ENVIRONMENTAL SETTING

The Warwick Site (18CE371) is located in southeastern Cecil County, Maryland, near the watershed divide between the Delaware Bay and the Chesapeake Bay. The Delmarva Peninsula consists of two major physiographic provinces, a small section of the Piedmont to the north and the Coastal Plain to the south. The region has remained largely rural to this day, with development concentrated near the urban centers and shoreline communities. The forested site setting contrasts with the surrounding agricultural land (Figure 4 and Figure 5, p. 6).

Topography

Topography typical of the dissected plateau separating the streams draining east to the Delaware Bay and those streams draining west to the Chesapeake Bay surrounds the Warwick Site. Elevations within the site area range from slightly less than 21.3 meters (70 ft) toward the northeast and 18.3 meters (60 ft) to the southwest. In the immediate vicinity of the site, the young headwater streams have incised the environs to a lesser extent than downstream, resulting in limited topographic relief.

Figure 4: View Northwest Across the Warwick Site.

Figure 5: View East to Higher Ground East of the Warwick Site.

Geology

The Coastal Plain physiographic province comprises two subdivisions, the High and Low Coastal Plain sections. The High Coastal Plain physiographic zone stretches north from the Smyrna River, just south of the Warwick Site, to the Fall Line, the boundary between the Piedmont and Coastal Plain (Custer 1984; Custer and Bachman 1984; Hodny et al. 1989). Sand and gravel deposits of continental origin blanket the High Coastal Plain.

The Potomac and Columbia formations characterize the sediments of the northern Delmarva Coastal Plain. Potomac sediments include fluvial silts and clays deposited during the Early Cretaceous Period. Sediments of the Columbia formation, deposited by watercourses from the north during the Quaternary Period, cap the Potomac sediments in portions of the region. Glacial outwash near the end of the Pleistocene deposited extensive beds of coarse sands, pebbles, and cobbles across the High Coastal Plain as far south as the Smyrna River in Delaware. Sands composed primarily of quartz and feldspar, along with coarse gravels of sandstone, quartz, and chert, form the Columbia formation (Custer 1984; Jordan 1964; Petraglia et al. 1998:7).

The gravels resisted erosion which created a gently rolling topography with up to 50-foot (15.2 m) differences in elevation between floodplain marshes and headlands, thereby creating differences in plant communities. These topographic conditions combined with the presence of tidally influenced brackish watercourses and freshwater further inland to create habitats suited for a wide range of resources.

Hydrology

The Warwick Site sits atop a 21 meter (70 ft) terrace flanked by low-order (Rank 2) tributaries of the Sassafras River (Figure 6). U.S. 301 crosses the channelized, western stream southwest of the site. The tributaries flow south and east to join the Sassafras River, which empties into the Chesapeake Bay at Grove Point; the headwaters of the Bohemia River, also a tributary of the Chesapeake Bay, rise just northeast of the Warwick Site. Near the Delaware state line to the east of the Warwick Site, low-order streams flow north and east to form rivers that meander to Delaware Bay. The drainage divide between the Chesapeake and Delaware Bays is less than 1.6 kilometers (1.0 miles) east of the Warwick Site (Mueller 2011).

Figure 6: View Southeast of an Unnamed Tributary of the Sassafras River Southeast of the Warwick Site.

Natural Environment

The headwaters of streams draining into the Chesapeake Bay interrupt the farmland, wetlands, and deciduous woodland surrounding the Warwick Site. Braun (1950) classifies the area as the Atlantic Slope segment of the Oak-Pine Forest. Prior to the arrival of Europeans, hickory, shortleaf pine, loblolly pine, white oak and post oak covered the region. Mixed deciduous forest, relatively open at the time of the fieldwork, covered the landform. Drainage ditches along U.S. 301 bound the site to the west, agricultural fields to the east.

Soils

Fertile, well-drained soils attracted both humans and game over millennia. Moreover, the wild grasses, fruits, and seeds consumed by people both before and after the adoption of agriculture flourished in such settings. As a consequence, numerous archaeologists have cited the correlation between the distribution of level to gently sloping, well-drained, fertile soils and archaeological sites (e.g., Lukezic 1990; Potter 1993; Turner 1976; Ward 1965). Soil scientists classify soils according to natural and artificial fertility and the threat posed by erosion and flooding, among other attributes. Soil Classes 1 and 2 represent the most fertile soils, those best suited for not only agriculture but for a wide range of uses. Of course, soil productivity must be considered in relation to the productivity of the surrounding soils as well.

As mapped by the Soil Conservation Service (SCS), a northwest-to-southeast-trending band of Crosiadore silt loam extends through the site. The soils consist of silty Aeolian deposits overlying fluviomarine sediments. The SCS classifies the soils as Class 3w due to the limitations that the somewhat poor drainage places on the fertility and range of potential uses. Othello and Nassawango soils surround the site (Table 1). Both soil types formed in a mantle of silty, aeolian deposits overlying coarser textured fluvio-marine sediments dating to the Pleistocene and earlier (Mueller 2011; Wah 2003). The silty loess formed circa 11,000 B.P., near the beginning of the Younger Dryas (Wah 2003).

Table 1: Soils in the Project Vicinity (Soil Survey Staff 2013).

Soil Name	Class	Slope	Characteristics
Crosiadore silt loam	3w	0–2%	Somewhat poorly drained silty Aeolian deposits over fluviomarine sediments
Mattapex silt loam	2w	0–2%	Moderately well-drained silty Aeolian deposits over fluviomarine sediments
Mattapex silt loam	2e	2–5%	Moderately well-drained silty Aeolian deposits over fluviomarine sediments, slight tendency to erode
Nassawango silt loam	2e	2–5%	Well-drained silty Aeolian deposits over fluviomarine sediments, slight tendency to erode
Othello silt loam	3w	0–2%	Poorly drained silty Aeolian deposits over fluviomarine sediments

Paleoenvironment

In response to changing climatic conditions, in particular the receding ice-sheets, Chesapeake Bay sea levels rose continuously from roughly 15,000 years ago to the present. Simultaneously, local subsidence of the earth's crust also may have contributed to the formation of the Chesapeake Bay. Between 15,000 and 14,000 years ago, the waters of the Atlantic began to submerge portions of the continental shelf. For every 30 centimeters (1 ft) of sea level rise, approximately 510 meters (1,675 ft) of the shelf were

inundated. Ten thousand years ago the sea began to flood the mouth of the ancestral Susquehanna River, located near the present day mouth of Chesapeake Bay. Sea level rose at 0.2 centimeters (0.7 in) per year between 8000 and 3000 B.P. At 8,000 years ago, the head of the ancestral bay was near Smith Island, at 5,000, near Annapolis, and by 3,000 years ago, it had reached the Sassafras River (Brush 1986:149). Numerous archaeologists suggest that the stabilization of water levels in the bay at this time provided the necessary conditions for the development of extensive shellfish beds and habitats favorable for anadromous fish (e.g., Waselkov 1982). After approximately 3000 B.P., sea level rise slowed to approximately 0.12 centimeters (0.04 in) per year, and the Chesapeake Bay approached its present contours (Brush 1986:149; Dent 1995:69–95).

A more temperate climate characterized by greater seasonal variation in temperatures emerged as the Chesapeake estuary formed (Dent 1995:147). Vegetation changed from the patchy forest that lacked modern analogs to a mixed conifer-deciduous forest. Pollen data imply the presence of an essentially modern assemblage of vegetation as early as 6,000–5,000 years ago (Brush 1986:151; Delcourt 1979:277; Webb 1988:405), though relative abundances of taxa fluctuated over time. Sediment cores from the Chesapeake Bay reveal a diverse regional environment prior to the Late Archaic, with an increase in pine and birch between roughly 4000 and 2200 cal B.P., as oak, hemlock, and beech declined (Fiedel 2005:O-5). The radiocarbon curve flattens between 2850 and 2400 B.P., implying a climatic anomaly that injected carbon into the atmosphere. Sediment cores extracted from the North Atlantic Ocean floor document 1470-year cycles of warmer and cooler temperatures, with a shift to cooler conditions around 2850 B.P. (Fiedel 2001). Van Geel et al. (1998; cited in Fiedel 2001:122) believe atmospheric ^{14}C rose circa 2850 B.P. as a consequence of decreased solar activity. In addition, atmospheric cooling, Fiedel (2001:122) reasons, created colder ocean surfaces in the North Atlantic at 2850 B.P., which in turn reduced the absorption of ^{14}C and increased atmospheric carbon. Ice-rafting events indicate "abrupt cooling of the atmosphere and ocean surface waters, accompanied by massive reorganization of atmospheric circulation patterns" (Fiedel 2001:121). Van Geel et al. attribute the circa 2850 B.P. radiocarbon plateau to reduced solar activity that increased cosmic-ray flux, thereby raising ^{14}C production in the atmosphere, increasing precipitation, and most likely altering ocean circulation patterns (Fiedel 2001:122). Chesapeake Bay cores reveal Holocene peaks in *Pinus* pollen abundance roughly correlated with ice-rafting events (circa 8,200 B.P., 6,800 B.P., 6,200 B.P., 2,800 B.P., 1,400 B.P., ~500 B.P., and perhaps ~4,000 yr B.P) that indicate periodic intervals of very wet and probably cool conditions (Willard and Korejwo n.d.). Cool climatic conditions continued through 2400 B.P. (Fiedel 2001: 122).

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