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The Effect of Soils on Settlement Location in Colonial Tidewater, Virginia

Craig Lukezic

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THE EFFECT OF SOILS ON SETTLEMENT LOCATION IN COLONIAL TIDEWATER VIRGINIA

A Thesis

Presented to

The Faculty of the Department of Anthropology

The College of William and Mary in Virginia

In Partial Fulfillment

Of the Requirements for the Degree of

Masters of Arts

by

Craig Lukezic

1986
APPROVAL SHEET

This Thesis is submitted in partial fulfillment of
the requirements for the degree of

Master of Arts

Craig Engebretson

Author

Approved, June 1986

Theodore Reinhart

Anne Yentsch

Peter Bergstrom
To Kimberly,

with love.
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THE EFFECT OF SOILS ON SETTLEMENT LOCATION
IN COLONIAL TIDEWATER VIRGINIA

ABSTRACT

Environmental factors are suspected as the cause of the decentralized rural settlement pattern in Colonial Tidewater Virginia. This study was designed to compare the various effects of natural and man-made environmental factors on site location.

Soils have been a key factor in site location in many agrarian societies. A case demonstrating the importance of soils as an attractive force in site location was constructed from a review of soil lore and agriculture practices. Since tobacco cultivation was the dominant economic activity in rural Tidewater Virginia, the environmental requirements of the tobacco plant heavily influenced the colonists' site location decisions.

The limited availability of sources of data, historical maps, and archaeological records, combined with time restrictions, confined the study area to the environs of Williamsburg and Yorktown, Virginia circa 1781. Natural and man-made environmental factors, featuring the proximity of navigable water, roads, drinking water, nearest neighbor, soil type, and slope were compared. The results confirmed the primacy of the role of soils in the decision of site location in a tobacco based economy.

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THE EFFECT OF SOILS ON SETTLEMENT LOCATION
IN COLONIAL TIDEWATER VIRGINIA
A Theoretical Introduction

An analysis of the settlement pattern of English Tidewater Virginia during the eighteenth century yields insights into the Colonial English culture of Virginia. Settlement pattern is the concept of how a culture uses land and organizes itself in space. According to Carville Earle, settlement pattern is "an appendage of its society and economy: settlements, routes, and other human systems" (Earle, 1976:6). The settlement pattern can be thought of as the physical and spatial embodiment of culture. This phenomenon results from the interplay of a number of connected but sometimes conflicting systems: the social, economic, political, and ideological systems.

Perhaps the best definition of settlement pattern, certainly the most frequently quoted, was written by Gorden Willey in Prehistoric Settlement Patterns in the Viru Valley, in 1953. Willey defines settlement pattern as:
...the way in which man disposed himself over the landscape on which he lived. It refers to dwellings, their arrangement, and to the nature and disposition of their buildings pertaining to community life. These settlements reflect the natural environment, the level of technology on which the builders operated, and the various institutions of social interaction and control which the culture maintained.

Because settlement patterns are, to a large extent, directly shaped by widely held cultural needs, they offer a strategic starting point for the functional interpretation of archaeological cultures.

(Willey, 1953:1).

For the sake of clarity, the term "settlement pattern" denotes the actual spatial distribution of a population's buildings and activities, whereas the term "settlement system" refers to the abstract rules and generalities a culture creates in developing the settlement pattern through time (Winters, 1969:110). There are at least three levels or scales within the settlement pattern studies. According to Bruce Trigger (1970), David Clarke, (1977), and others, spatial studies in archaeology range from examining the arrangement of activity areas within a single site to those of a community, town, or even a region. Although the terminology varies, three scales are repeatedly mentioned. The first is the distribution of artifacts within a single site or building. The distribution of structures and activity areas within a single community is the second scale or level of analysis. Both of the first two scales mentioned are beyond the scope of this paper; but the third, the distribution of sites on a regional scale, will be explored further.

Within the broad regional perspective, there are two frequently used approaches. In the first, settlement patterns exhibit a culture's social organization, including political and ideological systems. But it is the second one, the ecological approach, that will be the focus of this paper. Within the ecological approach, settlement pattern is seen as "a product of the simple interaction of two
variables - environment and technology" (Trigger, 1970:250). Still, this view is too simplistic, since environment and technology are not two variables but, perhaps, two classes of variables.

Separating the variables of the ecological approach from the variables of social approach is difficult. Bruce Trigger cites eight cultural factors to be the major determinants of settlement pattern on a regional scale: 1) trade, 2) political organization, 3) warfare, 4) religion, 5) taste & symbolism, 6) migration, 7) population change, and 8) natural resources in subsistence (Trigger, 1970: 251). As one might guess, all of these determinants are connected. Trade affects political organization and warfare, in turn, influences trade and so on. When using systems theory to interpret these factors, none of the factors can really be isolated from the others.

The eighth variable, natural resources and subsistence, tends to be studied heavily when scholars observe primitive cultures but glossed over when they examine complex cultures. A solid case has been made by Julian Steward that man's adaptation to the environment is the foundation on which other systems rest. The "cultural core" contains the elements of culture that are shaped by subsistence and economic activities (Julian Steward, 1955:37). He defined the cultural core in relation to his observation:

Patrilineal bands of bushmen, Australians, Tasmanians, Fuegians, and others represent a type in ecological adaptation and the levels of integration are the same in all of these cultures. In these and other cases, factors producing similar types of environment, food resources, means of obtaining food, the social co-operation required, population density, the nature of population aggregates, socio-political controls, the functional role of religion, warfare, and other features, will have an understandable relationship to each other.

(Steward, 1955:89)
By using Steward's concept of the cultural core, one can study the fundamental components within cultural systems that respond and adapt to the environment. This approach is implicitly functionalist: the elements of culture that can be readily explained with it are the functional ones.

Within a functional view of culture, one assumes that all human beings will opt to spend the least effort to gain the maximum return in subsistence and economic activities (George Zipf, 1948). Geographers apply this concept to movement on land with the label of "the friction of distance". Briefly, the friction of distance is the general tendency of people to choose an optimal location in which to dwell or work in order to minimize the distance of their necessary travels. This concept underlies most geographical theories of the location of settlement and land use (Haggett, 1967 Chisholm, 1968 Found, 1970, and others).

The idea of friction of distance has been applied to agricultural settlement location. Generally, the fields in which a farmer labors are located fairly close to his farmstead. Due to the energy expended in transportation, the farther a field of crops is from the farmstead, the higher the amount of labor a farmer must invest in it to make it produce. Correspondingly, as the distance from the farmstead and field increases, the energy return of the field to the farmer decreases. Even with the use of fossil fuels in farming, this tendency to minimize distance still exists. In the 1960's Michael Chisholm discovered that the average English farmer spends one third of his working day in transportation of his produce while his Dutch counterpart spends one half of a day in transportation (Chisholm, 1968:49).

William Found further explored this situation of diminishing returns. He plotted the degree of the use of fields in relationship to their distance to the farmstead. A negative curvilinear relationship appeared, leading Found to
conclude that the intensity of land use correlates inversely with its distance to the farmstead (Found, 1970: 165-178).

The same "law" of diminishing returns must have been very pronounced in pre-industrial Virginia where agricultural transportation consisted of manpower, draft animals, and watercraft, without the aid of machines using fossil fuels. English Tidewater Virginia in the eighteenth century was an agrarian society, specializing in tobacco cultivation. One can assert, since tobacco cultivation was labor intensive, that tobacco growers would be severely affected by the friction of distance and would opt to minimize the distance between their tobacco fields and the farmstead. Therefore, by plotting the location of a colonial farmstead on a map, one can expect the most intensively cultivated fields to be concentrated closely around it. Furthermore, if the tobacco plants were sensitive to the soils they grew in, tobacco planters would locate themselves near where tobacco-suited soils appeared. It can not be expected however that every tobacco planter optimized the location of his farm and field, but that the trend would be broad and strong enough to be statistically relevant.
Scope of the Thesis

"What determined the dispersed settlement pattern of the Southern United States during the Colonial Period?" is an old question among scholars. A small element of this broad question is, "What role did the quality and location of soils have on settlement location in Tidewater Virginia?" It is the contention of this thesis that soil type and location, in conjunction with the labor-intensive tobacco agricultural system, were prominent factors, if not the major factors, in the settlement location of rural homesteads in the environs of Williamsburg and Yorktown by the third quarter of the eighteenth century. A basic locational strategy can be discerned by uncovering the factors that influenced an Englishman's choice of settlement location. When a colonist settled, he chose a micro-environment located close to critical resources. It is assumed that the colonist placed himself nearest to the resources he valued as most important and/or used most often. If the dominant economic activity in Colonial Virginia was tobacco agriculture, then a micro-environment well suited for cropping tobacco was a valuable resource and colonists should have been strongly attracted to it.

In order to find out which factors influenced English Colonial settlement locations, their provenience must be plotted in time and space. To do this, a study area must be identified. The study area is primarily defined by the availability of historic map data, a major source of information. The French and British cartographic data compiled during the Yorktown Campaign of 1781 and 1782 tend to be concentrated in the environs of Williamsburg and Yorktown, Virginia. The area mapped by the cartographers, hence, the study area, is bounded on the North by the York River, on the South by the James River, on the West by Powhatan
Creek, and on the East by Yorktown Creek. Today, as it did in the eighteenth century, these 80,200 acres of land lie in James City and York Counties and include the city of Williamsburg. (see Map No. 1). The availability of historic maps also limits the study area temporally to the third quarter of the eighteenth century, or more specifically, to the years of 1781 & 1782.

Archaeological data gathered from surveys and excavations will supplement the historic cartographic data. Although both sources of data are biased, by using them in conjunction one might avoid a skewed result from the analysis.

In order to discover the primary factors of the settlement system, the site locations will be transferred from the historic French and British maps, and archaeological data will be transferred to United States Geological Survey maps of 1:24,000 scale and United States Soil Survey maps. Using these maps, the distance to environmental resources, such as soil type and drinking water can be measured along with the distance to social resources, such as nearest neighbor, navigable water, or roads.

In comparing these distances, one can judge which resources were favored in settlement location. However, the sheer abundance of one resource in comparison to the dearth of another might skew this simple analysis. It might appear that the availability of suitable soils is disproportionately large compared to roads, for example. To counter this, another method of measurement will be devised. Soils will be reclassified as to their ability to support commercial grade eighteenth century tobacco. Rectangular sample units will be imposed on the soil maps in order to determine the relative proportions of the soil types present. Within these sample units, soil types underneath the siting of a settlement will be recorded. Then, a chi-square test will be conducted to determine if the locations of
the settlement are random in relation to soil types. When comparing the results of these measurements and tests, one can judge whether or not soil characteristics were a primary factor in determining settlement location.
Map No 1
Location of Study Area
The Environment

The study area, the environs of Williamsburg and Yorktown, is located in the middle section of the "Peninsula" along the western edge of the Chesapeake Bay which lies in the Atlantic Coastal Plain (see Map No. 1). This peninsula has been termed "the Yorktown Peninsula" or simply "the Peninsula". Perhaps the most descriptive label is the "James-York Peninsula", since it is bounded by the James River to the South and by the York River along the North (see Map No. 2).

Only certain elements of the environment have been outlined. These are the ones which affect the development of colonial tobacco agriculture, not other activities. Scrutiny of the fauna and small flora present in the study area would be valid if hunting or grazing activities were to be examined, but are not pertinent to tobacco cultivation.

The geological formation of the Peninsula is ancient, with bedrock dating back 140 million years. All of the bedrock near the surface in the study area is from sedimentary formations. Lagoons, streams, and deltas deposited sand and clay since the Cretaceous period (Robert Giles et al., 1974:9-11). Therefore, all of the parent mineral material of soils developed from marine or fluvial deposition.

Later, during the Tertiary and Quaternary periods, fluctuating sea levels formed several beaches in the lower Peninsula. Today, these ancient beaches, deltas, and riverbanks are known as "scarps". The predominant scarps in the study area are the Surry Scarp, the Camp Peary Scarp, and the Kingsmill Scarp. The Surry Scarp transverses the Peninsula through Williamsburg (see Map No. 3). Its crest reaches 110 feet above sea level while the toe is 90 feet. The Camp Peary
Scarp runs parallel with the York River, separating the Coastal Plain Uplands from the Coastal Plain Lowlands and river terraces. Along the James River flank, the Kingsmill Scarp demarcates the Uplands from the Lowlands. The Uplands that lie between the two scarps are known as the Lackey Plain. The plain's altitude averages 70 feet above sea level (Gerald Johnson et al. 1981:2-5).

Several stream systems drain into the James and York Rivers and dissect the study area. Those emptying into the York River tend to have steep slopes in comparison to the longer streams draining into the James River. The James and York Rivers are not fast moving rivers, but their water flow does cause significant erosion along their banks. Both rivers are estuaries of the Chesapeake Bay, each consisting of brackish water, and flank the study area.

The topography of the Peninsula is composed of uplands and lowlands (see Map No. 4). Each zone is characterized by its own soil complex (see Table No. 1). The higher areas in the uplands feature loamy Slagle, Izagora, Emporia, and Kempsville soils along with the clayey Craven, Caroline, and Bethera soils. In contrast, the soils of the river terraces and flood plains of the lowlands tend to be the loamy Tomotley, Dragston, Altavista, State, Johnston, Pamunkey and Tetotum soil types. The lowland flats also feature the clayey Dogue and Peawick soils (Hodges, et al. 1985:85).

The topography also affected the development of flora along with the soils. Certain communities of plants frequently locate themselves in select areas of the landscape. On the higher areas, shortleaf pine, Virginia pine, and red oak can be found. The upper slopes and crests of the uplands usually support white oak, red oak, and hickory. The lower areas and the bottoms are usually inhabited by swamp chestnut, cherrybark oak, sweetgum, nutall oak, willow oak, and yellow poplar. The poorly drained wet areas usually harbor cottonwood, sycamore, American elm.
pecan, sweetbay, swamp tupelo, baldcypress, water tupelo, black willow, sugarberry, red maple, and green ash. An exception to this general description is the ubiquitous loblolly pine which dominates the flora throughout all of the region.

Along with the flora, climate and precipitation are critical environmental factors in land use patterns. They narrow the range of crops that can be grown in a region. This, in turn, limits the variety of agriculture feasible in a region which partially determines the land use and settlement pattern. The climate of Tidewater Virginia is not a harsh one. The effective growing season varies from 175 to 217 frost-free days in one year. In the winter, the mean temperature is 41 degrees F, with the average daily minimum of 30 degrees F. The summers are warm, with the average temperature of 76 degrees F, and the daily average high of 87 degrees F. (Hodges et al. 1985:1). The amount and form of precipitation also influence land use. On the average, 47.29 inches of water fall in a year on this region. About 55% of the precipitation will fall during the growing season of April through September (Hodges et al. 1985:1). As the early English Colonists discovered, crops suited to a temperate climate thrive in Virginia; but vineyards and mulberry bushes, with their silkworms, do not.

Certain environmental characteristics of the study area have been altered since the eighteenth century. Although some of the fauna and flora have dramatically changed from the time of contact with the first European Colonists to the present, the environmental factors affecting agriculture have not. It is well known that the soil fertility of this region has been depleted through hundreds of years of tobacco cultivation and erosion. But the actual fertility value of soil is not the focus of this study. It is the soil structure and mineral parentage that are the critical values to be examined, and they should not have changed through time.
Table 1
Estimated Composition of Soil Complexes in the Study Area

<table>
<thead>
<tr>
<th>LOW COASTAL PLAINS</th>
<th>ACRES</th>
<th>PERCENT OF TOTAL</th>
</tr>
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<tbody>
<tr>
<td>LEVY-PAMUNKY-DOGUE</td>
<td>3,840</td>
<td>4.8%</td>
</tr>
<tr>
<td>EMPORIA-BOHICKET-SLAGLE</td>
<td>16,355</td>
<td>20.3%</td>
</tr>
<tr>
<td>PEAWICK-EMPORIA-LEVY</td>
<td>6,683</td>
<td>8.3%</td>
</tr>
<tr>
<td>LOWLAND SUBTOTAL</td>
<td>26,878</td>
<td>33.4%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>UPLANDS</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>BETHERA-IZAGONA-SLAGLE</td>
<td>5,048</td>
<td>6.3%</td>
</tr>
<tr>
<td>SLAGE-EMPORIA-UCHEE</td>
<td>23,463</td>
<td>29.3%</td>
</tr>
<tr>
<td>EMPORIA-CRAVEN-UCHEE</td>
<td>19,837</td>
<td>24.7%</td>
</tr>
<tr>
<td>KEMPSVILLE-EMPORIA-SUFFOLK</td>
<td>4,971</td>
<td>6.2%</td>
</tr>
<tr>
<td>UPLAND SUBTOTAL</td>
<td>53,325</td>
<td>66.5%</td>
</tr>
</tbody>
</table>

TOTAL                               | 80,203 | 99.9%            |

All figures calculated from: Hodges, Robert L. P., Ben Sabo, David McCloy, and Kent Staples. 1985, Soil Survey of James City and York Counties and the City of Williamsburg, Virginia. United States Department of Agriculture, Soil Conservation Service in cooperation with the Virginia Polytechnic Institute and State University. P. 139, 'General Soils Map.'
Map No 4
Environmental Zones

- York River
- Coastal Upland
- Williamsburg
- Coastal Lowland
- James River
- Yorktown

Scale
2 miles

North
The Importance of Soils in Historical and Recent Archaeological Literature

The Colonial Virginian settlers and modern scholars have recognized the importance of soil type in the location of farms. Before the first colonist beheld the New World, the English had developed a tradition of soil lore. The English husbandman could predict the agricultural properties of a soil by the type and condition of vegetation it supported. Several period documents demonstrating their awareness of the soil types are available today.

In 1610, Walter Folkingham wrote about which varieties and conditions of the flora indicated certain soil characteristics in The Synopsis or Epitome of Surveying Methodized. The soil characteristics predicted by flora include soil texture, fertility, drainage, depth, and mineral content. The folk classification of soils was immediately applied to the new world by Captain John Smith in his work, True Relation and Description of Virginia (1608): "...But the best ground is known by the vesture it beareth, as by the greatness of trees or abundance of woods". (Lyon Tyler, 1946: 83). Smith went on to classify land into four types using the original flora as an indication for agricultural suitability. On "first rate" land grew oak, hickory, sassafras, walnut, cherry, black ash, elm, and beech. The occurrence of spicewood among the beech marked the land as "second rate"; additional spicewood and smaller trees denoted "third rate" land; while the presence of myrtle bushes foretold "fourth rate" land (Tyler, 1946: 83). If the initial and subsequent English settlers followed Smith's typology, they would seek land with large strands of hardwood to settle on.
Writing almost a century later, Robert Beverley described the agricultural potential of the soils in coastal Virginia in *The Present State of Virginia* (1705). According to Beverley, the lowlands along the rivers are characterized as having a fat "mould", ideal for cultivating heavier grains along with rice, hemp, and maize. Large oaks, poplars, pines, cedars, cypresses, and sweet gums were found growing in this soil. A "cold, hungry, sandy soil" was also present in this land, covered with huckleberry, cranberry, and chincapin vegetation (Beverley, 1705:123-125).

The second type of land described by Beverley, the "middle" or "land higher up the river" is directly applicable to the study area. This type of land was stated to be generally level with shallow valleys, small hills, and fresh streams. In some areas the mould of the soil was described as black, fat, and thick, while in other areas it was described as light and thin. In the area on the middle of the necks, or ridges between the rivers, the soil was thought to be a poor light sand. Beverley goes on to say that chestnuts, chinkapins, scrub-oak, and reedy grass grew on this ridge soil, and he believed it produced good fodder for cattle. The rich zones of the second type of land lie near the rivers and their branches with groves of large oak, hickory, walnut, ash, beech, and poplar (Beverley, 1705:123-125).

After reviewing the works of these Colonial Period sources, one can conclude that the Colonial Virginian farmer was well aware of the kind of soil he farmed and its effect on the quality and quantity of his crops. The English folk soil classification used by Folkingham, Smith, and Beverley pinpointed the prime agricultural land as being the lowlands where the large stands of hardwood trees grew.

Today, archaeologists have widely acknowledged the importance of soil characteristics in relationship to settlement location. Many studies in settlement
Patterns of prehistoric and historic populations utilize soils as a key factor. From the late 1950's to present, environmental factors, including soils, have been a popular theme of explanation in archaeology. However, the importance of soils in archaeological literature dates back to much much earlier. In 1932, Cyril Fox wrote *The Personality of Britain*, in which he identified soil characteristics as a major factor in settlement location. Fox realized that the cultures of the Bronze Age, Iron Age, and Medieval periods preferred different soil types, and varied the location of their settlements accordingly. S.L. Woodridge and D.L.Linton (1933) refined the idea for Southeast England. The various preferences for soil type were thought to be caused by the different levels of agricultural technology available to a culture. For example, clayey soils would only be attractive if a culture employed a plow capable of making those soils arable, as did the medieval period agriculturalists.

Several studies in prehistoric and historic settlement patterns have already laid the groundwork for the application of soil types to locational analysis of archaeological sites. A. Ellison and J. Harriss have defined idealized site catchment areas for Iron Age, Roman, and Saxon settlements in Wiltshire and Sussex. From tabulating the topographical features and soil type present at each site, a composite catchment basin (a circular zone or territory surrounding a site from which its inhabitants exploited natural resources) was developed for each culture. Essentially, Ellison and Harriss have discovered a characteristic pattern in settlement location for each culture from the micro-environments chosen for settlement (Ellison and Harriss, 1972). With these results, these two scholars employ geographical models to explain settlement patterns by agricultural practices.
Also using soils as a locational factor, Ian Wells developed a computer model to use remote sensing data gathered from the LANDSAT satellite program. In his Master of Arts thesis, "A Spatial Analysis Model for Predicting Archaeological Sites in Delaware and its Potential Application for Remote Sensing," Wells created a predictive model with topographical factors for the prehistoric settlement patterns in the Appoquinimink River valley in Delaware (Wells, 1981). He employed Jay Custer's simplified classification of soils into woodland and open field types (Custer, 1980). Wells contended that 72% of the variation of settlement is explained by six variables: distance to minor streams, lakes, open land soils, marshes, and the slope gradient, along with topographical relief (convexity).

Soil type and other environmental factors were analyzed by J.M. Kent Gritton in a study of prehistoric settlement location in the James River Basin of Virginia. The study was based on the data from the state archaeological site files at the Virginia Research Center for Archaeology at Yorktown. Sites were categorized on the basis of the PaleoIndian, Archaic, and Woodland cultural periods. Several factors were recorded for each site. These were the proximity of a site to drinking water, streams and rivers, local topography, soil type, and elevation. In his analysis with soils, Gritton used the soil survey classification based on the limitations of a soil's use and the restrictions of suitable crop varieties for each soil type (Hodges et al., 1985). Gritton constructed the ideal site setting for each cultural period. A relationship was established between Woodland settlement and soil fertility. While Woodland period sites were strongly associated with fertile soils and drinking water, Archaic and Transitional populations favored locations near rivers and on various types of soils (Gritton, 1979). These findings confirm the popular theory that the Woodland populations were agricultural and the Transitional and some Archaic populations depended on marine and fresh water.
resources. From these locational tendencies demonstrated by Gritton, one can make inferences as to the kinds of resources that were highly valued by one population and overlooked by another.

In a paper with a similar perspective to this thesis, Michael Smoleck analyzed the settlement patterns of seventeenth century English colonists in Maryland. Smoleck used the locational variables of soil type, proximity to drinking water, and access to the waterfront in his analysis. He blended soil type and topography to produce a general prime agricultural soil. In Maryland, this prime soil type is usually found on gently sloping river terraces. A high percentage of seventeenth century sites is found to be in association with this prime soil. Settlement location also correlated with fresh water and access to the rivers and the Bay (Smoleck, 1984). However, the draw of the waterfront and prime soils (on river terraces) pulls the settlements to locate in the same area. Perhaps one genuinely strong factor is masking the minimal pull of the other factor.

In comparison to the studies discussed in this chapter, this paper will expand in the direction of agriculture and soil types. Information about the kind of agriculture practiced in Colonial Tidewater Virginia will be reviewed and soils will be reclassified in relation to it. Environmental locational factors will be compared to social locational factors to assess the relative "pull" of each. The actual role of soils in site location will be explored further. Soils will be reclassified in light of the agricultural practices of the study period, not by modern uses. In all, this thesis strives not to repeat previous themes and studies, but to refine our understanding of the role of soils in settlement location.
Agriculture in Colonial Tidewater Virginia

Throughout history, farmers have recognized that the type and quality of soil were major factors in crop production and the agrarian society of British Colonial Virginia was no exception. When English farmers first settled at Jamestown in 1607, they came with a tradition of European soil lore. Classification of soils was based on its color and texture, along with the type and condition of the vegetation it supported. But European agricultural methods frequently failed to provide good harvests.

The colonists then adopted certain Indian crops and cultivation techniques with success. They employed a method of "swidden" or "slash and burn" agriculture. In this practice, the planter cleared a plot of land by girdling the trees and sometimes burning off the dead timber. Crops were planted by hand and then tended with a hoe, for the few plows that were imported soon became useless among the many stumps in a freshly cleared plot. Indian corn was planted amidst beans, peas, and squash in small mounds of soil. A major advantage of this Native American system was that it required only the simple technology of hoes, hand mortar, and querns to process the crops instead of the horse drawn plow and grist mills used in Europe.

As tobacco production in the colonies was highly profitable during the early decades of the seventeenth century, planters focused most of their energies on this cash crop. Tobacco agriculture became so pervasive and dominating that it dispossessed the cultivation of possible competing crops which never fully
materialized in the seventeenth century. Wheat, for example, had to be harvested during the same time of year as tobacco; therefore, wheat was an unpopular crop. Instead, Indian corn continued to be the staple that fed the colony. The minimal effort required for the cultivation of Indian corn placed few demands on the planters' time during crucial periods of the life cycle of the tobacco plant. Since the cultivation of Indian corn was so compatible with tobacco cropping, both were practiced together without major modifications throughout the eighteenth century.

The colonists' European soil lore, based on locating prime soil to raise English grains, changed to accommodate the needs of tobacco planting. Instead of seeking the rich, heavy, fertile mould of the lowland soil in the riverine plains, the tobacco planters preferred the sandy, well drained soil of the uplands. William Tatham perceived these conditions in the 1760's:

So much depends on the choice of ground suitable for the cultivation of this plant, and so much is this kind of cultivation by commerce in Virginia, that this consideration has heretofore had considerable influence on the value of estates. Indeed, this would seem to be a good criterion to decide the innate worth of soils; for it is certain that lands which produce good crops, or full grown plants, of tobacco, will succeed in any other branch of husbandry (Tatham, 1800:5).

Suitable soil for the tobacco plant was only the beginning for the labor intensive practice of tobacco cultivation. During the seventeenth and eighteenth centuries, land was relatively plentiful and labor scarce. Therefore, land was usually used extensively while little effort, save crop rotation, was expended in maintaining it. On an eighteenth century farm, after raising tobacco in a field for three to five years, the planter followed with crops of wheat and Indian corn (Gray, 1933:197). When the soil became exhausted, or depleted of its organic and
mineral nutrients, the planter abandoned the field and cleared another one. This practice was so prevalent that it appeared in the planters' language. Tatham recorded that freshly cleared ground or "new ground" was synonymous with "tobacco ground" (Tatham, 1800:6). He goes on to describe how and why Virginia farmers did this:

...and to procure his new ground you will observe him clearing the woods from the sides of the steepest hills which afford a suitable soil; for a Virginian never thinks of reinstating or manuring his land with economy until he can find no more new land to exhaust, wear out, as he calls it; and besides, the tobacco he produced from the manured or cow-penned land, is only considered, in ordinary, to be a crop of second quality (Tatham, 1800:6).

Old fields were abandoned for new as the planter shifted to adjacent plots. According to Carville Earle, soil exhaustion was temporary, not permanent. The planter would return to his old tract several decades later, working it again for three or four years. When the fertility of the field began to decline again, the planter let it go to fallow for a second time. This practice permitted a tract to return to long term fallow for several more decades. Thus, if a planter owned enough land and only cropped a small portion at a time, he could continue to have a supply of rested land available (Craven, 1926:69, and Earle, 1975:24).

The planters' land use strategy required relatively low man power per acreage when compared to agricultural techniques of contemporary Europe. The ratio is estimated at about one laborer to fifty acres. In other words, to maintain the productive fertility of the land, a laborer could not work less than a total of fifty acres throughout his life time. If the ratio did fall below one to fifty, the land would have been cleared more frequently than once every twenty years, and that would result in the soil not having enough time to recover, and in a decline in overall fertility. But if the ratio was kept low, tobacco production could be stable. In Tidewater Maryland, All Hallow's Parish maintained a similar level of
production for a hundred years, from the mid seventeenth century to the mid eighteenth century. In fact, Earle contends it was the over-harvest of the wood that was the critical factor in keeping up the fifty acres to laborer ratio (Earle, 1975: 34).

Tobacco production began to decrease in certain areas of the Chesapeake region during the second half of the eighteenth century. For example, tobacco production was slowly declining in Middlesex County, Virginia, while it remained relatively constant at All Hallow’s Parish in Maryland (Rutman and Rutman, 1984B:17). Market surplus, low price levels, and soil exhaustion contributed to the decline of tobacco cropping. The wars in Europe interrupted the tobacco trade, which in turn, created a bust cycle in Virginia that forced planters to diversify their crops. Wheat and other grains began to challenge the supremacy of tobacco as the major crop in certain areas of Colonial Virginia. The Seven Years War and wheat blight disrupted agriculture in Europe, resulting in an international demand for grain (Craven, 1926:67). Also, wheat and corn could be successfully raised on land already depleted by tobacco cropping. The combination of these factors in the eighteenth century contributed to make wheat and corn major exports.

Although wheat and grain production rose in the eighteenth century, the tobacco planting tradition was not quickly nor completely replaced. Land was still selected for tobacco cropping; wheat was planted only after the land could not support high grade tobacco. In the 1760’s, the anonymous author of American Husbandry observed the relationship between tobacco and wheat agriculture:
...the wheat and other corn which is among these exports, are raised principally on old tobacco plantations that are worn out for that plant without the assistance of manure. This is a point that deserves much attention: Exhaust the lands of these colonies as much as you will with tobacco, you will leave it in order for grain, which is a matter of great consequence for the settlers; since corn is there a very profitable article of culture, upon the great lands of this country will (even tobacco) yield large crops with very little assistance with manure.

The usual course of business has been the planters exhausting the land first with tobacco, and then retiring backwards with their negroes in quest for fresh lands for tobacco, selling their old plantations to newcomers who have not money enough to go largely into tobacco with negroes and therefore confine themselves to common husbandry; and this is upon the whole very advantageous. Planters who meet very fresh woodland, employ themselves so eagerly on tobacco as scarcely to raise enough corn for their families, in which case their little neighbors are very useful to them in selling it... (1939:187).

Clearly, the cultivation of tobacco was the intent of most of the initial settlers on a given tract of land. Only when the soil was depleted for raising tobacco was the land planted in wheat and other grains.

The broad agricultural trends mentioned above also occurred in York and James City Counties, but they are difficult to document. Unfortunately, few records concerning farming practices during the eighteenth century for this region survive today. However, several references do exist on which a reconstruction can be built.

Tobacco agriculture was a major economic force in the two county area during the eighteenth century. The Yorktown Peninsula was recognized as an ideal location to grow the lucrative strain of "sweet scented" tobacco (Hugh Jones, 1724:37). In order to discover patterns of crop selection in the study area, samples of the York County probate inventories were taken and examined (see Table No. 1). When analyzing the tool assemblages of the farmers, it is possible to infer what kind of crops a farmer raised by noting the presence or absence of appropriate specialized tools. It is assumed that a farmer cultivated substantial
amounts of wheat if he invested in a plow, and possibly scythes, or reaping hooks. However, if a farmer exclusively used hoes, he focused on tobacco or corn cultivation. Also, it follows that if the planter had large amounts of a kind of produce in storage, he was actively cultivating that crop. These items were quantified into time periods of a full year, thus negating seasonal variation. Due to time constraints, only two years worth of inventories were sampled per decade. For the sample, only the inventories of obvious full time agriculturalists were counted, as opposed to those of part time planters or town dwellers. This distinction was made on the size of the landholding and the presence of non-agricultural professional tools and other clues. In all, five decades were sampled; the sample size for each decade fluctuated from twelve to forty. Therefore, it was necessary to derive a ratio by dividing the number of farmers who owned specialized tools and stored crops in a decade by the number of total farmers sampled for the same decade (see Table No. 2). Upon examination of Table No. 2, no obvious trends were discernible for the quantity of farmers possessing reaping hooks, scythes, and hoes, nor for those storing corn or wheat. Nevertheless, the ownership of plows, needed for grain agriculture, increased after 1760. In addition, the number of planters storing tobacco tapered off from the 1750's to the 1780's. The purpose of this inventory study is to demonstrate that wheat and grain agriculture had not surpassed tobacco cultivation up to the revolutionary war. But it appears that wheat farming was starting to make inroads by the 1760's.

By the time of the Revolutionary War, tobacco was still seen as a major crop in the environs of Williamsburg by Nicholas Cresswell: "...the land in general appears barren. the produce appears to be tobacco and corn..." (Cresswell, 1777: 206). As implied in Cresswell's journal, the farms in the study area suffered during the war. Generally, the nature of Southern agriculture underwent
profound changes from the end of the war in the 1780's into the nineteenth century. In the 1790's, it appears that the cultivation of tobacco in the study area was minimal. When Duke La Rochefoucault Liancourt visited Yorktown and Williamsburg in the 1790's, he described the current agricultural techniques:

... the proprietor possesses so great an extent of land, that he cultivates but a small portion of it. The ordinary rotation of crops here is Indian corn, - next wheat or other grain - then three or four years in fallow during which the crops of grass furnish the cattle with good sustenance. After this rest of the three or four years, the ground is again cultivated in the same manner (La Rochefoucault, 1795: 26).

If this passage is taken at face value, one could conclude that farmers in James City and York Counties were in the process of dropping tobacco planting in favor of grain cultivation and a conventional European fallow system in the 1790's. But the post-war agriculture shift occurs after the study period and should not be discussed in depth here.

Tobacco planting dominated Tidewater agriculture from the early seventeenth century to the period of the American Revolution. From the mid eighteenth century onward, grain production seriously competed with tobacco cropping in certain areas as a response to overall market conditions. By the 1780's, tobacco cultivation was declining in Virginia (L.C. Gray, 1934:766).

The actual settlement in the study area occurred from 1620's or 1630's up to 1700. During this time period, tobacco cropping was the major source of income and thus affected land use. Although the locational data from the historical maps actually date to 1781 and 1782, the initial settlement decision to occupy a given tract of land occurred as much as a century or more earlier when tobacco cropping dominated the economy. Regardless of when the colonial planters settled in the study area, they devoted their energies to tobacco cultivation and marshalled their time and location to suit the needs of the tobacco plant. Further,
the high standards of the tobacco inspection system forced the planters to concentrate their efforts on producing only high grade tobacco, since inferior grades were worth nothing (Herndon, 1957). Good soils were a crucial element for the production of high grade tobacco (Tatham, 1800: 6). Therefore, soils that produced good tobacco were probably in high demand. In the study area, the sweet scented strain of tobacco was very profitable and was grown in light sandy soils of the upland areas. It follows that the planters favored these good tobacco soils and adjusted the location of their settlement to a site that maximized their access to them. These trends are discernible in the 1781 map data.
### Table 2
#### Frequency of Tools and Crops in the York County Probate Inventories

<table>
<thead>
<tr>
<th>YEAR</th>
<th>SAMPLE</th>
<th>HOES</th>
<th>PLOWS</th>
<th>SCYTHES &amp; HOOKS</th>
<th>CORN (BARREL)</th>
<th>WHEAT (BUSHEL)</th>
<th>TOBACCO (BARREL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1740</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1741</td>
<td>18</td>
<td>5</td>
<td>0</td>
<td>4</td>
<td>5</td>
<td>0</td>
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<tr>
<td>1750</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1751</td>
<td>19</td>
<td>5</td>
<td>0</td>
<td>2</td>
<td>8</td>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>1760</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1761</td>
<td>12</td>
<td>4</td>
<td>0</td>
<td></td>
<td></td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>1770</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1771</td>
<td>27</td>
<td>3</td>
<td>5</td>
<td>6</td>
<td>11</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td>1779</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1780</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1781</td>
<td>40</td>
<td>9</td>
<td>11</td>
<td>6</td>
<td>11</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

**NOTE:** The figures given are a count of individual tools present on planters' probate inventories for a sample of a decade.

**SOURCE:** York County Records. 1740-1782.
### Table 3

**Ratio of Farmers with Specialized Tools to All Farmers per Decade**

<table>
<thead>
<tr>
<th>DATES</th>
<th>HOES</th>
<th>PLOWS &amp; HOOKS</th>
<th>SCYTHES (barrel)</th>
<th>CORN (bushel)</th>
<th>WHEAT (barrel)</th>
<th>TOBACCO</th>
</tr>
</thead>
<tbody>
<tr>
<td>1740-1</td>
<td>0.2</td>
<td>0.0</td>
<td>0.2</td>
<td>0.3</td>
<td>0.0</td>
<td>0.2</td>
</tr>
<tr>
<td>1750-1</td>
<td>0.3</td>
<td>0.0</td>
<td>0.1</td>
<td>0.4</td>
<td>0.2</td>
<td>0.4</td>
</tr>
<tr>
<td>1760-1</td>
<td>0.3</td>
<td>0.0</td>
<td>0.1</td>
<td>0.5</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>1770-1</td>
<td>0.1</td>
<td>0.2</td>
<td>0.2</td>
<td>0.4</td>
<td>0.3</td>
<td>0.1</td>
</tr>
<tr>
<td>1779-82</td>
<td>0.2</td>
<td>0.3</td>
<td>0.2</td>
<td>0.3</td>
<td>0.1</td>
<td>0.0</td>
</tr>
</tbody>
</table>

**NOTES:** The ratios were derived by dividing the number of tools in a category by the number of inventories in the sample of that decade. This was done to control the fluctuations of sample populations through the decades.

**SOURCE:** York County Records. 1740-1782.
Classification of Soils

In Colonial Tidewater Virginia, a good soil for tobacco cultivation was vital to tobacco profits. As observed by several historical sources, the cultivation of good high grade marketable tobacco required a light, well drained soil. This still holds true for modern tobacco agriculture. Tobacco plants require a certain narrow range of environmental conditions to thrive, described in T.C. Tso's *Physiology and Biochemistry of Tobacco Plants*:

Tobacco plants may wilt or die when their roots are deprived of Oxygen, as happens under flooding conditions. At the same time, the plant needs an adequate amount of water to maintain turgidness and expansion of the leaf. To meet both of these conditions, tobacco must have an open loose structure with good drainage, such as a light sand or sandy loams.

(Tso, 1972:19)

Good drainage is such an important requirement of a soil in reference to tobacco agriculture that soil fertility can be considered a secondary factor (James Tramel, 1985). In the eighteenth century, tobacco that grew on poorly drained soils was termed "non-burning" and considered substandard, having little market value (Hugh Jones, 1724:77). Therefore, a gentle slope to provide drainage, with a grade between two to six percent, was optimum (Smoleck, 1984).

Soil structure and slope, affecting drainage, are not the only restricting environmental conditions the tobacco plant needs. Tobacco also requires certain key minerals to grow and mature properly. If the plants do not absorb nitrogen, potassium, magnesium, iron, manganese, calcium, boron, sulfur, zinc, copper, and molybdenum, they suffer characteristic symptoms and fail to produce good quality tobacco (Tso, 1972:21). Acidity of the soil is another factor that affects
tobacco growth. However, the long term localized use of lime to raise the pH level, a practice dating back to the early 1800's, makes it difficult to estimate the original pH of the soil.

The taste of tobacco is strongly influenced by the kind of soil in which the plants are raised. Soils with a mixed mineral parentage tend to give the plant a strong flavor. In contrast, soils with a siliceous parentage impart a subtler, thinner taste on the tobacco (Robert Hodges, 1985). In the eighteenth century, a subtle tasting tobacco, known as "sweet-scented", was in high demand in England and sold for a good price. The James-York Peninsula was one of the few areas where this profitable variety could be successfully raised (Hugh Jones, 1724:34), and it follows that the planters would value the prime "sweet-scented" tobacco-growing areas and maximize their use. Therefore, the planters in the study area would select a sandy soil or sandy loam on a gentle slope to raise tobacco. Although soil fertility has been downplayed, it remains a relevant factor. If the close association of the location of farm dwellings and heavily worked fields can be accepted, one can expect to observe a strong connection between prime tobacco soils and settlement location.

Prime tobacco soils need to be defined in relation to the current information supplied by the Soil Conservation Service. In the publication, Soil Survey of James City and York Counties and the City of Williamsburg, Virginia (Hodges, et al., 1985), soils are classified into types by modern agricultural requirements and construction properties, but not how they affect tobacco plants. For this study, soil types need to be grouped into classes in reference to tobacco cultivation. (A list of soils present in the study area and their properties can be reviewed in Table No. 3). For the sake of clarity, the term "soil type" denotes a category of soil used by the Soil Conservation Service, and the term "soil class"
refers to the grouping of soil types in this paper. In assessing the suitability of a soil type to tobacco cultivation, they are sorted by several key factors. First, soils are sorted on the basis of whether they have a mixed mineral or siliceous parentage. Then, they are rated on the basis of slope, moisture retention, and fertility: the latter is measured in wheat yields which test the soil under most stress (see Table No. 4). For this study, siliceous soils are divided into a continuum of three categories, S-1, S-2, and S-3. Soils in class S-1 are considered to be optimum for tobacco, being siliceous, well drained, fertile, and found on a gentle slope. In contrast, S-3 is the least fertile and not necessarily found on a gentle slope. Following this, the mixed mineral soils were classified along the same lines, M-1, M-2, and M-3. All the soils that are too wet or too steep for general agriculture are classified W (wet) and ST (steep), respectively.

If the assumption about the planters' general desire to maximize the use of good "sweet-scented" tobacco is correct, one would expect the soils classified S-1 to be the most heavily used, S-2, the next, decreasing with each drop in quality through M-1, M-2, M-3 to ST and W which would be nearly ignored. If site location corresponds to intensity of land use, the S-1 class of soil should be the most heavily occupied.
Table 4
Soil Types and Characteristics

<table>
<thead>
<tr>
<th>MAP SYMBOL</th>
<th>NAME</th>
<th>MINERAL PARENTAGE</th>
<th>SLOPE</th>
<th>CROP YIELD WHEAT (BU/ACRE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ALTAVISTA FINE SANDY LOAM</td>
<td>MIXED</td>
<td>0-3%</td>
<td>55</td>
</tr>
<tr>
<td>2</td>
<td>AUGUSTA FINE SANDY LOAM</td>
<td>MIXED</td>
<td>0-2%</td>
<td>30</td>
</tr>
<tr>
<td>3</td>
<td>AXIS VERY FINE SANDY LOAM</td>
<td>TIDAL MARSH</td>
<td>0%</td>
<td>--</td>
</tr>
<tr>
<td>4</td>
<td>BEACHES</td>
<td>N/A</td>
<td>0-10%</td>
<td>--</td>
</tr>
<tr>
<td>5</td>
<td>BETHERA SILT LOAM</td>
<td>N/A</td>
<td>0-2%</td>
<td>TOO WET</td>
</tr>
<tr>
<td>6</td>
<td>BOHICHET MUCK</td>
<td>N/A</td>
<td>0%</td>
<td>SWAMP</td>
</tr>
<tr>
<td>7</td>
<td>BOJAC SANDY LOAM</td>
<td>MIXED</td>
<td>0-3%</td>
<td>40</td>
</tr>
<tr>
<td>8B</td>
<td>CAROLINE FINE SANDY LOAM</td>
<td>MIXED</td>
<td>2-6%</td>
<td>60</td>
</tr>
<tr>
<td>9</td>
<td>CHICKAHOMINY SILT LOAM</td>
<td>N/A</td>
<td>0-2%</td>
<td>TOO WET</td>
</tr>
<tr>
<td>10B</td>
<td>CRAVEN FINE SANDY LOAM</td>
<td>MIXED</td>
<td>2-6%</td>
<td>50</td>
</tr>
<tr>
<td>10C</td>
<td>CRAVEN FINE SANDY LOAM</td>
<td>MIXED</td>
<td>6-10%</td>
<td>N/A</td>
</tr>
<tr>
<td>10B</td>
<td>CRAVEN-UCHEE COMPLEX</td>
<td>MIXED/SILICEOUS</td>
<td>2-6%</td>
<td>40</td>
</tr>
<tr>
<td>11C</td>
<td>CRAVEN-UCHEE COMPLEX</td>
<td>MIXED</td>
<td>6-10%</td>
<td>35</td>
</tr>
<tr>
<td>12</td>
<td>DOGUE LOAM</td>
<td>MIXED</td>
<td>0-2%</td>
<td>60</td>
</tr>
<tr>
<td>13</td>
<td>DRAGSTONE FINE SANDY LOAM</td>
<td>MIXED</td>
<td>0-2%</td>
<td>40</td>
</tr>
<tr>
<td>14B</td>
<td>EMPORIA FINE SANDY LOAM</td>
<td>SILICEOUS</td>
<td>2-6%</td>
<td>50</td>
</tr>
<tr>
<td>14C</td>
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<td>45</td>
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<td>EMPORIA COMPLEX</td>
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<td>SILICEOUS</td>
<td>25-50%</td>
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</tr>
<tr>
<td>16</td>
<td>IZAGORA LOAM</td>
<td>SILICEOUS</td>
<td>0-3%</td>
<td>35</td>
</tr>
<tr>
<td>MAP SYMBOL</td>
<td>NAME</td>
<td>MINERAL PARENTAGE</td>
<td>SLOPE</td>
<td>CROP YIELD WHEAT</td>
</tr>
<tr>
<td>------------</td>
<td>-----------------------------</td>
<td>-------------------</td>
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<td>------------------</td>
</tr>
<tr>
<td>17</td>
<td>JOHNSTON COMPLEX</td>
<td>SILICEOUS</td>
<td>0-2%</td>
<td>TOO WET</td>
</tr>
<tr>
<td>18B</td>
<td>KEMPSVILLE FINE SANDY LOAM</td>
<td>SILICEOUS</td>
<td>2-6%</td>
<td>50</td>
</tr>
<tr>
<td>19B</td>
<td>KEMPSVILLE-EMPORIA FINE SANDY LOAMS</td>
<td>SILICEOUS</td>
<td>2-6%</td>
<td>50</td>
</tr>
<tr>
<td>20B</td>
<td>KENANSVILLE VERY FINE SANDY LOAM</td>
<td>SILICEOUS</td>
<td>2-6%</td>
<td>35</td>
</tr>
<tr>
<td>21</td>
<td>LEVY SILTY CLAY</td>
<td>TIDAL MARSH</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>22</td>
<td>MUNDEN LOAMY FINE SAND</td>
<td>MIXED</td>
<td>0-3%</td>
<td>45</td>
</tr>
<tr>
<td>23</td>
<td>NEWFLAT SILT LOAM</td>
<td>MIXED</td>
<td>0-2%</td>
<td>45</td>
</tr>
<tr>
<td>24</td>
<td>NIMMO FINE SANDY LOAM</td>
<td>MIXED</td>
<td>0-2%</td>
<td>TOO WET</td>
</tr>
<tr>
<td>25B</td>
<td>NORFOLK FINE SANDY LOAM</td>
<td>SILICEOUS</td>
<td>2-6%</td>
<td>55</td>
</tr>
<tr>
<td>26B</td>
<td>PAMUNKEY SOILS</td>
<td>MIXED</td>
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<td>75</td>
</tr>
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<td>27</td>
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<td>MIXED</td>
<td>0-3%</td>
<td>30</td>
</tr>
<tr>
<td>28</td>
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<td>0-2%</td>
<td>45</td>
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<td>29A</td>
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<td>40</td>
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<tr>
<td>33</td>
<td>TIMOTLY FINE SANDY LOAM</td>
<td>MIXED</td>
<td>0-2%</td>
<td>TOO WET</td>
</tr>
<tr>
<td>34B</td>
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<td>45</td>
</tr>
<tr>
<td>34C</td>
<td>UCHEE LOAMY FINE SAND</td>
<td>SILICEOUS</td>
<td>6-10%</td>
<td>30</td>
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<td>35</td>
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<td>N/A</td>
<td>0-70%</td>
<td>N/A</td>
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<td>YEMASSEE FINE SANDY LOAM</td>
<td>SILICEOUS</td>
<td>0-2%</td>
<td>35</td>
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</table>
Table 5
Soil Classification Based on Tobacco Plant Requirements

S-1  SILICEOUS PARENTAGE WITH VERY HIGH FERTILITY (50+ BU. OF WHEAT)
  KEMPSVILLE FINE SANDY LOAM
  EMPIRIA FINE SANDY LOAM
  KEMPSVILLE-EMPIRIA FINE SANDY LOAM
  NORFOLK FINE SANDY LOAM

S-2  SILICEOUS PARENTAGE WITH MODERATE FERTILITY (40-50 BU. OF WHEAT)
  CRAVEN-UCHEE COMPLEX (11B)
  SLAGLE FINE SANDY LOAM (29A & 29B)
  SUFFOLK FINE SANDY LOAM (31B)
  UCHEE LOAMY FINE SAND (34C)
  EMPIRIA FINE SANDY LOAM (14C)

S-3  SILICEOUS PARENTAGE WITH LOW FERTILITY (39- BU. OF WHEAT)
  UCHEE LOAMY FINE SAND (34C)
  YEMASSEE FINE SANDY LOAM
  KENANSVILLE VERY FINE SANDY LOAM

M-1  MIXED PARENTAGE WITH HIGH FERTILITY (50+ BU. OF WHEAT)
  CAROLINE FINE SANDY LOAM
  DOGUE LOAM
  PAMUNKY SOILS

M-2  MIXED PARENTAGE WITH MODERATE FERTILITY (40-50 BU. OF WHEAT)
  DRAGSTONE FINE SANDY LOAM
  ALTAVISTA FINE SANDY LOAM
  BOJAC SANDY LOAM
  SEABROOK LOAMY FINE SAND
  TETOTUM SILT LOAM
  MUNDEEN LOAMY FINE SAND
  NEWFLAT SILT LOAM

M-3  MIXED PARENTAGE WITH LOW FERTILITY (30- BU. OF WHEAT)
  CRAVEN-UCHEE COMPLEX (11C)
  PEAWICK SILT LOAM
  AUGUSTA FINE SANDY LOAM
  CRAVEN FINE SANDY LOAM (10C)
W **TOO WET TO FARM**

IZAGORA LOAM
JOHNSTON COMPLEX
CHICKAHOMINY SILT LOAM
BOHICKET MUCK
BETHERA SILT LOAM
BEACHES
AXIS VERY FINE SANDY LOAM
TIMOTLY FINE SANDY LOAM

ST **TOO STEEP TO FARM**

EMPORIA COMPLEX (15D, 15E & 15F)

Social Factors in Settlement Location

The English Colonists came from a highly developed state level culture, and it is quite possible their settlement location could have been heavily influenced by British social factors instead of environmental ones. In reference to this paper, social factors are the elements of culture that promote interaction with other people as opposed to interaction with the environment. These factors are the man-made or natural features of the terrain that attract habitation sites through the possibility of social contact.

Social interaction hinges on the ability to communicate. In this study, the spatial relationships of three social factors are briefly examined and measured. These spatial measurements show the relative importance of these factors to the colonists. They are: the accessibility of a public road, the accessibility of navigable water, and the proximity of the nearest neighbor. These three factors measure the ease of communication by the inhabitants of a settlement with other individuals or settlements.

Navigable Water

Waterborne transportation was an important form of transportation in the Chesapeake Bay area during the Colonial period. Using historical sources dating as far back as the seventeenth century, many scholars have developed what James O'Mara terms "the Riverine Myth". According to O'Mara, such venerable sources as John Clayton (1965), Thomas Jefferson (1787), and others, including modern scholars, all believe watercraft was the major mode of transportation. It is also
believed that preponderance of waterborne transportation was a major factor in the development of the dispersed nature of the settlement pattern (O'Mara, 1983:114-121). Contemporary Virginians believed it as well, and their views have been reflected by historical scholarship to date.

If waterborne travel was the main form of transportation and communication in Colonial Virginia, it would greatly influence the settlement pattern. Indeed, Michael Smoleck and Wayne Clark demonstrated that it did just that in the seventeenth century. (Michael Smoleck and Wayne Clark, 1982, Michael Smoleck, 1984). After studying the circa 1673 Augustin Hermann map and archaeological site locations for the Chesapeake Bay region, they concluded that settlement locations were drawn towards the riverbanks and major creeks. It is possible that access to navigable water was still a desirable resource throughout the eighteenth century.

Roads

The importance of overland transportation in the Colonial Tidewater region is just being recognized. James O'Mara and Carville Earle dispute "the Riverine Myth" of colonial transportation in favor of an emphasis on roads in colonial transportation. O'Mara goes on to state: "... It was roads and land transportation that were the first and foremost means for social and economic intercourse." (O'Mara, 1983:122). Earle has tabulated the frequency of watercraft, horses, and horse accouterments in the parish inventories. He compared the relative frequency of the water crafts to horses, and reasons that the use of horses, and
hence, roads, overtook watercraft in All Hallow's Parish, Maryland, by the beginning of the eighteenth century (Earle, 1975: 145).

Direct references to road construction can be found in the Colonial Virginian legislative acts. As early as 1632, the legislature acknowledged the need for roads by passing an act to begin a program in road construction (William W. Hening, 1820-35: v 1, 199). Based on his experience in using the York County records, Ronald Grim observes "that a fairly extensive road system had evolved by the second half of the seventeenth century." (Ronald Grim, 1977: 219). Even though Grim's observation is only pertinent to the York County section of the study area, one can assume that James City County had at least an equally developed road system since James City County hosted the political center of the colony, Jamestown. Any overland transportation to the capitol, Jamestown, must have come through James City County. Unfortunately, the county records of James City County were destroyed in the Civil War. Still, a well developed road system is present in both James City County and York County on eighteenth century maps. By examining the United States Geodetic Survey maps drafted at the beginning of this century, it becomes clear that many of these rural colonial roads are still in use today, and the majority were in use throughout the first half of the twentieth century.

For the sake of analysis, the roads in the study area are divided into three classes: arterial, collector, and local. The arterial order roads were the peninsular highways: major roads which ran parallel to the York and James Rivers and, for the most part, along the drainage divide that separates the rivers. These routes were established in the early seventeenth century in order to connect courthouses, counties and churches to each other. The Colonial Virginia
legislature ordered the construction and maintenance of roads to connect these institutions (Hening, 1820, 1:436). Present day highway U.S. Route #60, which was known as "Old Stage Coach Road", and possibly Virginia Route #5, were arterial roads.

The collector roads are a broad category. These tend to run along the divides that separate creek watersheds. Collector roads connect mills, landings, ferries, paths, and local roads to the arterial roads and other collector roads.

The local roads are essentially private roads that connect a residence to a public road. In 1705, the Virginia Legislature thought it appropriate that every residence should have a road connecting it to a public road (Hening, 1820, 3:394). If locating near a public road was a priority to colonial settlers, the average distance between a farmstead to a public road should be small when compared to the distances to other resources. Local roads should be omitted in this exercise, since the planter was required to build them from a public road directly to his plantation, and they were probably constructed after the site location decision had been made (see Map No. 5).

The third social factor is the accessibility of one settlement to another. This can be gauged by measuring the absolute distance between the closest farmsteads. A nearest neighbor measurement can detect the degree of aggregation of settlement, to see how strong the tendency was to settle by groups into hamlets or towns. The statistical test of the nearest neighbor analysis has previously been conducted for the seventeenth century James River basin area by Frederick Fauz (1971). It appears to be obvious that colonial settlements in the study area during the seventeenth and eighteenth centuries tended to avoid clustering into substantial communities with the notable exceptions of Yorktown and Williamsburg. Although family members and friends may have lived in the
same region (Rutman and Rutman, 1984 A: 120-121) they rarely located very close
to each other.

The social factors briefly discussed above are measured along with the
environmental variables. The purpose of this chapter is to outline the possible
importance of these social factors. In the final analysis, the two groups will be
compared to each other to discover if one has a markedly stronger pull on
settlement location.
Methodology

Several sources and methods were employed in order to collect and analyze site location data. The kinds of sources and their inherent problems will be discussed first, followed by a review of the methodology and its implications.

Sources

The data used in the study was collected from two different kinds of sources: historical maps and archaeological records. The narrow availability of the maps limit the study to the environs of Williamsburg and Yorktown during 1781 and 1782. Only during the Yorktown Campaign of the Revolutionary War did anyone map the colonial countryside of the Peninsula with accuracy and detail. The most impressive maps were drawn by the cartographers of the French Army.

The French Military under Comte de Rochambeau maintained units of topographical engineers or *Ingenieurs geographes des camps et Armees du Roi* who reconnoitered terrain and drew the plans of camps, routes, and battles (Howard Rice Jr. and Anne Brown, 1972:191-195). The skill of these specialists contrasts sharply with that of their amateur counterparts in the American Army. Not only were the French maps made to a higher standard than the American and British ones, but more of them were produced for the Yorktown Campaign than for any other area. The battle of Yorktown was the largest successful engagement
of the French forces during the Revolution; and since the maps made of the engagement were to commemorate it, their quality was high and their numbers large. Over thirty French maps were drafted of the Yorktown area (J.B. Harley, Barbara Petchenik, and Lawrence Towner, 1972.) Identifying the author of a French Military map can be difficult. The actual signature on the map does not indicate for certain who did the actual survey, nor, who drew the map. It is possible that any given map may be the copy of another map that no longer exists (Rice and Brown, 1972). The excellent work of two cartographers, Colonel Desandrouins and Louis-Alexander Berthier, rose above the already high standards of the French. Maps drawn by Desandrouins and Berthier captured the topography of the study area with astonishing accuracy. Not until the United States Coastal Surveys were printed in the 1850's were there any maps made of the area that could equal those of the French.

Generally, there are several biases inherent in the French or other maps of this period. Frequently, the surveyors display a distortion in the perception of the countryside that can be termed "road vision" (analogous to tunnel vision). Objects and topography close to the road are treated with more detail than the empty hinterlands farther away from the roads. Perhaps this is a general tendency that occurred in cartography before balloons and airplanes were used. Another flaw is the distorted sense of proportion that land masses have. One notable phenomenon is the large widths of the mouths of Queens and College creeks compared to modern maps. Still, this may not be an error on the French cartographers' part, but a demonstration of the waterways silting up for the past two hundred years, which can be detected by geological measurements (Gerald Johnson, 1985).
To check the site locations obtained from the Revolutionary War maps, subsequent maps were examined. Coastal Surveys, Civil War period maps, and U.S.G.S. topographical maps of the early twentieth century all provided useful insights. This comparison reveals that, although the location of the structures have changed, the road system was the same until the mid-twentieth century.

Fortunately, the errors in the historical map data can be partially countered by the use of archaeological surveys. The Virginia Research Center for Archaeology retains site location information on U.S.G.S. maps gathered from different surveys. "The Phase II Archaeological Testing of the Proposed Second Street Extension, York County, and Williamsburg, Virginia." (Hunter et al, 1984); "Preliminary Report on The Maine Survey" (Outlaw et al., 1975); Kingsmill Plantations, 1619-1800, Archaeology of Country Life in Colonial Virginia. (Kelso, 1984); "The York County Archaeological Survey Draft Report." (Derry et al. n.d.); "Phase 2 Survey of the Route 199 Extension in James City County, Virginia." (Hunter et al., 1985); and "Phase I Archaeological Reconnaissance Survey of the Proposed Route 199 Project, James City and York Counties, Virginia." (Hunter and Higgins, 1985); as well as other archaeological manuscripts and publications, make up the archaeological data base.

The archaeological data base, as with the historical map data, is biased. With the exception of some Cultural Resource Management surveys, most of the archaeological surveys are conducted in areas already known to contain sites. Therefore, certain areas are thoroughly surveyed, for example, Jamestown, while other areas are passed over for practical reasons, such as national security in the case of Camp Peary, a military base located along the York River. The archaeological record is further skewed by the uneven survival of various types of sites. The public tends to perceive certain types of sites as being worthy of
preservation while others, such as middle and low class farm houses of the eighteenth century, are destroyed.

It is clear that both sources, archaeological and historic maps, have biases. It is hoped that, when using both of these sources together, the strength of one will complement the weakness of the other. For example, researchers using an archaeological survey will discover the exact location of a site but might only infer a general date for the occupation period while the existence of the site on a French 1781 map confirms the occupation date before 1781. Although both sources are employed in this study, their contributions are not equivalent. For the entire study area, 324 rural agrarian sites have been plotted. The map sources alone account for 303 of the 324 total sites plotted. Archaeological surveys have exclusively discovered 21 sites existing in 1781, but confirmed at least 34 sites present on the maps. Although both sources are flawed, they are the best information available on the actual location of Colonial Period settlements.

Procedure

In order to determine if eighteenth century farmers were attracted to certain soils, the availability of each soil type in proportion to others in the study area had to be quantified. By using the "General Soils Map" of the Soil Survey of James City and York Counties and the City of Williamsburg, Virginia, (Robert Hodges, P. Ben Sabo, David McCloy, and C. Kent Staples, 1985) the acreage of both environmental zones in the study area was tabulated. Roughly, 66.5% of the total
acreage lies in the upland zone, while the remaining 33.5% is in the lowland coastal plain (see Table No. 1).

The study area contains a total of 80,200 acres. Due to the constraints of time and resources, it was impractical to tabulate each soil type for the entire study area. Therefore, a sample had to be taken to document the relative availability of various soil types in the study area and to establish their relationship to the location of settlement. The large number of settlements in the study area and the corresponding required measurements, also necessitate the use of a sample.

A stratified non-aligned sample strategy appeared to be the most appropriate choice. This allows separate sampling of the upland and lowland environmental zones in proportion to their respective area in the study area. Since the lowland zone occupied about one-third of the total acreage in the study area, one-third of the sample units were in the lowland zone while the other two-thirds were in the upland zone. Within an environmental zone, the sample unit locations were selected at random.

The soil survey report (Hodges et al., 1985), uses a grid that divides the study area into 35 rectangles. These rectangles are used as sample units. A sample unit is a rectangle measuring 2 by 1.75 miles containing 3.5 square miles or 2,240 acres. Each sample unit should contain 2.79% of the total area of the study unit. Therefore, six rectangular units should represent 16.74% of the study area. However, this estimate is overly optimistic. A substantial amount of each sample unit may contain disturbed land, water, or censored military bases, (i.e., Camp Peary) thus obscuring a portion of the sample acreage. To counter this, an additional sample unit is used, thus maintaining a valid sample size (see Map No. 6).

In all, seven sample units were randomly chosen to cover approximately 10,369 acres or 12.92% of the study area. Of the actual sample, 3,375 acres or 32.5%
are in the lowland zone. The upland zone contained 67.4% of the sample or 6,994 acres. Therefore, the sample is of a large enough size to be legitimate and proportionately representative of the two ecological zones.

The actual sample units were imposed on the soils maps in the soil survey report (Hodges et al., 1985). The corresponding acreage for each soil type was then calculated for each unit. Then, the site locations earlier plotted on U.S.G.S. maps from historic map and archaeological sources, were transferred to the soils maps. In all, 64 sites, about 20% of all known sites in the study area, fell inside the sample units. For each site, a series of measurements were taken with a straight edged scale. These include the distances to 1) contemporaneous neighboring sites 2) navigable water, 3) roads, 4) the nearest drinking water, and 5) distance to class S-1 and S-2 prime tobacco soils (see Table No. 6). Additional data collected includes the type of soil on which a given site was situated and its elevation. Each of these distance measurements was tabulated and a mean with a standard deviation was calculated in order to compare the settlement factors they represent.

In order to test the hypothesis that prime tobacco soils were the major factor in settlement location by the third quarter of the eighteenth century, one must compare the relative density of settlement in the eight soil classes. If the hypothesis is correct, one expects to find the prime tobacco soils heavily settled in relation to other soils. To demonstrate this, the soil classes are ranked by tobacco suitability (see Table No. 7). Also included is the acreage of each soil class present in the sample units and the sites located on them. To arrive at a value that reflects the density of settlement without the distortion caused by the uneven amounts of acreage in each class, a ratio was derived by dividing the number of sites by acreage for each class (the values are denoted by "p"). A trend becomes apparent when examining the p values; it appears that prime tobacco soil classes have
larger $p$ values, and therefore, denser settlement. However, the trend is not overwhelming and needs to be verified by a statistical test. The Spearman's Rank Correlation Coefficient $r_s$ is a practical and well tried test that applies to this situation. This test measures the association of two sets of values ranked in ordinal order. Also, the data to be tested were collected from sample units and not the entire study area; therefore a non-parametric test, such as Spearman's Rank Correlation, must be used.

The Spearman's Rank Correlation Coefficient $r_s$ will test if the soil classes ranked in order of tobacco suitability correlate with the density of settlement. For the test, two opposing hypotheses are stated as follows:

$H_0$: the rankings (between $p$ and the soil type) are independent.

$H_a$: A positive correlation exists between the ranking of the sets.

The first step of the test is to rank separately the soil classes from best to worse for tobacco cultivation, and the values of $p$, from the heavy to light density. Then, the values of $p$ are matched with their corresponding soil class (see Table No. 8). The test statistic is then calculated from summed squares of the difference between the ranked values. The $r_s$ is now compared to critical value alpha at the .05 level and confirmed at the 93% level of confidence. This positive correlation demonstrates that prime tobacco soils were settled on and farmed more often than other kinds of soils.
Table No. 6
Spatial Distance to Environmental and Social Factors

Distance in feet to:

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<th>Neighor</th>
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<th>Road</th>
<th>Drinking Water</th>
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<td>OBSERVED COUNT OF SITES</td>
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<td><strong>64</strong></td>
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**NOTE:**
The site/acre ratio is derived by dividing the number of sites found on a soil class by the number of acres in that soil class.
Table 8
Statistical Analysis Demonstrating the Correlation Between Soil Class and Settlement Density

<table>
<thead>
<tr>
<th>SITE CLASS</th>
<th>RANKED SOIL CLASS</th>
<th>RANKED VALUES OF P</th>
<th>([R(S) - R(P)]^2)</th>
</tr>
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<tr>
<td>S-1</td>
<td>0.021</td>
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<td>0</td>
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<td>S-2</td>
<td>0.011</td>
<td>2</td>
<td>0</td>
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<tr>
<td>S-3</td>
<td>0.0</td>
<td>3</td>
<td>16</td>
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<tr>
<td>M-1</td>
<td>0.008</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>M-2</td>
<td>0.0</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>M-3</td>
<td>0.005</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>ST</td>
<td>0.001</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>W</td>
<td>0.0</td>
<td>8</td>
<td>1</td>
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</table>

\[ r_s = 1 - \frac{6}{n(n^2-1)} \sum_{i=1}^{8} [R(S)_i - R(P)_i]^2 \]

\[ r_s = 0.6428 \]

NOTE:
- \(n\) = number of classes
- \(R(P)\) = rank of \(P\)
- \(R(S)\) = rank of soil class
- \(r_s\) = correlation coefficient
Table 8 Continued

The $r_s$ must be greater than the critical value of $Z$ to reject null hypothesis $H_0$ and claim there is a positive correlation between the two rankings. To achieve a level of significance at the 95% confidence level, alpha must be .05 and the $z=1.645$.

$$r_s > Z \alpha \frac{1}{\sqrt{n-1}}$$

$.6428 > 1.645 \frac{1}{\sqrt{7}}$

$.6428 > .6218$

Therefore, reject $H_0$, the null hypothesis, and accept $H_A$, the positive correlation.

Source: Noether, Gottfried E.

Conclusion

By measuring the spatial relationships of settlement location to environmental and social resources, one can deduce the relative priority in which the colonists held the resources. This is based on the "friction of distance" concept. If a planter desired to minimize the distance he routinely traveled to an important resource, he would opt to locate closer to it than to other resources.

In British Colonial Virginia, the vast majority of economic activity was agrarian. Tobacco agriculture dominated economic activities. It was so prevalent that many planters gave tobacco production a higher priority than raising edible crops. The tobacco agricultural system focused on raising a high quality cash crop that required certain soils and good conditions to produce. In order to raise a marketable crop, the planter had to invest a large amount of labor in the plants. It would be very advantageous for a planter to live near his plants (and soil) in order to tend to them regularly.

Indeed, the tendency to locate near high quality tobacco soil was very strong and dominated the locational strategy. By comparing the relative spatial relationships of the five environmental and social factors and ranking them, the powerful attraction of the environmental factors becomes clearly visible. In Table No. 9, prime tobacco soils were the closest resource to 87 percent of the sampled sites, followed by drinking water for 10.9 percent. The factors were arranged on the table in order of descending attraction, with prime tobacco soils first, drinking water, second, then public roads, nearest neighbor, and finally, navigable water. Again, it appears that prime tobacco soils exerted a strong draw
on colonists. Not surprisingly, the prime tobacco soils also hosted a higher concentration of settlements. In the previous chapter, a positive correlation between soil class and settlement density was established by the Spearman's Correlation Coefficient $r_s$ test (see Table No. 8). As one can see on Table No. 7, the highest concentration of sites per acre is in the S-1 class, and it descends gradually down through the "S" group and "M" group, bottoming with the lowest frequency in the "W" class. The high frequency of settlement on these soils underlines the importance of prime tobacco soil to the colonial agriculturalist. The heavy density of settlement on prime tobacco soils combined with the overriding strong attraction of these soils prove the contention that soil type and location, in conjunction with the tobacco agricultural system, is the prominent factor in settlement location in eighteenth century Colonial Tidewater Virginia.

But the domination of settlement patterns by tobacco soils is just one component of the pervasive impact of the tobacco agricultural system upon Colonial Virginia culture. It seems that the social life of the colonists was greatly affected by the tobacco oriented settlement pattern. In his recent work, Tobacco Culture, T. H. Breen observed the adverse influence the dispersed tobacco oriented settlement pattern had on socializing:

Virginia’s dispersed settlement pattern had obvious cultural implications. Social relations among the colony’s great planters were less frequent, less spontaneous than were those enjoyed by wealthy town dwellers in other parts of America. Religious services, no doubt, brought people together, but churches were inconveniently located. Inclement weather frequently kept planters at home. Militia practice occasionally broke the work routine, and it was not unusual for planters to use these gatherings as an excuse to get roaring drunk. Meetings in the county courts served a social, as well as, legal function. But however important these events may have been, the great majority of the planter’s life was spent on his plantation in the company of his family, servants, and slaves. (Breen, 1985: 43-44)
In summary, the needs of the tobacco plant and European demand dictated a set of extensive agricultural techniques, practices, and schedules. The development and implementation of this agricultural system, in turn, shaped many of the cultural elements of Colonial Tidewater Virginia. The structure of the settlement pattern and the resulting social effects is a manifestation of this process.
### Table No. 9
Factors Ranked in Ordinal Order by Proximity to Sites

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<th>FIFTH</th>
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<td>1.5%</td>
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<td>36</td>
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<td>5</td>
<td>1</td>
<td>64</td>
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<td>COUNT OF SITES</td>
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<td>64</td>
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<tr>
<td>PERCENTAGE</td>
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<td>37.5%</td>
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<td>21.8%</td>
<td>6.2%</td>
<td>100%</td>
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<td>7</td>
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<td>64</td>
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<td>15.6%</td>
<td>29.6%</td>
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**NOTE:** For each site, the distance to every factor was ranked in descending order, from the closest to the farthest. Table No. 9 shows the ranking of each factors' status in terms of all sites. Data taken from Table No. 6.
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