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Evidence for Prehistoric Maize Horticulture at the Pine Hill Site, Deerfield, Massachusetts

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EVIDENCE FOR PREHISTORIC MAIZE HORTICULTURE AT THE PINE HILL SITE, DEERFIELD, MASSACHUSETTS

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The degree of reliance on maize horticulture by New England Algonquians during the Late Woodland Period (AD 1000–1600) is a subject of debate among archaeologists in the region. Archaeological evidence from the Pine Hill site (19FR17), Deerfield, Massachusetts, indicates that while maize was apparently stored by native peoples in subterranean pits, it was not necessarily a staple food; there is, in fact, more evidence to suggest that maize was a dietary supplement in the middle Connecticut Valley (Massachusetts portion) during the Late Woodland period. Evidence from the Pine Hill site and other sites underscores the need for attention to diversity in subsistence-settlement economies of Woodland peoples.

Il existe un debate sur l'importance de l'agriculture du maïs dans la vie des Algonquiens de Nouvelle Angleterre durant le Sylvicole supérieur (AD 1000–1600). Données archéologiques du site Pine Hill (19FR17), à Deerfield, Massachusetts, suggèrent que tandis que le maïs était approvisioné par les peuples autochtones dans les fosses souterrains, il ne s'agissait pas un aliment indispensable. En effet, il es plus probable que le maïs a servi comme un aliment complementaire dans la vallée Conneticut (portion Massachusetts) pendant la période Sylvicole supérieur. Les résultats du site Pine Hill et autres soulignent la necessité de concentrer nos investigations dans la diversité économique des peuples du Sylvicole.

INTRODUCTION

In general, prehistoric farming is extremely difficult to detect in New England because of poor preservation conditions for plant remains in general (Dincauze 1981:58). Like most seeds, maize kernels will usually not preserve for very long unless they are charred or deposited in an anaerobic environment. While preservation is a problem in many archaeological contexts, in New England the problem is exacerbated by acidic soils and freeze-thaw weather conditions. Although improved recovery techniques, such as flotation, have become more prevalent in recent years, New England archaeologists still base their interpretations about subsistence on relatively scant evidence. When maize is recovered, direct radiocarbon dates are rarely obtained, most likely because of the expense of accelerator mass spectrometer dating (which is needed for small samples, such as maize kernels). Direct dates on maize are extremely important because they leave no doubt about the association between the maize itself and the radiocarbon age (see Hart 1999a).

In western Massachusetts, the recovery of prehistoric cultigens is particularly rare. However, in the summer of 1995, approximately 200 charred maize kernels and kernel fragments were recovered from a storage or possible food-processing feature at the Pine Hill site (19FR17) in Deerfield, Massachusetts. There are only two other sites in western Massachusetts for which evidence for prehistoric maize has been published: (1) Riverside, Gill (Garman 1991); and (2) Indian Crossing (Mulholland 1988). However, only a few kernels were recorded for each of these sites. There are large maize samples from the Guida Farm site in the Young Collection (Springfield Museum), but the context is unclear (for a discussion of this site see Byers and Rouse 1960). Thus, the maize remains from Pine Hill are unique for the Middle Connecticut Valley (an area defined as the Massachusetts portion of the valley for this study) in that they are plentiful and well-documented *(Figure 1)*.

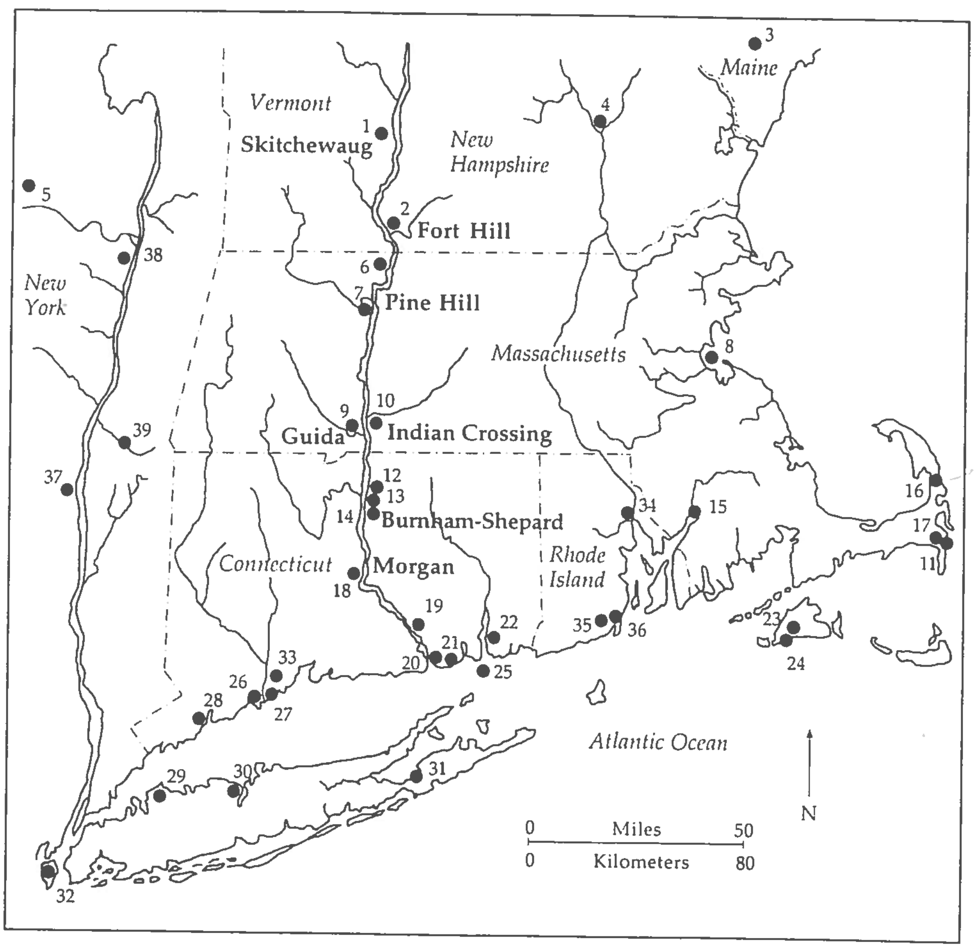

Figure 1. Map of Southern New England, showing the location of archaeological sites with prehistoric cultigens and key sites referred to in the text.

Key to Figure 1. Archaeological sites with prehistoric cultigens in Southern New England.

Site #	Site Name	Citation
1	Skitchewaug	Heckenberger et al. 1992
2	Fort Hill	Thomas 1979
3	Early Fall	Cowie and Petersen 1990
4	Campbell	Bunker p.c. in Bendremer and Dewar 1994
5	Klock	Kuhn and Funk 1994
6	19-FR-329	Garman 1991
7	Pine Hill	Chilton 1996
8	Calf Island, Worlds End, HL-6	Luedtke p.c. in Bendremer and Dewar 1994
9	Guida Farm	Byers and Rouse 1960
10	Indian Crossing	Mulholland 1988
11	Mattaquason Purchase	David Schafer p.c. 1997
12	6-HT-116	Jordan p.c. in Bendremer and Dewar 1994
13	Kasheta	Bendremer et al. 1991
14	Burnham-Shepard	Bendremer and Dewar 1994
15	Gardner's Neck	Bunker p.c. in Bendremer and Dewar 1994
16	19-BN-288	McManamon 1984
17	Malluzo	Dunford p.c. in Bendremer and Dewar 1994
18	Morgan	Lavin 1988a
19	Selden Island	McBride 1984
20	Tubbs	Russell 1946
21	Mago Point	McBride 1984
22	72-31	McBride 1984
23	Hornblower II	Ritchie 1969
24	Lucy Vincent Beach	Chilton and Doucette 1997
25	Barlow Pond, Hawk's Nest	Funk and Pfeiffer 1988
26	Muskrat Hill	Coffin 1940
27	Indian River	Rogers 1943
28	Highland	Wiegand p.c. in Bendremer and Dewar 1994
29	Pleasant Hill	Ceci 1979-80
30	Matinecock Point	Smith 1950
31	Sebonac	Ceci 1979-80
32	Bowman's Brook	Ceci 1979-80
33	294A-25-2, 294A-AF2-1	Cassedy and Webb 1999
34	RI 2050	Handsman 1995, Leveillee 1996
35	RI 1818	Begley and Leveillee 1996
36	RI 110	Leveillee and Harrison 1996
37	Hurley	Funk 1976
38	Dennis	Funk 1976
39	211-1-1	Cassedy and Webb 1999

In this article we provide an archaeological background for the Pine Hill site, describe the methods and results of both archaeobotanical and faunal analysis, and discuss the significance of the presence of prehistoric maize at Pine Hill in light of what is known for the region as a whole.

SITE BACKGROUND

Pine Hill was tested by the University of Massachusetts Archaeological Field School for six field seasons between 1980 and 1997. The site is located on a glacial-lake delta remnant in the Deerfield Valley (Chilton 1990); it lies approximately 150 feet (45.7m) above sea level and overlooks the ancient floodplain of the Deerfield River *(see Figure 1)*. The main site area is approximately 1700 m^2.

While the site is multi-component, it is clear that most of the prehistoric activity dates to the Late Woodland period (ca. AD 1000–1600). This assessment is based on the prevalence of Levanna and Levanna-like projectile points and Late Woodland pottery, as well as the association between Late Woodland artifacts and features *(Figures 2 and 3)*. Twenty-one pit features and approximately 50 scattered postmolds have been identified over the past several field seasons *(Figure 4)*. No clear pattern is evident in the postmolds; they seem to represent small, overlapping wigwams. Two radiocarbon dates on wood charcoal from pit features 17 and 30 were: (1) 655 +/- 165 BP (GX-20581; $d^{13}C$ = -26.2%); and (2) 430 +/- 90 BP (GX-20582; $d^{13}C$ = -26.2%). Calibrated dates for these same samples are (1) AD 1194–1446 (p = 1.00), and (2) AD 1420–1521 (p = .67) and cal AD 1568–1627 (p = .33). Both dates are calibrated at 1 sigma with CALIB 3.0.3 (Stuiver and Reimer 1993).

The overlapping distribution of the pit features and postmolds, the lack of an identifiable midden deposit, and the archaeobotanical analysis described below suggest that the site represents a seasonal encampment where small groups periodically coalesced. Nevertheless, it is one of the few large Late Woodland occupations known for the middle Connecticut Valley.

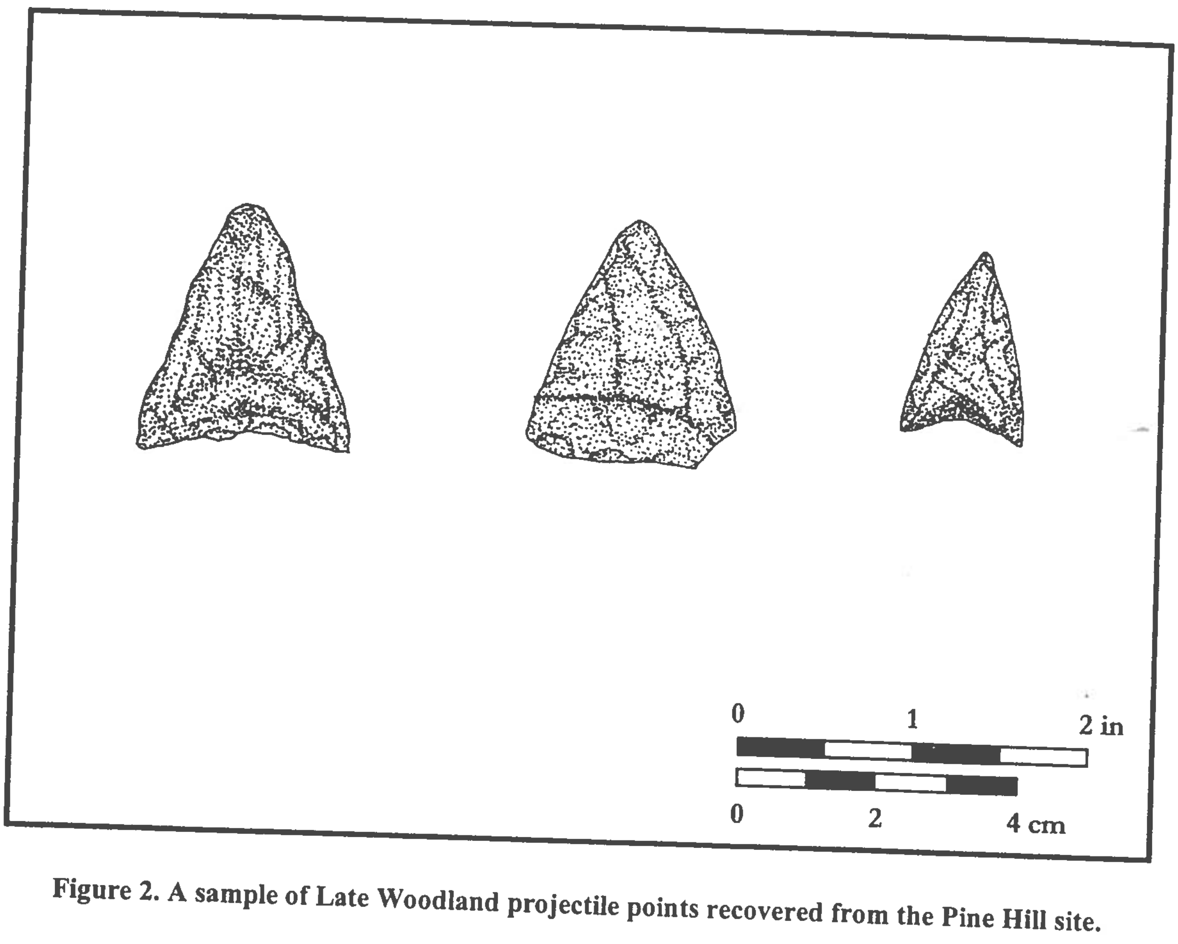

Figure 2. A sample of Late Woodland projectile points recovered from the Pine Hill site.

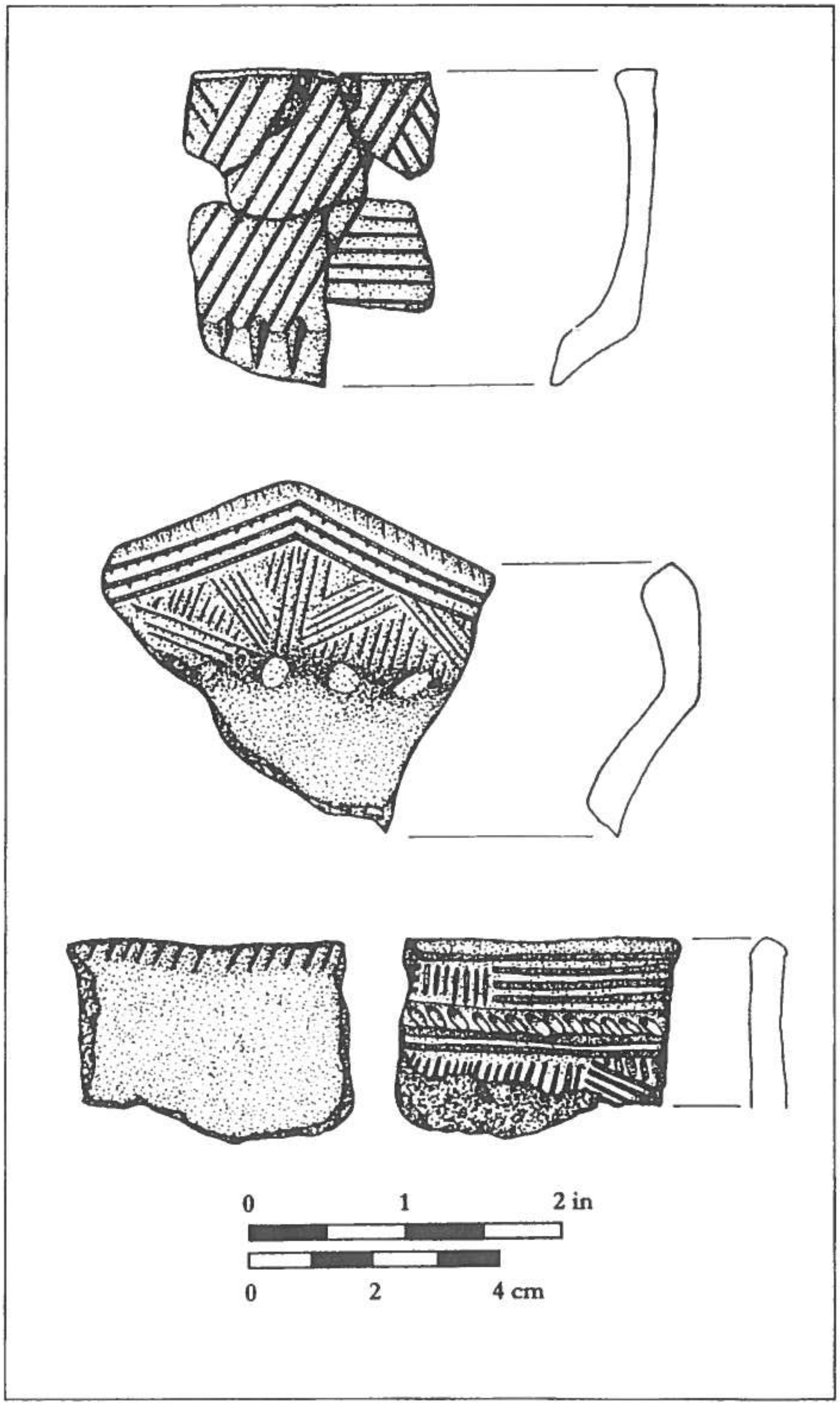

Figure 3. A sample of Late Woodland pottery sherds recovered from the Pine Hill site.

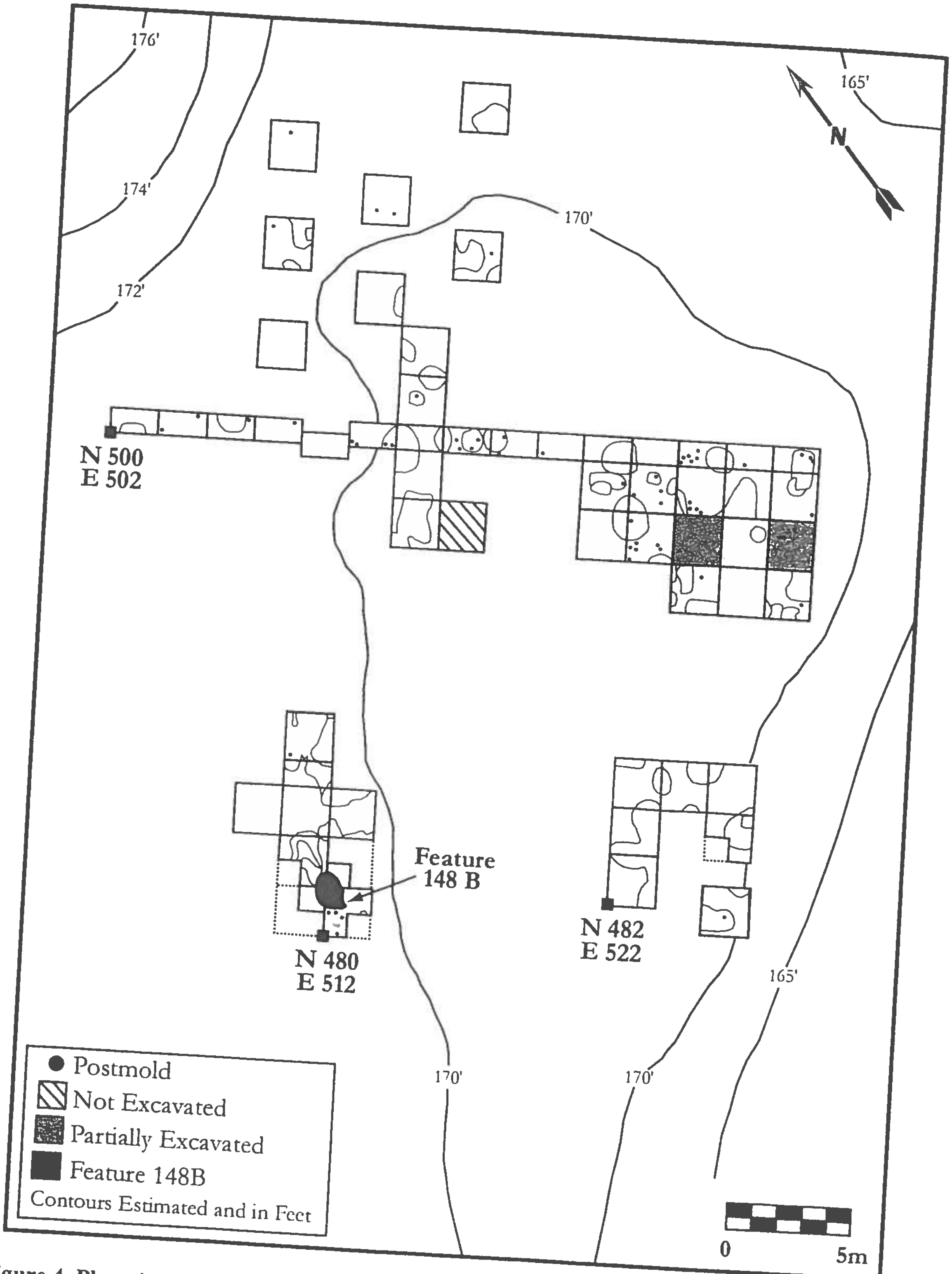

Figure 4. Plan view of the Pine Hill site, showing the location of excavation units and features.

Pine Hill Features

In the summer of 1995, charred maize was recovered from one of the pit features at Pine Hill: Feature 148b. As mentioned previously, 20 other, similar features were identified at the site. Fifteen of these features have been at least partially excavated. The pits averaged one meter in diameter and 1.5 m in depth. Almost all of the pit features contained several distinct lenses of fill—some dark in color and containing concentrations of ash and charcoal, others barely distinguishable from the surrounding subsoil. All fifteen of the excavated pit features were screened using 1/8" mesh. The recovery of charred botanical remains of any kind was extremely rare. Soil from four of these features was floated and analyzed by an archaeobotanist (described below). For each of the four features that received flotation and archaeobotanical analysis, roughly the same volume of soil was floated *(Table 1)*.

Artifacts recovered from pit features included relatively small amounts of aboriginal pottery, lithic tools, debitage, fire-cracked rock, and charred floral and faunal remains. Artifact density within features was low relative to the density of artifacts in the shallow plow zone. Therefore, these features were apparently not primarily refuse pits, but may have been used for short-term storage and/or food processing (see Moeller 1992 for a description of food processing features). One pit feature had evidence of a clay lining at the bottom, but none of the other pit features had evidence for a lining of any kind. Based on soil micromorphology conducted by Michael Volmar (1998) some of the pit features filled in slowly over time, primarily due to slumping and colluviation, while others were intentionally filled in. Volmar's (1998) analysis also indicates that some of the features were re-excavated and filled at least a second time.

Table 1. Flotation Volumes for the Pine Hill Site.

Feature/Unit	Sample Type	Depth (cm)	Sample Volume (l)
17	bulk	23	1.5*
17	bulk	38	1.5*
17	bulk	38-43	1.5*
30	bulk	94-106	1.5*
30	bulk	117-121	1.5*
35	bulk	112-116	1.5
35	bulk	112-116	5.0
148b	bulk	21-22	0.3
148b	bulk	65-70	0.5
148b	bulk	65-70	2.5
148b	bulk	65-70	1.0
N500E522	control	24-28	1.5
N480 E512	column	0-7	1.0
N480 E512	column	7-17	1.5
N480 E512	column	20-30	1.0
N480 E512	column	40-50	1.5
N480 E512	column	80-90	1.5
N480 E512	column	110-120	1.5

*approximate

Feature 148b

Feature 148b was identified in test unit N480 E512 as a large, dark, circular soil stain approximately one meter in diameter *(Figures 5 and 6)*. As with all 2 X 2 m units excavated at the site, this unit was excavated by shovel-skimming the shallow plow zone to expose the surface of the B-horizon. All features at the site were visible at this interface. The feature was first identified and mapped at the base of the plow zone, 20–22 cm below the surface. There was a small scatter of fire-cracked rock and red (oxidized) soil surrounding the feature at this level. On the basis of Volmar's (1998) micromorphological analysis, this soil was not fire-reddened, but rather the result of pedological processes related to the breakdown of inorganic compounds. A flaked and ground celt was recovered from the reddened soil at the top of the feature *(Figure 7)*.

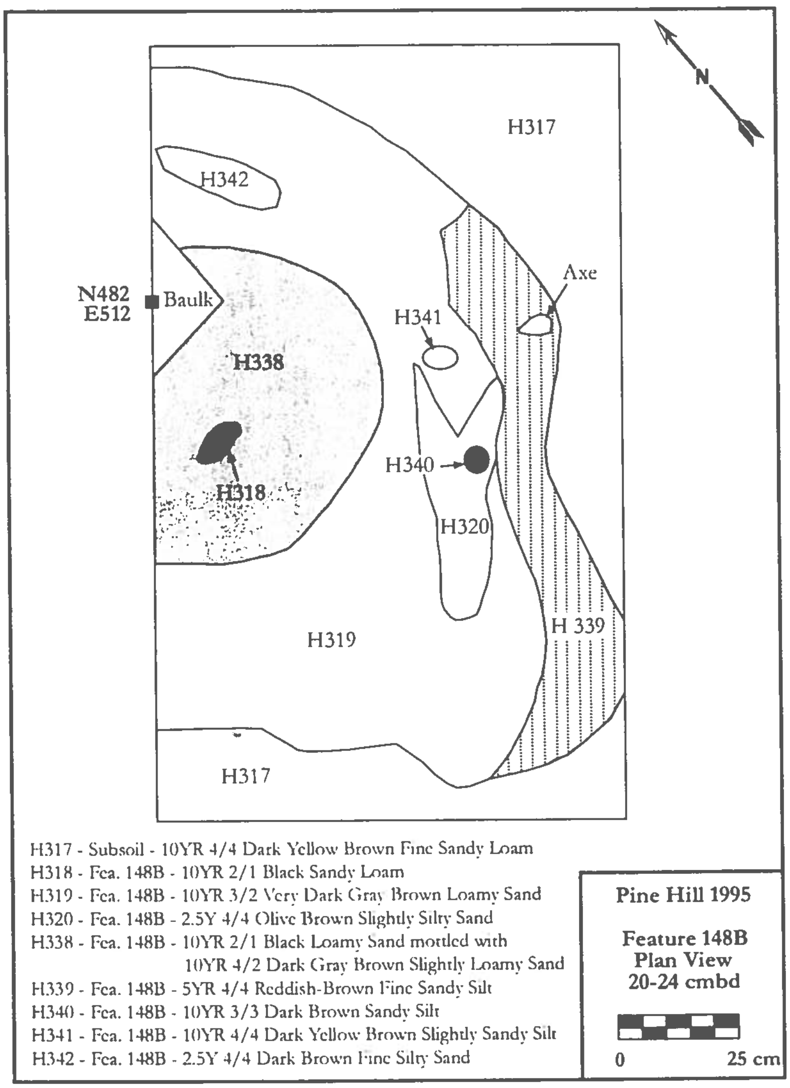

Figure 5. Plan view of Feature 148b, Pine Hill site.

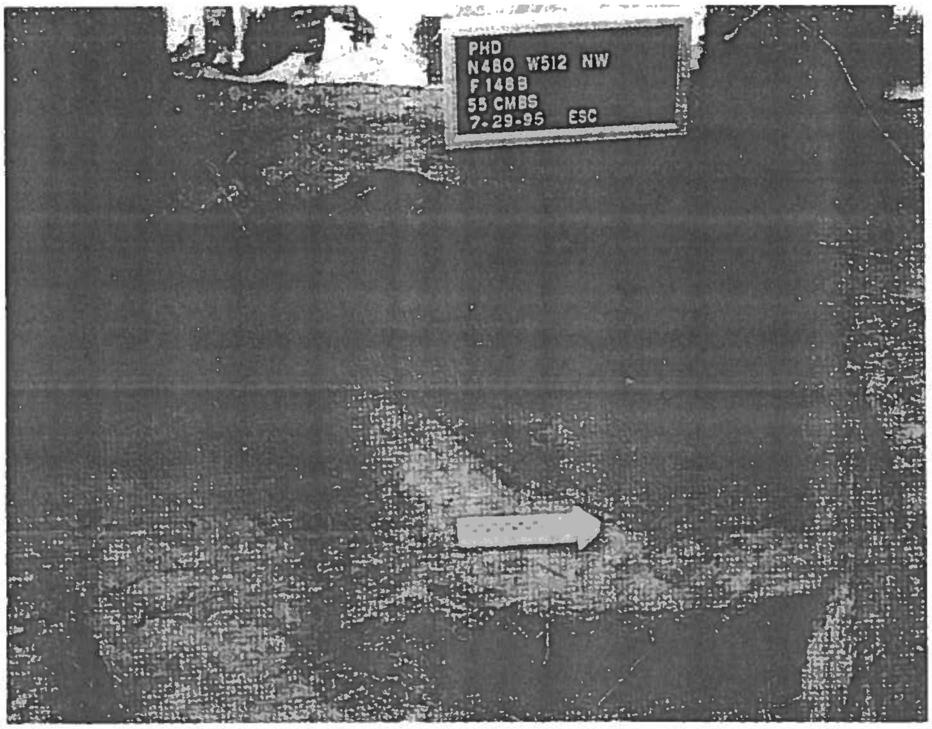

Figure 6. Plan view and partial profile of Feature 148b, 55 cm below surface, Pine Hill site.

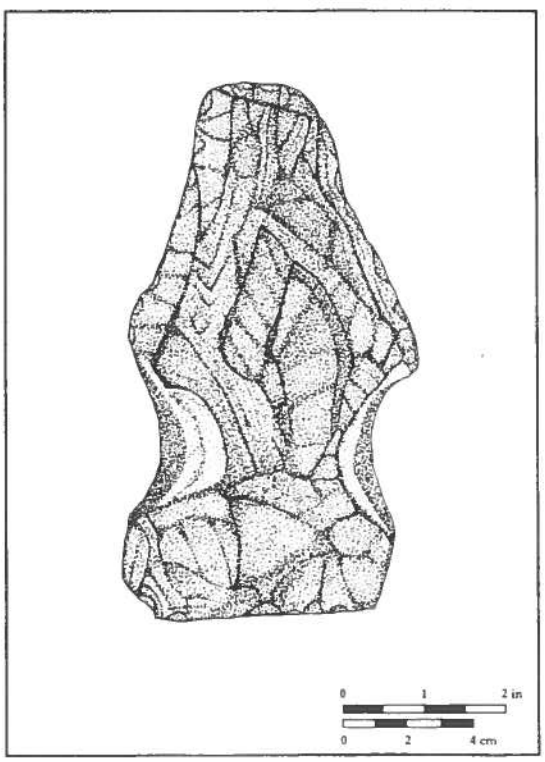

Figure 7. Flaked and ground stone celt, Feature 148b, Pine Hill site.

The feature was quarter-sectioned, and the south-east quarter was excavated using a modified Harris Matrix method (Harris 1989). The bulk of the feature was left intact for future investigation. The feature was excavated by 5 cm arbitrary levels within natural strata; artifacts and soil samples from different strata were kept separate. As with all features, soils were screened with 1/8" mesh. A total of seventeen 5-cm levels were excavated; Feature 148b continued to a depth of 103 cm below surface. Quarter-sectioning allowed profiles of the feature on north-south and east-west axes. The feature was roughly semi-circular in profile, suggesting a cultural, rather than natural, origin *(Figure 8)*.

The first 20–40 cm of the feature contained the greatest quantity of cultural material. Two hundred and seventy-nine flakes of chert, quartz, slate, and other raw materials were recovered. Aside from the celt, two other lithic tools were identified: a rhyolite drill tip and a chert biface. Three small potsherds were encountered in the feature; all three sherds had smooth interior and exterior surfaces. Fire-cracked rock, fire-reddened rock, bone, and plant remains were recovered throughout the feature. Artifact densities decreased between 30–65 cm below surface, increased between 65–70 cm below surface, and then dropped off again. Very few artifacts were recovered below 70 cm.

Maize kernels were encountered from just under the celt (20–24 cm below surface) to the bottom of the feature, approximately 100 cm below surface. Of the 196 maize kernels and fragments recovered from Feature 148b, 182 were identified in situ and fourteen were recovered from flotation. A radiocarbon date for one maize kernel recovered from the feature at 55–60 cm below the surface was 400 +/- 60 BP (GX-21994–AMS; dC^{13} = -8.2%). The 1 sigma calibrated date for this sample is AD 1442–1518 ($p = .65$) and cal AD 1578–1625 ($p = .35$).

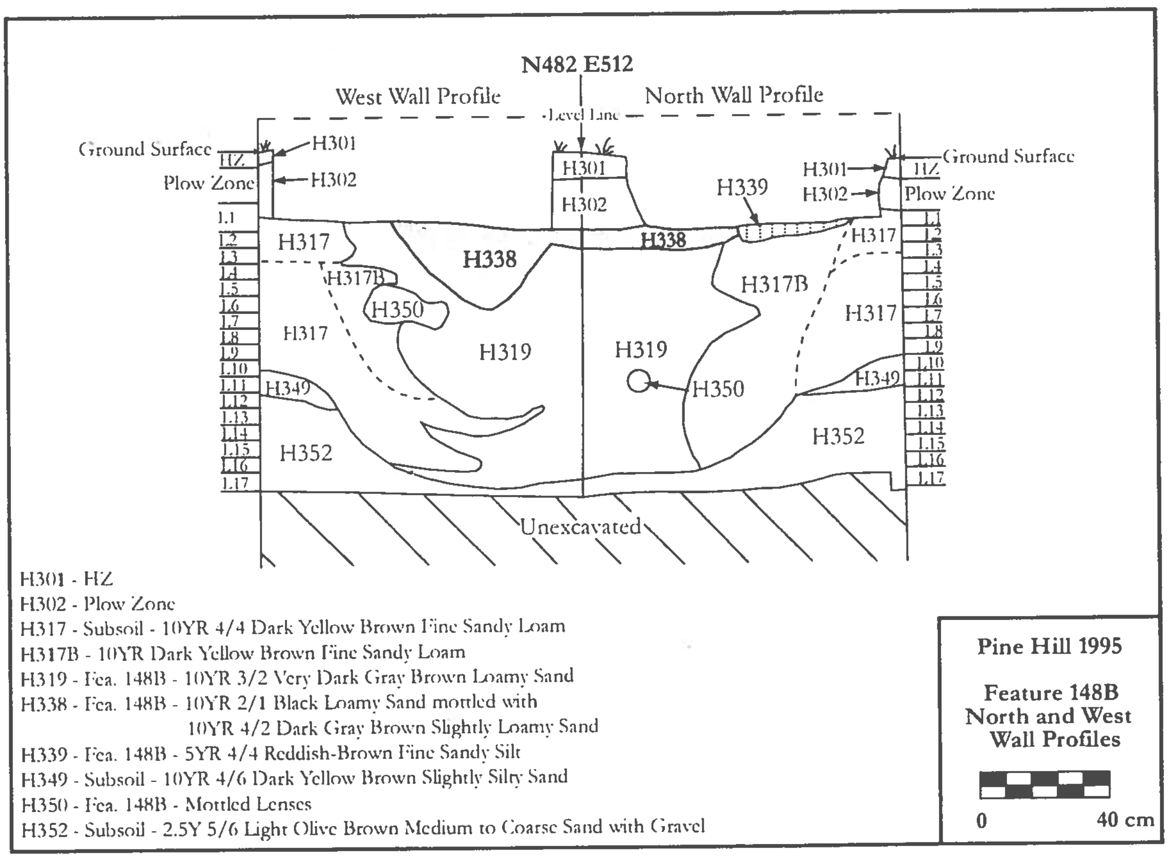

Figure 8. Profile of Feature 148b, Pine Hill site.

Previous Archaeobotanical Analysis for the Pine Hill Site

Prior to the discovery of maize in Feature 148b at Pine Hill in 1995, seven flotation samples from three other features were analyzed by Tonya Largy (1995). These features, 17, 30, and 35, were excavated in 1991 and contained ceramics and radiocarbon dates associated with the Late Woodland period (radiocarbon dates for two of these features are reported above).

A few fragments of butternut *(Juglans cinera)* shell were recovered from these pit features, as well as a number of charred bush-honeysuckle seeds *(Diervilla lonicera; Table 2)*. Several tree taxa were also identified from charred wood samples; these include ash, elm, oak, hickory, beech, alder, willow family (willow or aspen/poplar), and, possibly, flowering dogwood. One conifer sample represents either pine, spruce, or larch/tamarack. The composition of wood taxa suggests some activity involving pioneer species (willow family) and wetland shrub species (alder). Largy (1995) has suggested that the presence of charred bush-honeysuckle seeds, as well as the presence of the pioneer tree species listed above, indicates a general and possibly intentional burning of the area sometime in the late spring or early summer. The area may have been cleared and burned for either settlement or horticultural purposes. New England peoples apparently practiced some wildlife management through the selective burning of the forest understory (Johnson 1993; see also Day 1954; Martin 1973; Morton 2000 [1637]: 172; Patterson and Sassaman 1988; Wood 1977 [1634]). According to Cronon (1983: 50–51), this selective burning created what ecologists refer to as "edge habitat," which promoted the diverse, mosaic quality of the New England ecosystem. The effect of this burning was the creation of ideal habitats for a wide variety of plants and animals: beaver, deer, elk, hare, turkey, edible grasses, and many different kinds of edible berries (see also Whitney 1994).

Table 2. Plant Material Recovered by Flotation from Features 17, 30, and 35, Pine Hill Site.

Feature	Depth (cm.)	Fraction	Count	Wt. (g)	Common name	Taxonomic Name
17	23	light	1	0.05	unid. hardwood dicot	
17	23	light	1	<0.01	grass family	*Graminae*
17	23	light .	1	<0.01	sedge family	*Cyperaceae*
17	23	light	1	<0.01	lambsquarters	*Chenopodium* sp.
17	38	light	1	<0.01	unid. immature fruit	
17	38	light	1	<0.01	unid.plant	
17	38	light	2	<0.01	conifer, unid. bark chip	
17	38	light	1	0.01	diffuse-porous	
17	38	light	1	0.02	conifer	*Coniferales RC+*
17	38	light	1	0.04	oak	*Quercussp.*
17	38	light	1	<0.01	unid. seed coat frag	
17	38	light	1	<0.01	unid. plant	
17	38-43	light	1	<0.01	unid. leaf bud	
17	38-43	light	1	0.02	willow family	*Salicaceae*
17	38-43	light	1	0.14	oak	*Quercussp.*
17	38-43	light	1	<0.01	conifer, unid. bark chip	
17	38-43	light	5	<0.01	blueberry	*Vaccinium* sp.
17	38-43	light	1	<0.01	rasp/blackberry	*Rubus*, sp.
30	94-106	light	1	0.02	beech family	*Fagaceae*
30	94-106	light	1	0.02	willow family	*Salicaceae*
30	94-106	light	1	0.01	conifer, unid. bark chip	
30	117-121	heavy	1	0.15	butternut	*Juglans cinerea*
30	117-121	light	1	0.15	willow family	*Salicaceae*
30	117-121	light	1	0.07	alder	*Alnus*, sp
30	117-121	light	1	0.02	oak	*Quercus* sp.
30	117-121	light	1	0.22	beech	*Fagus grandifolia*
30	117-121	light	1	0.43	elm	*Ulmus*
35	112-116	heavy	1	0.11	unid. tiny wood frags	
35	112-116	light	1	0.01	unid. root	
35	112-116	light	1	<0.01	unid.	
35	112-116	light	1	0.11	unid. wood and bark	
35	112-116	light	1	0.04	diffuse-porous	
35	112-116	light	1	0.01	black ash?	cf. *Fraxinus*, sp.
35	112-116	light	2	0.02	red oak group	*Quercus Erythrobalanus*
35	112-116	light	1	0.02	oak	*Quercus* sp.
35	112-116	light	2	<0.01	conifer, unid. bark chip	
35	112-116	light	1	0.09	unid. hardwood dicot	
35	112-116	light	2	0.02	diffuse-porous	
35	112-116	light	1	<0.01	oak	*Quercus* sp.
35	112-116	light	1	0.03	flowering dogwood	*Cornus florida*
35	112-116	heavy	1	<0.01	unid. plant (stem?)	
35	112-116	heavy	5	<0.01	unid. wood	
35	112-116	heavy	1	<0.01	hickory	*Carya* sp.
35	112-116	heavy	1	<0.01	sumac	*Rhus* sp.

ANALYTICAL METHODS

The remainder of this paper focuses on the remains from Feature 148b. Largy (1998) analyzed botanical and faunal materials that were recovered from this feature during excavation and subsequent flotation of bulk soil samples. Eighty-two samples were analyzed from Feature 148b: these include 69 excavated samples *(Table 3)*, eight radiocarbon samples, and five flotation samples *(Table 4)*. A control column sample was excavated from the soil profile adjacent to Feature 148b; six bags of soils from this column sample were processed by flotation and analyzed as well *(see Table 4)*.

Flotation was conducted under the direction of Marina Mozzi (Archaeological Research Specialists, Meriden, Connecticut). One-hundred percent of the flotation samples from Feature 148b was analyzed. Fifty percent (total volume) of the light fractions from control samples from stratum one and two was analyzed, since these strata contained a large amount of uncharred plant remains in varying stages of decomposition. Due to time and budgetary constraints, a random sample of only twelve excavated wood samples was analyzed. Many of these wood fragments were too small to identify. For those that were identified, the taxa were consistent throughout the random samples.

The faunal assemblage analyzed from Pine Hill consisted of sixteen samples of mostly calcined bone. Several more bone fragments were found with the excavated plant samples. In general, preservation of bone at the site was extremely poor.

All samples were examined using a stereomicroscope. Magnification ranged from 5 to 280 X. All materials were weighed to the nearest 0.01 g using a balance scale. Identifications were made to the nearest taxonomic level possible. Taxonomic nomenclature for the plants follows Gray's Manual of Botany (Fernald 1950).

ARCHAEOBOTANICAL RESULTS

Maize

A total of 83 individual kernels, 110 kernel fragments, two maize embryos, and one possible kernel were recovered from Feature 148b *(Table 5)*. Most (80 kernels, 99 kernel fragments, one embryo, and one possible kernel) were collected in the field. Three additional kernels and eleven fragments were found in the flotation samples. No maize was recovered from the column samples.

Maize kernels were distributed throughout the upper levels of Feature 148b. However, the majority of the kernels (65%; 67 kernels and 105 fragments) were recovered from 50–65 cm below surface.

No maize cobs, cupules, glumes or stem fragments were present, perhaps due to differential preservation and exposure to fire, rather than being an indication of horticultural practices (Largy et al. 1999:78). There are no data recovered from Pine Hill thus far to suggest that maize was being processed on site.

Charred Nutshell

A total of 453 (9.03 g) nutshell fragments were identified from all excavated samples *(Table 3)*. Fifty-six percent by weight was recovered from Feature 148b. Of this, 52% was recovered by excavation, 3% from flotation, and 1% from a radiocarbon sample. There was a concentration (32% by weight) of butternut shell between 30–35 cm below surface, but, in general, it was found throughout the feature.

The majority of nutshell is butternut *(Juglans cinera)*, except for two (0.04 g) fragments of hazelnut (*Corylus* sp.). The presence and quantity of butternut shells both within Feature 148b and the column sample strongly suggest that butternut trees were growing near or on Pine Hill. Butternut trees grow in well-drained soils of bottomlands and floodplains in mixed deciduous forests (Elias 1980:268). Nuts ripen and fall off the tree in autumn and remain available throughout the fall, unless eaten by animals.

Table 3. Excavated Plant Taxa and Other Materials from Feature 148b, Pine Hill Site.

Harris	Depth (cm.)	Count	Wt. (g)	Common Name	Taxonomic Name
317	20-25	13	0.49	butternut	*Juglans cinerea*
317	20-25	6	0.19	unidentifiable wood	
317	25-30	16	0.59	butternut	*Juglans cinerea*
317	25-30	7	0.39	unid. wood	
317	30-35	46	1.62	butternut	*Juglans cinerea*
317	30-35	1	0.06	maize	*Zea mays* (kernel)
317	30-35	2	0.07	unid. rhizome	
317	30-35	1	0.42	unid. wood	
317	35-40	3	0.17	butternut	*Juglans cinerea*
317	35-40	1	0.04	unid. wood	
317	40-45	1	0.04	hazelnut	*Corylus* sp.
317	40-45	1	0.04	unid. stem	
317	60-65	1	0.01	conifer, unid. bark chip	
317	60-65	3	0.02	maize	*Zea mays* (kernel)
317	60-65	7	0.07	maize	*Zea mays* (kernel frags.)
317	60-65	1	0.02	oak	*Quercus* sp.
317	60-65	1	0.08	oak	*Quercus* sp. (stressed)
317	60-65	1	0.05	pine family	*Pinaceae RC+*
317	60-65	1	0.38	unid. wood	
317	70-75	1	0.01	unid. plant	
317	70-75	1	0.06	unid. wood	
317	75-80	1	0.27	unid. wood	
317	85-90	1	0.01	conifer, unid. bark chip	
317	85-90	1	0.36	unid. wood	
319	20-25	2	0.11	butternut	*Juglans cinerea*
319	20-25	1	0.25	unid. wood/rhizome	
319	25-30	1	0.02	unid. plant	
319	25-30	1	0.31	unid. wood	
319	30-35	4	0.23	butternut	*Juglans cinerea*
319	30-35	1	0.44	unid. wood	
319	35-40	1	0.05	unid. wood	
319	40-45	2	0.03	conifer, unid. bark chip	
319	40-45	1	0.92	unid. wood	
319	45-50	2	0.02	conifer, unid. bark chip	
319	45-50	23	0.78	maize	*Zea mays* (kernels, kernel frags)
319	45-50	3	0.14	maize?	*Zea mays* (carbohydrate?)
319	45-50	1	0.17	oak	*Quercus* sp.
319	45-50	1	0.1	oak (red oak group)	*Quercus* sp.
319	45-50	1	0.23	pine family	*Pinaceae RC+*
319	45-50	1	0.02	unid. stressed dicot	
319	45-50	1	0.83	unid. wood	
319	50-55	1	0.01	conifer, unid. bark chip	
319	50-55	10	0.47	maize	*Zea mays* (kernels, kernel frags)
319	50-55	1	1.05	unid. wood	
319	55-60	1	0.03	maize	*Zea mays* (kernel used for C-14)
319	55-60	1	0.3	maize	*Zea mays* (kernel used for N-15)
319	55-60	49	2.92	maize	*Zea mays* (kernels, kernel frags)
319	55-60	1	0.05	oak	*Quercus* sp.
319	55-60	1	0.53	pine family	*Pinaceae RC+*
319	55-60	1	0.43	unid. wood	
319	60-65	44	1.15	maize	*Zea mays* (kernels, kernel frags)
319	60-65	1	3.8	unid. wood	
319	65-70	1	0.05	oak	*Quercus* sp.
319	65-70	4	0.1	pine family	*Pinaceae* (stressed)
319	65-70	3	0.13	pine family	*Pinaceae*

319	65-70	1	1.1	unid. wood	
319	70-75	5	0.02	conifer, unid. bark chip	
319	70-75	1	0.01	hazelnut	*Corylus* sp.
319	70-75	2	0.01	unid. (maize?)	
319	70-75	1	4.36	unid. coniferales & dicot*	
319	75-80	3	0.02	conifer, unid. bark chip	
319	75-80	1	1.67	unid. wood	
319	80-85	1	0.05	butternut	*Juglans cinerea*
319	80-85	5	0.04	conifer, unid. bark chip	
319	80-85	1	0.01	monocot, unid. rhizome	
319	80-85	1	2.68	unid. wood	
319	85-90	2	0.02	conifer, unid. bark chip	
319	85-90	1	4.41	unid. wood	
319	90-95	1	0.04	ash	*Fraxinus* sp.
319	90-95	1	0.08	conifer, unid. bark chip	
319	90-95	1	0.04	dicot (stressed)	
319	90-95	1	0.08	oak	*Quercus* sp.
319	90-95	1	0.66	pine family	*Pinaceae RC+*
319	90-95	1	0.01	unid. plant	
319	90-95	1	<0.01	unid. stem?	
319	90-95	1	3.06	unid. wood	
319	95-100	11	0.1	conifer, unid. bark chip	
319	95-100	2	0.02	hard pine, unid. cone scale tips	
319	95-100	2	0.02	monocot, unid. rhizome	
319	95-100	1	0.02	oak	*Quercus* sp.
319	95-100	2	0.09	unid. plant	
319	95-100	8	0.28	unid. rhizome	
319	95-100	1	11.15	unid. wood	
319	100-105	1	0.73	unid. wood	
320	20-25	2	0.15	butternut	*Juglans cinerea*
320	20-25	1	0.015	unid. wood	
320	20-25	1	0.03	unidentified	
338	20-25	1	0.12	unid. wood	
338	30-35	3	<0.01	conifer, unid. bark chip	
338	30-35	1	0.06	maize	*Zea mays* (kernel?)
338	30-35	1	0.01	oak	*Quercus* sp.
338	30-35	1	0.06	pine family	*Pinaceae*
338	30-35	1	0.1	unid. wood	
338	35-40	1	1.01	unid. wood	
338	40-45	1	0.11	pitch? pine	*P. rigida?*
338	40-45	1	0.65	unid. wood	
338	50-55	12	0.75	maize	*Zea mays* (kernels, kernel frags)
338	50-55	1	0.72	unid. wood	
338	55-60	1	0.02	maize	*Zea mays* (kernel)
338	55-60	1	0.38	oak	*Quercus* sp.
338	55-60	1	0.12	pine family	*Pinaceae RC+*
338	60-65	1	0.55	unid. wood	
339	20-25	5	0.32	butternut	*Juglans cinerea*
339	20-25	7	0.13	maize	*Zea mays* (kernel, kernel frags., embryo)
339	20-25	1	0.07	unid. wood	
339	25-30	1	0.02	butternut	*Juglans cinerea*
339	25-30	7	0.1	maize	*Zea mays* (kernels, kernel frags)
339	25-30	1	0.03	unid. wood	
349	85-90	3	0.05	unid. rhizome	
349	85-90	1	0.87	unid. wood	
350	50-55	7	0.02	maize	*Zea mays* (kernel frags.)
350	50-55	1	0.2	unid. wood	
350	60-65	1	0.27	unid. wood	
350	65-70	1	0.08	butternut	*Juglans cinerea*
350	65-70	1	0.4	unid.	

350	65-70	1	0.01	unid. (maize?)	
350	65-70	1	0.02	unid. wood	
350	70-75	1	0.01	unid. plant	
350	70-75	1	0.24	unid. wood	
350	75-80	1	0.17	unid. wood	
350		1	0.01	calcined bone	
351	75-80	7	0.51	butternut	*Juglans cinerea*
351	75-80	1	0.62	unid. wood	
353	95-100	3	0.03	conifer, unid. bark chip	
353	95-100	1	0.02	dicot, unid. twig	
353	95-100	1	0.03	maize	*Zea mays* (kernel frags.)
353	95-100	1	0.02	monocot, unid. rhizome	
353	95-100	9	0.02	rhizome/stem	
353	95-100	1	0.02	unid. plant	
353	95-100	7	0.14	unid. rhizome (base), frags.	
353	95-100	2	0.06	unid. stem/rhizome	
353	95-100	2	0.02	unid. twig/stem	
353	95-100	2	2.6	unid. wood	
353	100-105	1	0.01	conifer, unid. bark chip	
353	100-105	1	0.12	hickory	*Carya* sp.
353	100-105	1	0.05	unid. wood	
317b	70-75	2	0.1	butternut	*Juglans cinerea*
317b	70-75	1	0.2	unid. wood	
317b	80-85	1	0.23	butternut	*Juglans cinerea*
317b	80-85	1	0.24	unid. wood	
floor scrape	65-70	1	0.1	unid. wood	
floor scrape	75-80	1	0.32	unid. wood	
floor scrape	80-85	1	0.4	unid. wood/bark	
floor scrape	90-95	1	0.17	unid. wood	
wall scrape		4	0.08	maize	*Zea mays* (kernels, kernel frags)

* Coniferales is the order which includes two families (Pineacea and Taxaceae). Dicot is short for dicotyledon which, in New England, included all the hardwoods.

Table 4. All Material Recovered by Flotation from Feature 148b, Pine Hill Site.

Harris	Depth (cm.)	Fraction	Count	Wt. (g)	Common name	Taxonomic Name
319	65-70	heavy	27	0.24	butternut	*Juglans cinerea*
319	65-70	heavy	2	0.01	unid. nutshell	
319	65-70	heavy	2	<0.01	unid. nutshell?	
319	65-70	heavy	4	0.01	unid. plant	
319	65-70	heavy	1	<0.01	unid. plant, stem?	
319	65-70	heavy	1	0.03	unid. rhizome	
319	65-70	light	1	<0.01	birch	*Betula* sp.
319	65-70	light	1	<0.01	bone?	
319	65-70	light	2	0.03	conifer	*Coniferales*
319	65-70	light	16	0.08	conifer, unid. bark chips	
319	65-70	light	1	<0.01	copperleaf	*Acalypha* sp.
319	65-70	light	1	<0.01	domesticated pepper	*Capsicum annuum*
319	65-70	light	1	<0.01	grass family, unid. rachis	
319	65-70	light	2	<0.01	loosestrife	*Lysimachia* sp.
319	65-70	light	10	0.04	maize	*Zea Mays* (kernel frags.)
319	65-70	light	3	0.07	maize	*Zea Mays* (kernels)
319	65-70	light	1	<0.01	maize	*Zea Mays* (kernel frag.?)
319	65-70	light	1	<0.01	nightshade	*Solanum* sp.
319	65-70	light	1	0.07	pine family	*Pinaceae* RC+
319	65-70	light	3	0.02	pine family	*Pinaceae*
319	65-70	light	1	<0.01	pitch pine	*P. rigida* (needle)
319	65-70	light	2	0.01	unid. nutshell	
319	65-70	light	5	<0.01	unid. plant	
319	65-70	light	2	<0.01	unid. seed	
319	65-70	light	1	<0.01	unid. stem	
319	65-70	light	1	<0.01	white pine	*P. strobus* (needle)
339	20-25	heavy	4	<0.01	unid. nutshell	
339	20-25	light	2	<0.01	grass family	*Gramineae*
339	20-25	light	2	<0.01	white pine	*P. strobus* (needle)

Table 5. Charred Seed, Nut, and Maize Taxa from Pine Hill

NUT	EXCAVATED		COL. FLOT.		FEA. FLOT.		C-14		TOTAL	
TAXON	CT.	WT.	CT.	WT.	CT.	WT.	CT.	WT.	CT.	WT.
Butternut	104	4.67	308	3.98	27	0.24	1	0.05	440	8.94
Hazelnut	2	0.05					1	0.02	3	0.07
Nutshell					10	0.02			10	0.02
TOTAL	**106**	**4.72**	**308**	**3.98**	**37**	**0.26**	**2**	**0.07**	**453**	**9.03**

MAIZE	EXCAVATED		COL. FLOT.		FEA. FLOT.		C-14		TOTAL	
PART	CT.	WT.	CT.	WT.	CT.	WT.	CT.	WT.	CT.	WT.
Kernel	79	4.87			3	0.07	1	0.12	83	5.06
Frags.	99	1.78			11	0.04			110	1.82
Embryo	1	0.01					1	0.01	2	0.02
Kernel?	1	0.01							1	0.06
TOTAL	**180**	**6.67**			**14**	**0.11**	**2**	**0.13**	**196**	**6.96**

SEED	EXCAVATED		COL. FLOT.		FEA. FLOT.		C-14		TOTAL	
TAXON	CT.	WT.	CT.	WT.	CT.	WT.	CT.	WT.	CT.	WT.
Rubus			1						1	
Solanum					1				1	
Betula					1				1	
Unid.					1				1	
TOTAL			**1**		**3**				**4**	

Aside from their food value, there are documented medicinal uses of butternut among northeastern native groups. Both the Micmac and Iroquois used the bark as a cathartic while Moerman (1986:239) describes the use of various parts of the tree by the Iroquois to treat a variety of medical conditions. Other uses for butternut among the Iroquois include mixing butternut oil with bear grease to deter mosquitoes (Moerman 1998:280).

Rhizomes

Rhizomes (underground stems) are present in several levels of Feature 148b *(Table 4)*. The majority, however, were recovered from 95–105 cm below surface—at the very bottom of the pit feature. Largy (1998) identified four fragments as monocotyledons based on the arrangement of vascular bundles. The other rhizomes are either poorly preserved or they require higher magnification to classify their vascular tissue. Pine Hill rhizomes identified as monocots are not likely to be roots of maize plants because of their small size; they may be either grass *(Gramineae)* or sedge *(Cyperaceae)*. Rhizomes similar to the Pine Hill specimens were identified from a burial feature at the Millbury III site, a Late Archaic (ca. 3000 BP) cremation cemetery site in south-central Massachusetts (Largy 1994). Charred rhizomes have been found occasionally in other archaeological contexts, but are difficult to identify.

The concentration of charred rhizomes in the lowest levels of the feature suggests that they were not an accidental inclusion. Grasses and sedges had ritual and utilitarian uses, and were also possible food sources. The ethnohistoric literature for New England does not mention native use of the seeds of either taxa for food. However, wild grasses were important in the food economy of midwestern regions of North America (Ford 1985:349). No charred grass seed was recovered from Pine Hill, but one charred rachis (grass seed stalk) was recovered by flotation from 65–70 cm below surface.

Grass had other uses among northeastern native peoples. Numerous charred stems of *Andropogon gerardii* were recovered from a storage pit feature at the Burnham Shepard site, a Late Woodland period site located in the lower Connecticut Valley (Bendremer et al. 1991). In this case, the researchers interpreted the presence of grass stems as a lining for a storage pit (presumably for the storage of maize). The use of grass for lining a storage pit is also reported by Heckenberger et al. (1992) for the Skitchewaug Site. The presence of grass may also indicate a ritual function. One species, *Hierochloe derata* (sweet grass), was used in rituals by various North American groups. In the northeastern United States, the Iroquois, Malecite, and Micmac used it as a fiber plant, primarily to make baskets (Moerman 1998: 266).

Charred Seeds

Two taxa of charred seeds were identified in flotation samples from Feature 148b: nightshade (*Solanum* sp.) and birch (*Betula* sp.). Nightshade is most often found in open, disturbed soils and in midden deposits. This species begins to flower in May, and the fleshy fruits are available from early to mid summer into fall.

Birch grows in a variety of habitats, from rich upland woods to open, cleared fields. Charring has removed the fragile "wings" from this seed, making more precise identification impossible. Most species of birch produce seeds in early to mid summer (Elias 1980).

Nightshade and birch are among those plants that might be found in disturbed soils near a campsite. They cannot necessarily be interpreted as subsistence resources even though birch sap, bark, and wood were used by native peoples, and the fruit of some nightshade species are edible (Fernald and Kinsey 1958:334–35).

ANIMAL BONE FROM FEATURE 148B

Sixteen samples of calcined bone were recovered from Feature 148b. Seventy-eight percent were identified as mammal *(Table 3)*. The remaining twenty-two percent were not positively identified. No fish or reptile bones were identified in this assemblage. Only one bone could be identified to the genus level: a left distal fibula of a gray squirrel *(Sciurus carolinensis)*. Other small mammals are represented by thirteen (1.45 g) fragments.

The only other bone to be positively identified from Pine Hill is a large fragment of a moose tibia, which was recovered from the top of another pit feature in 1991 (Feature 34, 37 cmbs; the bone was identified by Donald Crisman). Most of the other bone fragments from the site were too small or degraded to be identified.

SEASONALITY

Interpretation of site seasonality is a complex process. Usually it is based on the presence of certain species of plants and animals. However, the storage of dried berries, parched maize kernels, and smoked or dried meat and fish for later consumption must be considered. Also, not all plant and animal remains that ended up in the campfire were food remains.

Despite these cautions, data from Feature 148b provide overwhelming evidence for an early summer through fall occupation, assuming all plant remains such as charred seeds, nutshells, and maize kernels were deposited in the feature shortly after collection and processing. Since maize and nutshell are concentrated mainly in the upper half of the feature, it is possible that the feature was used beginning in the spring and then gradually filled up throughout the summer.

INTERPRETATIONS: PINE HILL MAIZE IN CONTEXT

It is clear from the contents of Feature 148b at Pine Hill that maize was a part of the subsistence base of the Native American inhabitants of the site during the latter part of the Late Woodland period. Does this mean that maize was a staple for the prehistoric inhabitants of this site? In other words, was maize necessary for the survival and wellness of the Pine Hill community?

Most archaeologists in New England agree that maize was a relatively minor constituent of the diet of coastal peoples during the Late Woodland period (Bernstein 1999; Ceci 1979–80; Little and Schoeninger 1995). While there is clear evidence for the presence of maize horticulture in the interior, especially in the lower Connecticut Valley (Connecticut portion; see Bendremer 1999; Lavin 1988a, 1988b), the degree of reliance on maize is much debated (cf. Bendremer 1999; Chilton 1999a). The senior author has discussed the "maize debate" in detail elsewhere (Chilton 1999a). Thus, we include only a brief summary here.

Several archaeologists emphasize continuity with Middle Woodland subsistence at the beginning of the Late Woodland period and suggest that maize was a dietary supplement and not a staple (see Dincauze 1990; McBride and Dewar 1987). However, Bendremer and Dewar (1994:391) suggest that intensive horticulture in the New England interior is indicated by the presence of: (1) more than one type of cultigen at inland sites in Connecticut; (2) storage pits, and; (3) "substantial amounts" of horticultural remains (although they recognize that the large quantity of maize found may, in part, be a sampling effect). They define "substantial amounts" as more than 1500 kernels at the Burnham-Shepard site and more than one hundred kernels at the Morgan site (see Lavin 1988a). Likewise, Lavin (1988a) reports "numerous maize kernels from virtually all of the features" at the Morgan Site, although precise numbers are not given. On this basis she suggests that maize was a "major food source," while acknowledging that it was likely part of a broad spectrum hunting and foraging base (Lavin 1988a:18). Similarly, Heckenberger et al. (1992) conclude that maize is an "important dietary constituent" by the early Late Woodland period at the Skitchewaug site in southeastern Vermont. They base this interpretation on the presence of maize in all seven storage pit features excavated at the site, even though these features contained far larger quantities of charred nutshells and seeds.

At the heart of the maize debate is an assumption by many that there is a correlation between the amount of maize or the diversity of cultigens preserved on a archaeological site and the importance of these cultigens to the prehistoric inhabitants. However, because the preservation of cultigens is so rare and uneven in New England, we simply cannot use the quantity or diversity of cultigens to argue for their relative importance (Chilton 1999a)

An important factor in the maize debate is the misapplication of archaeological theory. As John Hart (1999b) discusses, archaeologists still largely adhere to "natural state models" in which "all members of a type or kind are expected to reflect the natural state." It is assumed that the natural state of maize use is intensive agriculture, such that once maize is adopted it becomes the center of a focal economy (Hart 1999b). However, maize agriculture does not have a natural state because it is shaped by the dynamic and complex relationships between plants and human populations (Hart 1999b). Thus, the degree of reliance on maize can not be determined simply on the basis of its presence on archaeological sites. Instead, the presence of maize needs to be interpreted within the broader cultural context, which includes—but is not limited to—the full range of subsistence activities, settlement practices, and other technical systems (e.g., ceramics).

So, what is the evidence for maize specialization in the middle Connecticut Valley? As discussed above, the evidence from Pine Hill indicates that the site represents a seasonal encampment where small groups periodically converged, primarily during the summer and fall. Is it possible that Pine Hill is a small, aberrant site in the archaeological record for the middle Connecticut Valley? Is it simply a task-specific fall hunting camp—an outlier to a more sedentary village nearby?

Pine Hill is one of the largest Late Woodland occupations known for the middle Connecticut Valley. For nearly two decades, the middle Connecticut Valley has been the focus of archaeological investigations conducted by the University of Massachusetts-Amherst Archaeological Field School. For most of that time we conducted reconnaissance specifically aimed at discovering Late Woodland and Contact period sites. While it is certainly possible that large, Late Woodland villages in the middle Connecticut Valley have not yet been found due to historic development, digging by amateurs, and geomorphological processes (Hasenstab 1999), until or unless we find direct evidence of such villages we must base our interpretations on the available evidence. Thus, at this point we do not have evidence for large, year-round horticultural villages in western Massachusetts. While there is some ethnohistoric evidence for intensive maize horticulture during the Contact Period (Thomas 1979:96–97), there is also a great deal of evidence for diversity in the New England diet (see Josselyn 1988[1674]; Rasieres in Jameson 1909; Wood 1977[1634]). While Thomas (1979) reports evidence for intensive maize horticulture at the late seventeenth-century Fort Hill site in New Hampshire *(see Figure 1)*, it is clear that by this time native lifeways had been significantly transformed by the drastic movement of peoples and other socio-economic changes brought about by European colonization.

Ceramic data for the middle Connecticut Valley also suggest that maize was not a staple during the Late Woodland period (Chilton 1996, 1998, 1999b). A high degree of ceramic diversity at the Pine Hill and Guida Farm sites indicates that pots were made at a variety of locations throughout the year, in diverse social and environmental contexts (Chilton 1996). The great diversity in middle Connecticut Valley ceramics indicates a high degree of mobility and small group size for Algonquian groups in the New England interior; the ceramic data do not indicate the degree of sedentism required for intensive horticulture. On the basis of temper type, temper density, and vessel wall thickness, the ceramic data also indicate that Connecticut Valley ceramics may not have been ideal cooking pots, especially in comparison to Iroquoian ceramics from the Mohawk Valley (Chilton 1996). The significance of this is that the type of maize used by Native peoples in the Northeast—which was similar to modern varieties of 8–row, Northeastern Flint corn—needed to be cooked for long periods of time in porridge or stew form (see de Champlain 1907 [1604–1618]; Fenton 1940). Connecticut Valley pots may have been sporadically used for cooking, but they were not ideal for cooking maize over hot fires for long periods of time (Chilton 1999a).

While the extant data from western Massachusetts indicate that maize was a dietary supplement during the Late Woodland period, I am not proposing the same interpretation for the entire New England interior. Since the adoption of horticulture in the region was itself a long and complex process (Bodner 1999; Cassedy and Webb 1999), it was most likely adopted unevenly across the region. There may be, in fact, more diversity within than between the sub-regions of New England, both on the coast and in the interior.

Many of the answers to our questions concerning the importance of maize horticulture in the New England interior undoubtedly lie buried in the gray literature and on museum shelves, not to mention the Connecticut Valley flood plain. Stable isotope analysis and AMS dating of previously excavated samples will prove critical in sorting out the complex history of the adoption and development of maize horticulture in the Northeast.

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