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The Tivoli Bays as a Middle-Scale Setting for Cultural-Ecological Research

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Introduction

Major river valleys attract more attention from archaeologists than most other geographic features of the northeastern landscape. This seems to be especially true of estuarine river basins like the Hudson, which is tidal as far north as Troy, 150 miles from its mouth.

There are various reasons for this appeal. Archaeologists' files are replete with information on sites concentrated along rivers and their large tributaries; fewer sites are on record from back-country, upland or mountainous regions. Many of the riverine sites tend to be relatively large and productive of artifacts with associated data. They have contributed disproportionately to current knowledge of prehistoric events. This is not an unmixed blessing, because a more thorough accounting of back-country and upland sites is badly needed to remedy current gaps in our understanding of prehistoric settlement patterns.

It is also well known that major river basins were highly productive in terms of the quantity and diversity of wild animals and plants used as food by the Native Americans. Valley bottoms as large-scale environmental zones can be divided into a variety of smaller units which I refer to as "local habitats". Each of these units can be characterized in terms of conditions and resources important to human groups.

For example, flood plains, with their periodically renewed soils, were ideal locales for growing maize during the Late Woodland period (ca. A.D. 1000-1600). The soils in some valley bottom locales favored the growth of hickory, butternut, oak, and other trees that produced nuts, an important food resource in late summer and early fall. Tributary streams were home to great

numbers of spawning anadromous fish, such as shad and alewives, in the early spring. White-tailed deer, raccoon, turkey, passenger pigeon and other game were plentiful in the forests, while rivers, lakes, and wetlands supported large numbers of migratory fowl in season.

Adding to the Hudson's intrinsic interest as an environment for native peoples are the marine animals associated with this estuary. For example, the sea sturgeon, Acipenser studio, was heavily used at least as far back as the Middle Woodland period. Historically, before the advent of pollution it was so much in demand that it was called "Albany beef". Also, the Hudson's water is brackish as far north as Poughkeepsie. The degree of salinity has probably changed through postglacial millennia, but oysters were being harvested and consumed in lower reaches of the valley by 7000 years ago. They were especially abundant south of Storm King Mountain (Udell 1962; Brennan 1962, 1974; Salwen 1965, 1975).

The Hudson River, Mahicanituck or "Great River of the Mountains" to the Algonkian-speaking Indians living along its shores at the time of Henry Hudson's visit in 1609, is indeed exceptionally rich in cultural resources, both prehistoric and historic. Many hundreds of prehistoric archeological sites still exist within this vast basin, but only a small percentage are listed in professional data files. Some are known to avocational archaeologists but for various reasons have not been reported to the professional community. An unknown, but doubtless large, number of sites have been destroyed or severely disturbed since Colonial times by the activities of Euroamerican civilization.

I was drawn to the Hudson Valley's great archeological potential from the beginning of my undergraduate anthropology studies at Columbia University. In 1952 a friend who was majoring in geology mentioned a fine-looking rockshelter he had seen while hiking in Bear Mountain Park. Together we applied to park management for permission to excavate the site, but to our great disappointment, we were rejected. It wasn't until I joined the New York State Museum staff in 1960 that I experienced my first venture in Hudson Valley archeology. Ironically, in 1963 collections from rockshelters and other sites in Bear Mountain Park, stored at the Trailside Museum, were very generously made available to me by park management and staff for my dissertation research. By that time, building on the foundation laid by the work of William A. Ritchie (1958, 1965, 1969), I had embarked on a program of testing and excavating sites throughout the valley. My basic research objectives can be repeated here (Funk 1976: 1-2):

1. To expand and, if need be, to modify the tentative framework in Ritchie's preliminary report, filling in the gaps in culture sequence and content, with primary emphasis in the field on stratified and closed sites;

2. To develop an absolute chronology for the areal sequence, based on radiocarbon dates;

3. To reconstruct prehistoric Indian cultures of the Hudson Valley in their environmental settings, within the limits afforded by available data;

4. To compare these cultures with others outside the area, establishing differences and similarities, determining possible cross-ties, sources, or directions of influence.

My main concern was therefore described as culture-historical integration, defined by Willey and Phillips (1958:12) as "both the spatial and temporal scales and the content and relationships which they measure". I also explicitly adopted their terms for archeological culture units

(component, phase, etc.), spatial units (site, locality, region, area), temporal units (local sequence, regional sequence) and integrative units (horizon, horizon style, tradition, climax). I added my own term, "complex", for cultural units defined solely from projectile point styles and perhaps a few other traits, falling short of a phase. The term "assemblage" stood for a collection of artifacts from a site which was assumed to represent relatively brief occupation by a single cultural group. Complexes or phases, on a higher level of abstraction, were defined on the basis of one or more assemblages.

I also acknowledged my debt to the published projectile point typology of Ritchie (1971), and the ceramic typologies of Ritchie and MacNeish (1949), Ritchie (1952), and MacNeish (1952). I organized the available data according to the historical- developmental culture-historical framework of Ritchie (1965), as adopted and modified from Griffin (1952).

Although some workers may feel that I adhered to "old- fashioned" or "outdated" schemes of northeastern prehistory, for example naively importing Ritchie's central New York cultural classifications without qualification to eastern New York, I stated (Funk 1976:3): "There are pitfalls in applying phase designations originally developed in one region to similar manifestations newly discovered in another region. This procedure is to be followed with great caution. Comparative analysis may demonstrate that significant differences exist, with the result that the entity under investigation merits its own name. The writer was in fact repeatedly confronted with such a decision during his research on the Hudson Valley sequence, and has proposed new names for several phases displaying similarities to phases first observed and named in central New York and other regions".

Most of the stated objectives were achieved, to varying degrees of satisfaction. It was especially gratifying to construct a convincingly detailed cultural sequence from the Late Archaic through Late Woodland periods, aided by stratified sites excavated within the basin and supported by a number of new radiocarbon dates (Funk 1976: Figure 27). I was also able to offer settlement and subsistence pattern interpretations for major segments of prehistoric time. It was clear, however, that the available data left much to be desired, particularly with regard to the earliest Archaic complexes.

Much archeological work has been done in the Hudson Valley since 1976. It includes regular academically supported research, such as Eisenberg's (1978) work at the Twin Fields Paleo-Indian site and at the Mohonk Rockshelter, with its major Middle Archaic component (Eisenberg 1984a, n.d.), Hetty Jo Brumbach's study of Middle Woodland fishing technology (Brumbach 1986), New York State Museum excavations at the Zappavigna and Dutchess Quarry Cave No. 8 Paleo-Indian localities (Funk, et al 1990; Steadman and Funk 1987; Funk and Steadman n.d.)and most recently, Lindner's Grouse Bluff excavations. It also includes cultural resource management projects, such as the recent exploration of the Wickers Creek shell midden, Westchester county (Greenhouse Consultants 1988), the Fort Edward Site, Washington county, excavated by Joel Grossman and associates, and the investigations at the Lower Saranac River site, Clinton County (Hartgen Archeological Associates 1991). A recent summary of currently available data on upper Hudson Valley archeological contexts was written by Curtin and Bender (1990) for the New York State Office of Parks, Recreation, and Historic Preservation. The above is far from an exhaustive listing of recent work.

While academically supported research has declined, great masses of largely undigested data are being generated by environmental impact studies. Most of these studies remain unpublished in

standard scientific formats. It is not clear therefore to what extent my original research goals may have been met, or what the consequences might be for my interpretations. The terminology and concepts of Willey and Phillips (1958), Griffin (1952), Ritchie (1965) and others are still very much with us, despite the changes in theory and method that have arisen from the interaction of the "New Archeology" and cultural resource management programs over the last 15 to 20 years. The former oriented the filed more toward anthropological contributions through increased application of scientific methods, and latter pursued legislatively mandated research in anticipation of construction.

There seems to have been no substantial change in the cultural sequence and chronology I published, but I am pleased to acknowledge that parts of that framework have been expanded, filled out or reinforced by recent work. New radiocarbon dates have been published for nearly every major stage or period. Probably the major contributions have been to knowledge of the Paleo-Indian and Middle Archaic stages in the valley (Eisenberg 1978, 1984a, n.d.; Kopper, et al 1980; Steadman and Funk 1987; Funk 1983; Funk and Steadman n.d.; Gramly and Funk 1990). Our knowledge of later stages has also grown. As I anticipated in the conclusions to my report, evidence of regional diversity has steadily accumulated (Funk 1976: 311-313).

What was not apparent in my synthesis was an explicit cultural-ecological approach, although there were a few bows in that direction. Since that time, my own theoretical orientation has become more consciously directed toward cultural materialism and cultural ecology, inspired by the writings of Marvin Harris (1968, 1980) and Karl Butzer (1971, 1982). The rationale is simply that these approaches work, they are consistent with the larger body of scientific knowledge and can generate hypotheses that are testable in the real world. These conceptual systems also clearly underlie the work of Lindner and his students at Tivoli Bays.

The Tivoli Bays Study Area

The Tivoli Bays represent a middle-scale geographic setting for prehistoric habitation. They are unusual landscape features in middle portions of the Hudson Valley, where the river banks are straight and fairly steep-sided except where they are entered by large tributaries such as Esopus Creek. Also unusual in this stretch are the islands, Magdalen, Cruger, and a former island at Saugerties, now called Rocky Point (Funk 1976: 136-140). Of course, there are other islands north and south of the Kingston- Saugerties reach of the river, as well as peninsulas and embayments. Few embayments, however, are as large and broad as those at Tivoli.

The Tivoli Bays must have been a very favorable environment for aboriginal peoples, with high potential in terms of wild food resources. This potential was perhaps unusual even for the Hudson estuary (Kiviat 1978). The North and South Bays are shallow and must have provided abundant fish, shellfish, and water birds to people living along the shore or on the islands. Fresh water clam shells are a major constituent of middens on North Cruger Island, Magdalen Island, and Rocky Point, and other shell deposits are known in the area. Shallow mud flats are exposed at low tide around the islands and in the Bays, and would have provided an ideal habitat for mollusks. White-tailed deer, turkey, and other terrestrial food resources would have been available on the bluffs and uplands.

It is necessary to establish how long the Bays and flats were in their present configuration. The North Bay has been largely filled with a fresh-water tidal marsh since 1900, while the South Bay is now almost filled with sediment. The neck of land connecting Cruger Island to the mainland

was a natural wetland prior to construction of a causeway circa 1835 for vehicle access. Apparently the sediments in the bays were not dredged from the shipping channel, because the river is naturally deep in this stretch.

Deep cores have been taken by engineering firms in the Bays, showing organic sediment overlying late-glacial silts and clays, in turn overlying till that rested on bedrock. Bedrock was reached at a maximum depth of 30 meters below sea level. No pollen samples were collected, hence no data are available on the past vegetation at Tivoli Bays.

Like the Hudson's main bedrock channel, the bedrock basin under the Bays must have been scoured out by the Wisconsinan ice sheet, which retreated northward from this area by about 16,000 years ago (Connally and Sirkin 1986). The semicircular bluffs adjoining the Bays and paralleling the Hudson elsewhere in this reach are partly deltaic and of late-glacial origin. The break in the line of bluffs represented by the Bays may have resulted from large blocks of ice, wedged in place by the bedrock rise forming the islands, that became detached from the main mass and melted slowly while on the margins of northward-expanding Lake Albany. In place stagnation of the ice sheet was characteristic of the Hudson Valley's middle reaches (Dineen 1986).

The Tivoli Bays were probably relatively shallow in late prehistoric times, although the tidal marsh was less developed, and provided a rich bounty of aquatic foods that supplemented terrestrial resources. But if published curves for postglacial sea level rise can be extrapolated to the Bays (Gordon 1983; Oldale 1986; Bloom 1983), the river was at least one meter lower in Late Woodland times (ca. 1000 B.P.) than it is today. A subsequent sea- level rise of this magnitude is also indicated by the complete inundation of several acres of land with historic stone walls at Esopus Meadows, near Kingston, apparently within the last 300 years (Eisenberg 1984b).

Waterman (this issue) speculates that at the close of the Pleistocene the bottom of the Bays was a level plain, occasionally flooded by spring run-off. This implies the river then flowed in the deepest part of its channel. It is difficult, however, to formulate an accurate geoarcheological model without better data that could resolve contradictions in presently available boring logs.

Even if the Bays have accumulated considerable organic silt since the terminal Pleistocene, the river bottom and tidal flats immediately surrounding the islands may have been good places to gather shellfish as far back as the Archaic period. But when sea level was several meters lower, the Bays may not have been quite as favorable to aquatic life as they are today.

As a middle-scale environmental setting the Tivoli Bays represent an ideal study area. This is true not only from a cultural-ecological and geoarcheological viewpoint, but also because they are reasonably well-defined in geographic attributes, relatively small in size, and therefore manageable for study by relatively small investigative teams. They also may be considered a microcosm of the larger Hudson drainage, in the sense that data and insights achieved at the Bays may to some extent be legitimately extrapolated well beyond their boundaries.

In these respects the Bays are similar to two other areas studied by the writer in the recent past, via., the Upper Susquehanna Valley reach from Oneonta to Wells Bridge, New York (Funk, et al 1974; Funk and Rippeteau 1977; Funk 1983; Funk and Wellman 1984), and Fishers Island, New York off the eastern tip of Long Island (Funk and Pfeiffer 1988). The Upper Susquehanna study

area is 16 miles long, averages one half to one mile in width and confined chiefly to valley floors, It is a riverine environment within the dissected Allegheny Plateau. Fishers Island is only seven miles long and a maximum of one and a half miles wide--an area of 1080 hectares. It lies within a marine environment. The Tivoli Bays area is a little over three miles long. It is about one mile wide if we incorporate the bordering blufftops and lower creek drainages, excluding the west side of the Hudson. Therefore the total area is about 800 hectares. This is both an estuarine and a riverine environment.

In each case, considerable amateur activity going back 60 or more years preceded the professional investigations, and gave clues to the presence of prehistoric sites in those areas. The collecting activities of amateur archeologist and naturalist Henry L. Ferguson (1935) stimulated professional interest in Fishers Island archeology (Briggs 1976; Funk and Pfeiffer 1988). Amateur knowledge of sites on Magdalen (Goat) and Cruger Islands led to further explorations by Mary Butler in 1939 and 1940 and by W. A. Ritchie (1958) at South Cruger Island. More recently, Elizabeth Chilton (1991) has analyzed the Butler collection from the Goat Island Rockshelter for her master's thesis at the University of Massachusetts, Amherst.

Fishers Island and Tivoli Bays are more similar as environmental settings than either is to the Upper Susquehanna study area. Both are at sea level, their margins are subject to tidal fluctuations, both prehistorically offered a substantial quantity and diversity of aquatic food resources, and they are close in size. Both areas were strongly affected by rising postglacial sea level. They are, however, located some 300 miles apart by water route, in regions that differed substantially in some culture traits at the time of Contact. Other differences arise from geomorphologic features, for example the presence of fresh water ponds on Fishers Island, but not on the Bays, and the existence of sizeable creeks on the Bays, lacking on the island. Another difference comprises the availability of salt-water mollusks and other marine life on the island, in contrast to the fresh water mollusks, etc., available on the Bays. We should expect, then some differences in prehistoric adaptive patterns at these locales.

Culture History

Since the current state of our knowledge concerning the prehistory of the Bays is so limited, my comments will be brief and heavily reliant on comparative data from elsewhere in the Hudson Valley. There is no reason to suspect radical departures from the culture-historical framework known for the whole Hudson Valley, but we might expect some local variability, particularly in settlement and subsistence traits.

There are 43 sites listed in the New York State Museum archeological site files within the Saugerties 7.5 minute United States Geological Survey topographic quadrangle. Nearly all of the sites are prehistoric, and 30 are located within or adjoining the Tivoli Bays area. This unusually high concentration reflects not only the actual abundance of aboriginal sites, but the continuing efforts of Lindner and his associates to identify and record cultural resources in the area.

As previously stated, much information was originally supplied by amateurs, who are still an important source. Professional research has often followed leads from those individuals. Relatively few sites have been recorded from systematic surveys. Professional excavations have been confined to North Cruger Island (actually several loci), South Cruger Island, Magdalen Island (three loci), and currently Grouse Bluff. Other data have come from sporadic reports of artifacts found on the surface or in contract archeology projects.

Ritchie's (1958) excavations at the South Cruger Island site provided important stratigraphically based data on the local sequence. Although no radiocarbon dates were obtained, the basal assemblage denoted a sojourn by people of the Vosburg phase, a Laurentian expression elsewhere dated from about 3200 to 2500 B.C. (Funk 1976, 1988). Later Archaic, Transitional and Woodland materials were intermixed in overlying deposits.

Prior work by Mary Butler for Vassar College, never analyzed and published, resulted in the accumulation of data from North Cruger Island and Magdalen (Goat) Island. Stratigraphic separation of components was lacking, but the materials from these sites can contribute to Hudson Valley prehistory and merit scholarly study. Most of the recovered materials pertained to Middle and Late Woodland occupations (see Elizabeth Chilton's report, this issue). A sequence similar to that established for the rest of the valley appears to be emerging from the meticulous work of Christopher Lindner and his students at the Grouse Bluff site on the Bard College campus (see also Lindner, this issue). Interestingly, Grouse Bluff may have been first occupied about 7000 years ago, at least 1500 years before South Cruger Island.

Paleo-Indian sites of any kind (camps, burials, quarries, etc.) and stray finds of fluted points remain to be reported for Tivoli Bays or for the larger area represented by the Saugerties Quadrangle. This lack of information also prevails in Dutchess county outside the quadrangle, but at least two isolated fluted points and one encampment, Twin Fields (Eisenberg 1978) have been reported in Ulster county south and west of Saugerties.

I am not aware of any evidence for Early Archaic occupations of Tivoli Bays, specifically related to the Dalton, Palmer, Kirk, and bifurcated-base projectile point horizons. These would fall in the period from about 10,000 to 8000 years ago. Lindner's recovery of Middle Archaic Neville points from Grouse Bluff has previously been referred to. Some 20 Neville, bifurcated-base, and other early point types occur in collections from the large Winston Farm area near Saugerties (Joe Diamond and Bill Reinhardt, personal communications, 1990). The generally meager representation of Early to Middle Archaic materials is duplicated throughout the Hudson drainage. Only one site, the Mohonk Rockshelter (Eisenberg 1984a, n.d.) has yielded a large (but undated) sample of Neville type points. Small Neville assemblages from the Sylvan Lake and North Bowdoin Rockshelters in Dutchess county, and the Muddy Brook Rockshelter in Putnam county, have been radiocarbon dated from 6560 to 7170 years ago (Funk 1991).

Artifacts of Late Archaic age (from about 6000 to 3500 years ago) occurred in considerable abundance, not only at South Cruger Island and Grouse Bluff, but on many surface sites on both sides of the river.

The sequence includes Laurentian traits such as Otter Creek, Brewerton, and Vosburg points, along with ground stone gouges, plummets, and ulus; small narrow stemmed points (Lamoka and similar types) representing the succeeding Sylvan Lake complex; the narrow side-notched Normanskill points; and large, broad-bladed stemmed points (Snook Kill, Genesee) denoting the close of the Late Archaic as defined by most archaeologists. There are moderately abundant remains of Terminal Archaic (also called Transitional) occupations, in the form of Susquehanna Broad and Orient Fishtail points and soapstone vessels (usually fragmentary). Evidence of Early Woodland occupations (Adena and Meadowood points, Vinette 1 pottery, and other traits) is relatively meager. Middle Woodland and Late Woodland occupations are well-documented at Cruger Island, Magdalen Island, Grouse Bluff, Rocky Point, and other sites.

The great bulk of cultural debris reported in and near the Bays pertains to the Middle and Late Woodland stages, although quantities vary from site to site. Potsherds of these stages were abundant in the shell middens on Magdalen Island and North Cruger Island, an association that was repeated at Rocky Point. Mollusks such as Elliptio complanata were also associated with Middle and Late Woodland components farther upriver at Little Nutten Hook (Funk 1976: 113-115), Barren Island (Ibid: 46-58), Dennis (Ibid: 29-42) and Tufano (Ibid: 70-89). There is, however, some evidence that fresh water shellfish were being harvested and eaten during the Late Archaic. For instance, fresh water clam shells were present in Archaic levels of inland stations such as the Sylvan Lake Rockshelter, Bronck House Rockshelter, and Zimmermann Rockshelter, all reported by Funk (1976). In the lower valley between Poughkeepsie and Peekskill, the mild salinity of the water permitted the growth of oysters, the shells of which occurred in Archaic levels of the Bannerman and North Bowdoin sites (Ritchie 1958; Funk 1991).

A synthesis of the regional cultural sequence, chronology, and environmental change is presented in table 1.

Settlement Models

In my synthesis of Hudson Valley prehistory, I offered a classification of site types and locales determined by physiographic-topographic attributes and by distance from, or proximity to, the river and its major tributaries (Funk 1976: 194- 204). The principal types defined were high bluff sites along the Hudson, low-lying open-air camps and rockshelters along the river, back-country open camps and rockshelters, camps on major Hudson River tributaries, and also sites on large lakes. The crucial distinction was in the relation of "back-country" vs. "riparian". I then examined available archeological data from numerous sites, looking at the functional attributes of artifact assemblages and any evidence of subsistence practices. Artifact and subsistence data proved to be consistent with a settlement model of seasonal rounds. In this model, bands of Indian hunter-gatherers would spend most of their time near the river or large tributaries in the spring and summer, hunting, fishing, collecting mollusks and edible wild plants. In the fall they would harvest nuts, then begin dispersing into smaller family groups and moving into the back- country to hunt while the river and creeks were frozen over. With the return of warm weather people would move back to the riverine locations, to begin the cycle again.

Thus for example assemblages from back-country open sites and rockshelters showed the expected heavy predominance of projectile points, knives, and other products of hunting and butchering activities, with a converse lack of fishing gear. Food remains were consistent with an emphasis on hunting. These sites were presumably occupied in the fall and winter. But sites on or near the river, whether open-air camps or rockshelters, generally produced evidence of a broader range of subsistence activities, i.e., hunting, fishing, and the collecting of mollusks (fresh water clams in the upper and middle Hudson Valley, oysters, marine clams, whelk, etc. in the lower valley). These riparian sites were generally used through the spring and summer, although some groups probably remained along the river through the fall and winter. High bluff sites appear to have been heavily used in fall and winter.

A different model was proposed for a study of Upper Susquehanna Valley prehistory (Funk 1984). Due to strong upland- lowland contrasts in the Allegheny Plateau physiographic province (Fenneman 1938), three major, broadly applicable "environmental zones" were proposed: the valley floor, the valley walls, and the uplands. Here relief often exceeds 1000 feet. Each of the

major zones was subdivided into smaller units called "local habitats." My use of the term "microenvironment" was discouraged by a botanist colleague who argued that as used in biology it represented a much smaller size than my units or others generally employed by archaeologists.

Valley floors were subdivided into local habitats such as flood plains, outwash plains, kames and kame terraces, morainal hills, rock terraces and so on. The valley walls comprised benches, rockshelters, creek banks, and other features. Readily discernible in the uplands were summit knolls, saddles between knolls, the headwaters of creeks, outlets of ponds and swamps, and rockshelters.

Once again, examining existing archeological data, a pattern of seasonal transhumance was invoked. Valley bottom sites were preferred in the spring, summer, and perhaps the fall, but upland sites were occupied during the winter. It was clear from subsistence remains on many lowland sites that they were not only occupied in the spring and summer but at least for the early part of the annual period when nuts had ripened on the trees.

The Upper Susquehanna scheme is not used for the Hudson Valley because as part of the Hudson-Champlain Lowland Province (Fenneman 1938) the Hudson differs in important ways from the Susquehanna drainage. From Glens Falls to Sandy Hook, only the Hudson Highlands show severe relief contrasts. A narrow, discontinuous strip of flood plain borders the river from Coxsackie north to the Adirondack Mountains. But from Coxsackie south the river is so broad and deep that it can absorb spring freshets from its tributaries without significant rise in water level, and lacks a flood plain. The channel is bounded for most of its length by banks that rise gently from a few feet to steeply for up to 150 feet. Inland beyond the banks one finds softly undulating terrain broken occasionally by hills and ridges usually no higher in elevation than 350 feet. Higher elevations are attained 1 1/2 to 4 miles west of the river (Helderberg and Kalkberg escarpments, the Catskill Mountains, and the Shawangunk Ridge), and 15 to 20 miles east of the river (Rensselaer Plateau, Taconic Mountains). So the Hudson's physiography tends to dictate a back-country versus riverine settlement model, rather than an upland-lowland dichotomy.

At this stage of research, it is difficult to evaluate whether my scheme of site types and seasonal movements still seems valid, in view of recently acquired data. Within the Saugerties 7.5' quadrangle, one easily identifies high bluff sites, low-lying benches, islands and terraces along the Hudson, small inland creeks and wetlands, and one major tributary, Esopus Creek. Archeological sites have been reported on many of these locales. On the west side of the river, at least one occupied rockshelter is known on Esopus Creek, and another in the back-country near Katsbaan. Other inland shelters have been reported on the east side of the river in Dutchess and Columbia counties, outside the Saugerties quadrangle. One low-lying rockshelter exists on Magdalen Island, and another just a few miles to the south at Hyde Park.

Relatively few prehistoric sites have been reported in the Catskill Mountains, either on the west side of the Saugerties quadrangle or in adjoining areas. Nevertheless, a number of rockshelters were investigated by Schrabisch (n.d.) at Woodstock and in other parts of the Catskills. The only site type missing from the Saugerties quadrangle are lakeside camps, since natural lakes are lacking in the area.

My settlement model could doubtless be refined, and expanded to include additional site types or subtypes. For example, not all sites were habitation loci per se. Chert quarries and quarry-workshops are abundant in the valley, particularly in Greene county, and other special-purpose

sites probably exist. The "mix" of site types varies from one sector of the drainage to another, depending primarily on geologic and geographic factors, such as the size and number of tributary streams, the presence or absence of bedrock exposures containing chert or favoring caves and rockshelters, and the elevation of river banks.

Subsistence and Settlement in the Tivoli Bays Area

The Tivoli Bays area contains most of the site types postulated by Funk (1976): high bluff sites along the Hudson, back- country open camps, low-lying open sites and rockshelters. Yet to be reported are chert quarries and workshops, and inland rockshelters; and in the absence of large tributary streams or lakes, we cannot expect to locate camps associated with either geographic feature.

It would be pointless and arbitrary, however, to simply exclude from consideration potential local habitats and site types situated outside the Bays or even outside the Saugerties quadrangle area. The Esopus Creek could easily be reached by canoe from the Bays, and chert-bearing outcrops are located only a few miles distant to the north, south, and west. The settlement systems of people frequenting the Bays may have taken in large territories outside the local area.

The chert sources must have been known to and exploited by local Indian groups, just as the outcrops at Flint Mine Hill and other Greene county localities were used since Paleo-Indian times. One might also postulate seasonal rounds for all prehistoric groups occupying the Bays area since at least the Early Archaic period. These rounds would be driven mainly by weather-induced changes in the growth, distribution and abundance of economically important plants and animals.

In the absence of more data on subsistence from closed archeological contexts, it is not possible to evaluate the "goodness of fit" of my settlement scheme in the Bays area. Given the unusual environmental context, settlement aspects of prehistoric occupation in the Bays may prove to differ in some respects from those elsewhere in the Hudson basin.

Postglacial changes in climate caused changes in vegetation cover, as recorded in pollen profiles from bogs, swamps, and lakes across the Northeast. The character and timing of vegetation change were remarkably uniform over vast areas of the Northeast. These natural changes strongly influenced the number and distribution of animals on many phylogenetic levels. Most dramatic were the extinctions of over 44 genera of mammals that took place at the close of the Pleistocene epoch. Among those genera were the mammoth, mastodont, dire wolf, giant beaver, and other species that have been absent from the New York landscape for 10,000 years. These climate changes and extinctions forced cultural adaptations that transformed Paleo-Indian lifeways into the earliest Archaic manifestations.

The point being made here is that changing environmental conditions resulted in changing aboriginal adaptations, with consequent effects on different aspects of their cultures. Settlement patterns (the distribution of sites across the landscape) and settlement systems (the structured behavior of people who occupied the sites) were an important aspect of the adaptive response.

Therefore, through time we should expect to see changes in native peoples' use of the Tivoli Bays geographic setting. Some changes may not be directly ascribable to environmental change. Certain types of sites would be occupied in some periods, not in others. For example, in the

absence of a flood plain the high bluff sites might have been used more often by Late Woodland horticultural groups than by Archaic hunters and gatherers. Or, as Funk (1976) has suggested, people of the Susquehanna tradition (Transitional stage) may have tended to stay closer to the Hudson River through the year than Late Archaic groups, who spent much more time in the back-country. And the harvesting of finfish and shellfish may have reached its apex during Middle and Late Woodland times as sea level approached modern levels and the Bays filled with sediment.

Any consideration of prehistoric cultural ecology in the Bays must include possible effects from lowered sea level at the end of the Pleistocene and rising sea level throughout the Holocene. One problem mentioned earlier was the need for information on the configuration of the sediments underlying Tivoli Bays after deglaciation. The present shallowness of the Bays is partly due to siltation from Euroamerican land-modifying activities and to the blockage of river currents by the railroad bed (Kiviat 1978). During the period following drainage of Lake Albany ca. 12,000 B.P. the Hudson River at the Bays was above sea level, due to the low level of the sea on the Continental Shelf and the effects of isostatic rebound. The water was entirely fresh from runoff of precipitation. The river itself was probably narrower and largely confined to the deepest part of the natural channel. Waterman (this issue) speculates that at that time the bottom of the Bays was an exposed plain or terrace. The islands would then have been ridges connected to the mainland, and they would have stood well above the river and the flats that surrounded them.

This situation suggests that prehistoric habitation sites may lie off the present shore, if not eroded away by wave action. Bedrock benches, sand and gravel terraces, and other once habitable places probably exist underwater on the margins of the Bays. Some sites may be presently under water around the margins of the islands, on their rock-based roots or on fringing glacial gravels. Conceivably, Paleo-Indian and Early Archaic components, not presently known on higher ground in the Bays, are to be found under water. In early Holocene times small mammals, fish, turtles, shellfish and aquatic birds were probably available to Indian residents within the Bays but not perhaps in the quantities available today.

The high probability that sites formerly existed on presently submerged shorelines in the middle Hudson reach during lower sea level is exemplified by a site along the southern margin of the Cruger Island neck, shown to me by Frank Schambach, then a Bard College student, in 1962. Abundant artifacts littered the beach at low tide and extended out into shallow water, representing a prehistoric encampment under attack by the encroaching water and wind-driven waves. Farther south, near Hyde Park, the stratified and enigmatic Shagabak site is often submerged by extra high tides and its Archaic levels are below normal high tides, with the result that the deposits are gradually washing into the adjoining cove (Funk 1976: 141-145).

The complication of sea-level change in developing accurate models of prehistoric settlement patterns was also encountered during research on Fishers Island, New York (Funk and Pfeiffer 1988). There the cultural sequence established by our excavations began with the Late Archaic around 4200 B.P. and continued into the Contact period about A.D. 1600; again, Paleo-Indian and Early Archaic sites have not been found. The island was attached to the Rhode Island mainland as recently as 8000 years ago, after which it was isolated by rising sea level. At 6000 years ago it was still much larger than today, with at least one long embayment on the north shore that may have been inviting to early hunters and gatherers (Briggs 1976). We have hypothesized that Early or Middle Archaic sites once lay off the present north shore, could have survived wave erosion, and therefore could still provide valuable data given the technology and

funding needed to excavate them.

It we count the bluffs and upland terraces immediately bordering Tivoli Bays, the total area would approximate 800 hectares, nearly the same size as Fishers Island. Preliminary estimates from survey data indicate that as many as 500 aboriginal sites once existed on the island. This number may not be as unreasonable as it seems at first glance. The freshwater ponds on the island are roughly comparable to the Bays, as areas presently lacking in habitable land surfaces. Therefore, we might project a total of several hundred sites within the Bays habitat, chiefly atop the bluffs, on their lower slopes, on upland fields behind the bluffs, along the creeks, on benches near the water, and on landforms presently under water.

Recommendations for Future Research

Given the proven potential of the Tivoli Bays area to provide information on prehistoric Native American occupancy, natural ecological contexts, and paleoenvironmental reconstruction, it is to be hoped that the achievements to date by Lindner, Waterman, and Chilton, building on the work of their predecessors (Ritchie and Butler), will serve as the foundation for a larger, coordinated and interdisciplinary attack on research problems in this very interesting local setting.

In this issue, Lindner describes his research objectives at the Grouse Bluff site. Clearly, this work has already established a high standard for all subsequent archeological investigations in the Bays area. His strategy is directed at much more than the simple recovery of artifacts; it is designed with the recognition that context and associations are crucial to complete understanding of the formation and history of the site, and its place in native adaptations to the local environment. Systematic selection of areas to be sampled, attention to microstratigraphic analyses, careful delineation of features such as hearths, collection of subsistence remains, and attention to geoarcheological factors are integral parts of this strategy.

Beyond this point, it seems to me that the next step would be comprehensive surveys of the Bays habitat. This would include mapping of all known archeological sites, recording extant amateur collections, and gathering biological and ecological data of the sort reported by Kiviat (1978). Following this would be systematic field reconnaissance, including walkovers of cultivated fields, follow-up testing of observed surface traces of occupancy, and the digging of shovel test pits at specified intervals within wooded or uncultivated areas. Undoubtedly many new sites would be located in this manner.

The surveys could be "stratified," that is, divided into units of manageable size according to environmental parameters such as slope, elevation, landform, vegetation, proximity to the river, and so on. It might also be feasible to conduct a 100 percent survey of a limited area such as the Bard campus.

It would also be crucial to acquire additional environmental data with expert assistance, and this should include paleoenvironmental (geological, palynological, and paleontological) data. Deep cores are needed from the Bays, nearby tidal wetlands, and upland bogs or swamps in order to obtain data on the nature and chronology of past sedimentation and vegetation change. These data might prove useful to understanding regional culture change in relation to postglacial modifications in landforms, sea level, hydrologic regimes, climate and vegetation. For example, shifts in the shape and elevation of land surfaces due to rising sea level would have reduced the number and diversity of habitable places in and around the margins of the Tivoli Bays themselves.

Conclusions

The Tivoli Bays provide an unusually interesting setting for long-term archeological and ecological research projects. In the middle Hudson Valley this combination of islands, large embayments, wetlands, high bluffs and upland creeks is almost unique. The present-day abundance and diversity of wild plants and animals, both terrestrial and aquatic, has probably existed for at least 1000 years. Despite the lack of detailed paleoenvironmental data, it appears that the Bays area was attractive to native peoples at least as far back as 7000 years ago. It is uncertain, however, whether mollusks, fish and other aquatic resources were as important during the lower sea levels of early Holocene time as they were during the higher levels of the Middle and Late Woodland periods.

The local cultural sequence, as revealed by investigations at South Cruger Island, Magdalen Island, Grouse Bluff, and other sites, had much in common with the culture-historical framework developed for the entire drainage (Ritchie 1958, 1965; Funk 1976, 1977, 1983; Brennan 1962, 1974, 1977). It began with Middle Archaic occupations showing affinities with the Neville complex of New England (Dincauze 1976), but there are indications from Winston Farm and other middle valley sites that evidence of Early Archaic groups who made and used bifurcated-base points will also be found at the Bays. Subsequent occupations could be classified as Laurentian (Vergennes?, Vosburg phases), "Narrow Point" (Sylvan Lake phase, perhaps also River phase), Broadspear (Batten Kill, Snook Kill phases), Susquehanna (Frost Island, Orient phases), possibly Meadowood, Middlesex, and Bushkill phases and definitely Point Peninsula, Owasco, and "Algonkian" (Late Woodland to Contact) ceramic horizons.

These wide relationships in artifact traits and trait- complexes could mask local variation in settlement and subsistence patterns. To learn the nature and degree of variation, possibly correlated with aspects of environmental change, we must await the results of long-term, multidisciplinary cultural-ecological study of the Tivoli Bays. Hopefully the necessary people and resources can be brought to bear by Christopher Lindner and his students in order to accomplish these goals.

Table 1

The Tivoli Bays as a Middle-Scale Setting for Cultural-Ecological Research

By Robert E. Funk, Anthropological Survey, New York State Museum

Years before Present *(Radio-carbon Years)*	Pollen Zones *(After Deevey)*	Environmental Synthesis	Clutural Stages	Phases, Complexes, or Horizon Styles	Major Hudson Valley Sites & Components *(Components on Tivoli Bays in Italics)*
500	C3b	Spruce pine rise, Cool, moist. (Correlates largely with Little Ice Age.) Sea approaches present level.	HISTORIC		Rip Van Winkle, Grape
1,000			LATE WOODLAND	Garoga, Chance Oak Hill, Ceramic Castle Creek, Canandiagua horizons, Carpenter Brook	Hurley, *S. Cruger*, Kingston, Chance, *Goat Island*, Coffin, *S. Cruger*, Dennis, Rural Cemetery, Welling
2,000	C3a	The Oak hemlock chestnut period. Cool, moist.	MIDDLE WOODLAND	Hunter's Home phase	Black Rock, Turnbull
				Fourmile phase	Tufano, Weinman, River, *Goat Island*
				Fox Creek phase	Westheimer, Ford, Parslow, *Goat Island?*, *Grouse Bluff?* Canoe Point
3000		Possible dry episode.	EARLY WOODLAND	Bushkill? phase	Westheimer, *Goat Island*, *Grouse Bluff*
				Middlesex? phase	Palatine Bridge, Dennis
				Meadowood phase	Dennis, Nahrwold, *Grouse Bluff*

	C2	The Oak Hickory period. Warm, dry. Increase in hickory, beech, white oak, hemlock. Rise in abundance of mast foods, small mammals, deer. Slower rate of sea level rise.	TRANSITIONAL	Frost Island phase? Orient phase	Coffin, Dennis, Lotus *Grouse Bluff, S. Cruger*
				Snook Kill	Vedder, Snook Kill, Weir
4,000		Hemlock lowest frequency	LATE ARCHAIC	Battenkill River phase	Oatman, Dennis, Bent, River, Young, Pickle Hill, *Grouse Bluff*
				Sylvan Like phase	Sylvan Lake, Weinman, Hennessy, *Grouse Bluff, S. Gruger*
				Vosburg phase	Sylvan Lake, Weinman, *Grouse Bluff, S. Gruger*
6,000	C1	The Oak Hemlock period. Warm, moist. High frequencies small mammals than previous period.	MIDDLE ARCHAIC	Vergennes? South Hill? Otter Creek points	Weinman, Bannerman, *S. Cruger*, Shafer, Sylvan Lake, Dogan Point, *Grouse Bluff*
				Stark? point horizon Neville complex	North Bowdoin, Muddy Brook, *Grouse Bluff*, Mohonk

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