Understanding the Significance of Small Sites in the Settlement and Procurement Strategies of Native Americans in Vermont

by Douglas S. Frink, Keith Knoblock and Charity Baker

Abstract

The function and role of small Native American archaeological sites in Vermont are inadequately recognized and defined. Presented is a predictive model based on site function which relates Native American sites to specific resource- abundant environments. Climatic reconstructions of the past 9,000 years for the study area indicate relatively stable conditions. Within this stable climate, discrete definable forest communities evolved. Each definable forest community would have provided early Native Americans with specific seasonally abundant resources. The 384 identified Native American sites in Chittenden County, Vermont, are categorized according to their reconstructed forest community context. One forest community, defined as perpetually juvenile, contains the majority of small undefined sites. The artifact assemblages of sites identified within the perpetually juvenile forest community are similar, normally consisting of one broken projectile point, one or more scrapers-knives and a small number (<50) of flakes, suggesting a common activity. Analyses of the resources in this forest community are examined for probable resource concentrations and seasonality. During winter months, these forest communities would have been ideal yards for the white-tailed deer. The artifact assemblages of these small Native American sites within this context of potential winter deer yards suggests that they may represent winter deer kill/butchering sites.

Introduction

Small Native American sites are the most frequently identified and evaluated sites listed in the Vermont Archeological Inventory (VAI). The environmental review permit process (Federal Section 106, State Act 250, and State Lands VSA 22) has resulted in a growing body of technical reports about these sites. Typically, the artifact inventory recovered from these sites includes a limited number of small thinning, retouch and use flakes accompanied by a few broken tools. These small sites may be described as unfocused scatters of cultural material covering areas from five square meters to over 1,000 square meters. Although these sites have been inventoried, explanations about their function and role in Native American cultural patterns have not been considered in most studies. Commonly, technical reports define these sites simply as resource extraction or procurement spots. Occasionally these sites have been defined as structurally disturbed, implying the past existence of structure and concluding a present lack of significance. These small sites have also been explained as resulting from incidental loss.

Background and Theoretical Context

Analyses of Native American archaeological sites in Chittenden County, Vermont, have led to the development of an environmentally-based model which offers hypothetical explanations for site locational selections (procurement strategy), and periods of use (seasonal). The fundamental assumptions of this study are:

(1) Zipf's "principle of least effort" (Zipf 1949), asserting that people tend to optimize resource procurement activities by locating themselves on the landscape in those places which minimize the effort required to obtain essential resources.

(2) Native American sites collectively reflect a pattern of seasonally scheduled procurement activities. This model suggests that Native Americans optimized their resource procurement activities by locating themselves in, or adjacent to, specific ecological environments, and the selection of site location was dependent on the seasonally abundant resource in the particular area.

Ecological Environments in Vermont

Pollen core studies in Vermont from Pownal Bog and Shelburne Pond suggest probable changes in the composition of the forest communities due to fluctuations in temperature and precipitation over the past 14,000 years. A tundra-like forest and climate are hypothesized for the first few millennia of postglacial Vermont, and the earliest evidence of human settlement of the Champlain Lowlands is from the time when this postglacial tudra-like environment was evolving toward conditions somewhat warmer and drier than today (Whitehead and Bentley 1963; Carr, Worley and Davis 1977).

The pollen analyses of core samples from Shelburne Pond suggest only one major climatic change, occurring sometime between 9,500 and 9,000 years ago. At this time, the evidence suggests a relatively rapid change in the forest community from the boreal forest dominated by spruce to the Transitional Mixed Hardwoods-White Pine-Hemlock forest environment (Carr, Worley and Davis 1977). The trend toward warmer and drier conditions reached its peak around 5,000 years ago, and since that time minor long term fluctuations in both temperature and precipitation are suggested. Although the presence and absence of certain tree species have been correlated with these long term fluctuations, there is no indication of significant changes in the general characteristics of the forest communities during the past 9,000 years.

Further support for the assumption that these forest communities remained relatively stable during the past 9,000 years is indicated by the degree of pedogenic development in many of the soils in Chittenden County. The soil profile development suggests that the environmental conditions in the area have been relatively stable for at least the past 5,000 years (Curtis, et al. 1976; Bakkevig 1980; Moore 1982).

When European-Americans began settling in this region approximately 350 years ago, they cleared the land and obscured the former forest communities. Siccama (1971) has proposed a reconstruction of the probable forest communities based on soils and topography and on tree species recorded in original land surveys for Chittenden County. This reconstruction has been used to identify some of thc eological environments which existed at that time (Figure 1).

The quantity and seasonal availability of potential resources varied according to forest community. The density and diversity of the biomass of the Bottomland Hardwoods and Fresh Water Marsh communities is dramatically different, for example, from Spruce-Fir-Birch and Northern Hardwoods Spruce communities. Site locations are expected to reflect the biomass density and diversity.

Specific ecological environments in Chittenden County are conspicuous in their seasonal high biomass and would have afforded Native Americans with a wide range and/or large quantity of exploitable resources. These ecological environments include:

(1) The Bottomland Hardwood forests bordering the Lamoille, Winooski, Browns, and Huntington Rivers, and Lewis Creek. Fish, various sized fur-bearing mammals, small mammals and reptiles, greens, grains, tubers and small fruits were plentiful and easy to procure during mid-to-late summer months.

(2) The Pitch Pine - Oak forests located on the sandy glacial outwash deltas of the Lamoille and Winooski Rivers. Nuts, seeds and fruits were abundant during the late summer and early autumn months. This rich botanical resource would attract and concentrate deer, bear, and various smaller mammals and birds.

(3) The Fresh Water Marshes located in the deltas and lower reaches of the Lamoille and Winooski Rivers, the numerous shallow bays of Lake Champlain, the shallow fringes of Colchester and Shelburne Ponds, and various no-longer-extant ponds and marshes indicated by muck and peat soils. Migratory fowl, quality-fur-bearing mammals, tubers and small fruits were plentiful during mid-to-late autumn.

In addition, point-specific geographic features, such as falls and rapids along major rivers, would have concentrated seasonally migrating fish. A fourth ecological environment to be added to this model includes:

(4) The falls and rapids along the Lamoille and Winooski Rivers. Pike, land locked salmon, bass, and sturgeon, migrating to upstream spawning grounds during mid-to-late spring, were available in large quantities. Eel were available in the spring.

Database of Native American Archaeological Sites

The locational data for known Native American archaeological sites in Chittenden County strongly supports this

Table 1. Native American Site Components by Ecological Environment for Chittenden County, Vermont

Ecological Environment	Count	% Components
Falls and Rapids	16	2.8%
Bottomland Hardwoods	39	6.7%
Pitch Pine - Oak	106	18.3%
Fresh Water Marshes	136	23.5%
Undetermined	287	48.7%
Total	579	100.0%

Table 2. Native American Site (Undetermined Resource) Components by Forest Community for Chittenden County, Vermont

Forest Community	Count	% Components
Bottomland Hardwoods	2	0.7%
Northern Hardwoods - Hemlock	1	0.4%
N.H. - Hemlock - White Pine	13	4.6%
N.H. - Spruce - Hemlock	1	0.4%
N.H. - White Pine	238	84.4%
White Pine - Transitional Hardwoods	19	6.7%
Northern White Cedar Bluffs	3	1.1%
Total	282	100.0%

settlement/procurement model. To date, a total of 384 Native American sites have been identified and recorded in the Vermont Archaeological Site Inventory (VAI) for Chittenden County. Of these, 198 have one or more temporally defined cultural components. Counting each recognized cultural component as an independent occupation results in a sample population of 579 Native American occupations. Over half (51.3%) of these occupations are located in, or adjacent to (within 500 feet), one of the four ecological environments defined above. Table 1 shows the correlation between Native American occupations and the four primary ecological environments. The low values for the Falls and Rapids and Bottomland Hardwoods environments may reflect the lack of studies, the relatively limited acreage when compared to the other environments, and the probability that the dynamics of the adjacent rivers have destroyed or buried sites in these areas.

Native American sites with undetermined environment-specific resources likely represent occupations during those seasons not covered by the defined ecological environments. The vast majority (84.4%) of the "undetermined environment specific resource" sites are located within the Northern Hardwoods-White Pine forest community. Table 2 shows the Native American site component distribution of undetermined resource sites by forest community. The variability in distribution may partially reflect the relative sizes of these forests communities and the uneven distribution of archaeological studies in the county. However, these factors do not account for the extreme preponderance of site components associated with this forest community. The VAI inventory has been compiled from information obtained by collectors and environmental review studies. Collector information reflects larger, highly visible sites while environmental review studies are restricted to development projects. Most of Chittenden County's prime agricultural land, where plowing has increased the visibility of Native American sites, is located within the Northern Hardwoods-White Pine forest community. Many of the characteristics which determine prime agricultural land (drainage, slope, accessibility) make these areas prime areas for development as well. Few, if any, amateur or professional studies have been conducted in the upland

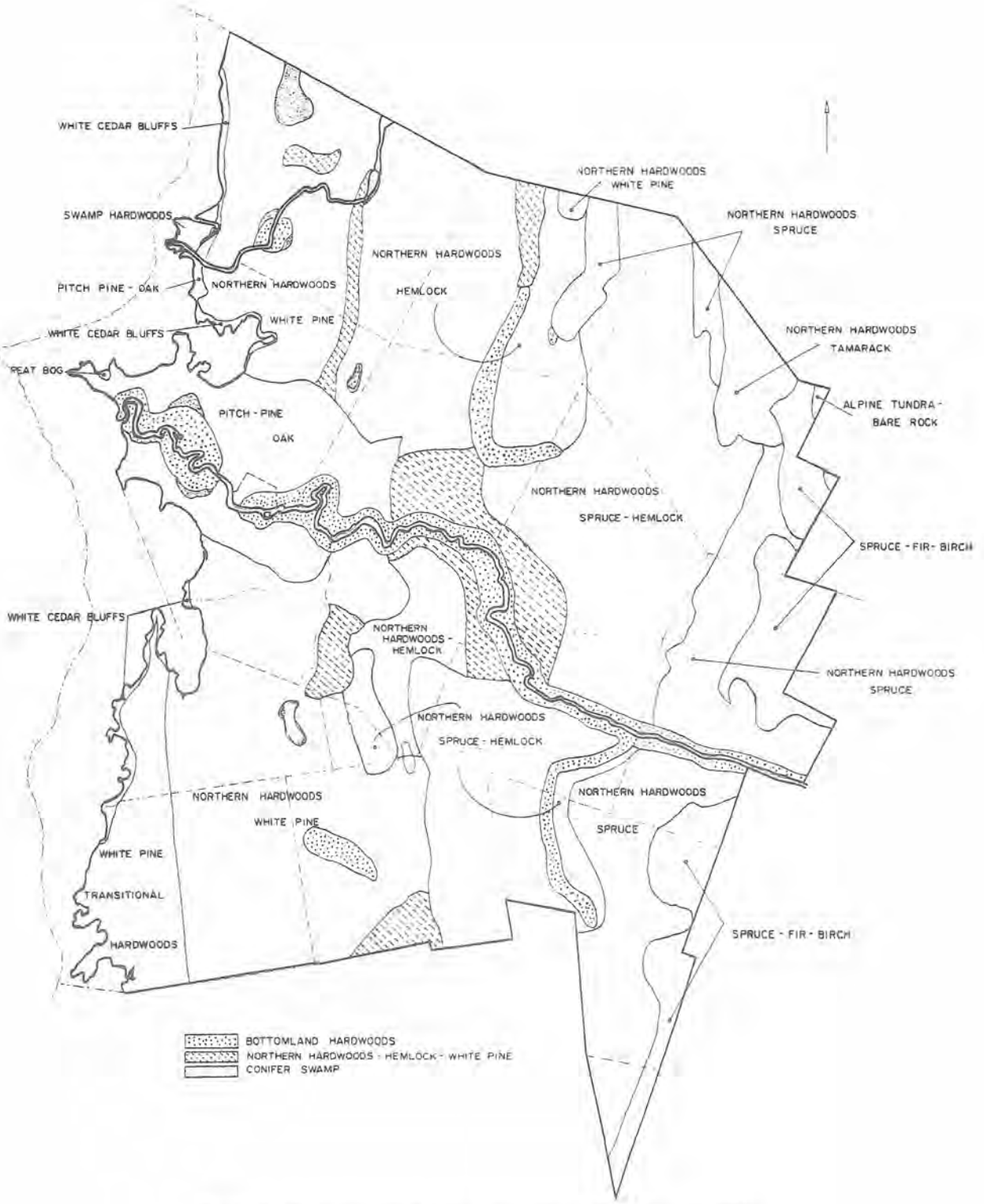

Figure 1. *Reconstructed forest communities (after Siccama 1971).*

areas of the county, where forest cover obscures visibility, and development pressure is low.

The Northern Hardwoods-White Pine forest community has a high carrying capacity from spring to autumn. Numerous resources can be found throughout this widespread forest community. Specific resources tend to be dispersed and are therefore difficult to predict. Native American settlement and procurement strategies would be expected to reflect this dispersed pattern within the forest community as well. However, Native American sites within this forest community tend to cluster in and around specific soil groups. As soils exert a strong influence on the development and composition of forest communities and the various resources available within the forest community, this apparent clustering may indicate a specific resource focus.

Defining a Potential Resource

Applying the "principle of least effort" to Native American sites within environments having undetermined resources, we assume that people would have situated themselves so as to optimize procurement of resources. An examination of the archaeological remains, specifically faunal remains, provides the information required to form a hypothesis for identifying the potential resource base of many of these sites.

Faunal analyses of archaeological remains from Native American sites in Chittenden County, Vermont, are rare. The majority of identified archaeological sites in the county have not been sufficiently studied, and even when faunal remains are recovered, they are rarely analyzed thoroughly. Also, faunal remains rapidly decompose in the mostly acidic soils of this region. Faunal material, when identified, is usually associated with a cooking hearth, where the heat of the fire has fixed the calcium of the bone and rendered the bone relatively inert.

In the few sites where faunal material has been recovered and thoroughly analyzed, the white-tailed deer (*Odocoileus virginianus*) is generally well-represented. Although deer provides a good source of meat, it is unlikely that Native Americans relied on this one food source in their diet. Gramley (1977) presents the argument that Native Americans living in the northern Northeast may have exploited deer principally as a clothing resource and secondarily as a food resource. Amongst these northern cultures, deer hides were preferred as clothing above elk and bear (Newcomb 1956). While deer hide was preferred for warmth and comfort, it lacked durability, particularly in the wet environments of the Northeast. Gramley suggests that, on the average, 3.4 deer hides would have been required per person per year. Additional deer hides would likely have been used for blankets, shelter coverings, and containers.

If deer was an important Native American resource, the strategy used to exploit this resource needs to be determined. Did Native Americans obtain this resource using a generalist procurement strategy, where resources were advantageously gathered in the course of wandering across the landscape, or through a specialized procurement strategy of a scheduled seasonal focus on specific resources? If the procurement of deer was the focus of a specialized strategy, we expect to find the following:

1) A unique kind of archaeological site definable as a deer procurement spot. This site type will be small and contain only those artifacts associated with procurement activities.

2) Sites will be located on the landscape to optimize the procurement process. This procurement process will consist of two parts: obtaining the resource efficiently, and transporting the resource for consumption or transformation into a usable product.

Behavioral Patterns of the White-Tailed Deer

In a paper presented at the 1991 Annual Meeting of the Eastern States Archaeological Federation, John Cavallo argued that to interpret the activities and settlement patterns associated with Native American procurement strategies, one must first understand the behavior of the resource. Procurement strategies reflect a unique relationship between humans and their food source. Human behavior, evidenced in site selection, structure and seasonability, will be dependent on the behavior of the resource (Cavallo 1991).

White-tailed deer remain within a fixed geographical area. If an area presents a sufficient quantity of food and acceptable places of shelter, a deer will live its entire life within a one to two square mile area of its birthplace. Deer have distinctive grouping patterns throughout the seasons. Aside from rutting season, bucks and does remain in separate groups. Bucks tend to travel individually or in groups of two to five deer, while does tend to aggregate in groups of two to nine deer. Doe groups usually contain composites of one doe, one yearling and two fawns

(Stokes 1986). At approximately eighteen months of age, yearlings will reach maturity, and at this time, fawns will leave the doe and form new groups. Definitive territorial areas are established by both bucks and doe groups. During spring, summer and fall, the optimal feeding times of the year, these groups tend to traverse a one- to two-square-mile area, where plentiful food resources are available within the deer territory. Grasses, wildflowers, and green leaves from trees, shrubs and vines provide an abundance of nourishment. In the fall, the diet is supplemented by various types of fruits and nuts.

Winter adds a new dimension to the feeding strategy of deer. The available summer graze has died or is unattainable and covered by snow and ice. In response, deer change from a grazing to a browsing strategy, relying on buds, twigs and bark from deciduous and coniferous vegetation. As deer stand only two to four feet tall, feeding is limited to those varieties of food or plants that are in reasonable proximity to the ground. The Viburnum and Cornacae families contain several species fitting this criterion. The toothed arrow-wood (*Viburnum dentatum*), the withe-rod (*Viburnum cassinoides*), and the sheep-berry (*Viburnum lentago*) are common shrubs occurring in moist, poorly drained soils. Their heights vary from two to twelve feet, and all have accessible slender shoots, broad leaves, and edible berries.

The high cranberry-bush (*Viburnum opulus*) is another prime food source. These shrubs are scattered throughout swamps, low lying woodland habitats, and form the understory vegetation of juvenile forests. These shrubs provide an ideal winter food source because they retain berries on their branches throughout the winter. The dogwood (*Cornacae*) is also common throughout Vermont. The panicled dogwood (*Cornus paniculata*), red-osier dogwood (*Colus stolonifera*), silky dogwood (Cornus amomum), round-leaved dogwood (*Cornus circinata*) and alternate-leaved dogwood (*Cornus alternifolia*) are all low lying, slender-branched shrubs with a high nutritional content.

In addition to shrubs, white-tailed deer will feed upon bark, twigs, and terminal and lateral buds of juvenile hardwood trees up to 10 inches diameter-waist- height. The light soft woods of conifers and juvenile hardwoods enable deer to strip the bark of these twigs and branches and reach the inner cambium layers of the bark, an additional food source. Unlike the widely available graze resources for deer in the warmer seasons, winter browse material tends to be localized within specific areas, such as wetlands and openings in the mature forests. As many as twenty-five deer may congregate in these limited niches during the winter season (Burt and Grossenheider 1976). This behavior is known as "yarding."

With Vermont's winter conditions, deer expend a large amount of energy keeping warm and navigating through deep snow. When the deer congregate in a particular area, trails to and from shelter and feeding areas are packed down and kept open, allowing easier passage throughout the winter yard and minimizing the expenditure of energy. Deer optimize their chances for survival by moving into and sharing areas with the capability of supporting their population. This behavior significantly increases the population density of deer in specific areas during winter.

White-tailed deer have multiple active periods during the course of the day. To reduce exposure to predators, deer will consume large amounts of food quickly and then return to a safe and secluded area to ruminate. These areas of shelter are an integral part of the deer habitat. During most of the year, deer select relatively exposed areas that provide relief from insects and allow them to see approaching predators. In winter, deer select shelter in heavy brush cover or dense stands of evergreens which provide protection from winter winds and seclusion for rest and rumination. During the winter season, the ideal deer yard environment is found in juvenile forests covering 50 acres or more. When a hardwood forest reaches maturity, sheltering evergreens and understory browse are "choked out." A juvenile forest, with its flourishing understory, provides shelter and accessible quality food.

Today, deer yards in Chittenden County are located primarily in young post-abandonment successional forests. During much of the eighteenth, nineteenth and early twentieth centuries, most of Chittenden County was clear of trees. Zadock Thompson wrote in 1853 that, "Their [deer] numbers have been constantly diminishing within the state, until they have become exceedingly scarce, except in a few of the most unsettled and woody sections" (Thompson 1853). This was not the situation in Chittenden County prior to European American settlement of the area, when the county was nearly completely covered in forest growth. To understand the relationship between the white-tailed deer and Native Americans prior to European American settlement of Chittenden County, we must reconstruct the forest environment of that time, and determine the locations of forests most likely to support winter deer yards.

Locational Model for Potential Winter Deer Yards

Before 1600 A.D., the probable natural forest vegetation for the Champlain Lowlands consisted of the Transitional Hardwoods-White Pine-Hemlock Zone (Westveld, et al. 1956). These generalized forests are not homogeneous, but rather form a mosaic of differing vegetation communities. Within each of the communities, differing soil, ground water, relief and aspect characteristics resulted in localized variations in the composition of these vegetational communities. To reconstruct and locate potential deer yards, we must examine the environmental factors which contribute to the maintenance of the perpetually juvenile forest — the "ideal" winter deer yard environment.

The maturity of forests depends on the soils. Well-drained soil is essential for hardwoods to reach maturity. Mature hardwoods depend on the presence of oxygen deep in the soil to support the growth of a deep anchoring tap root. A poorly-drained soil or a soil containing an impervious boundary close to the surface will not foster mature growth. Hardwoods in poorly-drained or shallow soils will grow but seldom reach maturity because they are more susceptible to disease and blowdowns. Forests in these soils tend to maintain a juvenile characteristic. Conifers are able to withstand wetter and shallower soils than hardwoods due to the extensive branching patterns of their roots. While conifers prefer a well-drained soil, they maintain a competitive position with the hardwoods in wetter and shallower soils.

Although limited areas of juvenile forest growth are available to deer in mature forests due to storms, disease and fire, these areas are unpredictable and short-lived. Forest areas characterized by perpetual juvenile growth are usually associated with certain soils characterized as poorly-drained or shallow to an impervious horizon.

Forty-one soil types have been surveyed and mapped in Chittenden County (U.S.D.A. 1974). These soils have been ranked (slight, moderate and severe) by the Soil Conservation Service according to their limitations in supporting certain forest compositions. Each soil was given an arbitrary value (1=severe, 2=moderate, and 3=slight) based on its potential ability to support a combination of hardwood, coniferous, and wetland vegetation. A numeric value ranging from 3 to 9 was calculated for each soil. The higher values correspond to conditions most likely to support winter deer yard habitats.

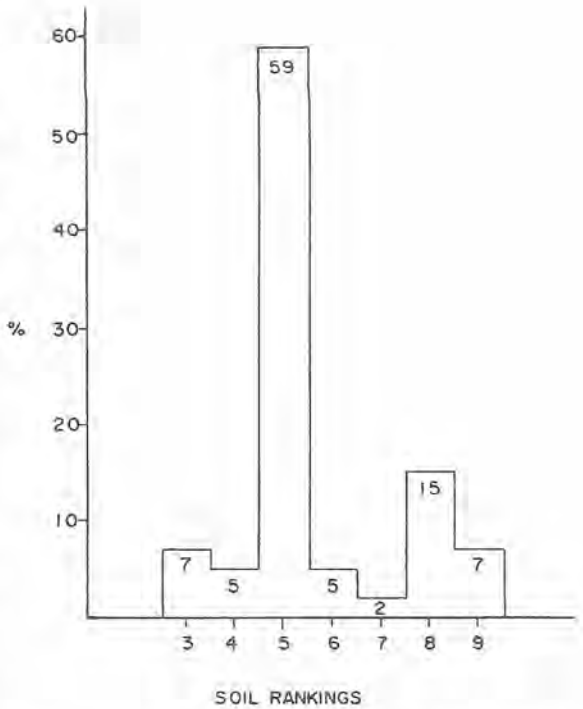

Figure 2. *Distribution of ranked soils supporting a combination of hardwoods, conifers, and wetland vegetation.*

Figure 2 shows a bimodal distribution of soils supporting the combined forest vegetation. The majority of soils are ranked with a value of five, with a second modal value of eight. Those soils associated with this second mode, values of 7, 8 and 9, represent the most likely location of perpetually juvenile forests suitable for winter deer yards.

Of the forty-one soil classifications, ten were rated at or above 7. These soils include the Limerick, Livingston, Peacham, Scarboro, Enosburg-Whately, Covington, Scantic, Au Gres, Massena and Cabot soils. Half of these soils are classified as Haplaquepts, two are Fragiaquepts, and the remaining three are Psammaquent, Ochraqualf and Haplaquod. These ten soils are characterized by the presence of seasonal high water influencing vegetational growth. Vegetation in these soils consists of shrubs, grasses and trees, which, due to the high seasonal water table, rarely reach maturity. Tree throws are common and are constantly churning the upper soil horizons (U.S.D.A. 1974).

Figure 3. *Reconstructed potential winter deer yards in Chittenden County, Vermont.*

The most commonly occurring soil in Chittenden County is the Cabot soil, a gravelly loam. Cabot soil occupies nearly 16,000 acres located primarily in the western hills of Chittenden County. The presence of a fragipan, an impervious soil horizon consisting of basal tills, in these soils restricts root growth and causes long periods of wetness in the upper soil horizons. Covington soil, a clay loam, is the second most common soil in the county and include 8,850 acres. These soils are found primarily in the southern half of the county and normally occupy areas of between two and two hundred acres. Livingston soil, another clay loam, is commonly found adjacent to or near the Covington soil, and is generally wetter for longer periods of the year than the Covington soil. Scantic soil, a silt loam, covers an area of 5,530 acres within the county and is represented in nearly every town. Typically, Scantic soils can be found in patches of two to sixty acres, with an average range of ten to forty acres.

Enosburg-Whately soil, a sandy loam overlying silt or clay Gloams, occupied over 3,100 acres in Chittenden County. It occurs in areas of between two and one hundred fifty acres, and is often in association with, or near, the Covington soil. The Au Gres soil, a fine sandy loam. includes an area of about 1,900 acres in the county. The larger areas of the Au Gres series are in the sand plains of Burlington, South Burlington, Essex, Colchester and Milton. The Scarboro soil, a silty loam, covers only 840 acres in the county. Although this soil occurs in small areas of two to eighty acres in irregularly shaped patterns, it is often found adjacent to the Au Gres soil. Most of this acreage is along the banks of the Winooski and Lamoille Rivers near Lake Champlain.

These seven soils are the most likely to support forest growth suitable for winter deer yards. They are found in Chittenden County in patches varying in size from as little as one acre to over 200 acres. Often those soils that occur in small to moderate sized patches are found adjacent to one another, effectively capable of supporting the same forest cover in a more extensive area than indicated by any one soil. The Limerick, Peacham and Massena soils all occur in small discontinuous patches associated with changing river beds. Due to the relatively ephemeral nature of these landforms, long term winter deer yards are not likely to be associated with these soils.

Since the ideal deer yard will contain a minimum of fifty acres, the soils that occupy areas of less than fifty acres have been excluded from this study. Information contained in the Chittenden County Soil Survey (U.S.D.A. 1974) was used to locate the soil or soil groups greater than 50 acres that would most likely support forest vegetation conducive to supporting winter deer yards. Two hundred and fifty-six potential deer yards were thus defined for the county. The locations of these potential winter deer yards are shown in Figure 3.

Correlation Between Reconstructed Deer Yards and Known Sites

As presented earlier in the discussion, there are 384 Native American sites recorded in the Vermont Archaeological Site Inventory (VAI) for Chittenden County. This inventory includes information provided by avocational and professional archaeologists. The professional studies have been the result of spatially limited environmental review projects and do not represent a statistically rigorous sample of the county. However, recognizing the inherent biases in the database for Chittenden County, locational and site description data from the VAI was used to discern any evident correlation between the reconstructed winter deer yards and Native American archaeological sites definable as resource procurement spots.

The locations of the presently identified Native American sites for Chittenden County were plotted and compared to the hypothetical "ideal" deer yards. Native American archaeological sites were found in or adjacent to (within 500 feet) 40 potential deer yards. This is a significant correlation (16%), because, as stated above, most of the county has not been studied for archaeological remains. This correlation becomes clearer when we look at the number of archaeological sites that fall within or adjacent to these 40 potential deer yards. One hundred thirteen of the 384 (29%) identified Native American sites in Chittenden County are found in or adjacent to the potential winter deer yards. This correlation index is not uniform throughout the towns where archaeological site information is available (Table 3). Only four of 63 (6%) sites located in the Town of Colchester are associated with potential deer yards, while in the Town of Williston, 62 of its 83 (75%) sites are associated with potential deer yards. This variability in correlation for towns in Chittenden County is strongly influenced by the uneven distribution of the soils identified as conducive to supporting potential deer yards (Table 4). The Town of Colchester contains seventeen potential deer yards covering only 1,440 acres (0.0060% of town), whereas Williston contains eighteen potential deer yards covering

Table 3.

Town	Total # of Sites	Sites Associated With Potential Deer Yards	
Bolton *	0	- -	- -
Burlington	17	- -	- -
Buel's Gore *	0	- -	- -
Charlotte	19	7	37%
Colchester	63	3	5%
Essex	37	4	11%
Hinesburg	36	15	42%
Huntington *	0	- -	- -
Jerico	3	0	0%
Milton	49	7	14%
Richmond *	0	- -	- -
St. George	2	- -	- -
Shelburne	43	3	7%
South Burlington	22	12	55%
Underhill *	0	- -	- -
Westford	5	0	0%
Williston	83	62	75%
Winooski	5	0	0%

*Towns where no site information is available.

Table 4.

Town	Total Acres in Town*	Acres In Town Covered by Potential Deer Yards	
Bolton	27,276,169	490	0.0017%
Burlington	6,751,360	650	0.0096%
Buel's Gore	3,226,240	0	0
Charlotte	26,433,280	9,685	0.0366%
Colchester	3,656,320	1,440	0.0069%
Essex	24,978,560	3,740	0.0149%
Hinesburg	25,544,320	2,035	0.0079%
Huntington	24,271,360	1,140	0.0049%
Jerico	22,517,120	4,890	0.0217%
Milton	31,105,920	2,110	0.0067%
Richmond	20,460,160	1,370	0.0066%
St. George	2,298,880	0	0
Shelburne	15,637,760	4,780	0.0305%
South Burlington	10,640,000	3,550	0.0033%
Underhill	32,781,440	2,240	0.0068%
Westford	24,975,360	1,690	0.0067%
Williston	19,434,240	5,000	0.0257%
Winooski	944,640	0	0

*Data obtained from 1990 Census.

5,000 acres (0.0257% of town).

Presented earlier was a strong correlation between Native American site locations and seasonal resource-rich environments. Four specific ecological environments in Chittenden County were suggested as conspicuous in their seasonal high biomass and would have afforded Native Americans with a wide range and/or large quantity of exploitable resources. Winter deer yards, like fresh-water marshes and waterfalls, are geographically fixed areas, the location and size of which would have been easily known to Native Americans. Winter deer yards would have provided a concentration of animals within a limited area, increasing the success rate of the hunt. Although the weight and fat content of the deer is optimum in the early to mid fall months, the winter coat of the deer would provide the greatest warmth. The concentration of the deer herd in the yards would have given Native Americans the opportunity to inventory and manage this resource. Healthy male deer normally drop their antlers just prior to yarding, while sick, diseased or weak males will maintain their antlers well into the early spring months (Halls 1978). If the deer herd was observed to be exceeding the carrying capacity of the area, pregnant does could have been selected from the winter yards to restrict population growth.

With the location of the potential winter deer yards specifically defined, the distribution of site components can be reexamined and ascribed a hypothetical resource focus. Over three-quarters (76.5%) of these occupations are located in, or within 500 feet of, one of the five defined ecological environments. Table 5 shows the correlation between Native American occupations and the specific ecological environments.

Hypothesized Procurement Strategies

An examination of the artifact assemblage for the 113 sites associated with the defined potential deer yards in Chittenden County suggests two different general site types: one consisting of few artifacts and artifact classes without clearly definable focused activity areas, and the other consisting of significantly more artifacts and artifact classes, demonstrating one or more focused activity areas. These two general site types are hypothesized to represent (1) single-event, specialized procurement spots, and (2) habitation sites of extended duration.

The fact that a significantly large percentage of the identified Native American archaeological sites are associated with a probable seasonally concentrated resource suggests that these two site types represent two distinct procurement strategies. The single event food procurement spots represent a strategy where an individual or small group go to specific resource areas, extract the resource, and transport the resource to a centralized habitation site. The habitation sites of extended duration represent a strategy where the social units (families or groups of families) locate themselves adjacent to the resource. One of these specific resource areas appears to be the winter deer yard. This suggests that these strategies may both be dependent on the seasonal, optimal availability of the resource.

These two strategies may also represent choices made in response to environmental variabilities influencing the behavior of the resource. In the case of deer, the amount of snow pack during the winter of any given year will vary. During years with deep snow, deer will tend to remain within their yards, even when predators are nearby. During years of moderate to low snow pack, deer might leave a yard if predators are constantly nearby. From

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Falls and Rapids	16	2.8%
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Fresh Water Marshes	136	23.5%
Winter Deer Yards	146	25.2%
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the human perspective, the cost of resource transport back to a habitation site would be higher during years with deep snow, than in years of moderate to low snow pack. The optimum strategy would be to locate the habitation site near the resource if the resource was not affected. If the resource was affected in moderate to low snow pack years and moved, the optimum strategy would be to gather the resource, and transport it to the habitation site, located at a comfortable (as defined by both the prey and the predator) distance from the resource.

Viewing the archaeological site within the context of specific exploitable resources provides a hypothetical explanation for site function, seasonality, and the site's relationship to other sites of the same cultural group (people). The hypotheses presented above can provide the basis for the research designs of site identification studies, intensive site excavations, and for anthropological syntheses concerning Native American culture.

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