3.0 ENVIRONMENTAL SETTING

3.1 Paleoenvironment

At the end of the last glaciation, much of northeastern North America was considerably colder and wetter than at present, with most areas covered by open tundra and boreal forests. Sea level has been estimated as much 130 m below current levels (Milliman and Emery 1968). During this time much of the continental shelf lay exposed and the present-day Chesapeake Bay and Delaware Bay had yet to form, each still consisting of a network of narrow, entrenched river channels. A general warming trend and the subsequent melting and retreat of continental ice sheets brought a rise in sea level, contributing to the flooding of the outer areas of the continental shelf, inundating coastal river systems, and ultimately resulting in the development of inland estuary environments. Northern forests and their associated faunal communities were gradually replaced with varieties more typical of southern temperate zones. By approximately 6000 years BP, climate and environmental conditions were similar to those of today.

These climatic changes did not occur at a smooth, unvarying rate, but rather as a series of short-term variations within a general trend. The potential resource base for prehistoric populations varied over the millennia as different flora and fauna were supported at different times. In the Northeast and Middle Atlantic regions of North America, the major climatic episodes are known as the Late Glacial, Pre-Boreal, Boreal, and Atlantic. The primary characteristics of these periods are summarized below.

Late Glacial ca. 15,000-13,000 years BP. The Late Glacial was a cold and wet period, with tundra-like vegetation present, particularly near the ice front. Further south lay abundant open parkland, with sedge and grass interspersed with stands of spruce and fir (Maxwell and Davis 1972; Wright 1981). It has been argued that a relatively undifferentiated boreal forest environment was in place in the Middle Atlantic region, and that herds of large game prevalent during the Pleistocene were probably not present by the time of the first documented human occupations (Custer 1990).

Pre-Boreal ca. 13,000-10,700 years BP. While primarily a cold and wet period, the Pre-Boreal saw the retreat of the continental ice sheet, which allowed regional temperature increases and created a gradual warming trend throughout the episode. A mosaic of tundra, open grasslands, and boreal forest provided habitats for a variety of animal species (Carbone 1976).

Boreal ca. 10,700-9200 years BP. Initially, this period was marked by an increase in warm air masses that continued the warming trend of the Pre-Boreal. Open grasslands diminished in extent, and spruce woodlands were replaced by pine forest and northern hardwoods, especially oak (Walker and Hartman 1960; Sirkin 1977). Webb et al. (1994) noted an extended period of desiccation in central Delmarva beginning around 11,000 years BP and continuing through the Boreal into the following Atlantic episode. Evidence for this dry period is derived from pond sediments suggesting depressed water levels throughout the period.

Atlantic ca. 9200-6600 BP. The early portion of the Atlantic period was characterized by warm and increasingly wet conditions, signaling the onset of a fully modern climatic regime, with associated modern floral and faunal communities. An oak-hemlock complex was well established at the Mitchell Farm site (7NC-A-2), in northern New Castle County, by about 7900 years BP (Custer and DeSantis 1985). Generalized deciduous forests, producing large quantities of mast foods, were in place by 6000 BP, and deer, small mammal, and turkey populations increased (Custer 1989).

Sub-Boreal ca. 6600-2000 years BP. The Sub-Boreal consisted of a warm and dry period, with a consequent re-expansion of grasslands and dominance of oak-hickory forests and xerophytic species. The burial of landscapes through aeolian, or windblown, deposition has also been observed throughout the Delmarva Peninsula, and is presumably associated with a combination of xeric soils and drying climatic conditions (Curry 1980, 1992; Ward and Bachman 1987; Curry and Ebright 1989; Daniels 1993). Increasingly cool and moist conditions prevailed near the end of the Sub-Boreal period.

Sub-Atlantic ca. 2000 years BP-present. A general, progressive cooling trend is noted throughout the Sub-Atlantic period. A rise in the incidence of organic debris in sediments along the St. Jones River in central Delaware, suggests increased precipitation (Daniels 1993).

3.2 Present Environment

3.2.1 Site Location and Physiographic Setting

The Black Diamond site (7NC-J-225) was situated approximately 7 kilometers (km) north of the town of Smyrna, in New Castle County, Delaware. Frederick Lodge, a large Greek Revival manor and the location of a contemporary mobile home park, was the closest modern landmark, lying along existing US Highway 13, approximately 500 m east-southeast of the site.

The Black Diamond site occurred in the Upper (or Northern) Coastal Plain physiographic zone of Delaware. The Upper Coastal Plain contains three sub-regions—the Bay Coast, Mid-Drainage, and Drainage Divide zones—that parallel the north-south trending coastline of the peninsula (Custer 1989). The Black Diamond site lay near the transition between the Mid-Drainage and Drainage Divide zones, straddling the divide between two Delaware Bay watersheds: areas south and east of the site are drained by the headwaters of Sawmill Branch, a low-order tributary of the Smyrna River; Sandom Branch, a tributary of Blackbird Creek, drains areas to the north of the site. The lower reaches of both the Smyrna River and Blackbird Creek are tidal and broadly embayed. Extensive fresh/brackish water wetlands flank the lower portions of both waterways, as well as the adjacent Delaware Bay shoreline, and extend within 2,500 m of the site along Blackbird Creek.

The Upper Coastal Plain is underlain by the southeastern extension of the Columbia Formation, a deposit of continental rather than marine sediment (Custer 1989). Being continental in origin, the Columbia Formation consists of unconsolidated and heavily reworked sands and gravels of Pleistocene age deposited as glacial outwash and originating from the Piedmont uplands (Groot and Jordan 1999). This deposit contains a wide variety of

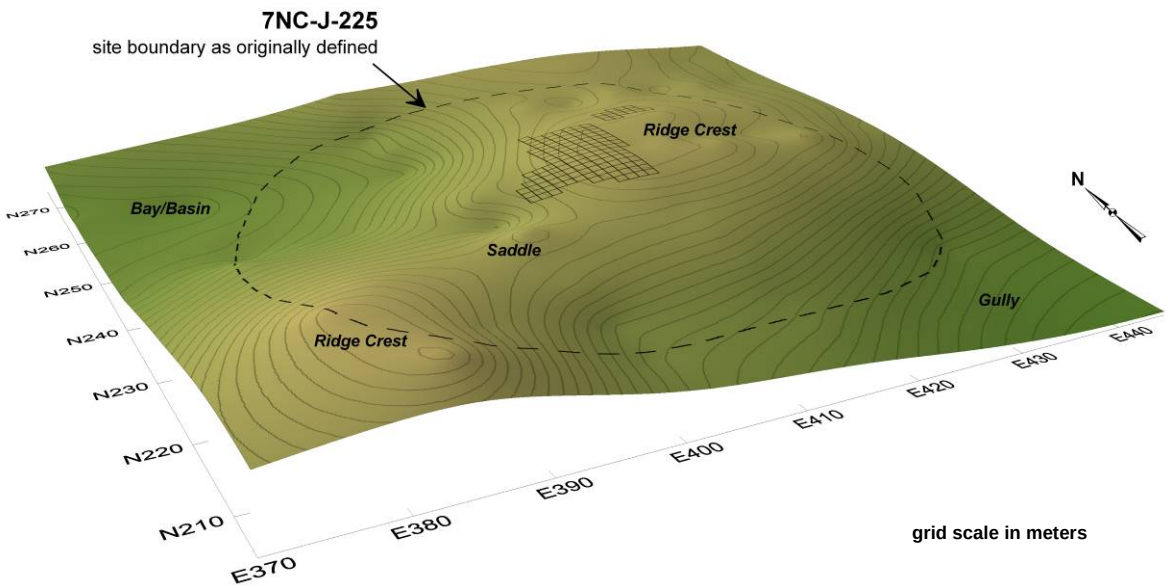
stone types, including quartz, quartzite, chert, and jasper, ranging in size from sorted sands, to gravels, cobbles, and occasionally boulders. A high percentage of coarse material that resists weathering occurs in the formation, which has contributed to the rolling topography characteristic of this physiographic zone. Portions of the underlying Columbia Formation are found exposed along stream banks, within eroded gullies, in large tree-throw depressions, and in eroded surface features. Where revealed, gravel deposits in the formation represented potential sources of raw material for stone tool manufacture for local prehistoric populations. The gravels occasionally include unusual material such as argillite or cuesta quartzite, a form of the latter being a major focus of activity at the Black Diamond site.

Surface elevations in the Black Diamond site area ranged from 15-17 m (50-55 feet) above mean sea level. Surface soils along the higher portion of the site area consisted of the Sassafras Series sandy loam. Soils in the surrounding bay/basin depressions are classified as Fallingston Series sandy loam (Mathews and Lavoie 1970).

The most distinctive topographic features in the vicinity of the site are a series of bay/basins, large shallow surface depressions that are common in certain parts of the Delmarva Coastal Plain. At various times in the past these features are likely to have contained surface water and wetland soils, and thus would have formed distinct micro-environmental zones potentially attractive to prehistoric populations. Bay/basins are seen as a key element in understanding the occupation of the Black Diamond site and surrounding areas. The site occupations occurred on the rim of a small depression that measuring approximately 100 m in diameter. The feature was dry at the time of the field investigation, although geoarchaeological testing suggested that it had retained surface water in the past. Similarly, two larger bay/basins exhibiting evidence of ponding were present immediately south of the site, associated with Archaic and Woodland period occupations at the Frederick Lodge Site Complex (7NC-J-97, 7NC-J-98, 7NC-J-99) (Versar 2011a).

A low, crescentic ridge was present on the east side of the Black Diamond bay/basin, and the archaeological site was centered on the high point of this landform. The difference in elevation between the crest of the ridge and the bay/basin bottom was relatively small, currently recorded as a maximum of 2.8 m. A topographic map of the site constructed on a 20-centimeter (cm) interval revealed distinct, if subtle, variations in the surface contour of the ridge crest, indicating that the ridge consisted of two distinct knolls separated by a minor saddle (Figure 3-1).

To the southeast, the ridge dropped to a broad, shallow gully. This area contained moist soils, possibly signaling a spring location that may have served as a further water source for the site occupation. Further east of the site, the landform contour became irregular. Broad incisions and minor scarp-like rises, reminiscent of relic stream channels and terraces, occurred in this area. Standing water was present in the lower parts of the area throughout the seasonally dry fall period. Terrain north of the site was relatively level and undifferentiated. Soils north of the site were relatively well-drained, except along the spring-fed headwater reaches of Sandom Branch, located approximately 1,000 m away.



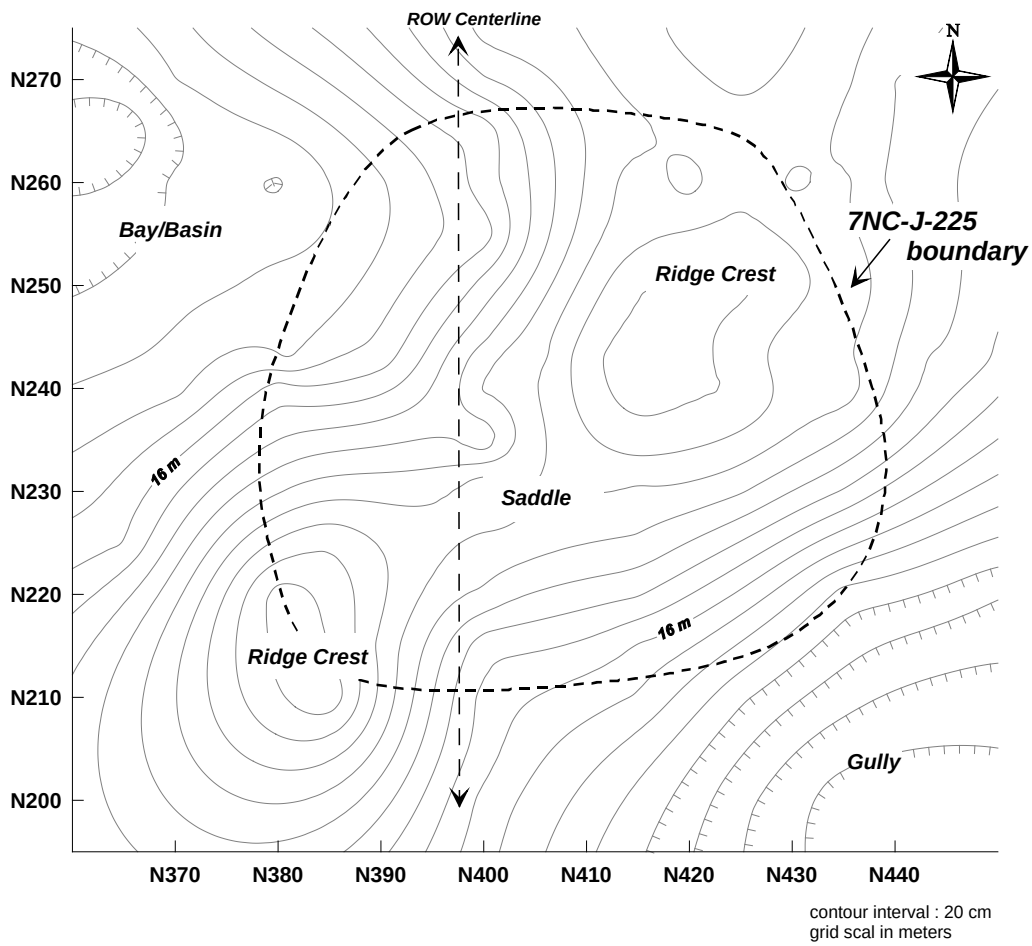


Figure 3-1. Topographic Setting of the Black Diamond Site (7NC-J-225).
(top, three-dimensional surface rendering; bottom, plan view)

At the time of the investigations, the Black Diamond Site was forested, mostly in maturing hardwoods with a dense secondary growth of oak and other hardwood saplings. However, archaeological and photographic evidence indicated that the entire site area had been plowed in late historic and modern times. Figure 3.2 shows an aerial photograph from the 1920s in which the site was open and apparently in pasture (Army Air Corps 1926). The site appeared to have remained open until sometime after World War II, based on the extent of modern tree growth. While numerous hardwood trees were currently observed, when first abandoned the field appeared to have been colonized by pines, as evidenced by pine logs and rotted stumps that occurred across the site area, along with certain soil formation characteristics (spodosols) documented in geoarchaeological investigations. These observations underscored a relatively rapid forest succession in this location.

3.3 Prehistoric Resource Base

Understanding the natural environment and its role in Native American life has long been an integral part of descriptive studies in Delmarva, as witnessed by the important and regionally influential work of researchers such as Thomas (et al. 1975) and Custer (1984). More recently the determinism implied in many paleoenvironmental studies in this and other regions has come into question (Anscheutz et al. 2001; Knapp and Ashmore 1999; Petraglia et al 2002; for an antecedent see Sauer 1925). Nevertheless, environmental and ecological research have long played an important role in analysis of Delaware prehistory. In general, the Coastal Plain of Delaware presented a productive environment that easily supported prehistoric hunting and foraging populations. A relatively mild coastal climate provided short winters. Soils were fertile, as evidenced in historic times by the state's rich agricultural tradition. A variety of environmental zones occur within a relatively small geographic area in the region. Thomas (et al. 1975) effectively summarized the various zones and the potential resource base offered by each: 1) saltwater bays/ocean; 2) tidal marsh and estuarine environments; 3) well-drained woodlands; 4) poorly drained woods and swamp; and 5) permanent freshwater (rivers/streams). With the exception of saltwater bays and the ocean along the Delaware Bay shore, all of these zones occur within the immediate vicinity of the Black Diamond site.

At present, the northern half of the Delaware Coastal Plain falls within the oak-hickory climax forest type (Braun 1950), and the key species in this forest have been an important component of the local forest cover for the last 6,000 years (Kellogg and Custer 1994). The Holocene pollen sequence recorded at the Walter's Puddle bay/basin, located just west of the project area, records an oak-dominated forest, along with vegetation characteristic of bog habitats (Newby et al. 1994). The oak-hickory forest, with its characteristic mast or nut production, represented a productive environment, with nutmeats constituting a plentiful and storable human food source that also served as primary seasonal forage for important game species, such as deer, turkey and squirrel.

As potential resource bases, bay/basin features were likely to have been distinctive settings within an already diverse and productive local environment. Freshwater ponds would typically support a variety of aquatic and amphibious animals. A number of mammalian species, notably beaver, muskrat, mink, otter, and weasel, live or feed along ponds and wetland fringes. The ponds also would have attracted waterfowl in various seasons. Cattail species and other emergent wetland vegetation would have offered both food resources and useful raw materials. Slopes adjacent to open pond margins would have supported forest fringe species, most importantly black cherry (*Prunus serotina*), wild plum (*Prunus americanaI*), and persimmon (*Diospyros virginiana*), which flourish in border areas (Taber 1985), as well as bayberry (*Myrica* sp.). The latter thrive in infertile soil along coastal areas and around the sandy, open rims of brackish-to-freshwater ponds and wetlands (Fernald and Kinsey 1958; Angier 1974), and form part a distinctive vegetative community from which the bay/basin features may derive their name. High, well-drained ground, such as the sandy knolls bordering the bay/basin, would have been preferred habitat for sweetmeat hickories, such as the pignut (*Carya glabra*) and mockernut (*Carya alba*) species (Taber 1995). As closed drainage areas, the basin soils would have been moister than the surrounding uplands and organically enriched, even in dry periods when the features were not ponded. Rich,

moist soils would have been ideal habitat for a variety of important edible plant species known to have contributed to prehistoric diets, including paw paw (*Asimna triloba*), hackberry (*Celtis occidentalis*) (Taber 1995), shadbush (*Amelanchier aborea*) (Sutton and Sutton 1985), and Jack in the Pulpit (*Arisaema sp.)* (Fernald and Kinsey 1958).