PREHISTORIC MODIFICATION OF THE FOREST COVER IN THE DELAWARE COASTAL PLAIN: AN INTERPRETIVE MODEL FOR LARGE D-SHAPED PIT FORMATION

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ABSTRACT

A well-known aspect of Delaware prehistoric archaeology is the occurrence of very large apparent pit features identified on prehistoric site locations. These features, which often exhibit a "D"-shaped or crescentic plan, have variously been interpreted as the remains of pit houses, simple tree falls, or as resulting from the interactions of multiple formation processes. This paper presents an alternative interpretation for the formation of these features. It is argued that these archaeological entities share a common, cultural origin. It is also postulated that the features represent disturbances caused by the active modification of the local forest cover by prehistoric peoples. Such modification would have been undertaken in order to promote the growth of edible wild plant food species, enhance mast production by eliminating competing trees, facilitate nascent horticulture, provide a ready supply of limb firewood, or a combination of these impetuses.

INTRODUCTION

Large D-shaped features, commonly encountered on prehistoric sites in Delaware were first documented in significant numbers on a series of archaeological mitigations undertaken by the University of Delaware Center for Archaeological Research in association with State Route 1 construction. Major sites on which these features were documented include Leipsic (Custer *et al*. 1994a), Pollack (Custer *et al*. 1994b), Snapp (Custer and Hsiao Silber 1994) and Carey Farm and Island Farm (Custer *et al.* 1995) sites. The very large features, upwards to three meters in size, are described as being D-shaped in plan, with other examples having a crescentic or kidney-like configuration (Figure 1). Profiles often show one steep side with the opposite flaring outwards at a shallower angle. Considerable controversy surrounds these entities. In fact, most researchers who have worked in Delaware have been unable to agree on a functional interpretation and even whether or not the features are cultural in origin. For the purposes of discussion, these entities are collectively referred to as D-shaped pits.

D-shaped pits have been identified on additional major excavations undertaken in central and northern Delaware by Parsons, including Hickory Bluff (Petraglia *et al*. 2002) Glasgow School (Bowen *et al*. 2003) Frederick Lodge (Egghart *et al*. 2003), as well as on the Puncheon Run (LeeDecker *et al*. 2001) complex investigated by Louis Berger and Associates.

THE DEGRADED PIT HOUSE MODEL OF D-SHAPED PIT FORMATION

Custer interpreted the D-shaped pits as the signature remains of semi-subterranean structures or "pit houses". According to this interpretation, the features represent storage facilities located inside shallow

Figure 1. D-shaped pit (from Petraglia *et al.* 2002).

semi-subterranean structures, most other evidence of which has been lost to plowing. The conceptual template for this was based on a single finding made on the Snapp site in New Castle County (Custer and Hsiao Silber 1994). Here a complex of features was encountered at the foot of a minor slope. The addition of colluvial soil had protected this area from the extensive plow truncation evident across the rest of the site. Designated Feature 153, the complex consisted of a narrow D-shaped pit set into one end of a much larger, shallow basin. A third small pit was defined in the approximate center of the larger feature. The cluster of pits was roughly enclosed by a pattern of nine, irregularly spaced post molds. The Feature 153 complex was interpreted as a dwelling composed of a shallow "basement", or living area, with a "sub-basement" storage facility located at one end with the post mold pattern representing a superstructure constructed over the below-grade house floor (Custer and Hsiao Silber 1994:43-52). This interpretative reconstruction was applied to a large number of the Snapp site D-shaped pits and extended to other Delaware sites on which similar features were present (Custer *et al*. 1994b:36-38, Custer *et al*. 1995:252-3). On the Leipsic site alone (Custer *et al*. 1994a), a total of 197 individual features were presented as sub-basement storage facilities located within dwellings, all other traces of which have been lost to plowing and soil deflation (Figure 2). This interpretation for D-shaped pit formation is herein referred to as the Degraded Pit House Model.

While this pit house interpretation for D-shaped features retains its proponents, it has been questioned by other researchers working in the state. Mueller and Cavallo (1995) argued that the features *primarily* represent tree throws, while leaving open the possibility that these tree throws could have been utilized or modified by aboriginal peoples. LeeDecker (personal communication 1998) viewed the D-shaped pits as representing house remains with skepticism noting the general lack of posts or other recognizable feature types normally associated with structure locations. Mueller and Cavallo (1995) also noted that both direct and indirect evidence for such intensive prehistoric settlement as would be signaled by hundreds of D-shaped pits representing structure locations, is completely lacking in the greater region. Equally problematic is the proposed storage function. The flaring form is poorly suited as a storage facility, particularly inside a structure where every square foot of floor space represents a significant investment in labor and material. Large cylindrical pits (Figure 3) interpreted as storage facilities *have* been identified in considerable numbers on Early and Middle Woodland sites in Delaware (Thomas 1981,

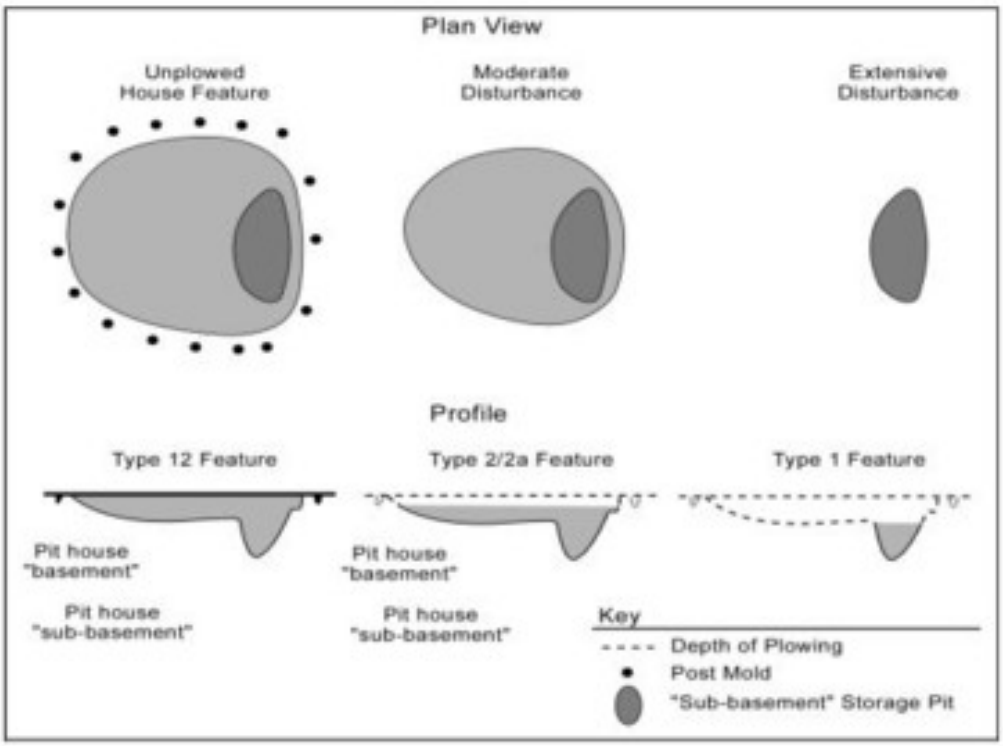

Figure 2. Degraded pit house (from Custer 1994:57).

LeeDecker *et al.* 2001, Petraglia *et al.* 2002). These features, dubbed silo pits (Petraglia *et al.* 1998) based on their form and presumed function, bear little resemblance to the trench-like configuration of the D-shaped pits.

Other researchers have suggested that the D-shaped pits represent simple tree throws. Contemporary tree falls and their resultant ground disturbances are readily observable in wide variety of Coastal Plain locations. These disturbances have a shallow, saucer-like form. Commonly observed tree throws typically *are* D-shaped in plan. The straight side marks the pivot axis (or fold) at ground level, while the rounded end is created by the lateral root fan splaying upwards opposite the side to which the tree fell. What is clearly lacking in the typical tree throw, however, is the deep, trench-like gouge that is a defining characteristic of the D-shaped pit.

ARCHAEOLOGICAL REVIEW OF D-SHAPED PITS

A review of the D-shaped pit findings in on numerous major sites in the Delaware Coastal Plain suggests that these entities share common morphological attributes. These include a D-shaped plan view suggestive of a tree fall location and a deep gouge-like profile atypical of a tree throw. A review of archaeological attributes of exhibited by the D-shaped pits on Delaware sites indicated that these features consistently exhibited evidence of cultural input (Custer *et al*. 1994a; Custer *et al*.1995; Custer and Hsiao-Silber 1995). The compilation of radiocarbon dates (Table 1) obtained from numerous D-shaped pits documented by the University of Delaware proved to be in agreement with the major occupation periods for the respective sites. The Hickory Bluff site D-shaped pits, in various permutations, yielded occupation period dates, contained elevated artifacts counts, and/or had elevated levels of elemental phosphorous (Table 2). At the Frederick Lodge site (Egghart *et al*. 2003) a single large D-shaped pit was fully investigated. Chemical analysis of the fill soil indicated significantly elevated levels of elemental

Figure 3. Delaware silo pit (from Petraglia *et al.* 1998).

TABLE 1: RADIOCARBON DATES FROM LARGE PIT FEATURES ON DELAWARE STATE ROUTE 1 SITES

Snapp Site (7NC-G-101) (Source: Custer and Hsiao-Silber 1994:103)

Feature	Date B.P.	Date Calibrated	Notes	Lab Number
105	1410±70	AD 576 – 666	D-shaped	Beta-56802
142/193	1150±80	AD 775 – 984	D-shaped	Beta-56361
153	2420±70	BC 350 – 72	Snapp House	Beta-56803
206	1640±70	AD 262 – 531	D-shaped	Beta-56360

Carey Farm (7K-D-3) (Source: Custer, *et al.* 1995:146)

Feature	Date B.P.	Calibrated Date	Notes	Lab Number
623	1640±70	AD 370 – 530	D-shaped	Beta-76845
371	1240±60	AD 695 – 880	D-shaped	Beta-76837
427	1680±60	AD 535 – 635	D-shaped	Beta-76838
440	1720±60	AD 245 – 410	D-shaped	Beta-76839
465	1300±60	AD 665 – 785	D-shaped?	Beta-76840
608	1660±50	AD 370 – 435	Round pit?	Beta-76841
686	1260±70	AD 680 – 875	D-shaped	Beta-76842

Leipsic Site (7K-C-194A) (Source: Custer, *et al*.1994a: 69)

Feature	Date B.P.	Date Calibrated	Notes	Lab Number
353 Area A	3650±100	2192 - 1890 BC	D-shaped	Beta-42878
314 Level 4	2070±70	199 BC – AD 1	D-shaped	Beta-42879
255/256 A	1080±130	AD 778 – 114	D-shaped	Beta-42881
255/256 D	770±170	AD 1040 –1390	D-shaped	Beta-42882
77 Level 3	1820±110	AD 60 – 340	D-shaped	Beta-42883
266	1400±80	AD 576 – 674	D-shaped	Beta-42884

TABLE 2: HICKORY BLUFF (7K-C-411) D-SHAPED ATTRIBUTE SUMMARY (Source: Petraglia *et al.* 2002)

Feature #	Tree Rot Morphology	Tree Throw Morphology	Cultural Morphology	Elevated Artifacts #	Elevated P Content	Absolute Dating
2	No	Partial	No	No	Yes	2790±40 BP
77	No	Partial	No	No	Yes	N/A
90	No	Partial	No	Yes	Yes	4070±40 BP
118	No	Partial	No	Yes	N/A	N/A
169	No	Partial	No	No	Yes	N/A

phosphorous near the bottom of the pit, suggesting cultural input. At a minimum, these findings suggest that the features were extant at the time of the occupations. While the data suggest a cultural association or connection, the sheer numbers in which these features have been documented, and the repetition on their basic form, both within and across sites, point toward a common formation process. While some researchers maintain that the D-shaped pits resemble tree throws and have postulated that tree falls constitute the primary mechanism for their formation, a significant body of data clearly points toward a prehistoric cultural association. The following interpretive model reconciles these seemingly divergent standpoints. The Culturally-Induced Tree Fall Model presents the D-shaped pit phenomenon as being both the result of a tree fall and as having a cultural origin.

THE CULTURALLY INDUCED TREE FALL MODEL

The Culturally Induced Tree Fall model presents the D-shaped pits as constituting the physical scar of a tree fall that had been induced to occur by prehistoric site occupants. The purpose of such activity would have primarily been to open forest areas to promote the growth of food producing plant species, and perhaps to enhance mast production by eliminating competing, non-economically valuable trees. A key consideration is the fact that soils in the Delaware Coastal Plain are mostly sandy and unconsolidated, allowing for easy excavation using primitive tools. Under these conditions, a tree could be induced to fall by grubbing around the base of one side, leaving the roots in place. A fire constructed in the resultant trench would burn through the exposed roots, either downing the tree outright, or killing it and leaving it unstable and to be felled by the next storm. Figure 4 schematically illustrates the conjectural procedure, as well as the anticipated archaeological signature. In this manner, a significant number of trees could be brought down with a minimum of labor. The resulting dead fall could either be left in place or burned to fully clear the area. This model can also explain a basic variability in D-shaped pits described by Custer (1994). Should the tree fall in the direction of the grubbing trench, the extant root fan on the opposite side would pull up, forming the typical saucer-like tree throw disturbance. This shallow depression would be present on one side of the grubbing trench, as the roots on the opposite side would have been fire-severed. Together the tree fall and the grubbing trench would leave a ground disturbance (Figure 5) strikingly similar to the Custer's (1994) Type 2 Delaware Woodland I feature type that forms the basis for

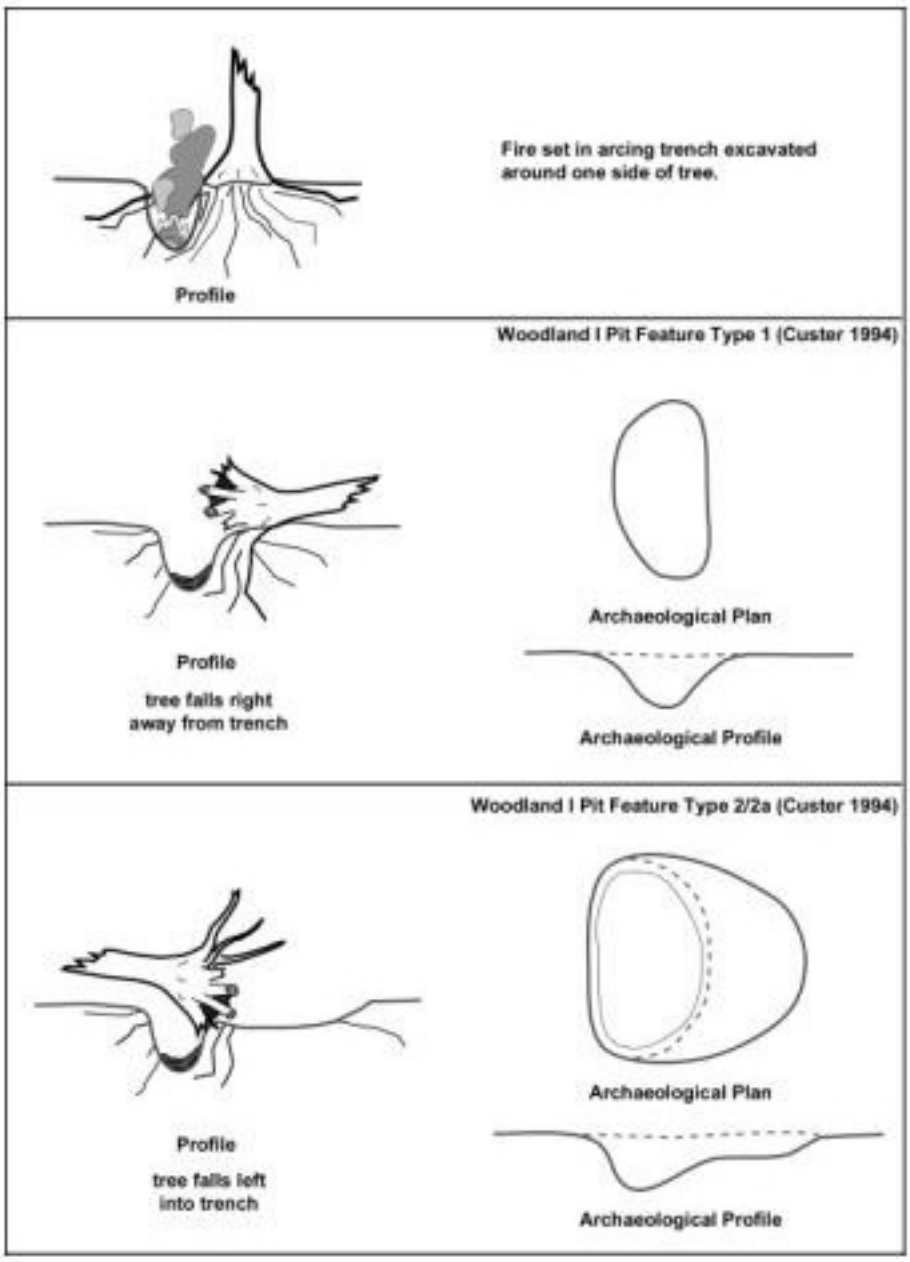

Figure 4. Culturally induced tree fall (from Egghart *et al*. 2003).

'basement/sub-basement" pit house interpretation. Conversely, if the tree were to fall in the direction away from the grubbing trench, then the lateral root fan on the "down side" side would simply fold over and not generate a significant disturbance for the archaeological record. In this latter scenario, the primary archaeological trace would be the grubbing trench excavated to expose the roots. Such a trench would appear very similar to the more narrow, crescentic Type 1 pit as defined in Custer's (1994) Woodland I pit typology. Prehistoric grubbing and burning around the base of trees could also account for the formation of the third type of very large pit categorized by Custer. The main characteristic of Type 6 feature is described as two opposing, crescentic trenches containing charcoal flecking (Custer 1994). Grubbing to both sides, or fully around a standing tree is anticipated to result in just such a ground disturbance as defined by Custer's Type 6 feature.

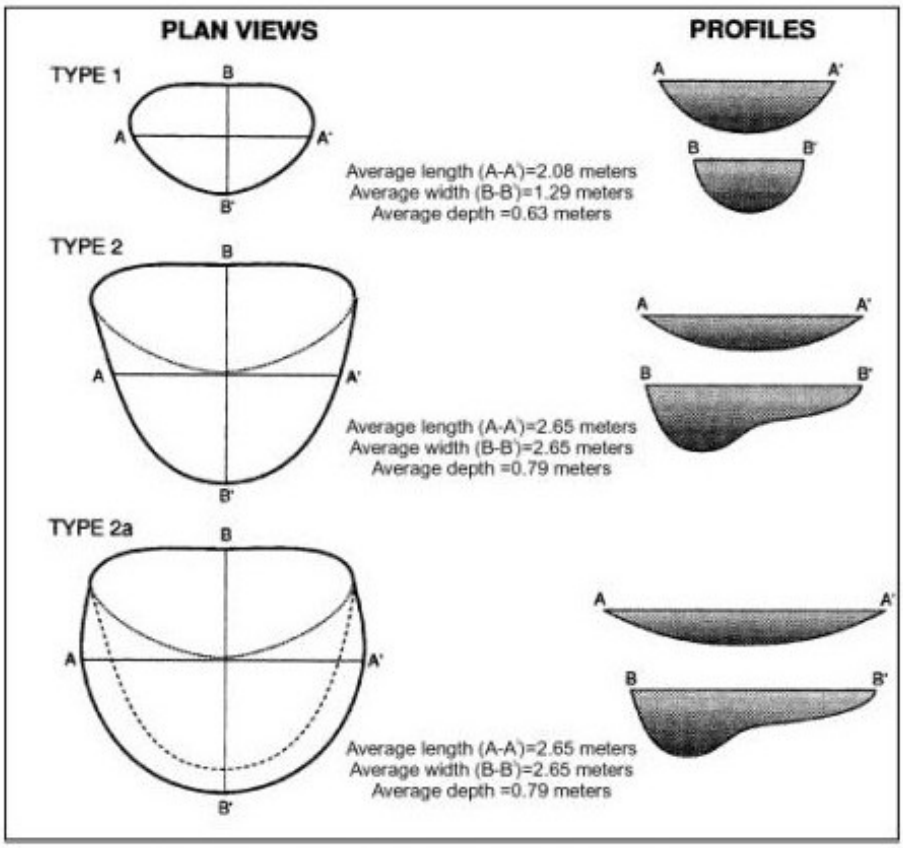

Figure 5. Type 1 and 2 Woodland I pit features (from Custer 1994:58).

It is recognized that girdling a tree would be effective in creating forest clearings, and that both Late Woodland horticulturists as well as early European settlers employed this technique. However, it is the physical disturbance of the ground, as well as the interruption of the forest canopy from felling trees that creates conditions most favorable to early succession plant communities. Selectively burning an area also fully removes the understory, releases nutrients, and results in conditions favorable to natural diversity (Sutton and Sutton 1984:24).

Peoples of the Delaware Early and Middle Woodland are generally regarded to have had a less than fully sedentary lifeway, sustained by wild foods. Seasonal availability of these resources and other factors dictated movements between occupation loci, probably within fairly regular and proscribed round. It is suggested that within this settlement round, people opportunistically, but on an ongoing basis, modified the local environment via the opening of minor forest tracts. This would have been done in order to expand the productive "forest fringe" and enhance the growth of food-bearing plant species that thrive as components of early succession communities in disturbed areas. The selective downing of trees may also have constituted a form of "forest management" applied to increase mast production or to otherwise favor individual economically important trees. Trees may also have been downed in order to provide an ample supply of limb fuel for return visits during the course of regular seasonal settlement rounds. In this context, it is useful to remember that prehistoric Native Americans were not capable of effectively processing trunk firewood, in the modern sense, within the confines of a lithic tool technology. Ongoing modification of the forest cover by prehistoric peoples would have had the ancillary effect of increasing the game carrying capacity of the given area. Patchy woods in varying stages of succession, containing open zones, breaks in the canopy and decaying trunks, are a more productive game habitat than a homogenous climax forest cover.

The interpretation of aboriginal clearing of forest areas to increase food bearing wild plant growth dovetails with generally accepted local subsistence and settlement models for the period. These models are predicated on continuing population growth and the advent of varying degrees of semi-sedentism, factors that in turn beget intensification of food procurement/production. Some researches have used the occurrences of the D-shaped pits along a site's periphery or even beyond the prehistoric occupation loci, to argue against a cultural formation of the features. In the Induced Tree Fall Model, this is precisely where they would be expected to occur — not necessarily on the occupation site, but along its edges.

Paleo-Environmenal Data

Data generated from local paleo-environmental research sponsored by the Delaware Department of Transportation in support of State Route 1 archaeological studies (Kellogg and Custer 1994) suggest that an active modification of the local forest cover may have occurred during the Middle Woodland period. Specifically, Brush's (1994) analysis of St. Jones River sediment cores just downstream from Hickory Bluff, and Cary Farm and Island Field sites show a dramatic, 400 percent spike in charcoal for samples dating between 2000 and 1500 years. This spike in charcoal, and the stratigraphically congruent pollen profile, are interpreted by Brush (1994:90-91) as evidence for frequent fires but with these events occurring within an overall moisture regime not significantly different than today's.

Regionally, there is a growing body of data suggesting an ongoing human alteration of the natural environment occurred in Eastern North America beginning in the Late Archaic period. Delcourt *et al*. (1986) provide data that suggest the floodplains of the Little Tennessee River were largely cleared by at least 4000 B.P. Synthesizing broad regional data, Stevens (1991) argued that human intervention, particularly the burning and clearing of floodplains, is reflected in geomorphologic record to include increased stream sedimentation and localized aeolian soil deposition. The purpose of this intervention would have to promote the growth of edible wild plant species that thrive as part of succession communities. Bruce D. Smith (1989, 1992) has convincingly argued that the promotion of certain pioneering, indigenous seed bearing species was undertaken in Eastern North America to the extent that the region should be recognized as a locus for independent plant domestication. Smith postulates that the intensive exploitation of indigenous seed-bearing plants developed into nascent horticultural practices long before the introduction of tropical cultigens. The propagation of these pioneering species depends on the physical disturbance of the ground as well as forest canopy. Smith (1989,1992) suggests that seasonal flooding along the rivers in Eastern North America originally provided this ground disturbance and that an exploitive focus of these areas developed into nascent horticultural practices a millennium or more prior to the acceptance of tropical cultigens and development of fully horticultural lifeways. A prehistoric modification of the local forest cover in the Delaware Coastal Plain is viewed within this context.

SUMMARY

In summation, it is hereby postulated that the distinctive D-shaped and crescentic pits, well-documented on numerous sites in Delaware, by and large, represent the physical traces of prehistoric peoples having purposefully induced trees to fall within and around their occupation loci. This would have been accomplished by grubbing along the base of a mature tree, then burning through the exposed roots. The primary purpose of this activity would have been to create forest openings for the growth and propagation of food bearing wild plant species that thrive as components of early succession communities. Trees may also have been downed along the periphery intensively occupied site areas and left in place order to provide a ready supply of limb firewood for extended, and/or seasonally repeating site visits. Minor tracts of forest may also have been selectively managed in order to increase mast production or to favor the growth of individual economically useful trees. These actions would have been undertaken within the context of a Woodland lifeway marked by diminishing residential mobility and an intensification of local food resource exploitation.

REFERENCES CITED

Brush, Grace S.
1994 Paleobotanical Analyses of Three Tidal Stream Valleys Along the Proposed State Route 1 Corridor, Kent County Delaware. In *Paleoenvironmental Studies of the State Route 1 Corridor: Contexts for Prehistoric Settlement, New Castle and Kent Counties*, edited by D.C. Kellogg and J.F. Custer, pp. 82-95. Delaware Department of Transportation Archaeology Series No. 114, Dover.

Bowen, C., P. O'Neill and E.A. Crowell
2003 *Archaeological Data Recovery Excavations at the Glasgow Elementary School Site, Site 7NC-D-212 William B. Keene Elementary School New Castle County Delaware*. Parsons Engineering Science, Fairfax, Virginia. Submitted to the Christina School District, New Castle County, Delaware.

Custer, Jay F.
1994 *Stability, Storage and Culture Change In Prehistoric Delaware: The Woodland I Period (3000 B.C. – A.D. 1000)*. On file at the Delaware State Historic Preservation Office, Division of Historical and Cultural Affairs, Dover.

Custer, Jay F., Lynn Riley and Glen Mellin
1994a *Final Archaeological Excavations at the Leipsic Site (7K-C-194A) State Route 1 Corridor, Kent County, Delaware.* University of Delaware Department of Anthropology Center for Archaeological Research, Newark.

Custer, Jay F., A. Hoseth, B.H. Silber, D.J. Grettler, and Glen Mellin
1994b *Final Archaeological Investigations at the Pollack Site (7K-C-203), State Route 1 Corridor, Kent County, Delaware*. Delaware Department of Transportation Archaeology Series No. 126. Dover.

Custer, Jay.F., and B.H. Silber
1994 *Final Archaeological Investigations at the Snapp Site (7NC-G-101), State Route 1 Corridor, Chesapeake and Delaware Canal Section, New Castle County, Delaware*. Delaware Department of Transportation Archaeology Series No. 122. Dover.

Custer, Jay F., Scott. C. Watson and B.H. Silber
1995 *Final Archaeological Investigations at the Carey Farm (7K-D-3) and Island Farm (7K-C-13) Sites, State Route 1 Corridor, Kent County, Delaware*. Delaware Department of Transportation Archaeology Series No. 146. Dover.

Delcourt, Paul A., Hazel R. Delcourt, P. A. Cridlebaugh, and Jefferson Chapman
1986 Holocene Ethnobotanical and Paleobotanical Record of Human Impact on Vegetation in the Little Tennessee River Valley, Tennessee. *Quaternary Research* 25:330-349.

Egghart, Christopher P. and Dennis Knepper and Chris Bowen
2003 *Prehistoric Settlement of Bay/Basin Landscapes in the Archaic and Woodland Periods: Phase II and Phase III Archaeological Investigations at the Frederick Lodge Complex, 7NC-J-97, 7NC-J-98, and 7NC-J-99, New Castle County, Delaware.* Delaware Department of Transportation Archaeology Series, No. XXX (draft). Prepared for the Delaware Department of Transportation, Dover.

Kellogg, Douglas C. and Jay F. Custer (editors)
1994 *Paleoenvironmental Studies of the State Route 1 Corridor: Contexts for Prehistoric Settlement, New Castle and Kent Counties*. Delaware Department of Transportation Archaeology Series No 114. Dover.

LeeDecker, C., J. Bedell and R. Jacoby.
2001 *Archaeology of Puncheon Run Site Volume I*. Louis Berger Group, Inc. Delaware Department of Transportation Archaeology Series, No. XXX (draft). Dover.

Mueller, Raymond G. and John C. Cavallo
1995 Multiple Working Hypotheses: An Analysis, Pit Houses or Tree Throws. Paper presented at the 1995 ESAF Conference, Wilmington, Delaware.

Petraglia, Michael, Dennis Knepper, John Rutherford, Philip LaPorta, Kathryn Puseman, Joseph Schuldenrein, and Noreen Tuross
1998 *The Prehistory of Lums Pond: The Formation of An Archaeological Site in Delaware.* Delaware Department of Transportation Archaeology Series No. 155. Prepared for the Delaware Department of Transportation, Dover, Delaware by Parsons Engineering Science, Inc., Fairfax, Virginia.

Petraglia, M.D., S.L. Bupp, S.P. Fitzell, and K.W. Cunningham, compilers
2002 *Hickory Bluff: Changing Perceptions of Delmarva Archaeology.* Delaware Department of Archaeology Series, No. XXX (draft). Prepared for the Delaware Department of Transportation, Dover, Delaware by Parsons Engineering Science, Inc., Fairfax, Virginia.

Smith, B. D.
1989 Origins of Agriculture in Eastern North America. *Science*. 246:1566-1571.

Smith, B. D. (editor)
1992 *Rivers of Change: Essays on Early Agriculture in Eastern North America.* Smithsonian Institution Press, London and Washington DC.

Stevens, J Sanderson.
1991 A Story of Plants, Fire and People: The Paleoecology and Subsistence of the Late Archaic and Early Woodland in Virginia. In *Late Archaic and Early Woodland Research in Virginia: A Synthesis*, edited by T.R Reinhart and M.N. Hodges, pp. 185-211. Council of Virginia Archaeologists, Archaeological Society of Virginia Special Publication No. 23.

Sutton, Ann and Myron Sutton
1985 *Eastern Forests*. The Audubon Society Nature Guides. Alfred A. Knopf, New York, NY.

Thomas, Ronald A.
1981 *Excavations at the Delaware Park Site (7NC-E-41).* Delaware Department of Transportation Archaeological Series No. 11, Dover.