboretum Field site also indicate long-term occupation, with some of the materials dating to the Late Archaic period, the same period indicated by the majority of artifacts at Harrison's Landing. These sites' spatial contiguity and similar artifact distributions suggest the location of a small village at the Arboretum Field, with Harrison's Landing functioning as the shellfish processing and refuse disposal section of this village site. As a result, the combined impact on the local topography and vegetation was more extensive in this zone than at any other Arboretum site. Reconstructions of Late Archaic lifeways suggest the possibility that villages were occupied throughout several portions of the year, within an economic system marked by foraging, hunting, shellfishing and fishing (Snow 1980). Horticulture was not practiced and neither of these two sites has produced domesticated plant remains or ceramics, which are the diagnostic attributes of Woodland Stage horticultural sites.

The form of the Mamacoke midden suggests use by people engaged in shellfish processing and broad spectrum hunting as part of seasonal occupations with the majority of evidence pointing towards the summer, fall and early winter. Due to its small size the impact of this site within the local landscape was limited when compared to Harrison's Landing and the Arboretum Field sites seen as a unit. The typological and radiocarbon dates known for both sites indicate that Harrison's Landing may have been unoccupied for a time when Mamacoke Cove was inhabited ca. 400 - 1200 A.D. It is difficult to understand fully this shift in the pattern of local site utilization, but one explanation is that the change was a consequence of decreased resource availability. Since the eastern oyster is the dominant species in both middens, the shift in location from a sheltered cove (Harrison's Landing) to a site closer to the Thames river (Mamacoke Cove), may indicate over-exploitation of oysters near Harrison's Landing. This view is supported by oyster shell sizes and their relationship to the Harrison's Landing stratigraphy. As the adjacent oyster beds were used over time, shell size decreased, perhaps as a result of over-exploitation, resulting in the need to use the more productive oyster beds which were closer to the larger riverine system. The Mamacoke Cove midden which resulted from this shift is adjacent to the river. This interpretation explains the local midden patterns, dates, and artifact distributions and may provide an archaeological perspective on the aboriginal phenomenon of resource over-exploitation and impact on the land.

A second explanation for the differences in the Mamacoke and Harrison's Landing middens probably relates to the overall economic system during Woodland times, when Mamacoke Cove was occupied. During the latter part of this era, horticulture based on corn, beans and squash increasingly became the dominant component of Indian nutrition after ca. 1300 A.D. in southeastern Connecticut. Within a horticultural economy, which included a greater variety of economic activities and settlement types than found in the preceding Archaic system, Mamacoke Cove functioned solely as a special-purpose shellfish processing and faunal refuse station used during limited portions of the year.

The possible association of horticulture with the presence of ceramics at the Mamacoke Cove occupation also indicates that the Indian impact on the land during later prehistory was marked by the presence of cultivated fields. These fields were clearly evident to the earliest European colonists and were a feature of the native economy and land tenure system for at least several hundred years before 1600 A.D. (Russell 1980). In the absence of reliable historical documentation, it is often difficult to determine the position of aboriginal fields and field systems of the prehistoric period, given local topography, vegetation change and development.[9] Fields were often quickly converted to colonial use with little chance for sub-surface preservation of diagnostic features. Prehistoric fields provide another instance of major Indian impact on the land, since horticulture required a substantial commitment to land clearance by a method know as swidden, or the slash and burn technique. In this technique, field clearance was accomplished by cutting and burning forested areas. Today, it is still a common method for preparing fields in many parts of the world. The burning aids in clearance and improves fertility by providing soil nutrients. Several colonial writers mention Indian burning as an aid to horticulture and as a method of clearing dense underbrush to facilitate hunting (Cronon 1983). Controlled burning for clearance rather than planting generally helped to maintain a healthy forest, particularly favoring large trees.[10]

Figure 14. Soil Study. Connecticut College students Roxanne Littlefield '82 (left) and Karla Evans '80 screen soil at Mamacoke Cove. All soils excavated at the site were screened through ¼ inch mesh to recover artifacts and environmental remains. Selected soil samples were also water processed using the technique known as flotation to recover organic remains such as small bone, seeds and nuts (Table 2).

CONCLUSION

The archaeological program undertaken in the Arboretum has uncovered much new information advancing our knowledge of Thames River prehistory. Along with a number of other professional projects and amateur investigations undertaken since the 1930s, Arboretum research has helped us to understand the Native American cultural heritage in southeastern Connecticut. This heritage is reflected in a set of surviving sites documenting several cultural patterns. First, one is impressed with the duration of the area's native occupation, which began some 4,000 years ago, if we are to judge by the oldest materials in the Arboretum. We also know of a still older Paleo-Indian site across the Thames River in Groton, which dates the earliest occupation in our region to at least 9,000 years ago.[11] Local botanical studies have helped us to understand that these ancient Native Americans lived in environments which were changing over time as post-glacial tundra evolved into deciduous and coniferous woodlands. These woodlands matured before European contact and provided the local aboriginal peoples with abundant resources, which were exploited using well developed environmental knowledge within a non-metallurgical technological tradition. The tools were made of lithic, bone, wood, ceramic, and woven materials. The economy at any period in local prehistory relied on plants and animals within seasonal and yearly patterns of availability. The Arboretum sites and their topographic contexts also indicate that several settlement and processing site types were developed in prehistory. Towards the end of the long prehistoric record, during the last five hundred years before European contact, horticulture primarily based on maize, beans and squash was adopted by local peoples to supplement the long-term exploitation of floral, mammal, fish, shellfish and bird resources. With the onset of the intensive pressures and diseases associated with European settlement, the aboriginal way of life began a gradual decline, although Native Americans continue to live in the region today. Recently, local Native Americans, the Mashantucket Pequots, have achieved Federal tribal status and have begun a program of tribal enhancement and economic development.

Complementing the focus on research, the archaeological program was also designed to use the Arboretum as a teaching resource for undergraduates at Connecticut College. Over one hundred students have participated in field archaeology courses in the Arboretum. Additionally, there have been numerous site visits and lectures for members of the College community and the public. These activities have advanced the Arboretum's long-term objectives and philosophy in the areas of teaching, public education, and the dissemination of scientific research.

Finally, the work has helped us to respond to an important issue in archaeology, that is, the widespread destruction of our prehistoric heritage.[12] The identification and study of the Arboretum sites has channeled our interest in learning about the past, as well as advanced our desire to preserve the past, through the surviving evidence of extinct ways of life. In archaeology, a preservation perspective parallels a similar concept in biology. The destruc-

tion of archaeological sites, reflecting cultural diversity, is analogous to the loss of species and habitats reflecting biological diversity. Many local, regional, and nationally significant prehistoric sites are in great danger of being destroyed in the near future as a consequence of growth and development. The protection provided by the Arboretum has given us an opportunity to study and preserve a group of related sites containing a record of the Thames River's long history of human occupation.

TABLE 1

Connecticut College Arboretum Sites and Their Relationship to Southern New England Prehistoric Cultures

Date B.C./A.D.	Stage	Culture	Documented Presence at Arboretum Site	Artifact Types
1700 - 1750 A.D.	Historic	American Colonial	Bolles Farm	Historic ceramics and metal
1550 -1690 A.D.	Woodland	Late Woodland/Contact Period	Soccer Field	Lithic blade
1300 - 1600 A.D.	Woodland	Late Woodland	Harrison's Landing—late levels	Madison and Levanna projectile points
			Mamacoke Cove—late levels	Ceramics
			Arboretum Field	Madison projectile points
200 -1300 A.D.	Woodland	Middle Woodland	Mamacoke Cove	Ceramics
500 B.C. - 200 A.D.	Woodland	Early Woodland	not found	none discovered in Arboretum
1000 - 500 B.C.	Transitional	Orient Point	Harrison's Landing	Orient fishtail projectile point
4000 - 1000 B.C.	Late Archaic	Squibnocket	Harrison's Landing Arboretum Field	Squibnocket Triangle projectile point
		Wading River	Arboretum Field	Wading River projectile point
		Brewerton	Arboretum Field	Brewerton Triangle projectile point Wading River projectile point
6000 - 4000 B.C.	Middle Archaic	Middle Archaic	not found	none discovered in Arboretum
8000 - 6000 B.C.	Early Archaic	Early Archaic	not found	none discovered in Arboretum
10000 - 8000 B.C.	Paleo-Indian	Paleo-Indian	not found in Arboretum, but presence established at site of Naval Housing directly across Thames River in Groton, CT	none discovered in Arboretum

TABLE 2

Connecticut College Student Research Projects on Arboretum Archaeology

Littlefield, Roxanne ('82) 1981	Report on Gastropod Analysis at Mamacoke Cove
Stark, Wendy ('83) 1982	The Analysis of Seeds Recovered Through Flotation at the Mamacoke Cove Prehistoric Site
Hayden, Philip ('84) 1983	Mamacoke Cove Site: Quantities and Percents of Bone, Ceramics and Lithics
Juhas, Melissa ('84) 1983	Shell Analysis at Mamacoke Cove, New London, CT

APPENDIX A

Analysis of the Mamacoke Cove Faunal Assemblage

by Nicolas Bellantoni and Brenda Dorr
Department of Anthropology, University of Connecticut

This report presents a summary of the zooarchaeological analysis of the skeletal assemblage of animal remains from Mamacoke Cove, a Woodland site on the Thames River in southeastern Connecticut.

Attritional Factors

Butchery: Many of the bones exhibit evidence of cutmarks and fractures that are usually associated with the successive attrition resulting from defleshing and marrow extraction activities. Butchering marks are primarily noted on the metapodials of large mammals.

Weathering: Environmental influences on skeletal remains leave their signatures in fragment size, density and porosity. The effects of the shellfish accumulation within the midden produces far less acidic soil conditions than would be prevalent elsewhere in the area's soils. As a result, the bone fragments are in generally good condition with relatively little surface damage. Fracture edges are still fairly sharp and unrolled. This pattern of attrition indicates that the midden has probably accumulated gradually over time rather than a single short term event.

Quantification: Skeletal remains were quantified by employing Number of Identified Specimens (NISP) and Minimum Number of Individuals (MNI) as defined by Klein and Cruz-Uribe (1984). MNI was calculated using both dental and bone elements, and by recognizing left/right and unfused/fused distinctions.

Seasonality: While some of the species identified could have been taken year round, the analysis of seasonality based on animal ecological ethnohistorical date indicate a summer, fall and early winter occupation.

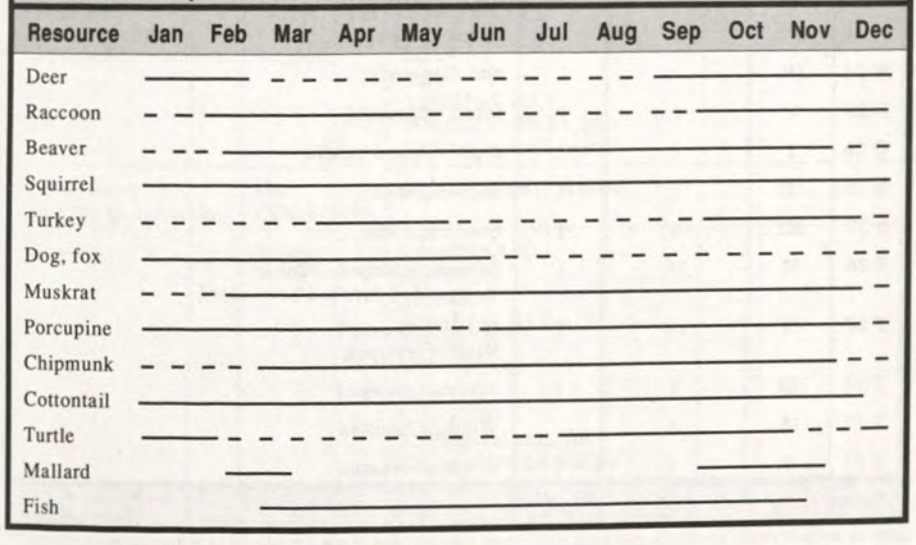
Minimum Numbers of Individuals represented by the first number and Number of Identified Specimens in parentheses are listed below by level. These are calculated from PASCAL programs for computing taxonomic abundance of animal skeletal remains from archaeological sites.

Minimum Numbers of Individuals (MNI)

Species	Levels I-II	III-IV	V-VI	Site Total
White-tailed deer *(Odocoilleus virginanus)*	3 (74)	5 (109)	1 (29)	9 (212)
Raccoon *(Procyon lotor)*	1 (3)	1 (2)		2 (5)
Beaver *(Castor canadensis)*		1 (1)	1 (1)	2 (2)
Gray squirrel *(Sciurus carolinensis)*	1 (4)	1 (5)		2 (9)
Wild turkey *(Meleagris gallopavo)*	1 (1)	1 (1)		2 (2)
Dog *(Canis familiaris)*		1 (5)	1 (1)	2 (6)
Vole *(Microtus* sp.*)*	1 (1)			1 (1)
River otter		1 (1)		1 (1)
Muskrat *(Ondatra zibethicus)*		1 (3)		1 (3)
Porcupine *(Exrethizon dorsatum)*		1 (1)		1 (1)
Red fox *(Vulpes fulva)*		1 (2)		1 (2)
Gray fox *(Urocyon cinereoargenteus)*		1 (1)		1 (1)
Chipmunk *(Tamias striatus)*		1 (1)		1 (1)
Cow *(Bos Taurus)*		1 (1)		1 (1)
Snapping turtle *(Chelydra* sp.*)*		1 (2)		1 (2)
Mallard *(Anas* sp.*)*		1 (2)		1 (2)
Eastern cottontail *(Sylvilagus floridanus)*		1 (2)		1 (2)
Mouse *(peromyscus* sp.*)*		1 (1)		1 (1)
Small-sized mammal	(2)			(2)
Medium-sized mammal	(1)	(5)	(3)	(9)
Large-sized mammal	(4)	(3)		(7)
Unidentified bird	(2)	(6)	(1)	(9)
Unidentified fish	(2)	(5)		(7)
Totals:	**7 (94)**	**21 (159)**	**3 (35)**	**31 (288)**

Percentage of Identifiable Fragments	
% of identifiable bone from total assemblage	18.68%
% of identifiable bone from each level:	
I-II	29.84 %
III-IV	59.00 %
V-VI	11.11 %
% of identifiable fragments per species:	
White-tailed deer	67.30 %
Raccoon	1.58 %
Beaver	.63 %
Gray squirrel	2.85 %
Wild turkey	.63 %
Dog	1.90 %
Vole	.31 %
River otter	.31 %
Muskrat	.95 %
Porcupine	.31 %
Red fox	.63 %
Gray fox	.31 %
Chipmunk	.31 %
Cow	.31 %
Snapping Turtle	.63 %
Mallard	.63 %
Eastern Cottontail	.63 %
Mouse	.31 %
Small-sized mammal	.63 %
Medium-sized mammal	2.85 %
Large-sized mammal	2.22 %
Unidentified bird	2.57 %
Unidentified fish	2.00 %

Seasons of Exploitation for Animal Food Resources in Coastal Connecticut



——— Maximum season of exploitation - - - - - Minimum availability

APPENDIX B

Ceramics from Mamacoke Cove

Unit*	Level**	Sherd Count	MNV***	Type/Design Motif Decoration	Bowl size-opening
J 26	II	16		shell tempered body sherds smooth interior, non-diagnostic	
J 26	III	14	1	shell tempered body sherds brushed exterior, non-diagnostic	
J 26	IV	10		shell tempered body sherds, non-diagnostic	
L 22	III	19	1	Sebonac stamped shell tempered	pot 8-10" d
				4 rim sherds	
L 23	IV	5	1	cord wrapped paddle decoration non-diagnostic	
M 21	II	17	1	Niantic stamped rim, the body sherds were stamped	rim too small to determine size
M 24	III	1	1	Niantic stamped collared Sebonac stamped	
M 24	VII	4	1	non-diagnostic body sherds fabric impressed	
T 75		2,11,25,16	2	Hollister plain Bowman Brook incised	pot 8" d BBI
M 24	I-II			fabric impressed and cord wrapped paddle	cup 4" d
N 22	V	2	1	Fabric impressed	
N 24	III	3		Sebonac stamped	
N 24	IV	1	1	non-diagnostic	
N 25	II	1	1	fabric impressed	
Q 26	I	1	1	cord wrapped paddle	
R 25	III	1	1	non-diagnostic	
S 27	III	6	1	non-diagnostic	
T 26	II	25	1	Sebonac stamped; Niantic stamped? 1 brushed body sherd	
T 27	II	10	2	Windsor brushed Niantic stamped	
T 27	III	5	1	Sebonac stamped	
T 27	!$	4		Windsor brushed	
T 27	V	1	1	Windsor brushed	
Totals		**200**	**19**		

*Refers to site map, Figure 5 **Refers to depth below soil surface ***Minimum Number of Vessels

APPENDIX C

Flotation Analysis from Mamacoke Cove

by Wendy Stark ('83)

Stratigraphic Distribution of Charred and Uncharred Seed Remains by Excavation Level

Level	# of Samples	Uncharred Seeds	Uncharred Seed Per Sample	Charred Seeds	Charred Seeds per Sample	Total # of Seeds in Level	# of Seeds per Sample
I	8	744	95.8	22	2.8	766	95.8
II	10	1189	118.9	43	4.3	1232	123.2
III	9	449	49.9	22	2.4	471	52.3
IV	1	9	9	1	1	10	10
V	2	41	20.5	1	.5	42	21
VI	1	5	5	1	1	6	6
Others	2	506	253	13	6.5	519	259.2

In all figures a sample is a particular level in a particular unit, i.e., S26/I/1.

Plants Specimens Represented by Charred Seeds at Mamacoke Cove

Latin Name	Common Name	Units Where Found	#	Total # of Specimens
**Ilex* sp.	Holly	Q26/I/A5,8,12	1	1
**Myrica Pensylvanica*	Bayberry	N25/I	1	10
		R26/I	1	
		S26/II/A4, B3,7	6	
		N24/III/A7,10,13, B14	1	
		S26/soil around feature	1	
***Quercus* sp. (possibly *Q. velutina*)	Oak (Black Oak)	S26/soil around feature	1	1
**Rhus* sp.	Sumac	Q26/I/A5,8,12	3	37
		S26/I/A2,3	5	
		S25/II/C8	2	
		S26/II/A4, B3,7	6	
		S26/III	14	
		N22?IV?A11	1	
		Q21/V/C9	1	
		N22/VI/B4	1	
		S26/special unit, A6	1	
		S26/soil around feature	3	

* Indicates tentative identification.
** Several samples appear to be charred acorn hull but only one whole seed has a definite identification as oak.

Charcoal Analysis	
Sample	**Findings**
M24/I/A14	Largest piece is *Pinus strobus* (white pine)
S27/I/B7,18	Largest piece is a hardwood, probably *Quercus* (oak)
Q26/I/A5,8,12	Largest piece is *Pinus strobus* (white pine) as well as some other medium-sized pieces One medium sized piece is a hardwood (willow, cherry, or poplar)
S26/I/A3	Very large piece is *Pinus strobus* (white pine)
Q25/II/B9,16	Largest piece is a hardwood
M25/III/B11,8,15	Largest piece is a hardwood

Known Uses for Plants Represented by Charred Remains at Mamacoke Cove

Plant Name	Uses	Source(s)
Ilex sp. (holly)	No mention in the sources of uses for holly but one assumes that the fruits might have been eaten or used for medicinal purposes	
Myrica pensylvanica (bayberry)	Source of food and wax Liquid obtained from steeping bark Used for kidney disorders	Russell 1980 Tantaquidgeon 1977
Pinus strobus (white pine)	Trunks used for dugout canoes Infusion of dried inner bark used to cure coughs Sap or gum used to relieve pain of boils and abscesses	Russell 1980 Russell 1980 Tantaquidgeon 1977
Quercus sp. (oak)	Acorns provided "flour" which was made into "bread" or mixed with various meats, clams, fish, oysters, lobsters, etc. White oak acorns provided an oil used like butter or lard Acorn flour added to water to make a "nut milk" added to various dishes Acorns roasted and then steeped in boiling water to produce a drink Bark used for roofing Wood used to make baskets, bowls, shelter, lye and canoes	Russell 1980 Kavasch 1979 Kavasch 1979 Russell 1980
Rhus sp. (sumac) *R. typhina* staghorn sumac *R. glabra* smooth sumac is referred to specifically	Berries used to make a beverage Berries were smoked alone or with other parts of the plant A stronger solution of the beverage mentioned above was administered as a gargle for sore throats	Kavasch 1977 Russell 1980 Tantaquidgeon 1977

Discussion of Plant Uses

Historically known plant uses include food, medicine, building materials, and so on. Sumac, holly, bayberry, and oak were food sources. The berries of smooth sumac (*Rhus glabra*), holly, and bayberry were eaten. Acorns from both white (*Quercus alba*) and red oaks were made into a flour[1] which was incorporated into a bread or mixed with meat, fish, clams, lobster, oysters, and other ingredients. When boiled, white oak acorns yielded an oil which could be used like lard or butter. The berries of staghorn sumac (*Rhus typhina*) were used to make a beverage (Kavasch 1979; Powell 1981; Russell 1980).

Sumac, bayberry, oak, and white pine were used medicinally. The same beverage made from the berries of staghorn sumac mentioned above was used in higher concentrations as a gargle for sore throats. The bark of the bayberry was steeped and the resulting liquid used as a remedy for kidney disorders. The inner bark of white oak was steeped and the resulting liquid used as a liniment. Red oak was also used medicinally. A cough remedy was made from infusions of the dried inner bark of white pine, while its sap or gum was applied to abscesses and boils to relieve pain. (Russell 1980; Tantaquidgeon 1977).

Sumac, bayberry, oak, and white pine all had various other uses as well. Sumac was used as a dye and in a tobacco blend. Bayberry provided a wax. Oak bark (both red and white) was used in six- to nine-foot strips for roofing material. Ashes from the read oak were good for lye. White oak wood was used for canoes and dishes, particularly bowls. Oak wood was also split and used to make baskets. White pine was used to fashion dugout canoes (Kavasch 1979; Russell 1980).

The historically derived uses for the plants listed above may or may not have been part of the Middle Woodland culture practiced by the people occupying Mamacoke Cove. There are, however, some uses of plants during the Middle Woodland period in the Northeast that have been archaeologically documented. Evidence (often charred remains) suggests that seeds form *Chenopodium* (goosefoot) and *Polygonum* (smartweed) as well as acorns, wild rice, hickory nuts, butternuts, hazelnuts, hawthorn apples, cherries, and plums were among the wide plant foods harvested. Cultivation of plants was just beginning in the Northeast at this time. Cultigens included corn (*Zea mays*), beans (*Phaseolus vulgaris*), and squash (*Cucurbitae* sp.) (Ritchie 1965; Snow 1980). Plants were incorporated into many of the tools used. Handles were fashioned from wood and attached to many of their lithic tools. Split wood was incorporated into baskets. Plant fibers were used to construct such things as fishnets and hawthorn spines were use for fishhooks (Ritchie 1965). Dwellings were also made from plant material (Ritchie 1965; Snow 1980). Evidence also suggests that Middle Woodland people lined food storage pits with grass (including *Andropogon gerardi*—bluestem) and/or bark (Ritchie 1965).

The five identified species represented in the charred material recovered at Mamacoke Cove may be found on or near Mamacoke Island today, suggesting that the environment present at the time of the site's occupation some 1,100 - 1,600 years ago, was somewhat

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1 Red oak acorns contain much tannic acid and had to be boiled with wood ashes before being used, making white oak acorns the preferred variety (Russell 1980).

similar to that existing today.

Palynological studies conducted in Connecticut appear to substantiate the belief that the surrounding forest at the time of Mamacoke Cove's occupation contained more pine, including white pine, than it does today. One study of particular interest involved the Red Maple Swamp in the Connecticut Arboretum. It indicates a period of pine dominance about 8,000 years ago followed by a period dominated by deciduous trees including oak, birch, hemlock, and chestnut, similar to those dominating today (Beetham and Niering 1961). The period of pine dominance is certainly well before the dates indicated for Mamacoke Cove, but the decrease of the pine and the influx of trees more like those existing today might have combined to create a forest that did indeed have more pine at the time of Mamacoke Cove's occupation. Another palynological study conducted at Roger's Lake in Lyme, Connecticut clearly shows pine to have been more abundant during the time period in question, but still accompanied by trees familiar in the area today (Davis 1976). If white pine were indeed more abundant during the site's occupation, then a slightly warmer or drier climate is indicated as certain species of pine including white pine are favored by such a climate (Beetham and Niering 1961; Davis 1976).

NOTES

1. An overview of recent Thames River archaeology is contained in Juli 1981.
2. Frank Malloy, a long-time college employee, collected artifacts of several prehistoric periods on the site of a former baseball field along Benham Avenue in the Arboretum.
3. There is a vast literature on analyses of prehistoric shell middens. For example see Byers & Johnson 1939; Cook 1946; Ambrose 1967; Will 1976; Brennan 1977; Sanger 1981; Kerber 1984 and Bernstein 1990.
4. Consult Snow 1980 for an overview of New England prehistory. This regional synthesis provides much background information for the general reader, particularly relating to archaeological concepts, terminology, dating, and the variety of prehistoric New England artifacts. For specific information on arrowhead and spearpoint forms and dating see Ritchie 1971.
5. An important synthesis of New England coastal prehistory with many sites similar to those in southeastern Connecticut may be found in Ritchie 1969. Ritchie 1965 describing extensive work in New York State should also be consulted.
6. Ritchie has excavated a similar feature at the Hornblower II site on Martha's Vineyard. See Ritchie 1969.
7. Two Connecticut College undergraduate research papers have been completed utilizing environmental remains recovered through flotation at Mamacoke Cove. See Littlefield 1981 and Stark 1982.
8. For several sources dealing with the question of Indian impact on the natural environment see Day 1953; Martin, P. 1967; Martin, C. 1978; Vecsey and Venables 1980; Cronon 1983 and Patterson III and Sassaman 1988.
9. An interesting description and photograph of a preserved prehistoric field excavated at Macon, Georgia may be found in Kelley 1938.
10. Sources mentioning Indian burning and the historic period include Smith 1616 and Morton 1632. Niering and Goodwin 1962 also discuss Indian burning and the forest during the seventeenth century in southeastern Connecticut.
11. The oldest site in Connecticut is in Litchfield County. It has provided a radiocarbon date of ca. 8000 B.C.. See Moeller 1980. Recently, evidence for an occupation at an early date along the Thames River has been recovered in Groton, CT. See Soulsby et al. 1981.
12. The interested reader may wish to consult the literature on archaeology and historic preservation. The following sources are excellent overviews of the subject. See McGimsey 1972: Hickman and Berg (eds.) 1977: Schiffer and Gummerman (eds.) 1977.

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About the Author

Harold D. Juli, an archaeologist, has been a member of the Anthropology Department at Connecticut College since 1974. Before coming to Connecticut he taught at Brandeis University and participated in archaeological excavations in Peru, Alaska, Israel, and the northeastern United States. His Ph.D. dissertation (Brown 1978) was a study of Chalcolithic pastoral herding societies in the central Negev desert, Israel. Since coming to Connecticut he has undertaken research on southern New England prehistory and historic sites archaeology. From 1987 to 1990 he served as Associate Dean of the Faculty at Connecticut College.

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