

WHAT INTERACTIONS AMONG NATURAL, CULTURAL, SOCIAL AND
ECONOMIC CAPITALS EXPLAIN THE ADOPTION OF BLUEBERRY CULTIVATION IN
THE RETREAT AREA OF NEW JERSEY DURING THE PERIOD 1800-1950?

By

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To my mother Shirlee Wescott Thompson and brother John Wesley Thompson III whose support
made this dissertation possible

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Landscapes in the US and throughout the world are changing rapidly. Natural lands are being impacted by development and resource bases threatened as a result of societal pressures. This research seeks to fill a gap in the existing land use planning literature by focusing on the drivers of landscape change in a social-ecological model of inquiry. A socio-ecological approach using an agent-based model was used in researching this question in order to identify the interactions between the social, cultural, economic and natural capitals that led to the successful adoption of the blueberry into commercial agriculture. The adaptive cycle concept put forth by Gunderson and Holling was used to identify the landscape phases that led to the formation of the cultural landscape in Retreat, New Jersey. Then the agent-based model of Matthews and Robins was used to identify the specific drivers of landscape change that led to the adoption of the blueberry into row crop agriculture.

The findings in this case study can lead to a greater understanding of the role of social networks and governance as drivers of landscape change and the role of sense of place in fostering landscape resilience.

CHAPTER 1 INTRODUCTION

The following case study chronicles a late 19th early 20th landscape transformation in the Pine Barrens of New Jersey by using an explanatory model for landscape change based on social ecological systems theory. The theory accounts for and explains the generic drivers of landscape modifications. The case study presented centers on the introduction of the blueberry into standard agriculture, which was prompted by the USDA, resulting in a new land use on what was previously an industrial landscape. As a result the research presented increases our understanding of the drivers of landscape change by answering the question, “What natural, social, cultural and economic capitals led to the successful adaption of the blueberry into traditional agriculture?”

The research identifies the drives and linkages of landscape change. The agent based model (ABM) specifically used in the research is based on this theory. The explanatory model in question was designed by Matthews and Selman, prominent modelers of landscape change (Matthews and Selman, 2006). Their improved model builds on the work of Gunderson who demonstrated that all landscape change can be categorized by four broad stages. In his work he concluded that landscapes over time cycle through four topological landscape stages. This landscape change process will be explained in detail in Chapter 2 (see also Gunderson & Holling, 2002). Mathews and Selman strengthened the model by identifying specific drivers of landscape change. Their improved ABM was used in this research and provides a methodological approach that broadens our understanding of the impact of human systems on landscape modification.

The case study presented builds upon this work and strengthens the model adding to the greater understanding of the cultural components of landscape change and links the changes to the natural systems that support life, forming a holistic approach to interpreting landscape

change. In my opinion it is only after we understand the full dynamics of landscape that we are able to adequately address the various components of economic development and environmental policy. This innovated approach enhances the understanding of the social, cultural and economic drivers of landscape change within the context of the natural environment that supports all life.

The specific case studied in the research here presented is the purposeful introduction of the blueberry into standard agriculture. Many people on the east coast of North America are familiar with the venerable blueberry. In many ways it is more American than apple pie. Less generally known is that the blueberry, *Vaccinium corymbosum*, or the swamp high bush blueberry, is one of the most recent additions to agriculture, only removed from the wild in the first quarter of the 20th century (Vander Kloet, 1988).

Crop introduction in itself is not particularly rare. There are many examples of new crops brought into agricultural systems, some successful and others not, in the United States and throughout the world. Some, like citrus in Florida, grapes in California, wheat in the Midwestern U.S., coffee in Costa Rica, and the banana in Latin America, transformed the landscape. They altered the environment in profound ways and became enduring elements on the landscape. Others were short-lived, such as macadamia in Costa Rica, kiwi fruit in Florida or cherries in Colorado. Many of these introductions greatly disrupted both natural and social systems. The introduction of the potato into Ireland is a striking example of the latter. By contrast, the introduction of a new crop into an existing agricultural system that is compatible with both environmental constraints and the cultural and social systems of the region is rare. For this reason the case of the blueberry in the Pine Barrens of New Jersey was chosen.

Moreover, crop introductions are only one of a variety of landscape transformations that potentially impact the environment in a deleterious manner. There is an urgent need to

understand the process of landscape change because environmental degradation is accelerating depletion of valuable natural resources. This is a constant problem facing the world, and SES theory and ABMs, as is demonstrated in this study, can be used to robustly explain the dynamics of landscape change.

Given that the introduction of the blueberry into traditional agriculture is a relatively new crop, people associated with the introduction were able to be interviewed and used in the data collection phase of the research. This added to the accuracy and richness of the cultural, economic and social data collected during the research phase of the project. In addition the known outcome, a blueberry landscape transformed out of an iron and glass industrial landscape, presented a unique opportunity for inquiry into the drivers of landscape change. As a result, the findings present a history of an intriguing social ecological system located in the Pine Barrens of New Jersey.

Four broad categories of literature were reviewed. They include a summary of the accomplishments of cultural geography, which places the work of landscape ecologists in context. This is followed by a review of applied ecology identifying the major trends in the field and those responsible for broadening the concept of human derived landscapes. Then suitability analysis is represented by a review of the work of Ian McHarg and Lyle Jenks, who were two twentieth century landscape architects that greatly influenced our understanding of the linkages between people and the environment. The chapter ends with a summary of social theories of landscape change that untimely informed my research and work.

In Chapter 3 the methodology is presented, the case selection is justified, and then the constructs are operationalized. The constructs of the theory as they relate to the research presented are provided in a convenient table. The principal methods of data collection used in

this research included personal interviews, review of archival-historic sources, and spatial analysis of maps. The archival data were separated into text data and image data. The data was coded and entered into a data base and analyzed using thematic analysis (Miles & Huberman, 1994).

The data analyzed in the preceding chapter is explained in detail in Chapter 4. The chapter is organized according to specific capitals and concludes with a summary of the findings. The chapter concludes by answering the question, “What natural, social, cultural and economic capitals led to the successful adoption of the blueberry into standard agriculture?”

Chapter 5, Discussion, begins with an evaluative discussion of the model, first underscoring its explanatory strengths. The discussion is next directed to the emerging themes that were not represented in the model. Finally, the chapter ends with a revised model reflecting the proposed additions, based on my results.

Finally, Chapter 6 begins with a short summary of the present conditions of the blueberry industry in New Jersey. The chapter concludes with the implications of the research on environmental policy and design.



Figure 1-1. Land for a new blueberry field is being prepared at Whitesbog. Source: Personal archives of Marie Coville Ortner.

CHAPTER 2 LITERATURE REVIEW

Literature from four disciplines provides the primary theoretical underpinnings of this research. They include cultural geography, applied ecology, suitability analysis from environmental design, and planning and social theories of landscape change. The first part of this chapter provides a review and historic context of cultural geography including its origins from the broader discipline of geography, focusing on the influences that led to the broadening and expanding field of cultural geography (Desfontaines, 1967). Specifically the theory of cultural geography developed by the Berkeley School was the initial focus of the literature review. This work originated with Carl Sauer and later became a prominent theme in human geography, which then branched out into many subfields, one of which was cultural geography. This literature deals with the aspects of geography that provide a framework for understanding the relationship between human culture and landscape form and characteristics (Dunbar, 2001). I focused on literature that was especially relevant to human interaction with natural systems.

A second body of literature draws on some of the important works of applied ecology as it expands the systems theory approach by including people into the scientific analysis of natural systems. The systems approach developed by H.T. Odum will be discussed, followed by a discussion of important ecological theorists. This is followed by a short synopsis of suitability analysis as it has been used in environmental design and planning, highlighting the accomplishments of two important twentieth century landscape architects.

The chapter will conclude with a summary of the important works that deal with theories of landscape change as represented in the literature by socio-ecological systems (SES) theory and Agent Based Models (ABM), an extension of socio-ecological theory. SES theory and ABMs were the theoretical perspective used to document the changing landscape of Retreat,

New Jersey, between 1800 and 1950. This perspective draws upon the bodies of literature described, and builds in particular on two seminal works, to develop a model for landscape change that includes the biological, social, and economic components as coequal forces interacting and resulting in landscape formations.

Early Geographic Concepts of Landscape

Originally geography developed as a holistic approach to understanding the relationship between people and specific landforms. The discipline split into two thematic components, physical and human geography during the end of the 19th century and the first few years of the 20th century. This intellectual position is referred to as the human/environment interface (Harpham, et al., 2002). The split (of human geography from physical geography) caused a number of problems throughout the early years of the profession's development. The separation is a product of specialization of effort found in every discipline, but the split within geography is perhaps more significant. "Geography and its corollary landscape formation is a holistic, synthesizing, and integrating discipline. The examples of the 'where' and 'why' questions asked by human geographers invariably enter the realm of physical geography with the 'where' questions. Further, the 'why' question may illicit aspects of physical geography that provide the soundest explanation" (Pitzl, 2004, p 124).

Human geography today considers all aspects of geography not covered by physical geography. The main focus of human geography is the presence and activities of humans. Themes within cultural geography reflect a number of perspectives: culture, population, economic activity, spatial behavior, political activity, urbanization, perception of space, and the many and varied ways in which humans interact with one another and with their environment (Duncan, 2006). "Among the many human geographies included are agricultural, behavioral, cultural, economic, elective, historical, industrial, political, population, rural, social, and

transportation. Within these sub disciplines are found three approaches, (1) spatial analysis; (2) the relationship of places; and (3) regional synthesis in varying forms.... Cultural geography is primarily interested in answering the where and why questions regarding human activities and is used in this study to understand the theoretical perspectives that form the drivers of landscape change” (Pitzl, 2004, p. 89).

Human geography is dynamic and attempts to reconstruct or interpret by seeing culture through the eyes of those inhabiting the human landscape (Sauer, 1925). Cultural geography focuses on human activity as it is linked to the environment. An exciting intellectual and emotional engagement has emerged from this discourse. Emanating from this discussion are multidisciplinary approaches that inform landscape change theories and models, which constitute the primary focus of this study.

The recent move toward interdisciplinary study does not suggest a return to earlier methodological approaches in geography, but rather indicates an expansion within the field. A new “environmental geography,” primarily focused on the interconnection between physical geography and human geography, has resulted. The elimination of environmental determinism as a primary focus of the field has been replaced by the concept of landscape evolution, opening up the possibility of a multiplicity of explanations for human environmental impacts.

Cultural Landscapes

Cultural geography, a subset of human geography, has a long and rich history stretching back to the early 20th century in the United States and to the late 19th century through German anthropogeography. Cultural geography in the United States, from its founding during the 1920s continuing into the 1970s, was dominated by Carl Sauer and his students at the University of California at Berkeley (Warf, 2006). Sauer created methodological approaches to research that unofficially became known as the Berkeley School. By the 1920s, he had rejected the then

fashionable theory of “environmental determinism,” which claimed that culture is determined by nature, and negated the influence of individuals or cultures in landscape formation. “Under the influence of cultural anthropologists R. Kroeber and A. Lowie, Sauer came to accept what was known as the ‘superorganic’ notion of culture, which treated culture as a blank slate which could be shaped by many facets in the environment (Warf, 2006). During the 1930s, Sauer continued to develop his theoretical approach by incorporating biological sciences into a methodological approach, and pioneered research that focused on the interaction between humans and the physical environment. He developed a historic timeline that focused on the human transformations of the earth by varying cultural groups either through conquest or assimilation, an approach often referred to as sequent occupation (Whittlesey, 1929).

Four principal themes emerged in the discourse on cultural geography in the first five decades of the field’s development, according to B. Warf, professor and chair of Geography at Florida State University. The first major thread is diffusion of cultural traits. Cultural geographers, like cultural anthropologists before the 1940s, sought to explain the development of culture through material cultural objects. The objects observed were domesticated plants, and animals, house types, field dimensions, tools and furniture. These were interpreted as representing collective cultural thoughts or ideas, rather than independent invention. In this manner, the movements of cultural groups could be traced by the material culture they left behind (Warf, 2006). “Cultural spore” was the term assigned to this phenomenon. It is still used today by an important cultural landscape scholar, Pierce Lewis, who writes extensively on the topic (Meinig & Jackson, 1979).

A second and related theme is the identification of cultural regions. Painstaking mapping and analysis identifies material and non-material culture through spatial analysis (Warf, 2006).

Non-material culture refers to the ideas and thoughts that people have about their culture, including beliefs, values, rules, norms, morals, language, organizations, and institutions. The plotting of the material cultural traits is correlated to the incidence of documented traits on the ground in order to identify relatively homogenous cultural regions (Warf, 2006). Henry Glassie's seminal work, *Patterns in Material Folk Culture of the United States* (1969), is a fine example of this methodological approach, which built on Sauer's and other early cultural geographers' innovative works.

Landscape interpretation is a third theme, and it attempts to trace the historical development of a particular landscape from its "natural" state into a cultural landscape (Stilgoe, 1982). A fourth theme is historical cultural ecology. In this approach, attention was focused on how people's perceptions and use of their environment are culturally conditioned. "Although these four themes continue to be active areas of research among North American cultural geographers, they no longer occupy the dominant position that they once did" (Warf, 2006).

Sauer's profound contribution to the field was the introduction of the use of a historical narrative to reconstruct past cultures based on empirical data. The idea of a cultural area or region grew out of Sauer's ideas and as a result came to the forefront of cultural geography. It is the major theoretical underpinning of the concept of a cultural landscape. The diffusion of cultural traits from region to region was not a new theme in scholarly research. It can be easily traced back to German anthropogeography and American cultural anthropology. However, Sauer placed a greater emphasis on the human relationship with the physical environment than did the anthropologists of the time. According to many authors, this was his most important contribution to the field. "His black boxing of culture posits that geographers need not concern themselves with social, psychological, or political processes" (Duncan et al, 2004, p 46). Cultural

geographers could easily describe the interactions of cultural groups without feeling obliged to understand the psychological or political processes involved. It was assumed that people behaved as they did because their culture made them do so. This simplified assumption allowed cultural geographers to focus on the abstract processes in which they were most interested. The focus of their research was often the historical diffusion of cultural traits across space and how particular cultural traits work.

By the last quarter of the 20th century, cultural geographers questioned the assumptions of the Berkeley School, particularly the notion that culture can be described adequately without understanding the political and psychological forces that impact a culture (Baudrillard & Gane, 1993). As a result, researchers began to explore the role of politics, social class, and individual initiative on cultural geography, ultimately culminating in the creation of a revised view of cultural geography (Warf, 2006).

During this time, traditional cultural geographic inquires, methods and interpretations were challenged by a new generation of cultural geographers. The challenges resulted as the influences of a Marxist-inspired geography attempted to understand social and political impacts on culture (Baudrillard & Lotringer, 1987). This created a humanistic geography that sought to understand the impact of individuals on culture and the environment. Oral interviews with study subjects were used as data when describing a cultural group or community. Culture became just one of the many constructs that would inform behaviors. More specifically, this theoretical approach highlighted the role of the individual, suggesting that an individual as well as a group could influence cultural patterns. Although the traditional and Marxist-inspired theoretical inquiries used different methodologies, they both prioritized social and political theory and used them extensively in their interpretations of social phenomena (Warf, 2006). “The result was a

fury of criticism of the traditional cultural geography as antiquarian, over simplistic, and deterministic in its explanation of social action and as incapable methodologically of handling the complexity of contemporary societies” (Warf, 2006, p. 126). Geographers questioned the superorganic concept of culture, which critics felt was romantic and antiquarian in its approach to understanding common landscapes and peoples.

A new thread of inquiry was formulated in Britain by the Birmingham Center for Cultural Studies under the direction of Raymond Williams. This contrasted with American cultural geography, which tended to chronicle cultural traditions. The approach emphasized cultural homogeneity over time. Cultural studies focused on diversity and change in the postindustrial societies, specifically focusing on urban areas. This broke with the American traditions, which centered on developing or peasant societies. Within the urban focus, researchers began to describe how cultural practices and policies shape individual identities by referencing class, race, gender, and sexuality in Britain and later in the US. Throughout the 1980’s and 1990’s, the differences between traditional and new cultural geography were at times great. Today they have softened, resulting in a renewed interest in the relationships between people and their environments as the primary focus of this research (Duncan et al., 2004).

Social geography is yet another approach that has furthered the understanding of community and the environment by emphasizing three areas of interest: (1) the disenfranchisement of members of society that emerged as a result of industrialization, (2) criticism of the capitalist system and socioeconomic inequality, and (3) the origins and impacts of poverty. Social geography is a recent addition to the discipline, officially recognized in the mid-1950s. Social geographers have focused on the problems of the city. The threads of the

inquiry date to the early 20th century when French geographer Paul Vidal de la Blache originated the theory of possibilism.

Possibilism contended that the environment was an influence on behavior, but that humans are free to create their own lifestyle within the environmental setting by using technology and their own ingenuity (Vidal de La Blache et al., 1926). This contrasted with environmental determinism, which argued that the physical environment determines the actions of the cultural group living in a particular setting. Possibilism centered on the actions of the individual, who could modify the environment and mitigate environmental influences on culture. People were seen as having greater choice in managing their lives within the physical environment. A cultural group or individual, it was argued, could influence how an environment or landscape was shaped. Social geography's most enduring legacy dates to the mid-1960s, a time of radical social change in the United States and other countries. Protests over US involvement in the Vietnam War, President Lyndon Johnson's war on poverty and his expansive legislation on social justice broaden our understanding of the variety of people and cultural backgrounds that were present in the country at that time. "This led to a focus on (1) the patterns of social activity and problem areas, especially in cities, and (2) the process that results in poverty and the decline of socioeconomic systems, which are critical components to understanding human social systems in a particular environment" (Warf, 2006, p. 126).

Human geography, social geography and cultural anthropology have influenced landscape interpretation, increasing our understanding of the causal influences and the role of environment together with culture in the formation of landscapes. Understanding these concepts was critical to understanding the causal influences on landscape change in the study area. In addition, landscape interpretation has tended to maintain important connections to traditional

cultural geography and has morphed into the study of cultural landscapes. In this approach, the landscape is seen as a material aspect of culture.

Revisiting Cultural Landscapes as a Concept

There are many who find contemporary definitions of culture problematic. Some still see culture as too broad and deterministic a concept. One could argue that the meaning of the concept collapses as boundaries between the traditional understandings of culture and new understandings of the role of economic and social forces on “culture” emerge. However, scholars believe the concept of culture needs to be rethought, not abandoned. The idea of culture in the form of simplistic explanations and justifications is increasingly mobilized by political leaders, journalists, judges, managers and businesses, and policy advisers. Therefore, it may be especially important to critically re-examine the concept. For example, some politicians and agencies concerned with economic development and the political concept of cultures of poverty attempt to explain underdevelopment in terms of what they believe is “backwardness” or the “laziness” in peasant cultures. Thus, now, just when the concept of culture is gaining wide use, often as a dangerously oversimplified explanatory term in the world beyond the academy, would be a very bad time for academics to abandon the concept rather than critically rethink it.

Nonetheless, there are persistent problems with the notion of culture. The first is that cultural geographers tend to see populations of particular regions as having the same culture, thereby homogenizing and ignoring differences within societies. The second is that it strongly identifies a dualism between culture and nature. The first of these problems can be overcome by thinking of cultures as broad systems of understanding, but not of agreement or shared values. This goes some way towards conceptualizing cultures as structured yet in no way homogeneous. The second problem – that culture is too focused on human agents – is resolved if culture no

longer is seen as something apart from nature, but rather is seen as embodied in humans that are a part of nature and whose bodies are essentially “open” to culture.

The more precise understanding of culture within a cultural landscape can elevate traditional cultural landscape by including community relationship in the interpretation. Cultural landscapes are often seen as a vernacular cultural region, which has a variety of meanings and values and in which the regions reflect the cultural identities of individuals or groups, and are derived from a strong sense of place (Warf, 2006). These regions derive from people’s feelings and images about a place. They are also popular or perceptual regions. For example, the American South has been described as a vernacular region. The association that people in the south have to the region is based on their cultural identity and emotional attachment to the place. Some argue, however, that the south is composed of a number of differing regions – some vernacular, some urban – and that the notion of a homogenized south is incorrect.

Sense of Place

Sense of place plays an important role in determining an individual’s connection to the landscape. Place is also important because it is the foundation of the social world (Sampson & Goodrich, 2009). The body of literature that deals with sense of place is voluminous and ranges from the romantic to the empirical. Sense of place is one of the most abstract and elusive concepts, and understanding what creates a true sense of place is a complex task (Shamai & Ilatov, 2005). However, there are commonly accepted definitions and components of sense of place that will be briefly discussed below. Due to the extent of this literature, a full review is not within the scope of this dissertation. The following summarizes the mutually agreed-upon aspects of sense of place.

“Common to the rapidly proliferating definitions of sense of place is a three-component view that weaves together the physical environment, human behaviors, and social and /or

psychological processes” (Stedman 2003, p. 671). Throughout the literature, the three constructs are typically accepted by most authors as together forming a working definition of sense of place. However there is a disagreement on which construct is the most important in forming a sense of place within the minds of individuals (Sampson & Goodrich, 2009). Attachment to place refers to the degree to which an individual is connected to a particular landscape or place. Attachment is defined as the romantic and emotional associations that bind one to place (Eisenhauer, 2000). Place is the center of one’s social world, and includes both social and psychological process. The sense of place is produced and maintained through socially constructed processes by attaching meaning and values to symbolic phenomena (Carter et al., 2007).

Thomas Gieryn, a major author on the subject of sense of place, identified three major aspects of place. The components include a unique setting, natural and manmade objects, and definitions, meanings and values within a social context. The aggregated attachment to place connects individuals to the group, creating a feeling of belonging along with identification with the region or place (Gieryn, 2000). Theoretical typologies of sense of place attempt to describe the complex array of processes through which individuals create symbolic connections to a geographic space. First, genealogical attachment connects people to place through their connection to family and family tradition. Gieryn found attachment to be strong when a family has long standing in a region or locale. It is reinforced through marriage, family connections, history and lineage. Low (1996) concluded that attachment was formed by economic conditions, the physical characteristic of place, cosmological relationships to place, and religious or spiritual connections. The narratives formed by the various aspects of attachment bind the community to a shared sense of place through their common connections, values and ideas. When the sense of

place deeply permeates an individual, the attachment to place is at its greatest (Jorgensen & Stedman, 2001).

Many authors argue that sense of place is not inherent to the physical location but springs from human interpretations of experience. In essence, environment has very little to do with the formation of a sense of place (Taun, 1977). “Spaces become places as they become imbued with meaning through lived experience” (Taun, 1977, p. 672). Taun argues that meaning is socially constructed, and that we attribute meaning to the physical environment on the bases of daily experiences.

R. C. Stedman (2003), a prolific author and scholar of sense of place, asserts that the physical environment has been undervalued in its contribution to creating sense of place. Sack (1997) agrees with Stedman and links culture, nature and social relations as the combined force that leads to sense of place.

Many authors conclude that we construct meaning from experience and that meanings are not intrinsically a part of a particular physical setting. In essence, people confer meaning on the environment in ways that reflect their social and cultural experiences (Stedman, 2003). This conclusion also assumes that there can be different meanings associated with a single place or locale, resulting in a contested landscape.

Stedman argues that socially constructed meaning has been over emphasized and that the effects of the environment on sense of place have been undervalued. He gives an example of this concept in his study of the lake region of Michigan. As the lakes become more developed and degraded, it changes people’s attachment to place. He found meanings change in response to environmental change. ”The physical landscape may change to such a degree that preferred

meanings become untenable or are maintained only through active effort” (Stedman 2002, p. 579).

The vernacular region occurs on every scale, from the city neighborhood to large parts of a continent (Hough, 1990). Boundaries are not clear. For example, researchers have attempted to determine the extent of the South by noting the frequency of use of the term Dixie in the classified section of telephone directories. On a different scale, residents of the North Shore of Lake Superior refer to the area as simply "the shore," and this reflects their personal connection with the place and the pride they have in the region. Lake Superior has a South Shore as well, but for North Shore residents, there is really only one shore of consequence. Vernacular regions, for the most part, are about place.

Because the vernacular region has an emotional and perceptual origin, it is distinct from the formal and functional region, which is widely used in geography and is based on the results of objective and possibly statistical analysis. Many theoretical approaches have been used in understanding human geography and all of its variants, including cultural geography and the concept of the cultural landscape. There has been a healthy climate of criticism, and scholars often revise their conclusions. Today new and vibrant insights are bringing new understanding about the people on the earth who have inhabited various landscapes for thousands of years.

Central Place Theory

Within this broad field of study, mid-range theories were developed to add to our understanding of landscape change and development. One such theory germane to this research is central place theory, developed by German geographer Walter Christaller in 1933. It is an important theory that explained the distribution of settlement practices prior to the industrial development of the 19th century (King, 1984). Central place theory is a spatial explanation and predictive framework for identifying the hierarchy of settlement types. The theory was first

operationalized and tested in southern Germany. Christaller concluded that people and cities existed for purely economic reasons (Beavon, 1977). This was primarily an economic theory with two underlying assumptions. First Christaller hypothesized that people would purchase goods from the most convenient location, and secondly that popular products with high demand would be available locally. He further defined these goods as high-order and low-order goods. Low-order goods were everyday items, purchased on a daily or weekly basis and would be found in small towns. High-order goods were highly specialized and would only be available in the larger cities (Beavon, 1977).

The hallmark of his research is the “central place system” composed of hamlets, villages, towns, cities and the regional center (King, 1984). According to the theory, the regional center would be encircled by a large geographic area or hinterland. The central role of this theory is to analyze how goods and services are allocated among settlements or central places, and in turn how central places are distributed over the landscape (Mulligan, 1997). The closer to the regional center, the greater the variety and availability of goods and services will be to the consumer. As one moves away from the regional center, the settlements become smaller and smaller. This pattern of central region and settlements within a hinterland can be spatially mapped and analyzed (Beavon, 1977).

Core concepts of the central place system method have been used to infer political boundaries from the sizes and locations of settlements. The population of a settlement is related to the extent of its political or economic control. Central place theory links the information available on the sites as they exist today to information about the past. Finally, central place theory is utilized to generalize key concepts in regards to the social, economic and political landscape. Although this theory is only robust in describing the patterns of 19th century Europe

and America and for regions that share the same geology, it has lost favor with contemporary geographers. Given the time period of the study, the theory can be utilized in an explanatory fashion for the purposes of this research (Palen, 2008).

Applied Ecology

The first scholars of landscape ecology developed the theoretical basis of the field and introduced the topic. This has expanded over time and developed into the discipline we know today. Foreman and Godron summarized the early development in their book, *Landscape Ecology* (1986). They conceptualized landscape ecology at a more basic level and offered an overview on recent rapid development and landscape ecological research. This approach quantifies landscape heterogeneity from the biological perspective, and became the basis for environmental impact statements that are often critical of human impacts.

Landscape Ecology

Landscape ecology is a very broad field of study, and the literature that will inform my work is more specifically that which deals with how human activities and ecological systems interact to shape landscape and its change over time. I also drew upon the work of landscape architects Ian McHarg and John Lyle (McHarg et al., 2007).

Landscape ecology originally developed on the interface between physical geography and ecology. In German literature, the term was first introduced by Troll (1939) for the inclusion of ecology and physical geography (Christaller, & Baskin, 1966), while in English literature Tansley (1946) introduced the concept of the ecosystem (Willis 1997). From its beginning to the present, landscape ecology has become a broad field of inquiry.

Naveh and Lieberman, important landscape ecologists, contributed to an expanded ecological view emphasizing the importance of the whole and the interdependence of its parts. They described the environment as a holistic entity, positing that the landscape ecology should

be thought of as a human, biological, geographic system working synergistically in creating landscapes (Naveh & Lieberman, 1994).

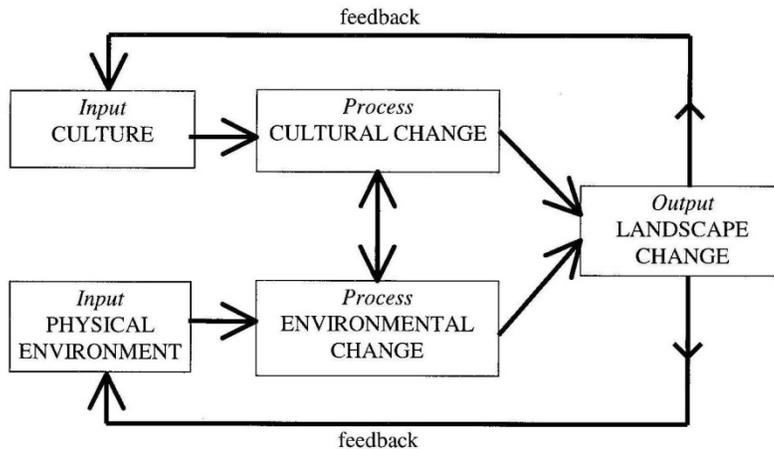


Figure 2-1. Landscape change model. Source: Wood and Handley (2001).

Robert Wood and John Handley are two contemporary scholars working in an interdisciplinary approach within landscape ecology, human geography, and cultural landscapes. They offered an innovative approach to understanding landscape change that included culture and environment (Figure 2-1). They first found that landscape change was cyclical. They also found that a change in economy and society directly reflects changes on the land. Wood and Handley built upon a theoretical model to explain simple landscape change in the post-industrial world, and presented the explanatory model in their research (Figure 2-2). To help further explain landscape change, they categorized disturbance regimes found within a landscape in order to understand the major causal factors. They coined the terms “obsolescence” and “dysfunction” and applied them to changing landscape patterns.

Obsolescence refers to a landscape losing its function as a result of a changing economy or societal needs. Train travel being replaced by automobile travel is an example of obsolescence. Dysfunction, on the other hand, refers to an inappropriate use of a particular landscape. An example of an inappropriate use might be turning Love Canal, a former toxic dump site, into a residential development. The beauty of this model is that it is both theoretical and practical, and can be used by the researcher to demonstrate the interplay between human behavior and natural processes in the formation of landscape change in a post-industrial setting. The important understandings, as exposed by Wood and Handley, are that the landscape, by its nature, is not a constant or steady state and that people are the main drivers of landscape changes.

This system's approach takes into account how culture impacts the environment and how changes in the environment influence culture, which forms a prominent feedback loop, compared to more traditional landscape ecology that underemphasizes the role of people in landscape systems. Wood and Hadley found that landscapes by their nature are open systems. There are complex, dynamic variables in the system. The landscape that results from the interaction of these variables can be described, qualitatively or quantitatively, as a process. The result is a landscape that reflects the values of the cultural group and natural processes. The author further notes that landscape, like everything else, is subject to the laws of physics and in particular entropy. In order for a steady state to be maintained, the environment is dependent upon renewed and continuous inputs in order for it to remain balanced. Stress is a constant force in nature that continually erodes the system.

However evocative are the findings of Wood and Hadley, they did not present a model that can easily separate the various human-derived forces from those of natural origin. Also the

topology is simplistic, and does not recognize pre-industrial drivers or precedents for affecting landscape states.

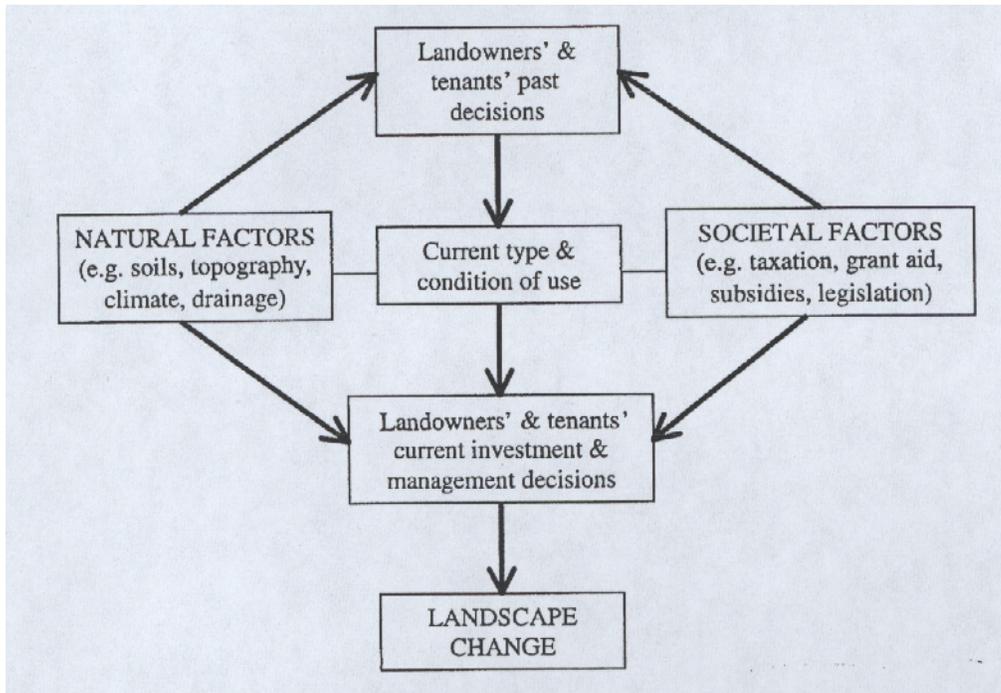


Figure 2-2. Simple model of landscape. Source: Wood and Handley (2001).

Systems analysis

Odum

An important figure in landscape ecology is H. T. Odum, who developed and popularized Systems Theory (Odum, 1994). Odum also espoused a holistic natural system. He describes the relationships between elements within the landscape and their interdependence, as well as the role of management and manipulation of the landscape and its relationship with the wider countryside (Odum, 1983). Such ideas originated from principles in biogeography and its original theoretical contributions, but have developed to involve studies of fragmentation and isolation of populations from the larger regional landscape. This had direct application to forest

planning which viewed clumps and gaps in the forests serving as “islands” evocating the application of island theory into forest management (Harris, 1984).

Gunderson and Holling

Possibly the most promising model to explain landscape change was developed by Gunderson & Holling (2002). They combine many of the theoretical perspectives of the researchers discussed above. Panarchy is a model that categorizes all landscape change into four types (Figure 2-3).

Their adaptive cycle model is a generic model that can account for all types of landscape change for most historical periods. As a result, their innovative work created an explanatory schematic that identifies a topology for ascertaining the generic characteristics of landscape change (Gunderson & Holling, 2002). The change can be applied to either pre-industrial or industrial landscapes. The adaptive change model identifies four phases associated with all landscape changes. The phases within the model topology include the exploitation phase, the

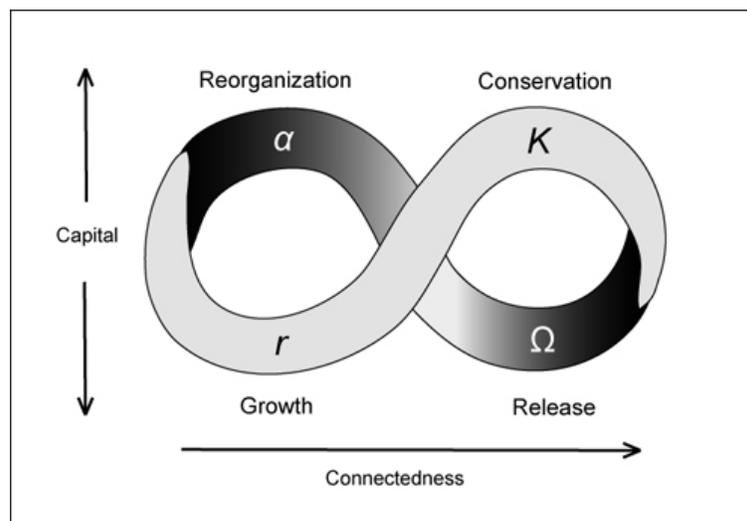


Figure 2-3. Adaptive cycle diagram. Source: Gunderson & Holling, (2002).

conservation phase, the creative destruction phase and a reorganization phase. Landscapes in this model are rarely seen as a system in balance, and thus this approach more accurately reflects

realities that are consistent with human/natural environments and visibly present on the landscape. Gunderson & Holling (2002) developed the idea of a “basin of attraction.” A basin of attraction is a systems state in which the system function and form do not differ substantially (Matthews & Selman, 2006). Accordingly, the researchers argue that a system at any point in time will be located within a particular basin, but over time it is hypothesized to move through the adaptive cycle in response to disturbance and change (Matthews & Selman, 2006).

The theory maintains that forces outside the basin can cause change to the basin by stimulating change within the system. The system is then transformed into the next phase of the adaptive cycle and remains in this phase until ample pressures cause transformational change. In this system, resiliency is seen as the amount of effort needed to maintain a present adaptive state. Sustainability within this theoretical model is the potential to maintain a specific desired basin. The authors used a clever analogy of an 18th-century Scottish landscape during the enclosure movement. During this historic time, small farms were transformed into large open pastures for sheep grazing, and by analyzing the variables in this system, Gunderson and Holling (2002) provide the following explanation as an example of the adaptive cycle. Small farming, the result of an earlier exploitation, was a new basin of attraction and moved into the conservation phase by strengthening the networks necessary to maintain small farming. Outside pressures, (industry, population growth, new markets and specifically the increase in wool prices) created pressures on small scale farming, which was in the conservation phase. As the system disintegrated, it moved into the release phase, resulting in a new basin of attraction, sheep grazing, which disrupted the people who were engaged in small scale farming. This created social and economic upheaval and necessitated a social, political and economic reorganization. During the reorganization farmers were either removed from the land and ventured elsewhere for

employment or were folded into the new industry. This morphed into the exploitation phase and a new basin of attraction.

The strength of the adaptive model is in its simplicity. Also, the model does not apply value judgments for or against a basin of attraction. In essence, the theoretical approach sees landscape as a constantly changing system and each stage is essential to landscape development. The weakness of the “adaptive cycle” model is the inability to describe, quantify and qualify specific drivers of landscape change accurately.

Suitability Analysis

Origins

The use of hand-drawn overlays of spatial data to inform design developed into suitability analysis beginning in the early twentieth century. According to Steinitz et al. (1976), one of the earliest uses of overlay interpretation of data was used in a planning study for the city of Billerica, Massachusetts in 1912. Four different natural factors maps and a traffic circulation map were all drawn at the same scale and analyzed. Although there is no direct evidence that the maps were physically overlaid, it seems obvious that this would have occurred given that the maps were all drawn at the same scale (Steinitz et al., 1976).

In 1922 a planning study engaged by the firm of Abercrombie and Johnson for the Dorchester region of England was another project that used a series of hand-drawn maps all executed at the same scale. Similar techniques are found in an economic plan for New York City in 1922, followed by a regional plan for New York in 1929. Maps all drawn at the same scale showing natural and social factors were again overlaid for analysis. By 1950 the technique was commonly used, and was mentioned in a British textbook called "Town & Country," attesting to its common use in the profession (Steinitz et al., 1976). However, it was in 1969 with the publication of popular work, *Design with Nature*, that the technique and strategy was eloquently

explained, replete with beautiful hand-drawn maps by Ian McHarg. The process of overlaying maps representing natural and social data for the landscape under study was named “suitability analysis” by McHarg. From this point on the method became a standard practice in the field.

Ian McHarg

Perhaps the greatest contribution of Ian McHarg was his insistence on inventorying the cultural context as an integral part of his innovative suitability analysis. His methodical approach influenced the field of ecology and ecological design. This was an early attempt to understand both the natural and cultural influences that create a landscape. History was a major part of this analysis, which traced landscape forms over long periods of time. Although this approach lacked an in-depth application of social theory, his method of inquiry was a major advance in landscape architecture and was interdisciplinary, resulting in a new field of environmental design as well as underscoring the importance of human action as it affects the land. McHarg was one of the earliest proponents of including social analysis in ecological planning and design (McHarg & Steiner, 2006; Steiner, 1991). His contribution to ecology was his insistence that natural systems be studied in the context of cultural phenomena. He argued that human systems must be integrated into all plans and designs in his human ecological approach. Although his approach never adequately addressed social science in ecological inquiry, he was one of the first to identify the critical importance of broad human impacts on natural systems.

John Lyle

John Tillman Lyle was one of the leading thinkers and educator in the field of environmental design. His seminal work, *Design for Human Ecosystems*, (1985) was the first to use the term “human ecosystems.” This text is a classic that explores methods for designing landscapes that both protect and enhance the environment. His underlying assumption is to heal

the already damaged earth by implementing a regenerative design process that included eleven strategies that resulted in sustainable designs. Lyle proposed methods to provide for the basic requirements for life. He was a professor of landscape architecture at California Polytechnic Institute where he founded the Center for Regenerative Design. Regenerative design describes a design process that restores, renews and revitalizes sources of energy and materials, and thus creates sustainable systems that integrate the needs of society with the integrity of nature.

This analytic approach attempts to put people in their proper cultural context within a particular landscape. This is the theoretical foundation for the GIS component that is implemented in this research design. Given the academic discussion that attempts to explain and quantify the exact impact that nature has on formation of culture, it is no wonder that landscape ecology is an important voice in the discussion.

The perspective used in this research incorporates a human ecological approach to identify the drivers of landscape change. This broad body of literature, known as socio-ecological systems theory, grew out of work by H. T. Odum, who developed systems theory (Odum, 1983). Odum's systems theory viewed all components of the ecosystem as interconnected, forming an intricate web of life. His view, however, did not account for human impacts on the natural system. Humans were often viewed as external to the ecosystem in biological ecology, thereby ignoring a major source of impacts on natural systems. It became apparent that a biological approach excluded one of the most important components of the environment: human behavior. Researchers found that systems theory was deficient in the analysis and description of the human ecological system (Gunderson, 2000). Adding social science to the analysis provided a more robust understanding of human environmental impacts (Ingegnoli, 2002; Wiens & Moss, 2005).

Social Theories of Landscape Change

SES Theories

Socio-ecological systems theory developed in response to the recognized weaknesses of systems theory and has become a recognized approach to landscape analysis. The SES theoretical approaches maintain that social and natural systems are linked and that delineation between social and natural systems is artificial and arbitrary (Berkes et al., 1998). The socio-ecological systems approach is useful in studying and understanding people in relation to their natural environment. Both ecologists and social scientists use SES theory to understand the impact of human behavior on life-sustaining resources (Miller, 2001; Redman et al., 2004). An expanded systems approach is replacing the view that resources can be treated as discrete entities from the rest of the ecosystem and social system (Berkes et al., 1998). Berkes also argued that “scientific concepts of ecosystems are deficient in the description and analyses of humans in natural systems” (Berkes et al., 2000, p. 9). So we are presently without a generally accepted method to analyze and study the interconnectedness of natural and human systems.

Berkes and Folke hold that human and natural systems are theoretically linked; however, measuring and quantifying these linkages is often difficult, and at times impossible. Scholars, ecological planners and designers continue to see an urgent need to construct new methods that emphasize an integrated ecology (Redman et al., 2004). Integrated ecology explicitly uses human decisions, cultural institutions and economic systems to manage and conserve natural resources (Steiner, 1991). A large body of research has contributed to the development of SES models that can identify and characterize drivers of environmental impacts and landscape change. The direct intent is to either make recommendations for environmental policy changes or craft interventions intended to promote desired environmental changes, based on theoretical perspectives (Wood & Handley, 2001).

Elisabeth Johann (2007) used the socio-ecological systems approach to study alpine forests. The implication of this research is important. She found that cultural knowledge is useful in protecting alpine forests but is equally critical to the future protection of the forest. Johann argues that local knowledge is lost in the modernization processes. To date, cultural conservation has emphasized protecting disappearing landscapes and peoples who have shaped cultural landscapes (Hart, 1975; Lewis, 1983). Such people are protected as museum pieces on the landscape, most often appreciated as artisans. This is not preserving a cultural knowledge base. It is protecting an artifact. Johann argues that local knowledge is rarely used well in SES modeling.

R. B. Harris (2010) used the approach to study the degradation of rangeland in Tibet. Harris identifies seven drivers of rangeland degradation in his findings. He deduced that we do not understand current socio-ecological systems sufficiently. He further concludes that we need to accurately identify the drivers of environmental decline. In order to do so, he argues, a precise understanding of social and ecological systems is required. The lack of such an understanding will lead to policy initiatives that fail (Harris, 2010). SES theoretical approaches have proven to be robust in their explanatory power, especially in connection to understanding the social and cultural components of the ecosystem.

Schandl et al., (2009) employed a socio-ecological conceptual framework in the study of energy use in a developing region of Asia. The area of study is densely populated and agriculture in the region is modernizing. The limited energy supply for the region presents enormous challenges. The research identifies possible energy- saving interventions by carefully studying the social systems of the region (Schandl et al., 2009). By viewing the entire system, the researcher gains a more robust explanatory power of the causal linkages that drive change.

Aranzabal et al. (2008) studied European cultural landscapes through a lens of socio-ecological theory in order to predict new landscape types that threaten older, preferred rural landscapes. Landscape change simulations were modeled to predict impacts on biodiversity. The two primary scenarios studied were abandoned farmsteads and agricultural industrialization. Both landscape types were viewed as threats to the preferred cultural landscape of crofting. If the drivers of change that potentially lead to abandoned farmsteads or agro-business can be identified, policy initiatives can be designed to drive the landscape away from these unwanted outcomes (Aranzabal, et al., 2008).

Nkhata, et. Al. (2008) used an SES model to explore the creation and maintenance of long term collaborative relationships within social networks. They argue that long term relationships are the backbone of social cohesion. “We conceive collaboration as a behavioral process that involves different actors working together to create more benefits than could be produced in unilateral settings” (Nkhata et al. 2008, p. 4). They found that most long-term relationships developed during times of instability. They used the adaptive cycle of Holling (2002) and plotted the relationships on the model. They argue that long term relationships build resiliencies. Collaborative relationships, they argue, are key ingredients for stability that result in conservative approaches to land management. This underscores the importance of strong social networks as the foundation of long collaborative relationships. Nkhata et al. argue that the importance of collaborative relationships is founded in functional social networks that also change and grow with the population in the community. Social networks and collaborative relationships are, in their view, an important predictor often overlooked in SES models.

Bell et al., (2009) used the theory of SES to study the decline of a rural community in Latvia. They identified sense of place as an important driver of landscape change that is

underestimated in most research focusing on understanding the causal factors that lead to rural decline. The researchers focused on identifying drivers of out migration from a rural area in Latvia. They found that the majority of people moved to the city for jobs. As the people in the rural settings left their communities, the infrastructure further declined. People who wanted to stay in the community and commute to the city for jobs were forced to move when the roads became impassable. They also hypothesized that sense of place was a factor that influenced migration decisions. The direct policy implication is that improving roads will lessen out migration (Bell et al., 2009). They measured sense of place using focus groups and self-completion questionnaires. They found that jobs were the main drivers of the decision to stay or leave the countryside. This was true even when the connection to the countryside was high. However they also found that the declining infrastructure left few intermediate solutions. They concluded that public policy must address the declining infrastructures, mainly roads and housing, by using EU structural funds for improvements (Bell et al., 2009). The drivers of in and out migration are important indicators of population stability. In most research reports using SES models, sense of place is not considered an important driver of landscape change. However, Bell et al found sense of place to be a critical component of landscape change. They found that when the number of local people with common ties to the area decreases, the incentive to leave the area increases. The out migration also influences social networks, an important community resource. When the social network declines, so does the possibility of collaborative relationships. This in turn perpetuates a downward spiral.

Agent-Based Models

Agent-based models (ABM) are attempts at defining the concepts represented by SES theory. Because concepts are not able to be directly observed, the researcher translates concepts found within the theory into something observable (De Vaus, 2001). Agent-based models define

and clarify abstract theoretical concepts and translate them into observable phenomena that can be measured. ABMs are simulations that attempt to capture multiple data, in an attempt to understand complex human phenomena. The specific benefits of ABMs, to my research and to that of other contemporary researchers, are many. They include the ability to model individual decision-making processes, to incorporate social process influences on decision making and to link social and environmental processes. I used the ABM designed by Matthew and Selman to explain the causal linkages in a small area of the Pine Barrens. Models of this type are being implemented in social-ecological studies to aid the researcher in answering specific research questions. A vast variety of uses are presently being incorporated into research design, and I will review several applications.

In his innovative work on a landscape in the Poconos, D.J. Marcucci used history as a primary tool of investigation, both to document changes and to identify causal linkages among those changes. He used an ABM in his seminal work, *Landscape History as a Planning Tool* (Marcucci, 2000), to study natural changes in the landscape. He used history to identify the disturbance patterns and resource uses of an area in northern Pennsylvania. The research attempts to identify and quantify human impacts, which are often hard to isolate in many systems theory approaches. This work led to a fuller understanding of human impacts and drivers of landscape change. Marcucci found that a number of major processes occurred over time that set the stage for the creation of a particular landscape. He defines these changes as “keystone processes.” The keystone processes include geomorphological processes, climate change, colonization patterns and growth of organisms, local disturbances of individual eco systems, and cultural processes (Marcucci, 2000). Marcucci identifies both human and natural processes and concludes that suburban sprawl in the Poconos brought cultural patterns that changed the

ecology of the forest. The change in ecology affected the plant communities and a traditional activity of gathering wild berries for sale. When the plant community changed, blueberries no longer grew prolifically and the practice was abandoned.

Lansing and Kremer (1993) researched the water temples of Indonesia. They developed a model to study the relationship between irrigation systems and cultural practices. They found that rice cultivation in Indonesia was intrinsically connected with cultural practices that regulated water use. More specifically, the religious and cultural rituals associated with management of water for rice cultivation had evolved into a very efficient system without intervention from government sources, resulting in an effective local governance structure. More to the point, local governance was efficient in distributing resources in a fair and equitable fashion. This underscores the possibility that there may be non-titular leadership within socio-ecological systems that efficiently manage local resources. It also suggests that top-down planning approaches may overlook these valuable local resources in the management of natural resources.

From 1993 to the present, ABM's have been increasingly used in a variety of research studies. In a review of ABM applications, Matthews and Selman (2006) categorized broad areas of model use. The areas include policy analysis and planning, participatory modeling, explanatory spatial analysis, testing social science concepts, and modeling landscape function (Matthews & Selman, 2006). Matthews's most current use of an ABM was used in this research project, providing a landscape modeling function, and will be explained in detail.

Weisbuch and Boudjema (1999) used an ABM strategy to evaluate agro-ecological programs and policies aimed at lessening agricultural pollution. Their goal was to replace older farming practices with newer conservation innovations. They found that education was insufficient to change long-standing agricultural practices. Highest rates of conservation strategy

adoptions were obtained when efforts were focused on important local individuals.

Dissemination of desired conservation outcomes began at these farms and spread to others. They concluded that legitimacy, the process by which power is institutionalized and given moral grounding, should not be overlooked in social systems (Allan, 2008). Moreover the concept of legitimacy is often under-utilized by researchers. Those people who have standing in the community can potentially get more done than an outsider who is not trusted. A recurring problem in public policy, planning and design is inadequately using local human resources in any intervention or study. People who have standing and trust in the community can often be more efficient at gaining buy-in and cooperation. It is not that social networks have not been studied. They have been studied, but they have not been utilized in gaining access to the specific people in the community who can get things done efficiently.

Deffuant et. al., (2000) used an ABM to predict the acceptance of organic farming practices in the Amazon rainforest. He found that the model predicted higher levels of adoption than was actually observed. Cultural resistance was responsible for lower adoption rates of organic farming. The researchers did not capture all of the social and cultural data needed to understand the socio-ecological system observed. The identification of social networks was missing in this example, and as a result the community was not properly represented. When community input is inaccurate or neglected, project failure often results. (Allan, 2008; Ballet et al., 2007).

Parker and Merestshy (2004) used ABMs to test and evaluate hypotheses relating to land use practices and settlement patterns in India. Parker and Merestshy concluded that landscape fragmentation in India is exacerbated by conflicts between urban and rural land users. The conflicts result in more fragmentation and inefficiency in agricultural production. The agent-

based model identified conflicting interests and their impact on landscape change. Conflict in other parts of the world is an important driver of landscape change, but we often do not understand social networks, how they operate and how they frame world views. Social networks and governance appear to be intricately tied and are under-represented in the literature.

ABMs are becoming increasingly rigorous and precise in their identification of human and social impacts on natural systems (Laney, 2004; Matthews & Selman, 2006). As they are used in different settings they will become more accurate in their ability to identify human behavioral impacts. The ABM identifies a broad set of variables and hypothesized linkages between the variables. “Although the inherent complexity of ABMs means that their prime use for the time being is likely to be for research purposes, however, there is a growing recognition of the need to improve their relevance by integrating modeling and deliberation with the public, particularly stakeholders and potential users of the model outputs” (Matthews & Selman, 2006, p. 203).

Matthews and Selman graft an ABM model onto the Panarchy model in an effort to isolate and explain causal relationships between natural and human systems. Their hypothesis was simple. Humans interacting with nature are a primary driver of landscape change. In order to understand the causal inferences between the complex interactions of human behavior on a landscape, one must isolate the causal linkages that drive the change. Matthews and Selman *a priori* hypothesized the causal linkages for a landscape that is in the conservation or sustainable phase (Figure 2-4). In this model, it is theoretically possible to isolate natural forces from cultural forces that drive landscape change. This addition to the adaptive cycle model explains causal factors that lead to landscape change in all four adaptive phases. This research has the potential to aid policy makers in adjusting their planning approaches to more accurately reflect human needs and goals. Furthermore, this model can be applied to all phases of landscape

change. The differences between the findings in one stage, compared to the findings of another phase can possibly explain what triggers a particular landscape change.

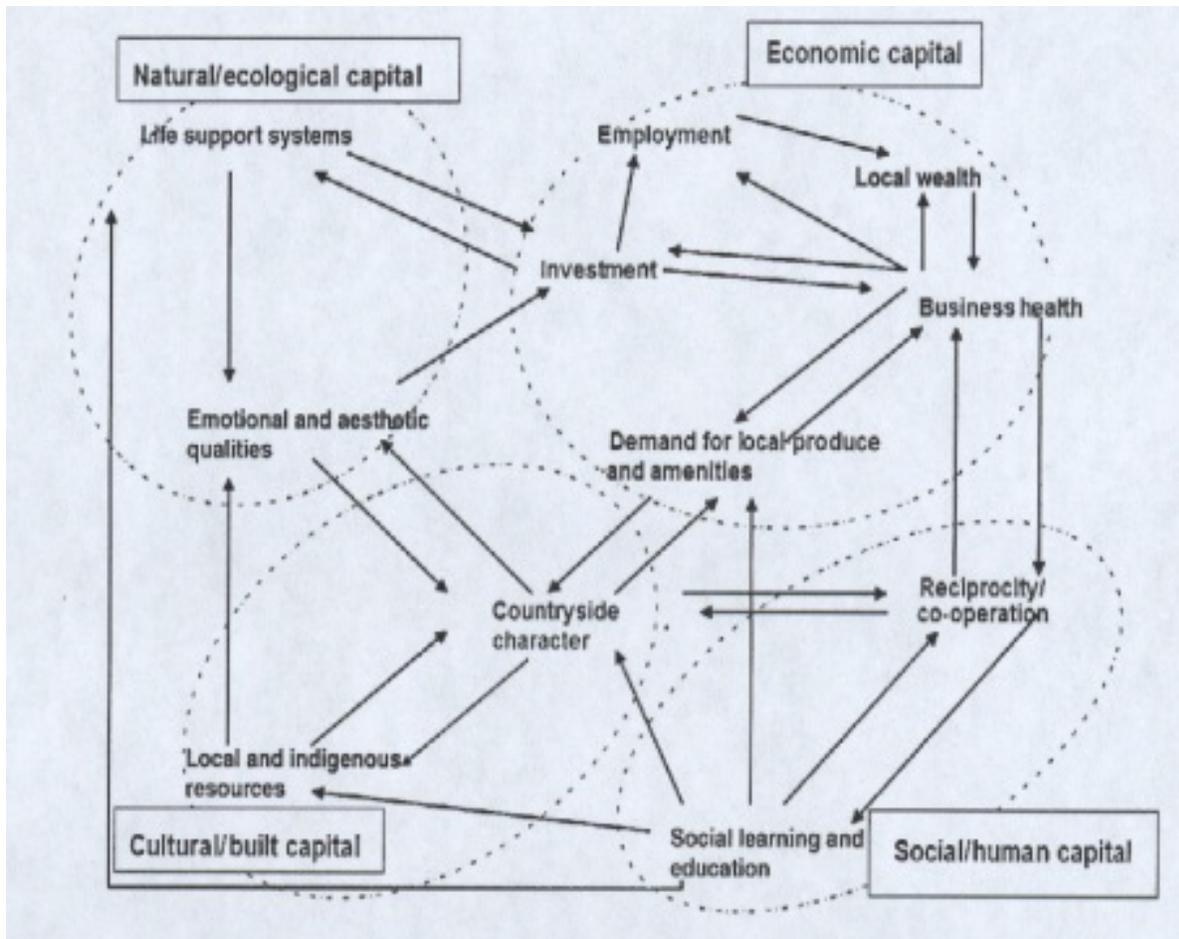


Figure 2-4. Hypothetical causal links within a cultural landscape. Source: Matthews and Selman (2006).

In the model above the hypothesized forces that fuel landscape change are represented as capitals inherent in all landscapes. The capital consists of natural/ecological capital, cultural/built capital, social/human capital, and economic capital. The natural capital includes biodiversity and natural resources. Cultural capital or material culture is represented by the built environment, including all types of structures on the land, and the cultural traditions associated with people who built the structures. Human capital encompasses the networks of

communication and institutions, both public and private, in the communities that exist upon a landscape; this includes processes of socialization, as well as education and skills.

The final capital, economic, comprises the systems that generate wealth and create opportunities for the inhabitants within the landscape and includes the linkages between natural and cultural assets. This model attempts to bring together both the natural and human aspects of landscape in order to identify what drives landscape change.

A recurring problem in public policy, planning and design is inadequately using local human resources in any intervention or study. Weisbuch and Boudjema (1999) used an ABM strategy to evaluate agro-ecological programs and policies aimed at lessening agricultural pollution. Their goal was to replace older farming practices with newer conservation innovations. They found that education was insufficient to change long-standing agricultural practices, and that the highest rates of conservation strategy adoptions were obtained when efforts were focused on important local individuals. Dissemination of desired conservation outcomes began at these farms and spread to others. Legitimacy, the process by which power is institutionalized and given moral grounding, should not be overlooked in social systems (Allan, 2008). It is often underutilized by researchers, as noted above.

Deffuant et al. (2002) used an ABM to predict the acceptance of organic farming practices in the Amazon rainforest. They found that the model predicted higher levels of adoption than were actually observed. Cultural resistance was responsible for lower adoption rates of organic farming. Because the researchers did not capture all of the social and cultural data needed to understand the socio-ecological system observed, the community was not properly represented. When community input is inaccurate or neglected, project failure results. Though there is an

abundance of social networks research, few works have focused on applying this theoretical knowledge to solving human problems (Allan, 2008; Ballet et al., 2007).

An ABM was used in this research and builds directly on the work of (Gunderson & Holling, 2002; Matthews & Selman, 2006) is presented as a robust method of analyzing landscape change. The combination of the two models, Panarchy and the ABM developed by Matthews, Robin and Selman presents a new method for understanding landscape development and was used to answer the question: What interactions among ecological/natural, human/social/, built/cultural, and economic capitals explains the adoption of blueberry cultivation in the area of Retreat, New Jersey during the period 1800-1950?

CHAPTER 3 METHODOLOGY

Research Design and Case Selection

This research used a case study design. The case study depends on the researcher's ability to identify one or more given outcomes of interest prior to initiating the study. Cases for study are then selected based on these outcomes. In essence, the case study allows the researcher to start with a known outcome and identify the conditions or events that produced that outcome. In some case studies, especially when the research is exploratory in nature, the predictor variables are largely unknown and emerge as a result of the research process (Bryman et al., 2004).

More commonly, the researcher identifies *a priori* variables that s/he postulates are important in producing the observed outcomes, based on the constructs and relationships in a specific theoretical framework. The task is to assess the degree to which the postulated relationships among predictor variables do in fact explain the outcome condition. Nonetheless, the researcher typically incorporates a holistic approach to data collection so that unidentified variables can emerge during data collection and analysis. Most theory-based research depends on the second approach. The researcher uses the theoretical framework to guide the data collection process, but incorporates an approach to data collection that will help ensure that unidentified variables emerge during data collection and analysis and, most importantly, as a part of the interpretation of the findings.

This study explores the factors that influenced a specific landscape change that resulted in the introduction of the blueberry into agriculture and its persistence as an environmentally and socio-economically viable crop. Evidence will be presented that the landscape was regenerating from the creative destruction phase in the adaptive cycle model of Gunderson and Holling (2002).

The first major crop of domesticated blueberries marketed by the Tru-blu cooperative sold for \$42,575.49 in 1928 (Tru-Blu Growers Cooperative, 1929-1956). This was a members-operated cooperative started by five large cranberry growers in 1929 (Tru-Blu Growers Cooperative, 1929-1856). Before then, all blueberries sold commercially were picked in the wild (Darrow, 1940). The first domestic crop was produced by 19 farmers, all of whom cleared land and planted the new crop in the acid soils of the Pine Barrens (New Jersey Pinelands Commission, 1980). By 1934, membership in the local cooperative rose to 54 individuals, and blueberry sales had more than tripled. The crop that year sold for \$144,838.60 (Tru-Blu Growers Cooperative, 1929-1956). Table 3-1, a crop report for New Jersey, is evidence of rapid growth of the industry in the period 1944-1956. What were previously woods and abandoned cranberry bogs became large and small blueberry plantations. Again, this study explores the factors that influenced this specific landscape change by observing the outcomes from the introduction of the blueberry into agriculture.

Table 3-1. New Jersey Crop Reporting Service. Acreage harvested, yield per acre, production, price and value of New Jersey blueberries, 1944-1956. Source: Doehlert, (1956c)

Year	Acres Picked	Yield per acre – Trays	Production - trays	Price per flat	Value per acre in 1000s
1944	1600	305	488,000	\$3.10	1513
1945	1800	140	252,000	\$3.95	970
1946	2000	255	510,000	\$3.40	1734
1947	2200	290	638,000	\$2.75	1754
1948	2400	165	396,000	\$3.65	1445
1949	2800	285	798,000	\$2.70	2155
1950	3100	250	775,000	\$2.65	2054
1951	3600	275	990,000	\$2.60	2574
1952	4100	235	964,000	\$2.75	2651
1953	4600	280	1,288,000	\$2.85	3671
1954	5000	320	1,600,000	\$2.75	4400
1955	5200	315	1,638,000	\$2.65	4341
1956	5200	225	1,170,000	\$3.15	3686

Site Selection

The blueberry fields of Retreat, NJ were chosen as the area of study. The small crossroads village is located 3 miles west of Vincentown on the western edge of the New Jersey Pinelands. This small settlement was once an iron plantation and cotton factory beginning in the first quarter of the 19th century. The period of study ranges from 1800 to 1950.

The site was chosen for several reasons. First, the site was a typical pinelands industrial village, one of many that were prosperous during the early 19th century and that spread throughout the pinelands of Burlington County (Peckitt, 1940). This site, like many others in the pinelands, was heavily impacted by the iron industry and was representative of the other industrial sites. The site was also home to some of the earliest blueberry fields in New Jersey that

spread throughout the Pine Barrens shortly after the successful trials at Whitesbog; these trials

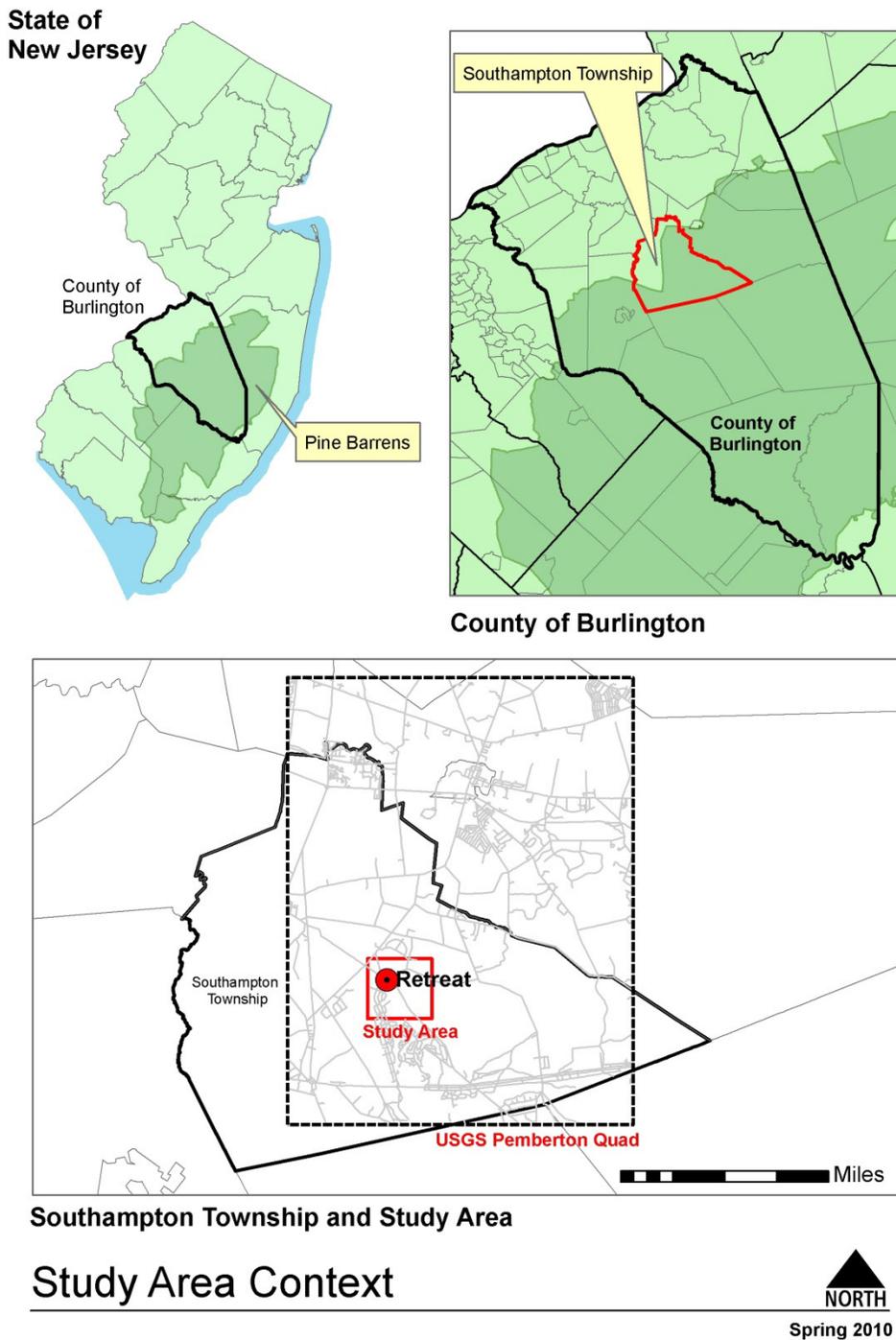


Figure 3-1. Regional Context Map.

perfected superior highbush hybrids and made them available to potential growers. Theodore Budd was the first in the area, and one of the earliest to enter the new industry. Early in 1920, he prepared fields and planted the new crop. People in the local community soon followed suit, so the site saw both large and small growers go into the new business during its formative years. Because Whitesbog was so heavily subsidized by the government, it did not present an ideal location to study, although it too was located on an old iron industry site. Budd's Bog, on the other hand, was an early attempt that took advantage of the government science; however, Budd cleared the land and planted the crop without government subsidy. In addition, Budd became a major source of propagated materials in 1927 (Wyman, 1941). Finally the site provided easy access to families, blueberry fields, and historic resources.

Theoretical Constructs

Matthews and Selman (2006) include four overall constructs in their model: ecological/environmental capital, built/cultural capital, social/human capital and economic capital.

The ecological/natural capital includes the "life-support system" underlying biodiversity and natural resources. Built/cultural capital includes the structures and land uses that give a relative degree of character to parts of the countryside, and the cultures and traditions associated with particular areas. Social-human capital includes the networks and institutions that underlie trust and civic-mindedness, as well as the potential for social learning within familiar and tangible settings, and the levels of the residents' education and skills. Finally, economic capital includes the opportunities for the generation of wealth, jobs, business confidence and investment that are associated at least partly with natural and cultural aspects.

Variables Representing the Construct

I identified several dimensions in each construct and defined the variables that would represent each dimension. For instance, one dimension of “built/cultural capital,” a construct in the model, was cultures and traditions associated with particular areas. Working with experts and using preliminary research results, I hypothesized that one variable representing this dimension was “pre-blueberry” activities based on natural resource extraction (cranberry, charcoal, moss). I followed this systematic approach to identify all dimensions of the constructs. This process continued until I had identified variables that adequately reflected the hypothesized dimensions of all constructs in the model. The constructs, dimensions, and variables representing the constructs are included in Table 3-2. During the pre-dissertation research, I identified sources of information pertaining to the variables, which are also included in Table 3-2.

Methods and Procedures

Three principal methods of data collection were used in this research: personal interviews, review of archival-historic sources, and spatial analysis of maps. The archival data were separated into text data and image data. The next step in the process was to design instruments for the collection of the data mentioned above (Bernard, 2000).

Interviews

Designing and testing interview questions were critical steps in this research. The validity of the information gathered relied on careful testing of the instrument. I designed a semi-structured interview to capture the information (Appendix A). For instance one question about “pre-blueberry activity” was: “Did you or any one in your family pick wild blueberries?” I tested the guide with several interviewees who were similar to the people who would be interviewed in the field.

Table 3-2. The Hypothesized Variables for the Matthews/Selman Theoretical Framework.

Type of Capital	Dimensions	Variables	Source of Information
Ecological-natural	Life support system underlying biodiversity and natural resources	Average temperature (summer high and winter low) Soil type Aquifer Naturally occurring wetlands High water table Areas suitable for blueberries	Existing Maps (USGS & Others)
Built -cultural	Structures that give relative degree of character to parts of the countryside		Existing maps Existing maps Existing maps to locate, pictures Historic photos, interviews, direct observation
	Land uses that give relative degree of character to parts of the countryside	Agricultural lands (including blueberry fields) Woodlands Settlement pattern	Existing maps Existing maps Existing maps, direct observation
	Cultures and traditions associated with particular areas	“Pre-blueberry” activities based on natural resource extraction (cranberry, charcoal, moss) Wild blueberry harvesting Anglo-Saxon heritage	Interviews, archival materials (newspapers, government publications, literature review) Existing maps & literature review, genealogies
Human-social	Networks that underlie trust	Kin Neighbors	Interviews, census records Interviews, newspapers
	Institutions that underlie trust	Church School	Interviews, archival data Interviews, archival data
	Potential for social learning with familiar and tangible settings	Shared labor (tasks) Shared sites for labor	Interviews, archival data, literature Interviews, existing maps
	Level of education and skills	Previous experience with natural resource based production activities Formal education	Interviews, literature Interviews, archival
Economic	Opportunities for generation of wealth	Resource-based businesses	Interviews, archival, literature
	Opportunities for generation of jobs	Cranberry plantations Ancillary work for cranberries	Interviews, government publications
	Investments that are associated at least partly with natural and cultural characteristics	USDA Cooperatives (cranberry, blueberry)	Interviews, archival data, government publications Interviews, archival data

I conducted personal interviews whenever possible to collect data. Interviews were semi-structured and well suited to this research, allowing emergent variables and concepts to be captured. The efficacy of the instrument was evaluated after three interviews. It was found to be working well, so no adjustments were necessary.

Ten interviews were conducted using a referral sample. During pre-dissertation research, initial respondents – people who were known to be active in the blueberry industry – were contacted based on personal contacts. As a long-time resident of the area, I was able to easily identify key informants. The informants consisted of long-time blueberry farmers, descendants of the original growers, wild berry gatherers and people involved with marketing the new crop. Selection of the initial or first tier of respondents (key informants) was critical. Any bias in the selection of this first tier can lead the researcher to fail to identify the full potential set of respondents. Therefore initial interviews were chosen carefully. Two criteria were used to identify the key informants: my own personal knowledge of key players, and referrals from interviewees. The interviewing period of the research was ended when no new information was forthcoming.

For each interview, extensive notes were taken, following the order of the questions themselves (Appendix B). The responses to each question created the basic unit of data and were archived according to the variable they represented. I summarized the responses after each interview was completed to ensure that the key points were retained. A summary form was created, using the interview questions and the representative variable as a basis for archival coding. Each unit included a summary section and a section for emerging themes. The summary included key themes addressed in the interview, including the theory-based themes that I identified *a priori*, and emergent themes that I did not anticipate.

After four interviews, I examined the summary sheets to identify similarities across the interviews. This process allowed me to identify common themes and categorize the emergent themes. For example, one *a priori* theme dealt with worksite learning. I found that some respondents learned the rudimentary workings of commercial blueberry production on the job. They were part of the work force that installed the first hybrid plantings on a large cranberry plantation, learning firsthand the necessary requirements for planting the new crop. Others learned from their parents or friends who had firsthand experience. After all of the interviews were completed, I explored the paths or linkages among variables to determine the degree to which the data corroborated (or did not) the proposed model and the linkages among constructs in that model. Finally, I adjusted the model to represent the findings from the data.

Archival data

Archival sources fulfilled four main purposes. First, these documents provided some leads to key informants for the interviews. Second, the content of the archival data was used to test and validate the information from the interviews. Third, archival data were used to build the proposed model for landscape change. Fourth, the archival data demonstrated how the people of the area viewed their community and how the community was viewed from the outside. The archival data were coded by type in order to check for bias within types. The types included research reports (R), interviews (I), historic interviews (HI), practitioner's journals (PJ) and newspapers and popular press (N). Data were recorded in the comprehensive data collection instrument (Appendix C). After data were reviewed for bias, they were entered into the "Hypothetical causal links within a cultural landscape" instrument (Appendix D).

My sample of archival data included, to the degree possible, all of the relevant documents from the ten-year period in question, as well as materials needed to reconstruct the previous phases of landscape transformation. Archival data included deeds, images, letters, memoranda

and other communications, agendas, announcements, minutes and other written reports of events, administrative documents, proposals, progress reports and other internal records, formal evaluations and studies of the site, newspaper accounts and similar articles that appeared in various mass media, such as community newspapers. Historic maps and charts, as well as personal records and diaries were also used.

One data source needs particular mention. During the pre-dissertation research, an important work was uncovered. A folklorist from the University of Indiana named Herbert Halpert, gathered folksong and stories in the Pines in the early 1930s. Within his work were interviews of local people, some of whom were related to the study site. The interviews were full text, and the researcher captured the sentence patterns and pronunciation styles of many local berry pickers. Interviews from this resource were treated in the same fashion as interviews by using the questionnaire and summary form to organize data collection.

The analysis procedure for the archival information was similar to that used for the interview data. During the pre-research phase, sources were identified and consulted. An instrument was designed to capture the historic data (Appendix E). Written text that corresponded to the variable representing each construct was noted in the form adjacent to the corresponding variable. I summarized the information and identified emerging themes. For instance, it became clear that women had an important organizing function in the community, which I had not identified *a priori*. This became an emerging theme. After all the data were collected, they were entered into the master data collection instrument, which became the clearing house for all the data that would be addressed in the final analysis.

Image analysis

The archival information included many images from the region at the time of concern in the study. I developed an instrument to capture the necessary data (Appendix F). These were

coded based on their relationship to the variables. For instance, photos were uncovered documenting the clearing of forest for the earliest blueberry fields. This picture was filed and coded, “land uses that give relative degree of character to parts of the countryside.” This procedure was followed for all images. An instrument was created for that purpose, similar to the archival data instrument.

In another example, the New Jersey Department of Agriculture (NJDA) published a book on cranberry culture and included a number of images that represented the ideal elements for cranberry cultivation. They included a cranberry packing house and the construction of bogs (Beckwith, 1931). The images were separately analyzed and coded sequentially as “structures that give relative degree of character to parts of the countryside,” and “land uses that give relative degree of character to parts of the country side.” They were then included in the comprehensive data base.

Spatial analysis

Soils, hydrology, land use and historic structures were analyzed using a geographic information system (GIS) data base. The data for items mentioned above were imported from the New Jersey Department of Environmental Protection, which is responsible for storing current GIS data. On-site observations and historic information were extrapolated from atlases found at the Burlington County Library and Historic Society and added into the GIS. A series of maps were generated from this information. Natural systems on the site were identified and analyzed using this data. Relationships between people and the environment were then added as findings to the data base.

The GIS was used to record spatial information when applicable, and maps were created that showed where people lived in relationship to the wild population of wild blueberries. Maps were generated and common themes were identified. The information gathered in this system

was used to identify site-specific environmental information shown in juxtaposition to its social context.

CHAPTER 4 RESULTS

Introductory Remarks

Four constructs were examined – natural/ecological capital, social/human capital, built/cultural capital, and economic capital – in order to answer the question, “What interactions between cultural, social, economic and natural capital explain the adoption of blueberry cultivation in the Retreat area of New Jersey during the period 1800-1950?”

First the natural systems are reported and reviewed using a McHargian multi-layered approach to identify key aspects of the natural systems. These findings are presented in a series of maps, including aquifer and soils, coastal plain, land use and geology. Maps drawn at several scales supplement this chapter. The first five maps (Figures 4-1 through 4-5) identify the important natural systems of the area. They are based on a USGS map for the Pemberton, NJ quadrangle. An inset within the map identifies the study site, and a series of study site maps follows chronicling changes in landscape for the area of Retreat. Interspersed among these maps are two railroad maps, one at the state level and one at the county level.

A description of human/social capital follows with narrative and maps. And a narrative approach with illustrations has been used to describe the built/cultural capital, comprised of a discussion of structures, land use and subcultures.

Economic capital is discussed chronologically documenting the spatial change in the region’s economic base beginning with European settlement and disruption of Native American Woodlands Culture and ending in 1950. Maps and illustrations accompany the narrative findings.

Thematic Analysis

Thematic analysis was used to interpret the narrative findings. Thematic analysis is a time-honored approach used for the analysis of data that can be collected in a narrative form, and then

coded for later analysis. In general, thematic analysis has three levels, which are analyzed sequentially (Bernard, 2000). The first step of the process is to collect and prepare the data for analysis. The data collected was then coded according to the constructs of the theoretical approach. And finally the body of data was reviewed in order to identify unified themes that represent the constructs of the theory, while also looking for emerging themes that were not covered by the theoretical perspective. The emerging themes are then added to our knowledge of theory.

The chapter concludes with a thematic analysis which answers the question, “What interactions among natural/ecological, human/social, built/cultural and economic capitals explain the adoption of blueberry cultivation in the Retreat area of New Jersey during the period 1800-1950?”

Ecological-Natural Capital

GIS analysis was used to inventory and analyze the natural features of the study site. This section provides a series of maps and a short summary of key geologic and hydrologic characteristics; then soils and their vegetative association are discussed. The section concludes with a short discussion of land use during the early 1920's.

Geology

The geology of this section was the result of marine and alluvial deposits of sediments over the past seven million years (Figure 4-1). During this period sea levels rose and fell several times in response to Pleistocene glaciations.

During glacial advances, the land surface was scoured and large amounts of material were trapped in the ice pack. During the interglacial periods, large volumes of melting ice released these materials, causing further erosion. As part of this interglacial melting process, gravel and yellowish sands were deposited on the newly exposed lower slopes of highlands and coastal

plains. Finer sediments of both terrestrial and marine origin were also deposited in these areas. Such Pleistocene deposits characterize the southern New Jersey Coastal Plain today and extend from Long Island along the coast ending in Mexico (Robichaud et al., 1973). These sediments are the parent materials of the site soils and formed the present day aquifers that influence the vegetation and settlement patterns.

Inner and Outer Coastal Plain

As shown in Figure 4-5, the study site straddles the area between the Inner Coastal Plain (ICP) and the Outer Coastal Plain (OCP). Table 4-1 identifies the percentage of the site that is in either the ICP or OCP, while Table 4-2 does the same for the study site. The ICP is generally higher in nutrient availability and water holding capacity. As a result, the ICP was cleared and used for field agriculture. The soils of New Jersey’s OCP, in general, can support little traditional agriculture (Wacker, 1975). The northwestern portion of the site sits on the ICP, while the southeastern portion is in the OCP.

Table 4-1. Acreages and percent of site in the Inner Outer Coastal Plan

Coastal Plain Classification	Area (acres)	% of Pemberton Quad
Stream and Flood Plains	9791.89	16.80
Inner Coastal Plain	22498.57	38.61
Outer Coastal Plain	25980.43	44.59
Total	58270.89	100.00

Although both the (ICP) and (OCP) have their origins in depositions of clay, silt, sand and gravel, the soils that have evolved in the two areas differ greatly (Figure 4-2). The ICP consists of deposits formed during the Cretaceous period and consequently overlain by interglacial deposits. The OCP consists of sediments deposited during the Tertiary period and overlain with sands and gravels during the Cretaceous. The interglacial sediments were deposited on both the ICP and OCP. However, the finer sediments were overlain on the ICP. Therefore the

soils that evolved differ in their percentages of sand, silts and clay. The finer soils retain more water and nutrients than the coarser soils.

Table 4-2. Acreages and percent of the study site in the Inner/Outer Coastal Plan

Coastal Plain classification	Area (acres)	% of Study Area
Stream and Flood Plains	519.08	12.32
InnerCoastal Plain	203.96	4.84
Outer Coastal Plain	3489.79	82.84
Total	4212.82	100.00

A series of hills that extends in a southwest to a northeast direction, beginning at the Atlantic Highlands and ending at lowlands along the Delaware River, separate the ICP from the OCP. The hills or cuestas are remnants of Cretaceous deposits. The ICP lies to the west of the cuestas and the OCP to the east. This formation covers all of southern and most of central New Jersey

Surface Water

Two tributaries bisect the study site; Friendship Creek and Haines Run and form the south branch of the Rancocas Creek. The low lying wetland areas are headlands of the south branch of the Rancocas system, which flows westward and combines to form the main branch of the Rancocas in Lumberton. These watersheds, with their fluctuating high and low water tables, severely impact the land use possibilities of the study site. The navigable portion of the creek then flows to the Delaware River.

Hydrology

The major hydraulic feature on the study site is the Kirkwood Cohansey aquifer. This hydraulic system is approximately 100 feet deep and recharges lakes, bogs and streams during low flow periods. This natural feature had an impact on the pre-fossil-fuel industries of the pinelands. During low flow, streams that run through this aquifer never ran dry, providing an

important industrial power source. From early spring to the first winter freeze, a reliable power source was available. Figure 4-3 shows the tributaries and aquifers in this system

Table 4-3. Acres and percent of soils for each listed type for the area

Soil Name	Area (acres)	% of Pemberton Quad
Adelphia	2973.06	5.10
Atsion	7249.59	12.44
Berryland	1617.55	2.78
Buddtown	3229.79	5.54
Colemaritown	175.34	0.30
Collington	1155.21	1.98
Downer	3810.22	6.54
Evesboro	7185.80	12.33
Fallsington	4.53	0.01
Fluvaquents	4851.66	8.33
Freehold	1995.73	3.42
Galloway	1012.05	1.74
Holmdel	2332.42	4.00
Jade Run	2014.61	3.46
Keansburg	311.04	0.53
Kresson	142.67	0.24
Lakehurst Lakewood	47.22	0.08
Lakehurst	2893.17	4.97
Lakewood	1662.42	2.85
Manahawkin	938.07	1.61
Marlton	30.68	0.05
Mullica	3931.83	6.75
Pemberton	9.70	0.02
Clay Pit	96.08	0.16
Sassafras	488.25	0.84
Shrewsbury	1852.44	3.18
Sand/Gravel Pits	262.54	0.45
Tinton	1047.52	1.80
Udorthents	115.63	0.20
Urban Land	80.73	0.14
Water	4372.27	7.50
Westphilia	293.26	0.50
Woodstown	85.82	0.15
TOTAL	58270.89	100.00

Table 4-4. Acres and percent of soils for each listed type for the study site

Soil Name	Area (acres)	% of Study Area
Atsion	3489.79	82.84
Buddtown	194.84	4.63
Fluvaquents	472.25	11.21
Galloway	9.11	0.22
Water	46.83	1.11
Total	4212.82	100.00

Soils

Soils of the New Jersey Outer Coastal Plain are typical of the soils of the study area. The parent materials range from 1,100 to 2,000 feet deep and consist of unconsolidated marine or riverine sediments. They overlie bedrock that gently slopes eastward toward the ocean, forming a wedge-like formation. The main difference between soils of the Inner and Outer Coastal Plain is pH. In general, soils of the Inner Coastal Plain have higher silt and clay percentages, and a higher pH, than sands of the Outer Coastal Plain. The latter not only have lower pH, but they also are less able to retain nutrients due to particle size. Plant communities of the Outer Coastal Plain adapted to these acid conditions in order to survive in a low-nutrient environment. However, the lower pH of outer coastal plain soils inhibits the growth of many plants that can easily grow on the higher pH of Inner Coastal Plain soils.

Thirty three soil types were identified using GIS Arc View 9 and soils data from the New Jersey Department of Environmental Protection (Table 4-3 and Figure 4-4). The descriptions of the soils on the study site are taken from the descriptions of soil types found in the Soil Survey of Burlington County New Jersey. The full data set is found in Appendix G. The following two soil types are those identified by the Soil Survey and GIS suitability analysis as the most propitious for blueberry culture.

Atsion Series

According to the Burlington County Soils Survey, the primary soil for blueberry and cranberry production is the Atsion series. The Atsion series is characterized by deep, poorly drained soils that formed in acid, sandy Coastal Plain sediments and are located in low positions on the landscape. The soils drain quickly and their water holding capacity is low. The root zone is restricted by the seasonal high water table. When drained, they have a low available water capacity. When the water table is low enough to permit percolation, permeability is moderately rapid. These soils have a moderate organic matter content and low fertility.

Although this soil is not usable for traditional agriculture, this type remains the predominate soil in blueberry and cranberry cultivation. In addition, these soils are highly acidic, and most native plants, like the cranberry and blueberry, have adapted to these restrictive conditions (Figure 4-6). Other than use for blueberry and cranberry agriculture, the soils did not have an economic use. The blueberry suitability map was created using the Burlington County Soils Survey. According to the survey, the Atsion series and Berrylands soils are the best soils for blueberry agriculture, and 90% of the lands used for this specialized agriculture occur in the above-mentioned soils. Atsion and Berryland soils were identified as suitable soils, and all other soils were identified as unsuitable. Refer to Table 4-4 for percentages of suitable blueberry and cranberry soils.

Native vegetation on Atsion soils are stands of pitch pine and scattered scrub oaks with a dense understory of highbush blueberry (*Vaccinium corymbosum*), sheep laurel (*Kalmia angustifolia*), sweet pepper bush (*Clethra alnifolia*), gallberry (*Ilex glabra*), and greenbrier (*Smilax* spp.) Where they are drained, these soils are suited to casual blueberries and cranberry cultivation. Blueberries are grown more extensively on Atsion soils than on any other kind of soil type in Burlington County.

In the management of Atsion soils for blueberries the water level in summer is controlled at about two feet below the surface by subsurface drainage ditches. The cropland is leveled to prevent surface ponding and to prepare the field for the heavy over-the-row harvesters. A difference of a few inches can make the difference between suitable berry soils and soils so wet that they are useless to this type of agriculture. Such differences in elevation are not as limiting as it would seem. By damming the head waters and draining fields with ditches, growers can easily use most Atsion soils for berry agriculture.

The Atsion soils are strongly acidic and have very low natural fertility, qualities which hold true for the study area. Added fertilizers leach readily, and the content of organic matter is very low. Because the soils are loose, they are subject to wind erosion and, on slopes, to water erosion. In addition, the water table is suitable only to deeply rooted plants, since the table only rises to within two feet of the surface in the summer, when plants need water most.

However, in the lower elevations one finds muck soils and Berryland soils, which support a wide variety of plants, including the swamp highbush blueberry. When properly drained, this soil type can also be used for blueberry and cranberry cultivation.

Berryland Series

The Berryland series consists of saturated sands that have a very dark surface layer over dark subsoil. The subsoil ranges from loose to very firmly cemented, and the substratum is sandy. Berryland soils are very poorly drained because they are in a nearly level area such as a marsh, swamp borders, or the bottom of circular depressions. In the very poorly drained Berryland soils, the water table does not drop below two feet in the summer when the rainfall is normal, and it is at the surface from November through May.

The native vegetation of Berryland soils is a forest consisting of mostly pitch pine, scattered Atlantic white cedar (*Chamaecyparis thyoides*), blackgum (*Nyssa sylvatica*), red maple

(*Acer rubrum*), and sweet bay magnolia (*Magnolia virginiana*). Normally, there is a dense understory of sweet pepper bush (*Clethra alnifolia*), highbush blueberry (*Vaccinium corymbosum*), gallberry (*Ilex glabra*), and leather leaf (*Chamaedaphne calyculata*).

Cleared areas are used primarily for blueberries and cranberries. Between 1850 and 1920 most areas were originally cleared for cranberries, and they were used for that purpose until about 1930, when much of the area was planted to blueberries. This trend was reversed around 1965, when the change to water harvesting cranberries caused a revival of interest in improving cranberry bogs or in building new ones.

John McPhee in his popular book *The Pine Barrens* summarizes the impact of the soil on land use.

The acidity of the soil—which precludes conventional farming—was apparently the main reason the Pine Barrens’ forest was spared the plow. However, the Pinelands are not virgin forest. It is a landscape whose resources supported the growth of the region. From earliest times, the resources from the woods have been used. The rapid development of Philadelphia depended on a wide variety of resources that came from the forest or depended on its resources, such as wood, pitch, and a variety of iron and glass products. One major building in Philadelphia best demonstrates the connection between Philadelphia and the pines. Independence Hall was built using large cedar timbers from the Pine Barrens for roofing trusses and cedar shingles for the roofing. In addition, iron nails made in one of the many iron furnaces and glass windows from one of several glass factories, all were manufactured in the Pine Barrens (McPhee, 1974, p. 102).

In conclusion, it is the Atsion and Berryland soils that continue to be productive and historically played an important role in the economic prosperity of the region after the decline of iron and glass manufacturing.

Plants of Interest

The natural vegetation of the area is pitch pine mixed with black and white oak (*Quercus velutina* and *Quercus alba*), black gum (*Nyssa sylvatica*) and hickory trees (*Carya* spp.). In the low-lying areas, Atlantic white cedar (*Chamaecyparis thyoides*) dominates. The understory

includes lowbush blueberries (*Vaccinium* spp), cranberries (*Vaccinium macrocarpon*) and scattered sheep laurel (*Kalmia angustifolia*).

The plants of the Pine Barrens have been studied for many generations. Beginning with Collomson in the 18th century, the plants of the pinelands have attracted international attention (Kalm et al., 1966). National and international scholars have written and published many accounts of the flora of the pines (Berger & Sinton, 1985; Harshberger, 1916; Robichaud et al., 1973). Given the focus of this research and the time available, the pines flora will be discussed as it pertains to the theoretical constructs of interest in the research (Geller, 2002).

A priori several plants were identified as having important economic consequences for the region under study. The pinelands were a resource base for the growing cities that flourished along the Delaware River, including Philadelphia and Trenton. Forests were cut for building materials and fuel. Oaks were used for the structural components of local buildings. Cedar was used for siding and roofing. Pine was used for making charcoal. Also important economically were the understory plants, including the cranberry, blueberry, and to a lesser extent clubmosses (*Lycopodium* spp.) and Christmas greens including a variety of pines, holly and laurel. During the years immediately after rail lines connected the region to the city markets, a cottage industry grew selling these commodities in urban markets to the west. Of the understory species that were commodified, the cranberry, and later the blueberry, both became industrialized.

The initial focus of the case study was centered on the introduction of the blueberry into traditional agriculture and the transformational role it played in changing the landscape economically. It immediately became apparent that it is difficult to separate the economic impact of the blueberry from the economic impact of the cranberry. In fact, I believe the introduction of the cranberry into commercial agriculture was the precipitating factor that ended the release

phase caused by the upheavals of the iron industry and began the reorganization phase. The history of the introduction of the cranberry mirrors that of the blueberry. The cranberry was a wild-gathered commodity that began to have economic value with the construction of the railroad. Improvement began when natural cranberry meadows were improved. This phase was followed by designing improved bogs for cultivation. Aided by government extension, the bogs became an important factor of the economic revival of the area.

This took more than good ideas and innovation. Both the blueberry and cranberry belong to the family Ericaceae and the genus *Vaccinium*. For a more detailed discussion of the relatives of *Vaccinium corymbosum* see Appendix H. Cranberries and blueberries both have special requirements that cannot be reproduced in all landscape settings. Cranberries, and to a lesser extent blueberries, have specific geographic and ecological ranges so they cannot be grown outside of their natural constraints. Based primarily on their evolutionary adaptations to acid and wet soils, their success in part relates to their biology. Agricultural introductions using wild stock adapted to the specific conditions of a localized site, and introduced into agriculture with economic success, are rare.

The original domesticated blueberries developed by the USDA are descended from wild-gathered individuals of *Vaccinium corymbosum* and in some instances crosses between *Vaccinium corymbosum* and *Vaccinium angustifolium* (Vander Kloet, 1988). *Vaccinium corymbosum* has a wide geographical range. It can be found as far south as south-central Florida, and as far north as Nova Scotia, and as far west as Michigan, wherever the soil is acid. Given the wide geographic range, the highbush blueberry has adapted to a variety of environmental conditions. In the wild, *Vaccinium corymbosum* has a wide range of morphological variation. At one time or another, 25 taxa, currently included in this species, have

been raised to the rank of species. This, in part, is due to natural hybridization between *Vaccinium corymbosum* and other members of section *Cyanococcus*, resulting from the removal of eco-geographic breeding barriers, a direct response to landscape disturbance.

Vaccinium corymbosum

Vaccinium corymbosum is a crown-forming shrub ranging in height from 1.5-4.5 m. Vander Kloet (1988) hypothesized that *Vaccinium corymbosum* and other members of section *Cyanococcus* are derived from ancestors similar to *Vaccinium darrowii*. *Vaccinium corymbosum* is perhaps the easiest to identify because all highbush blueberries are grouped into one species in the latest taxonomic treatments (Vander Kloet, 1988, 2009). *Vaccinium corymbosum* has often been called a “compilation species” because it accumulates morphological variation by hybridization with its close relatives. The twigs are angular to smooth, glaucous to bright green, and glabrous to densely pubescent. The leaves have a wide variety of forms. They range from ovate to narrowly elliptical and are usually deciduous. The leaves vary in size from 17-25 mm wide to 38-54 mm long. The blades have a margin that is entire to serrate, sub-serrate or sharply serrate. The corolla is cylindrical, white or pinkish white; the filaments are ciliate to occasionally pubescent along the margins. The berries range in color from dull to shiny black, to bright blue and glaucous.

Vaccinium corymbosum also varies in ploidy levels. They can be diploids ($2n=24$), tetraploids ($2n=48$) or hexaploids ($2n=72$) and can freely breed with other blueberry species that share the same ploidy level. This, in short, has led to considerable morphological differences, which is ideal for breeding purposes.

Vaccinium angustifolium

The other species important to the early hybridization of the blueberry is *Vaccinium angustifolium*, a lowbush blueberry that forms dense colonies of shrubs about 25 cm in height.

The species spreads by rhizomes. The leaves are elliptical and the underside can be waxy or not, and is sometimes pubescent. The leaf margins are serrated. The berries are blue with a waxy coating or shiny black. This species has a northern range generally extending from northern Canada to southern New Jersey (Vander Kloet, 1988, 2009). It also grows in parts of the Appalachian Mountains a little farther south, since the mountain climate is somewhat cooler than that of the coastal plain.

The first effort to hybridize the blueberry was attempted by the USDA. The experiments were under the direction of USDA scientist, Fredrick Vernon Coville. The idea first came to him in the summer of 1906 when he purchased an abandoned farm in Greenfield, New Hampshire. The land was covered by wild blueberries. The first bush selected from the wild was named 'Brooks'. Seeds from the specimen were grown to maturity in Washington, DC. In the spring of 1911, crosses between offspring of 'Russell' and 'Brooks' resulted in progeny of about 3000 individual hybrids. These were the seedlings that required an appropriate site for the next phase of the experiment, field trials.

After accepting an invitation from Elizabeth White, the daughter of a prosperous landed family who operated a successful cranberry plantation, the field trials were located in Browns Mills, New Jersey. With the help of local woodmen, White and Coville found an ample breeding stock that were used in the experiments. The next major find was located near Browns Mill by Ezekiel Sooy. 'Brooks' and 'Sooy' were crossed and became the first of a series of an improved variety named "Pioneer" in 1912 (United States. Dept. of Agriculture, 1937). From 1911 until Coville's death in 1937, approximately 16 hybrids were introduced to agriculture and became the foundation of the new industry (Table 4-5, Blueberry parentage).

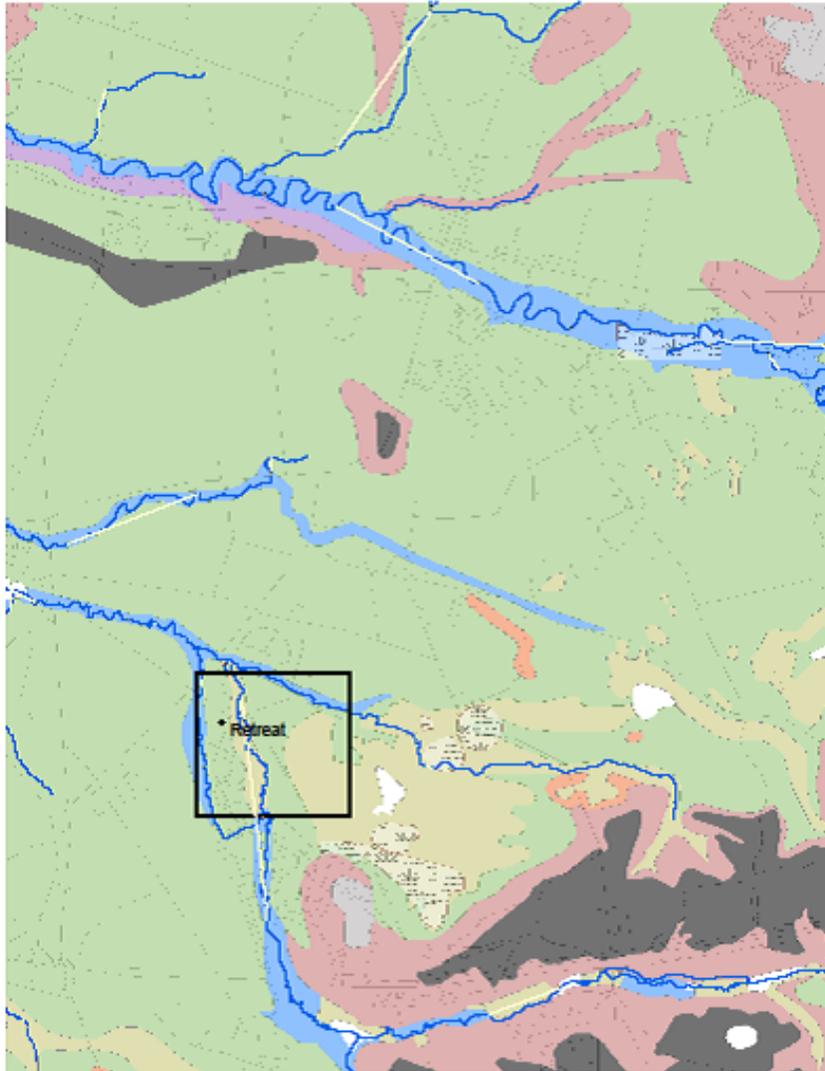


Figure 4-1: Surficial Geology of Study Area  NORTH
 Miles Spring 2010



Figure 4-1. Surficial Geology of Study Area

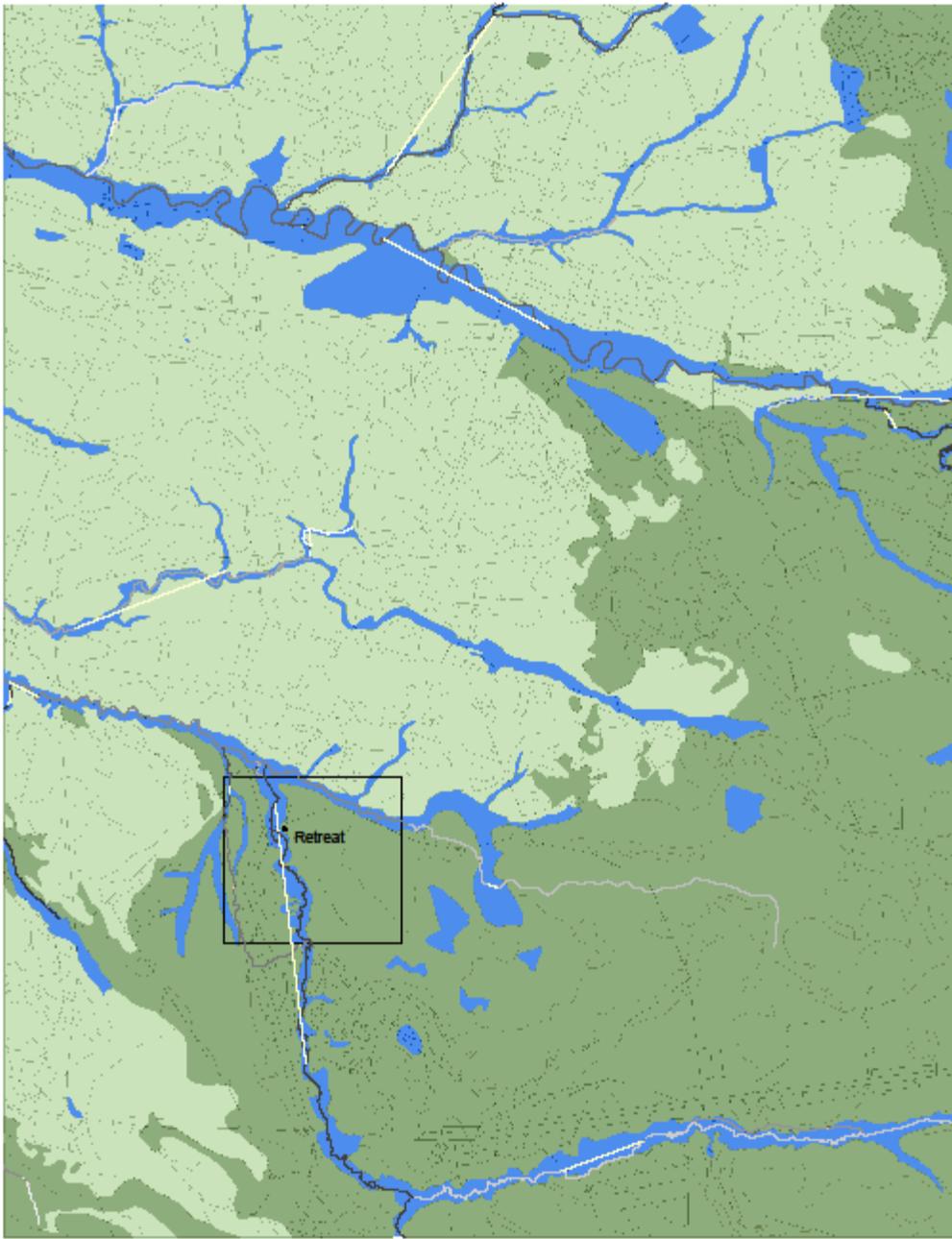


Fig. 4.2: Inner & Outer Coastal Plains of Study Area ▲ NORTH

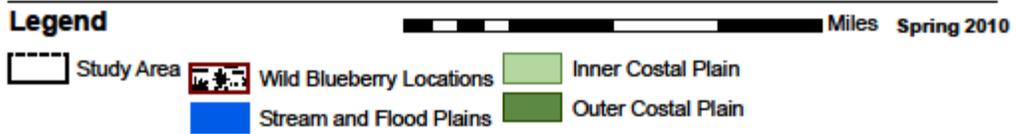


Figure 4-2. Inner & Outer Coastal Plains of Study Area

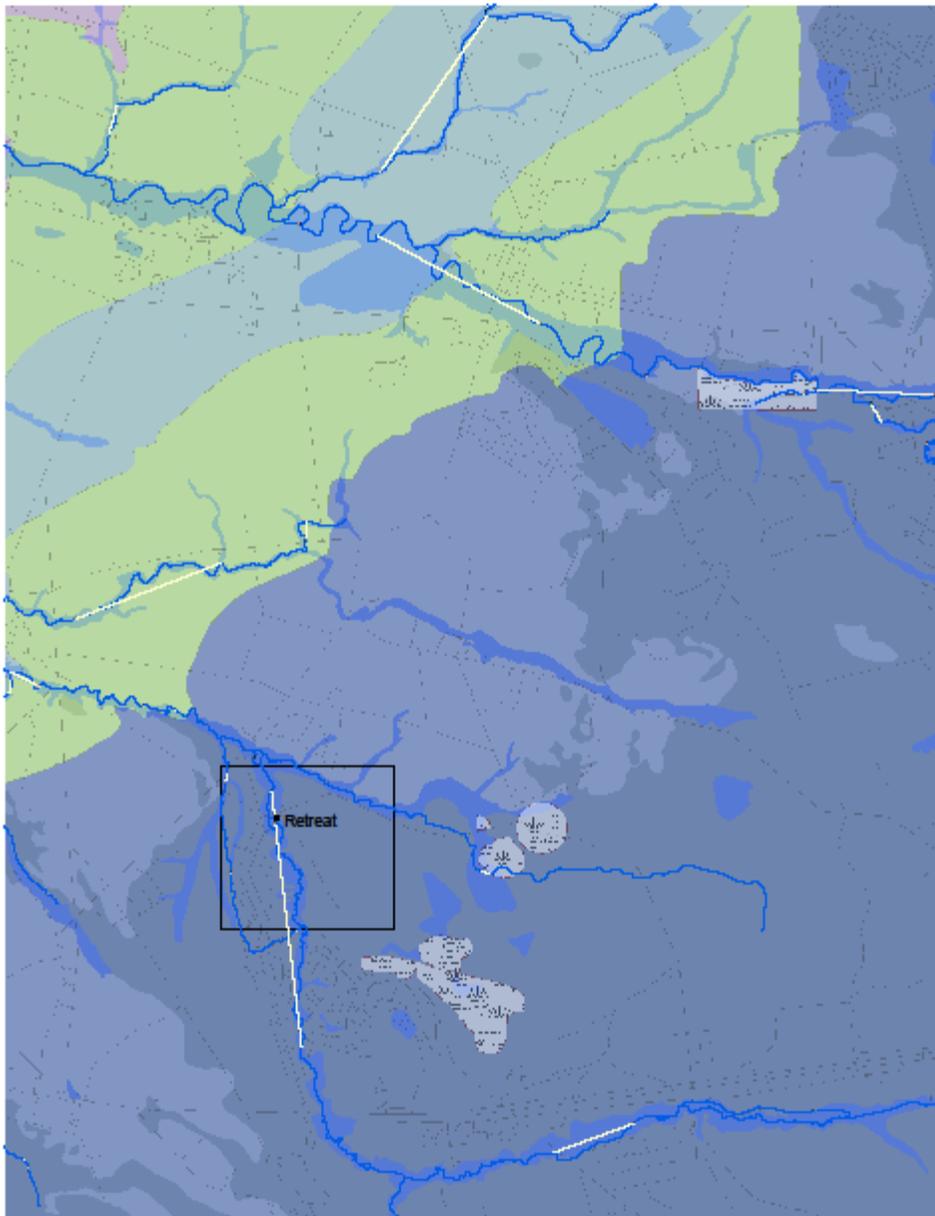


Fig. 4-3: Aquifer Soils of Study Area



Miles Spring 2010

Legend

- Wild Blueberry Locations
- Composite confining unit
- Kirkwood-Cohansey aquifer system
- Study Area
- Composite confining unit aquifer
- Mt. Laurel-Wenonah aquifer

Figure 4-3. Aquifer Soils of Study Area

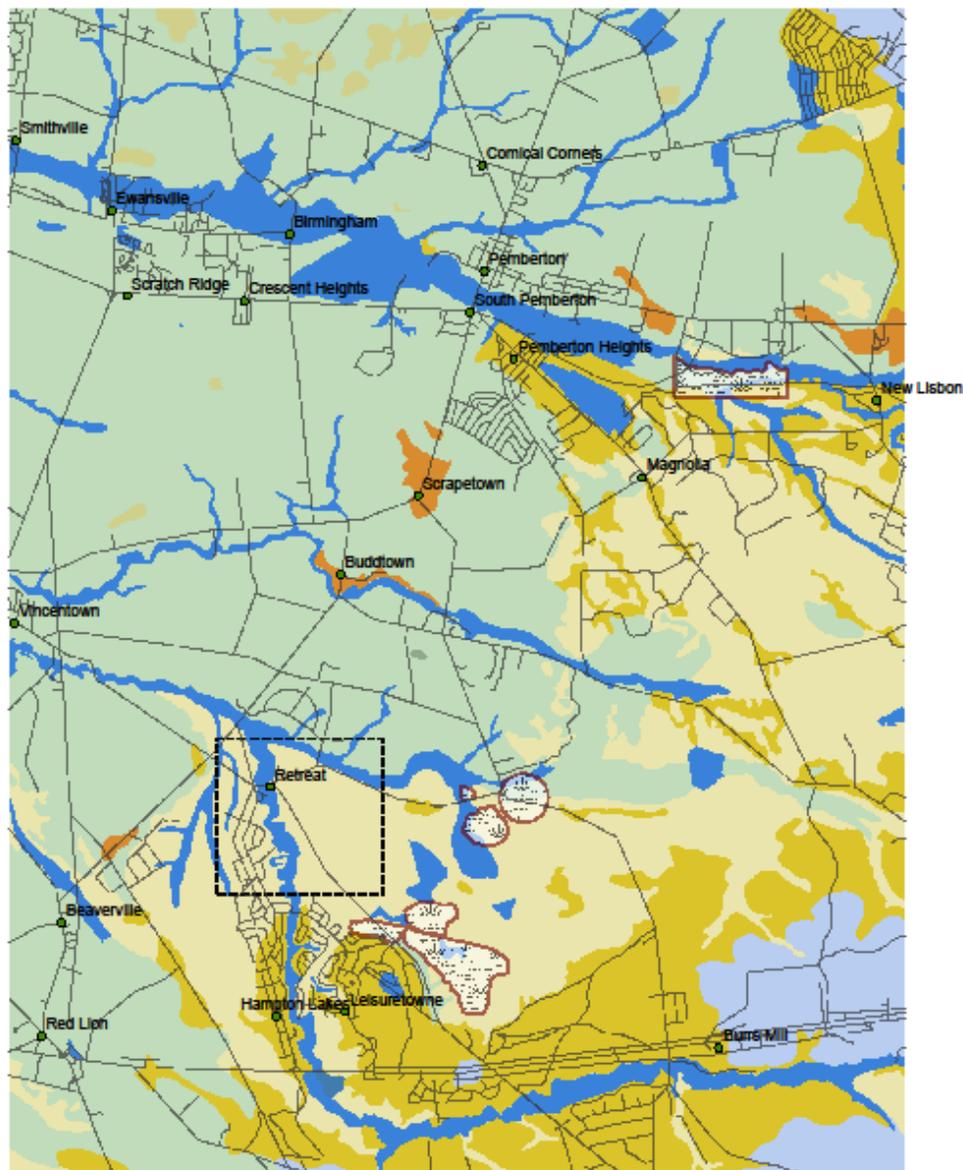


Fig. 4-4: Soil Associations in Study Area NORTH

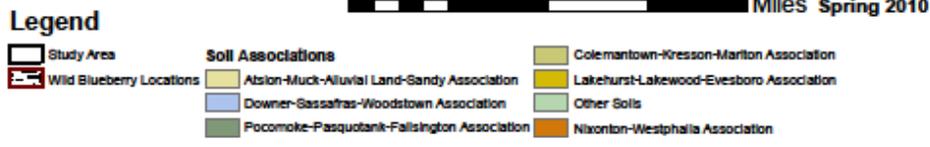


Figure 4-4. Soil classifications in Study Area.

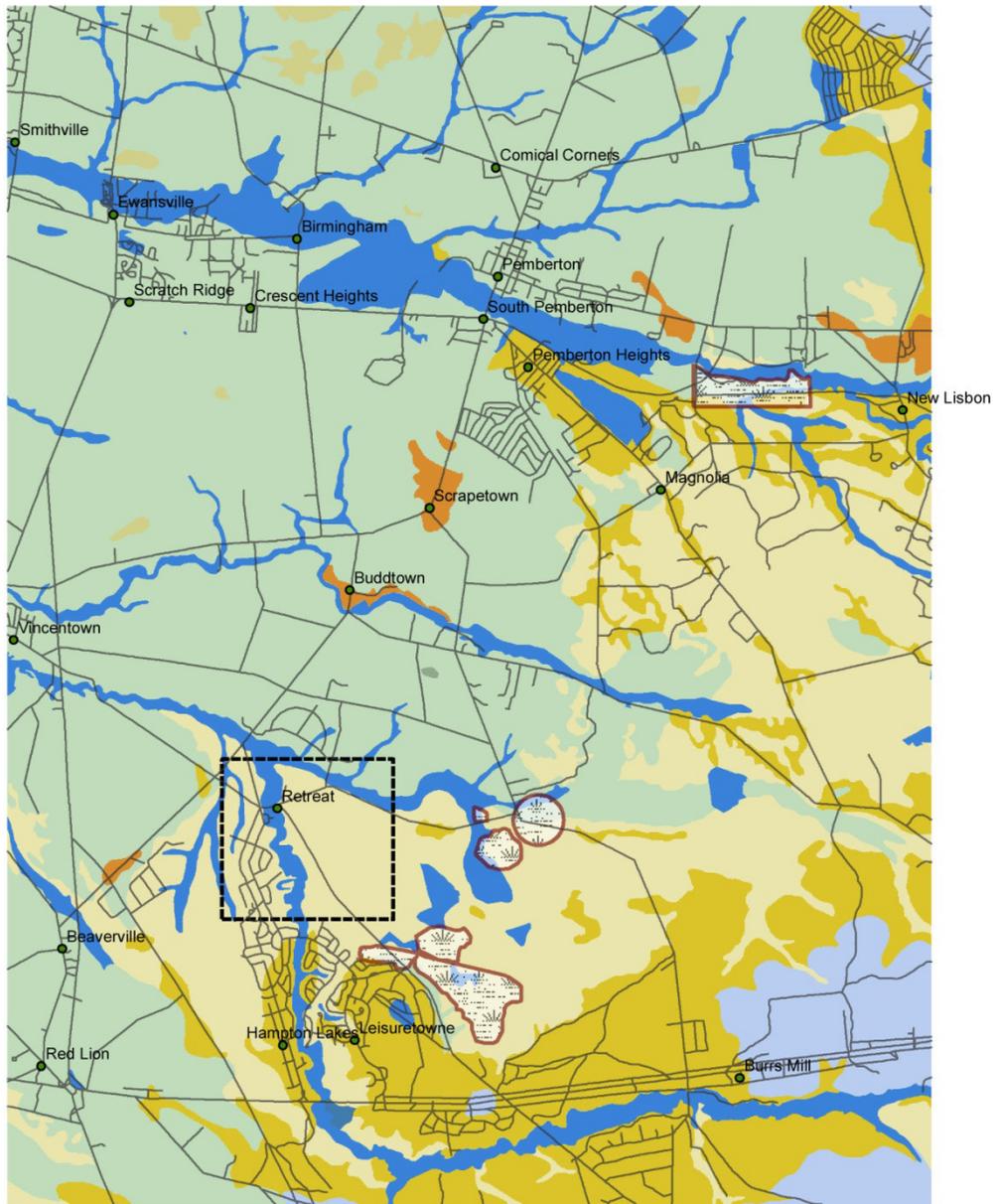


Fig. 4-5: Soil Associations in Study Area



0 1 2 3 4 5 Miles Spring 2010

Legend

- | | | |
|--------------------------|---|---|
| Study Area | Soil Associations | Colemantown-Kresson-Marlon Association |
| Wild Blueberry Locations | Atsion-Muck-Alluvial Land-Sandy Association | Lakehurst-Lakewood-Evesboro Association |
| | Downer-Sassafras-Woodstown Association | Other Soils |
| | Pocomoke-Pasquotank-Fallsington Association | Nixonton-Westphalia Association |

Figure 4-5. Soil Associations in Study Area.

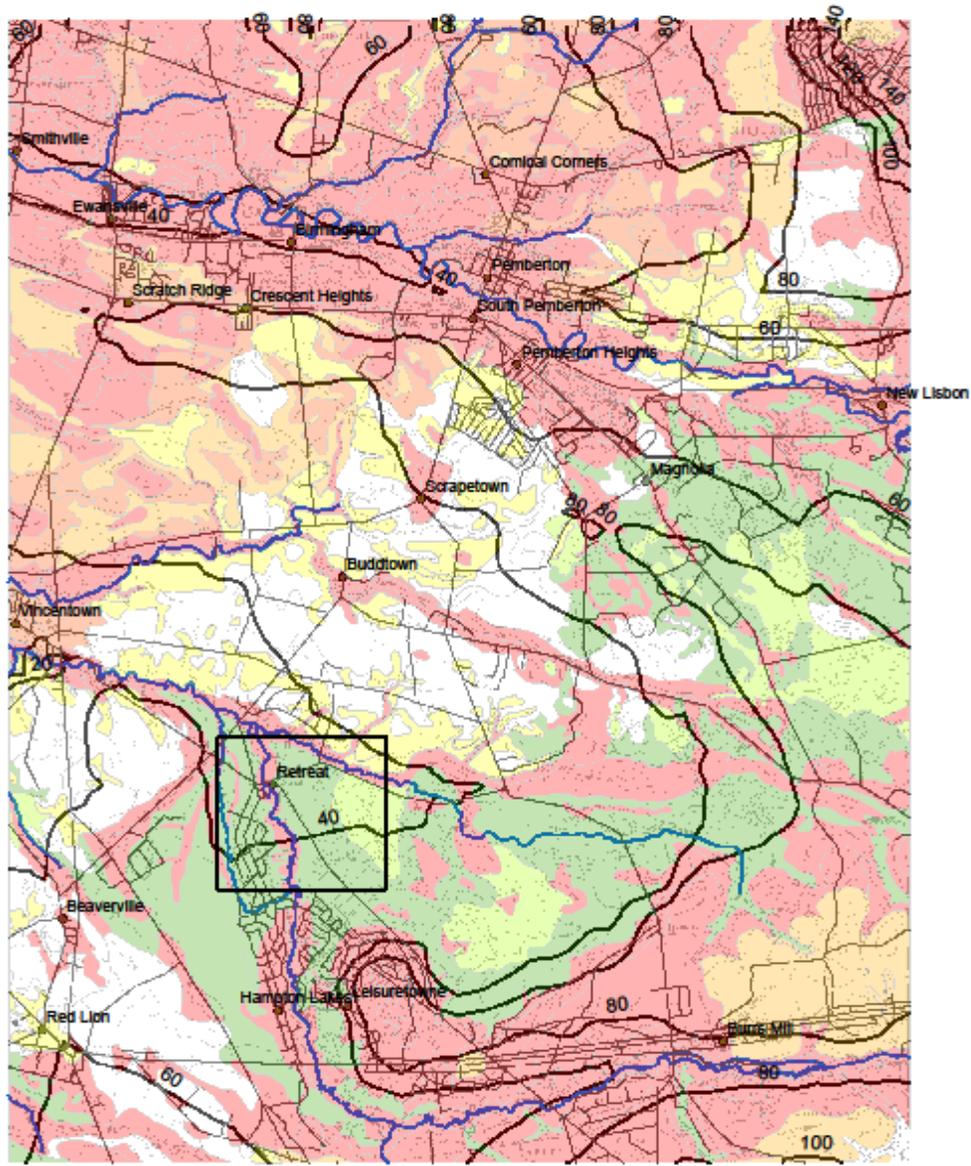


Fig. 4-6: Suitability for Blueberry Agriculture in Study Area ▲ NORTH

Derived from Burlington County Soil Survey Miles Spring 2010



Figure 4-6. Suitability for Blueberry Agriculture in Study Area.

Table 4-5. Blueberry parentage

Blueberry Parentage based on USDA Yearbook of 1937			
Named Hybrid	Parents	Year of Introduction	Cultural Information
'Greenfield'	'Brooks and Chatsworth'	1913	Greenfield N.H.
'Cabot'	'Brooks and Chatsworth'	1913	Cabot Coville
'Katharine'	'Brooks and Sooy'	1913	Katharine Woodburn
'Rancocas'	'Brooks and Russell'	1915	Rancocas Creek
'Scammell'	'Offspring of Brooks'	1915	H.B. Scammell
'Jersey'	'Rubel and Grover'	1916	State of NJ
'June'	'Brooks and Russell'	1916	Ripens early
'Wareham'	'Rubel and Harding'	1916	Town in Mass
'Concord'	'Brooks and Rubel'	1917	Large clustered berry
'Stanley'	'Katharine Rubel'	1921	Stanley Coville
'Weymouth'	'June and Cabot'	1929	USDA site in NJ
'GM37'	'Jersey and Pioneer'	1929	Large tasteless berry
'Redskin'	'Brooks and Russell'	1932	Albino blueberry
'Catawba'	'Brook and Russell'	1932	Albino blueberry
'Dixi'	'GM37 and Stanley'	1935	Latin for I am finished



Figure 4-7. The Peaceable Kingdom by Eliza Hicks. Source: Philadelphia Museum of Art.

Human-Social Capital

By using the model presented in the literature review, it is clear that environment is not the sole determinate of the cultural response. The Native Americans, the early Europeans, and contemporary suburbanites settled on the same geological formations, but had different cultural responses resulting in a wide variety of landscape forms (Sauer, 1971). By identifying and isolating the various basins of attraction as is required in this theoretical approach, and using the

human cultural component of the model, one can begin to see what drives landscape change. Beginning with the Native Americans, I will summarize the phase and some of the drivers of change.

Four dimensions of human-social capital were investigated (Roberts & Lacey, 2008). The first dimension identified was networks that underlie trust. Several networks promoted trust, the most important of which was family and kin relationships. The skills necessary to make a living from the woods were taught via family relationships. Children often accompanied their parents or grandparents and helped with gathering. Next in importance was the relationship between the plantation owner and the worker. Given the remote location of the bogs and later the blueberry fields, the local people became an important source of labor. The plantation owners took an interest in their employees and often knew them personally. The plantation owners allowed the local residents, many of whom were employed at harvest time, to use their land for wild gathering. Communication and cultural transmission were orally derived. These relationships proved to be very important in communicating economic opportunities to local inhabitants.

The second dimension, the church, also played an important role as a venue for social interaction and learning. During the time of the study, most people went to church regularly. Reading and interpreting the Bible was an important Protestant custom. Members were encouraged to bring their Bibles to church so they could follow along when the minister was reading the scriptures. This not only became a way to impart the Protestant culture to the attendees, it was perhaps more importantly a venue for literacy. The Church School Movement actively taught reading by using the Bible (Power, 1871).

Rural schools at this time were the typical one-room schoolhouse and were located in remote areas. The schools were often not staffed by a professional teacher, and most of the

teaching occurred by the children themselves, who would teach students in a lower grade. Erratic attendance made learning problematic, since students were often kept at home to help with work that supported the family. At the time of the introduction of the blueberry, many people only had a fifth grade education.

The third dimension, the potential for social learning within a familiar and tangible setting, was perhaps the most important for learning social and economic skills. The cranberry bog became an important educational venue.

There were supervisor jobs that taught leadership and management. There were bog construction jobs that taught grading skills, planting skills, and bog construction skills. Many people learned how to propagate cranberry vines, all at the work location.

Finally, regarding human-social capital, there was the level of education and skills. As mentioned above, the school at the time of the blueberry introduction did not play a significant role in disseminating information. The home, community and church were most responsible for this important dimension. Previous experiences learned on the bog, as well as those learned while helping the family, were most responsible for transmitting and teaching skills.

Native American

The Native American cultural practices of burning the forest shaped the understory, favoring the herbaceous and shrub layers. This directly influenced the blueberry and cranberry. The Europeans inherited this culturally derived landscape. Europeans observed the use of blueberries and cranberries in the Native American diet during the contact period, and in turn used them to supplement their own diet. In essence, the natural capital inherited by the Europeans was culturally derived. Therefore the blueberry and cranberry can be considered a cultural artifact and perhaps even as an example of co-evolution. Native American settlement patterns were influenced by the different soil characteristics of the ICP and OCP. Their semi-

permanent villages and farming plots were all located on the ICP, while the OCP was used for traditional hunting areas.

The first evidence of the presence of humans in the area comes from Indian artifacts found along the upper Delaware River Valley (Sauer, 1980). These have been dated to about 7,000 years ago. Despite this evidence, we have no accurate data on the number of Indians who lived in this area before the arrival of Europeans: Some experts believe the permanent Indian population was only 2,400-6,000, while others put it as high as 8,000-12,000 (Wacker, 1975).

The Leni-Lenape had lived in the study area for many generations. Their settlements were semi-permanent villages. Their last village was outside of Vincentown and near a burial site just outside the study site. The Leni-Lenape were primarily farmers. After depleting the resources of a certain area, the tribe would move to a new, undisturbed area, until its resources were depleted. The old village would regenerate and the cycle could start all over again.

They supplemented their agricultural harvests with fishing, hunting and gathering wild plants. Their villages were strung along the tributaries of the Delaware River. The Indians modified the forest's composition by setting fires (Gordon, 1953). The Lenape, as well as most all Native Americans, understood that fire could be used to drive game. Furthermore, Native Americans realized they could facilitate travel to and from hunting and fishing areas by clearing dense thickets and forest by burning. The causal linkages in the model between the demand for food and the character of the countryside can be easily identified. This is perhaps their most enduring legacy on the landscape.

The earliest European explorers observed this practice. For example, Henry Hudson, an early explorer of the Delaware and Hudson Rivers, observed large-scale landscape fires when he approached New Jersey from the Great Egg Harbor (Cronon, 1983; Wacker, 1975). Native

Americans used fire, among other strategies, to alter the understory of the native forest in order to favor the herbaceous layer, which was more attractive to large game such as the white-tail deer and black bear.

Fires were allowed to burn until extinguished by physical barriers or by other natural means. According to early ship journals, burns would occur in spring and fall. The report of a Dutch navigator nearing the coast of New Jersey in 1632 observed the vastness of the practice while nearing the coast:

smelt the land, which gave off a sweet perfume, as the wind was from the northwest, which blew off the land, and caused the sweet odors. This comes from the Indians setting fire, at this time of year, to the Woods and thickets, in order to hunt: and the land is full of sweet smelling herbs, such as sassafras, which has a sweet smell. When the wind blows out of the northwest, and the smoke is driven out to sea, it happens that the land is smelt before it is seen. The land can be seen when in from 13 to 14 fathoms (Myers, 1967).

Although the Native Americans did not permanently live on the study site, evidence indicates that this was a major area for hunting and fishing. Many informants shared their private collections of Native American artifacts collected over the years within the study site. It is hypothesized that the Native Americans used traditional burning practices on the study site and added to the co-evolution of the blueberry, which responds favorably to fire.

Early occupation by the Native Americans, and their cultural practice of burning, favored early successional species, including blueberries, cranberries and pines, and thus altered the forest composition. The “natural forest” encountered by early European settlers was not a virgin forest, but one that had been manipulated by cultural practice. It is hard to know exactly what the forest would look like if it had not been significantly altered by the Native Americans. However, what we do know is that the pines in the Pine Barrens need fire in order to reproduce. If there is no fire the oak trees will predominate because the fine pine seeds cannot work their way through the slowly decaying oak litter in order to germinate on mineral soils. The blueberries and

cranberries that adapted to the periodic burnings are in themselves an example of co-evolution and cultural artifact. The fruits found in the shrub and herbaceous layers of the forest were an important part of the diet of the Leni-Lenape (Trehane, 2004)

In conclusion, the forest composition is the main cultural remnant of this displaced people. Other than the alteration of the forest, Native Americans left few noticeable imprints on the landscape of New Jersey and in particular the study site. Yet, they are an important part of the cultural-built capital, because the character of the countryside is a direct result of their behavior and customs (Meinig, 1986). They are directly responsible for impacting the forest that was later settled by Europeans and influencing the structure of the forest.

They were major drivers of landscape formation and change. However simplistic, this was a land use that gave a degree of character to the country side and could be seen in the plants that were favored and encouraged. The open understory of the woods was immediately noticed by European immigrants who settled the east coast, and the bounty of the berries found in the understory was immediately incorporated into their diet.

European Settlement – Transmission of Anglo Saxon Culture

The early Europeans inherited a culturally derived landscape and directly observed the Native use of blueberries and cranberries. As development proceeded, there were two distinct responses to environmental conditions based on the soil characteristics of the ICP and OCP, promoting two different trajectories. Settlement patterns were a direct result of interaction with these two distinct capitals, promoting traditional animal husbandry on the ICP and subsistence farming and later industry on the OCP. The same Anglo-Saxons acted differently with the two different ecological capitals, resulting in different settlement practices. This clearly demonstrates that environmental realities inform landscape responses. They influence cultural perceptions, the

placement of roads, buildings and the iron technology. They also shape community structure and functions, including religious and community systems.

Most of the people who came to the New World and settled between the Penobscot River and the Chesapeake Bay had protested against the Church of England and were, by their very nature, different from the people at home. They were not adverse to taking risks or challenging authority. “One would assume they were generally unconventional and willing to challenge the ruling elite, at least until they in turn became the ruling elite” (Conzen, 1990).

The Anglo-Saxon immigrants inexorably cut the forest and created farmsteads on all lands that could support traditional agriculture. First came subsistence farming and the obligatory farmstead. As the populations grew, market economies became established and the natural resources of the pinelands became commodities that fueled the growth of towns and cities. As a result, the province of West Jersey, established in 1671, began to grow (Meinig, 1993).

Settlement began on both banks of the Delaware River and proceeded inland. Settlers cut forests, creating fields and farmsteads in their place. By the end of the 17th century, Anglo-Saxon culture and rule was firmly established upon the land (Baltzell, 1979). Farmsteads, mills and industry were cultural technologies transmitted to the new world and expanded upon the land (Horwitz, 2008).

The land running along the Delaware River, the ICP, was settled first. Settlements were created close to the major transportation network, the Delaware River, and the more fertile soils along the river. This land was somewhat sandy and acidic, but nevertheless fertile and could support traditional agriculture if the soils were managed carefully. On this landscape, roads radiated from the river to the various settlements adjacent to the river. A patchwork of farmsteads, many designed in the fashionable Georgian or Federal style, were linked to the city

by this developing road system. Barns, animals and field crops occurred one after the other on the ICP. Wagonloads of produce were taken via river transport or overland to the city. The farmstead and farm family became the techno-cultural apparatus and the major economic force during this period.

Adjacent to this region of fertile farmland is the vast area of the Pine Barrens, with much different soils. It was last to be settled and was of little use to traditional agriculture. Peter Kalm, an early 18th century botanist, gave a first-hand description of the area while on an expedition to see the majestic Atlantic white cedars that grew in the wetlands of the Pine Barrens. He noted in his journal the monotony of the landscape, which consisted of unbroken forests of pine and oak, punctuated by wetland bogs — lands that could not support traditional animal husbandry (Kalm & Benson, 1966).

The stereotypical farmstead replete with farmhouse, gardens, fields, barns and chattel upon the land was missing. In its place were mills, mill ponds, and industrial villages complete with manor houses, all based on Anglo-Saxon technology and a direct result of the industrial revolution which began in earnest in Great Britain. Farming, when it occurred, was subsistence farming, and the distinct land use differences between the Inner and Outer Coastal Plains were established. This again was due to the simple fact that the soils on the Inner Coastal plain support row crops that found cash markets in Philadelphia.

Philadelphia had a remarkable economic impact on the area and fueled industrial investment and growth in the Pine Barrens (Figure 4-8). The growth of the city placed increasing pressure on local resources. The pinelands as a resource base began to be economically important, and the resources were mined and used to fuel the growth of a city. Quickly and inexorably, the forest was cut. The landscape transformed into a series of farmsteads that were

linked by road and waterway to the capital city. The traditional farmsteads abruptly stopped at the edge of the Pine Barrens, where sawmills and iron and glass furnaces became the norm. The social-technological-economic practices of the Europeans not only impacted the countryside character, it created jobs, local business health and wealth.



Figure 4-8. Birch's View of Philadelphia from New Jersey. Source: Free Library of Philadelphia (1982).

Lewis, an authority on cultural landscapes, underscored the national impact of regional centers or “cultural hearths.” He wrote: “In the creation of the nation-state there has been a tendency for power and wealth to be concentrated in particular regions of the country or nation-state and then transferred to other parts of that region via cultural diffusion” (Lewis, 1983, p. 256).

In the United States, wealth and power were concentrated in the Northeast, particularly in Boston, Philadelphia and New York. The Northeast exerted an overwhelming effect on the placement of cities and roads, as well as the areas open to farming, and industry (Glassie, 1974). Ideas would move from the Northeast into those areas not inhabited by European settlers. From

the start, the predominant language and culture of the colonies was English and Protestant. The East Coast, with the exception of the Pennsylvania Germans, remained culturally Anglo-Saxon throughout the Revolution, and it is from these sources that British culture spread and shaped the land to reflect Anglo-Saxon culture and achievements. It spread with rapidity into the hinterlands of New Jersey, into what became the New Jersey Pinelands. Wealth and investment from prominent citizens directly impacted the Retreat, transforming the woods into an Anglo-Saxon landscape of industry and commerce (Smith, 1890). It is important to remember that the pinelands were not a backwater but instead an industrial resource center built on capital wealth from Philadelphia.

The landscape from the beginning became a proto-modern industrial landscape, built upon the most up-to-date technology, albeit one that can be directly traced to the technological advance of the Renaissance. The Northeast became the source both financially and culturally from which the Retreat was eventually developed and settled (Lewis, 1983). This created numerous jobs and led to local and regional wealth.

The rise of capitalism had a dramatic effect on the landscape. Dams and mill ponds powered industrial investments. At Retreat, this was an iron furnace and cotton mill, all aimed at making money. It is presumed that people were drawn to Retreat for employment. Social learning was inextricably linked to the economic resources of the woods, business health and work ethic. When the iron industry and cotton mill folded, the connection to woodland resources and belief in work were used in the cottage industries and on the cranberry plantations.

Residential architecture was also derived from English precedents. The hall and parlor house type, English in origin, was a type much older in origins than the fashionable central hall Georgian Plan (Figures 4-9 and 4-10). With exception of the iron master's house, which later

became the main house for the cotton factory, hall and parlor houses abound on the study site. Along with the ballads collected in the area, this house type can be traced to the late Middle Ages and early Renaissance (Halpert, 1976). It provided an efficient house type linked to the character of the countryside and made with local materials (Figure 4-11).



Figure 4-9. John and Ella Thompson standing in front of their hall and parlor house, Johnson Place, Burlington County, New Jersey. Source: Helen Zelly Family Archives



Figure 4-10. Contemporary view of a house at Johnson Place. Source: Helen Zelly Family Archives

Anglo-Saxon immigrants were a mobile population. This can easily be seen in the early names of the families who settled West Jersey. New Englanders followed the whales down the coast or left for lands that had tolerance for broader religious thought. Some eventually settled within the study site. English Quakers also found their way into the interior of the pines and settled on the study site. As a result, the infertile pinelands finally began to be settled at the end of the 18th century as people were drawn to the promise of jobs in growing industries that were prospering from the vast resources of the pinelands. The adaptation, however, was not to cut the forests and plant crops. This occurred only on the few exceptions where the sand was not quite as sandy and unforgiving. The farmsteads that resulted were modest, and the farmhouses contrasted greatly to the full-scale, central-hall Georgian farmstead found on the fertile soils just outside of the pinelands geographic region. The adaption was to use the area for industrial and commercial purposes, building upon the large resource base of the woods.

The earliest settlers were Quakers, whose unusual form of worship and “church” organization contrasted greatly to the established church in England. Decisions and actions of the members were locally generated at the Meeting or congregational level (Figure 4-12). They were not bound by outside influences or church hierarchy. They were and are free to follow their own conscience. Given the standard practice or acceptance of “continuing revelation,” the local meeting was easily able to change and develop as they saw fit to “follow their leadings.” Continuing revelation is a theological position that maintains that God has not stopped revealing the “truth” to believers. So in essence, the theology allows for radical change to occur within the community as a “way opens.” The names of many of the people who lived in Retreat during the study period were primarily Methodist. However, many were descendents of the earliest Quaker families who settled the area. To what extent this older philosophy influenced the culture of the



Figure 4-12. Evensham Friends Meeting house made of Jersey iron stone. Source: Evensham Monthly Meeting of Friends Website.

We should remember, too, that the people who migrated from Great Britain were not homogeneous (Glassie, 1969). They represented a wide variety of ethnic and cultural groups. Their distinctive cultural expressions could be traced back to a particular region, Great Britain (Deetz, 1977). It did not take too long for these differences to develop into regional cultural groups or "cultural hearths" in the New World. The two distinct cultural groups, or hearths, in the colonies were based in New England and Philadelphia. Ultimately, Protestant New England and Quaker Philadelphia became the dominant cultural influences on the Northeast and major cultural influences on the rest of the country (Baltzell, 1979; Pomfret, 1956).

New England was settled by post-Elizabethan Puritans who had broken away from the Church of England. They formed theocracies, which were self-contained religious communities that demanded conformity. It didn't take long for some people to rebel against the authoritarian rule of these Protestant communities (Foote, 1994; Wacker, 1975). Many began to leave the region and look for new lands and opportunities. A number of these people settled in West Jersey

where the Quaker religious practice of tolerance would be a most welcome relief from Puritan and autocratic New England (Wacker, 1975).

The other cultural hearth, Philadelphia, was the last area of the East Coast to be settled. It was founded by an eminent Quaker, William Penn. From the beginning, the community was based on Quaker practices of equality. The egalitarian spirit of the colony was attractive to people of many different cultural backgrounds and formed a diverse population with unprecedented tolerance toward one another.

Quaker emigrants flocked to Pennsylvania, and to New Jersey as well. In southern New Jersey, the home of the first Quaker Colony, Quaker influence was particularly strong. For example, Quakers formed the colony of West Jersey and the southern portion of the state was divided among Quaker leaders (Meinig & Jackson, 1979; Moonsammy et al., 1987). As the population in the Delaware Valley grew, many early Quaker settlers became wealthy through their investments. Ultimately, these investments greatly influenced the settlement of the Pine Barrens, and it may be hypothesized that the Quaker testimonies of peace, tolerance and simplicity made a mark on the communities of the region. This influence by the Quaker city of Philadelphia eventually was culturally overtaken by the vast number of non-Quakers who left their mark on the community. In any event, the Quakers who came to Philadelphia to do good, did well, accumulating vast amounts of wealth (Baltzell, 1979). Names in deeds and probate records suggest that residents of the Pine Barrens were primarily of British origin (Moonsammy et al., 1987).

Built Culture Capital Findings

There are three dimensions that were explored in this construct. The first consisted of structures that give a relative degree of character to the area. I identified four types of structures that are highly characteristic of the area: public use structures, roads, agricultural buildings and

homesteads. The buildings on the cranberry plantation were the dominant structures on the study site. The cranberry packing house was a three-story building covered in cedar siding that sat upon a bog iron foundation. On the periphery of the bogs were the worker's houses, including two large dormitories that housed the summer and fall workers. Interspersed along the two major roads were several houses believed to be remnants of the early iron plantation. They, too, are covered in cedar and situated close to the street.

The second dimension, land uses that give a relative degree of character to parts of the countryside, was explored, and the cranberry bog was the dominant character-giving structure in the study area during the period of interest. They were in transition, changing from largely natural to man-made features of the landscape. Government agencies and producer associations identified ways to improve bogs. They disseminated this information through experiment station bulletins, USDA circulars and association meeting reports. As a result, several types of bogs were present, newly constructed bogs using the latest recommendations, and cranberry meadows were the dominant landscape form found on the study site.

Finally, in the third dimension, cultures associated with particular areas were explored. Overwhelmingly people at the time of the study were actively involved in woodsman activities for commercial purposes. Local picking of wild blueberries and some wild cranberries for cash proceeds was found in all towns and villages in the study area. Cutting pine for charcoal was also an important industry in the study area, and the Protestant work ethic was expressed in the ability to work long days in order to provide a living. This was all aided by the railroad that first came to the area in 1865.

Economic Capital

Perhaps the most significant driving force in this landscape was economic capital, which for the purposes of this study is defined as including three dimensions: opportunities for the

generation of wealth, opportunities for the generation of jobs, and investments that were related to natural and cultural characteristics. In the period immediately after the Civil War, opportunities to generate wealth were few. Opportunities increased when the railroad came through South Jersey. At that time, collecting the wild resources in the woods became a cottage industry and people could supplement their subsistence farming with cash crops. First, harvesting cranberry meadows expanded into a commercial business, and later so did harvesting the blueberry. Both required labor, and as a result, jobs were created, the next dimension of the economic capital.

As the bogs were built, new jobs emerged in the community. Constructing the bogs required heavy hand labor as well as skill with horse and plow. When the bogs were designed, they needed to be planted. Large numbers of people were needed to complete the job. Then, of course, the berries needed to be picked, sorted and taken to the train station, again requiring a large labor pool.

After the cranberry boom came the blueberry boom. It provided economic opportunities for the small landowner who, using his family, could clear and plant a field with the new and promising crop. People who did not wish to go into the business could propagate and sell blueberry plants for profit. At the beginning of the industry this was a very profitable business.

The Iron Industry

The iron industry brought new technology, investment and attention to the pinelands. First in the Pine Barrens came the sawyers and millers, followed by the industrial manufacturing of iron, glass and textiles. The iron and glass masters were the first major settlers in the interior of the woods. The industry was based on British prototypes; therefore the furnace used a water source to power the bellows. Water power, charcoal as fuel, iron deposits and oyster shells were

found in juxtaposition and readily used in manufacturing iron. A furnace was established and named “Retreat,” and the study site bears this name today.

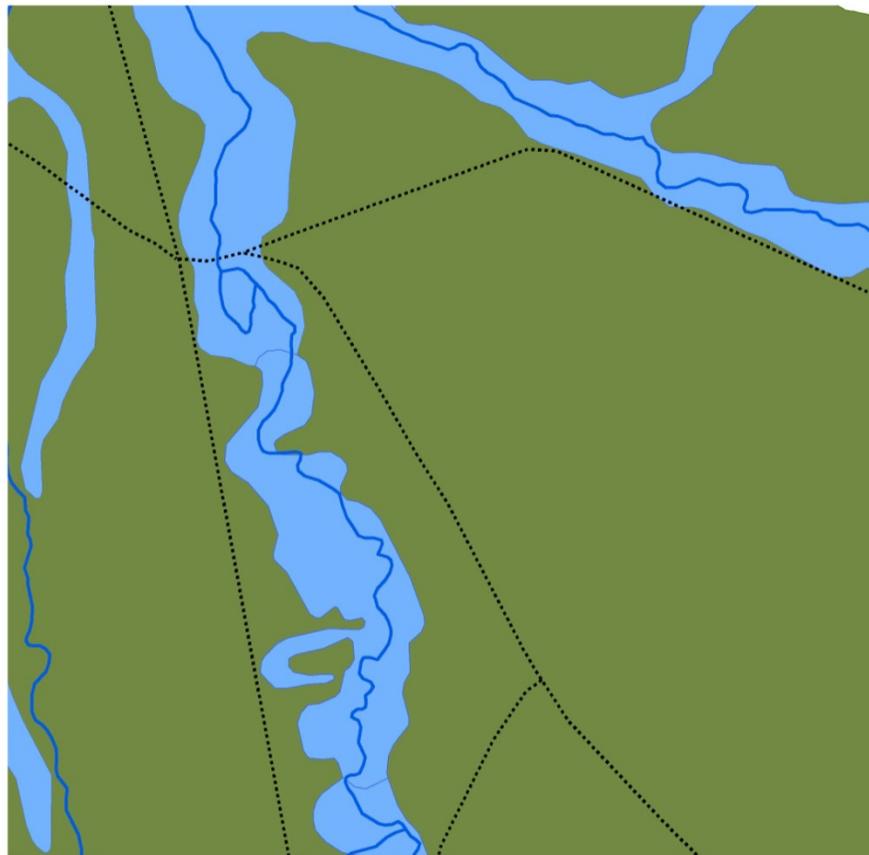
Prior to the iron investments, the area was sparsely populated, if at all. The first people to come to the area were those working the cedar swamps. Cedar and all wood products found ready markets in the rapidly expanding cities of New York and Philadelphia. In order for the iron to be dug, the cedars needed to be removed.

The industry had a dramatic impact on the natural system. The forest was clear-cut, causing serious erosion. The open areas were regenerated with secondary succession species. Among these species were blueberries and cranberries, which grew more abundantly than they would have under forested conditions. The iron industry declined, causing an economic collapse.

People were drawn to the area for employment opportunities, many as daily wage earners. They were mainly Anglo Saxons. This contrasted greatly to the subsistence farmers who were working on the pockets of productive soils. The iron industry was the beginning of social separation by class. The iron works were run by an iron master and his technocrats, while the majority of the labor was performed by the daily wage earner.

Bog iron

From the 1760s to the 1860s, bog iron was mined along river banks and in swamps. It was then carted to the furnace and smelted. Bog iron is a complex, naturally-occurring mineral ore formed by a biophysical process. Specifically, decaying vegetation forms an acid in the soil solution that percolates down through the aquifer. When it comes into contact with marl deposits, which contain iron in its sedimentary deposits, a chemical reaction occurs and iron is carried in solution into the streams of the Pine Barrens. This movement of water and soil solutes occurs easily in the sandy soils of the pine, which have large pore spaces between the individual soil



Pre-settlement Map of Study Area



Legend

-  Flood Plain
-  Original Cedar Forest (Based on Cedar Habitat)
-  Creeks
-  Future Roads

 Miles

Spring 2010

Figure 4-13. Pre-settlement Map of Study Area.

particles. The iron in the solution oxidizes and is deposited along stream banks. After years of accumulation it solidifies into solid ore, albeit one that is not a particularly high grade of iron (Pierce, 1957). Bog iron occurs widely throughout the Pinelands. This is also the case with Retreat, where iron deposits continue to accrue along streambeds. Another prominent feature today, as was also the case during the study period, are the iron beds that morphed into cranberry bogs shortly after the collapse of the industry. However, the picturesque quality of the present

day bogs with their reflection on the cedar stained waters would have been very different during the effective industrial period. Lands denuded of vegetation would have been the result. During the time covered in this research, the impacts of the industry can be assumed to have been highly visible.

Based on oral interviews, it is clear that the landscape at the turn of the 20th century was more open. People recall being able to see for long distances. During one interview, an informant told the researcher that he was able to see his mother's house, which was several miles through the woods, and that he would send smoke signals as a way of communicating.

Halpert¹ collected songs in the pinelands in the early to mid 1930's. While recording the songs he also interviewed many local residents of the old iron towns. He recorded the interviews verbatim using the dialect of those interviewed. The following description by an informant details bog iron mining in the local dialect. These iron plantations were scattered throughout

Burlington County (Figure 4-14). Although the description is for Hanover, the process was identical to that used at Retreat (Figure 4-15).

They dug the iron down in the Pines, different places. They carted this ore up to Hanover -- they had a furnace there -- where they melted it. This ore they dug it out right off the top of the ground. They would strip the sand and turf off, whatever was on top, down to the ore. The ore some places wouldn't be over a foot, then they struck sand after they dug through. They run different, from a foot to two foot. This ore came out in something like sandstone, something like that. You know -- pieces and chunks. After they stripped it off, they took a pick and turned it up. It was generally wet where they dug it. They called it "bog iron," them people. What was the common name for it, bog ore. You see there is no mountains around here or hills that have iron in. This iron was in the low ground. They could tell where it was by the color of the water. The water would have iron rust into it or iron color, reddish brown, red they called it. This water would come up on top of the ground and they could see. They'd test it then; see how much iron

¹ Kevin Halpert was a student of folklore at Indiana University. Due to lack of funds he was not able to finance a summer in Kentucky. Kentucky at that time was an important regional source of folktales and songs. Instead he was encouraged to study the Pine Barrens where his professor thought there might be material that had not been documented.

and how much dirt, sand, and stuff was mixed. In some places it was clear iron. They dig this out and screen it.

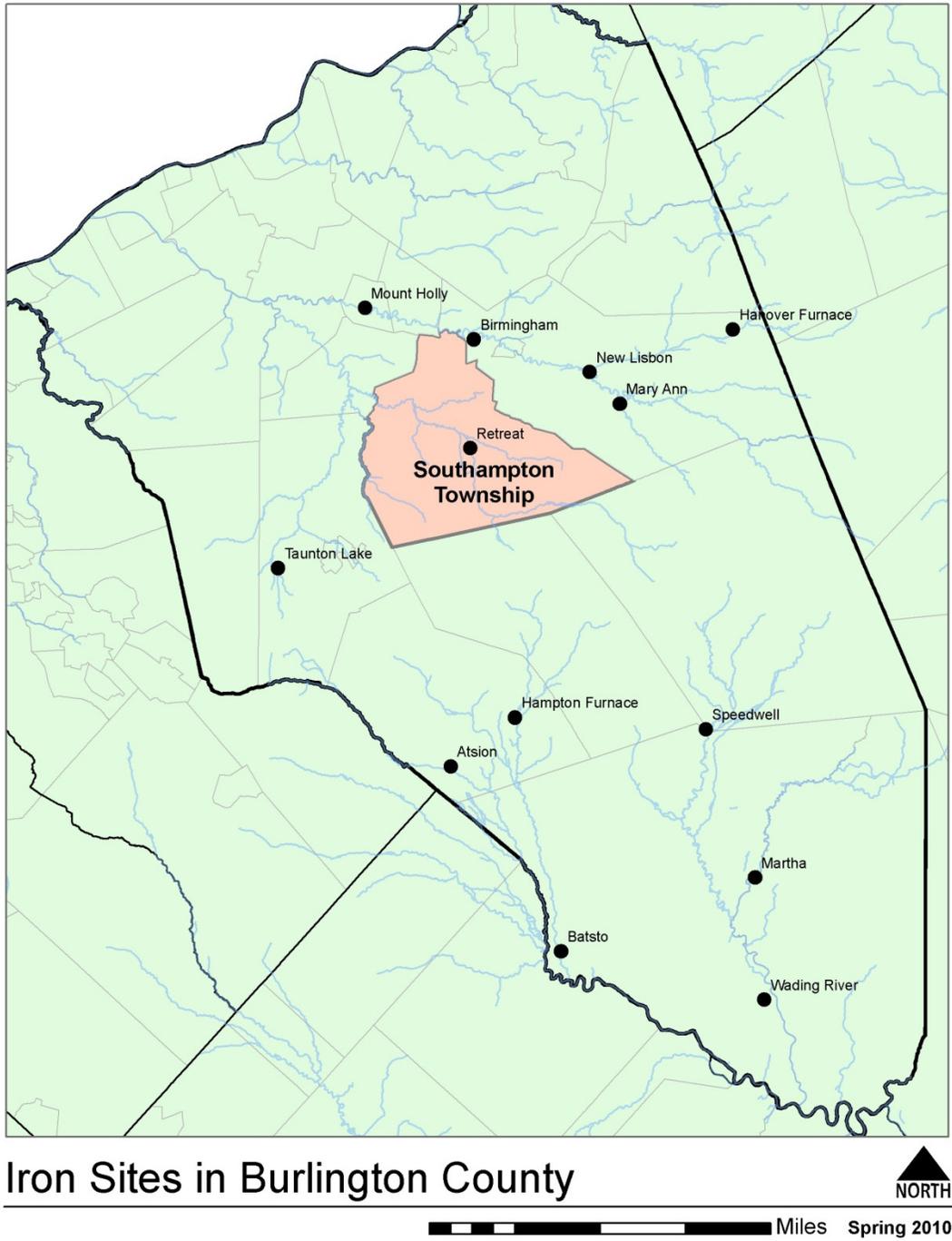
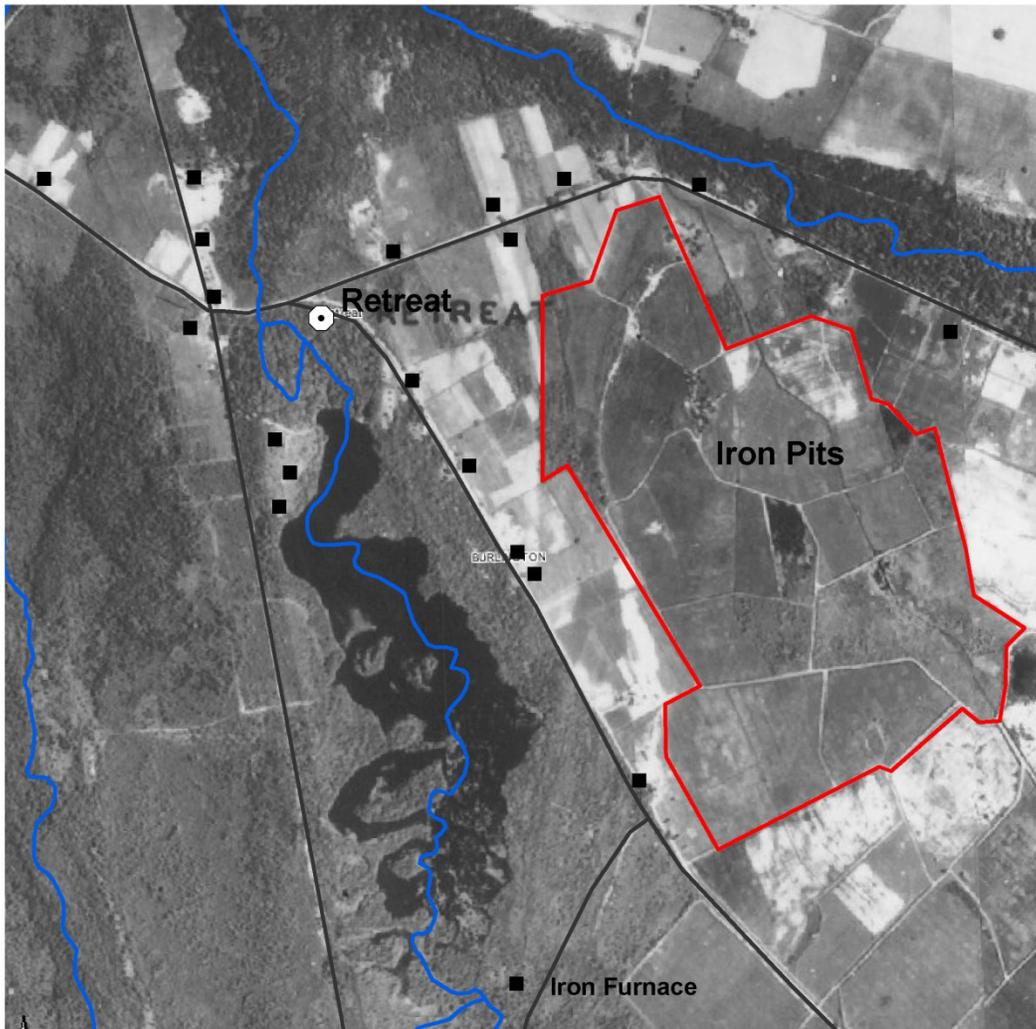


Figure 4-14. Iron Sites of Burlington County



Study Area: Iron Furnace and Iron Pits 1800-1830



Scale bar showing 0 to 1 Miles

Spring 2010

Legend

- Historic Buildings
- Iron Ore Pits

Figure 4-15. Iron Furnace and Iron Pits 1800-1830

They'd have a screen, something like a sieve, wires run all one way. They stand it up. These screens what they used had legs on and braces, and stood on a slant so that the ore, when they threw it up on the screen, would slide down into the box on the ground. That end had to be lowered down so it would slide and that the dirt would come out through the screen, run out of the ground. That was about only cleanin' it got. Then they loaded it onto wagons and carted it in to the place where

they melted it. 'Bout four it took for a gang to dig the ore. They had no machinery to dig with, they dug it all by hand in them days. It took one to strip it, that is clear off the top, and the rest picked it up, shovel it out on the screen. When the wagon was there, they loaded it out of the box on the wagon. Pretty much all two horse teams. The wagon took a square yard. 'Bout 28 to 30 hundred (Halpert, 1937, p. 63).



Figure 4-16. Charcoal pit demonstrating how the charcoal is staked and fired. Source: National Parks Service

Charcoal

The production of charcoal was a major occupation during the industrial period that continued well into the late 19th century (Figure 4-16). The need for wood was so great that the iron furnace at Retreat was relocated from Birmingham, six miles west of the present village of Retreat, in 1808, as a direct result of a wood shortage. When the furnace at Birmingham exhausted the wood supply in that locale, the owners chose to move the furnace closer to the fuel source and bog iron. This also suggests why finding coal in western Pennsylvania precipitated the collapse of the iron industry in New Jersey. They may have simply run out of fuel.

Charcoal was a major business in the Pines. Thousands of men worked in the Pines, chopped wood, and made coal. Oral histories and photographs from the turn of the 20th century show industrial devastation that kept the forest in a constant state of disturbance. Early secondary succession favored many of the plants that supported a variety of traditional activities. One possible impact of the iron industry on the natural system was the export of nutrients that left the

system by the wagonload. One can only wonder about this impact on the landscape and how this effected regeneration. Could this still today influence the growth and character of the existing forest? The cultural practices associated with the Anglo-Saxon industrial technology left an indelible mark on the present landscape form and natural systems. Denuded forests exposing the sandy soil was a blueprint for vast erosion episodes favoring those plants that could regenerate on bare mineral soils.

Water

According to Pierce², a recognized authority on the early New Jersey bog iron industry, “The Pine Barrens possessed an abundance of another principal requirement for iron manufacture: power to run the bellows and forge hammer” (Pierce, 1957, p. 11). Water is abundant in the pinelands, and the aquifers and streams in the Pine Barrens provided an ample source of water power from early spring to winter freeze. This caused the power generated by the millpond and race to be unavailable during the early winter months just before the streams froze and were not able to power the bellows or hammers of the furnace or forge. During the summer, when evapotranspiration was drawing water from the rivers and streams of the region, the constant movement of water in the aquifer replenished the streams, unlike many regions in the north where the streams went dry during the hot, humid summer months. The other major need was fuel to heat the furnace and smelt the ore, which was found in the pine forest in close proximity to the mill site. The manipulation of water and water systems is a lasting legacy. The water collected fueled the industrial period. By the middle of the 19th century, this same water

² Pierce did extensive research on the early iron furnaces in southern New Jersey. He is considered an authority on the subject. He worked during the 1930's and knew Halpert. Halpert acknowledged him as an expert in his book, *Folktales and legends from the New Jersey Pines; a collection and study*.

was used in cranberry culture. Flooding the bogs for insect control, frost protection, and irrigation became the industry standard.

These local and indigenous resources had a profound impact on the character of the countryside and later settlement practices, as did the vast wetlands that were not suitable for residential houses. Imagine the impacts of a denuded forest and shallow mine pits filled with sediments that stretched from wetland to wetland. The landscape of open iron pits stretched along the creek, and a denuded forest was an early form of industrial environmental pollution.

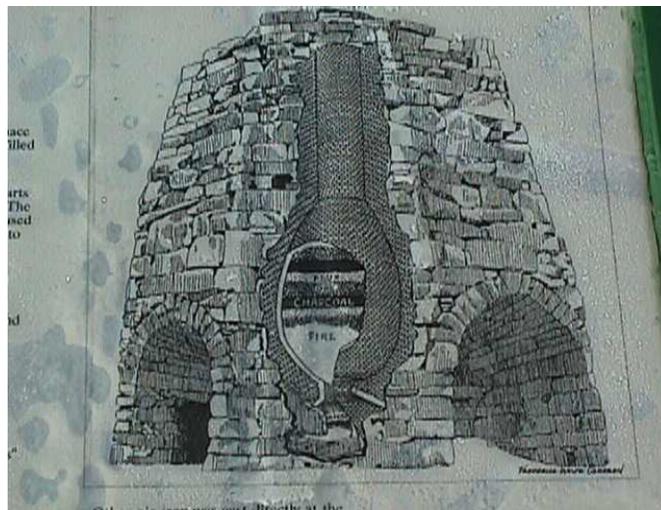


Figure 4-17. Typical furnace prepared for blast. Source: National Park Service.

Industrial processes used

The first European people to impact the pinelands were the millers who dammed the small tributaries to power saw mills. These materials found ready markets. Then the area came to the attention of capital investors. The Quaker-Episcopal elite invested large sums and established iron and glass factories throughout the pinelands. This was the industrial production that provided the iron and glass for Philadelphia and New York. It was also a major supplier of the ammunition and cannons for the Revolutionary War and War of 1812, resulting in an early industrial economy.

Halpert, a folklore student from the University of Indiana, came to New Jersey in the early 1930s to collect folktales and folksongs in the Pine Barrens. This important volume was republished in 1976 (Halpert, 1976). During his approximately ten years in the Pine Barrens, he also collected detailed information about the people he interviewed, which resulted in unpublished interview texts now on file at the Archives of Traditional Music, Bloomington, Indiana (Halpert 1937). In his first volume, *Folktales and legends from the New Jersey Pines; a collection and study*, he concluded that “iron and glass manufacture were the original foci of most of the communities in the pine. The people came there to work in the foundries, forges and glassworks.” According to Halpert, “communities varied in size anywhere from 40 to 700 persons” (Halpert, 1976, p. 36).

Many of the informants interviewed during this study were from the industrial village of Hanover, an iron furnace site six miles north of Retreat, or from the Lebanon glass factory, located eight miles east of Retreat. Halpert found that many of the descendants lived in the nearby towns or villages. The villages he named included Brown’s Mills, Chatsworth, Lakehurst, Whitings, Retreat and Buddtown, all within a few miles of the study area where many of the same family names are present today. Although there are few accounts of the detailed workings of the Retreat ironworks from descendants who worked in this factory, one can extrapolate from the accounts of Halpert’s key informants to form an understanding of the people and communities within the various iron plantations.

The iron plantation, as it was often called, was comprised of a manor house, workers’ cottages, and often a company store, school and church. The village was centered on the furnace and adjacent mines wherein people could walk to and from work easily (Figure 4-17).

In November of 1939, Halpert interviewed Charles Grant, a descendant of iron makers. Grant carefully described the architecture of a south Jersey furnace. Both his father and grandfathers on both sides of the family were employed by iron masters. Grant states that his family's predecessor emigrated from Scotland expressly to work in iron manufacturing. The furnace was the largest structure in the village and dominated the view. Not only would the furnace have been visible, it can be assumed that the fire and smoke of the furnace in blast would have permeated the site. Grant recounts:

Furnace built like a brick stack. There's where it was mixed and melted. They had a layer of charcoal on the bottom 'bout 18 inches 2 foot thick, to melt the iron. Then there'd be a layer of iron; a layer of lime on top of the iron -- but that wouldn't be so thick; then another layer of charcoal, another layer of iron on top of that again, and so on. They used to put in about 24 foot, coal, lime and iron, all mixed, layered at a time. The last layer was always lime. I don't know why they put that in but they always did. Stack (furnace) was from 60 to 80 feet high where they burnt the iron out – melted (Halpert, 1937, p. 22).

The furnace also needed power to run the bellows and stamping mills. This created a prototypical settlement type that could be found throughout the pinelands. Beginning in the mid-eighteenth century to the middle of the 19th century, the glass and iron factories required large investments as well as large acreages of land.

The Retreat Iron Works was just one of many iron plantations in the Pinelands, based on British technology developed during the Industrial Revolution, which in turn derived from mill and iron technology beginning in the Middle Ages (White, 1966). The operation of the furnace and forge was a grueling, ongoing and relentless process. “The furnace operated 24 hours a day, seven days a week, all the time it was in 'in blast.' Usually it was 'in blast' from seven to nine months of the year. Many furnaces never shut down until winter froze the streams, [which] halted the water wheels, and stalled the machinery” (Pierce, 1957, p. 12).

The Anglo-Saxon community structure and functional process required hundreds of laborers, and since the Pine Barrens was located in a remote area, paternalistic manufacturing plantations based on a new type of feudalism, developed in Great Britain, was transferred to the New World. These were the prototypical paternalistic towns “perfected” later in the century by the likes of Pullman and Carnegie (Carwardine, 1973).

Although the many iron plantations had different locations and no doubt some local variations on the theme, most industrial villages of the region included a manor house with onsite supervision, workers’ housing, a company store, a school and often a church. Workers would live in this setting, working long, arduous hours, miles away from any towns or cities. All such villages were centered on a blast furnace typical of the technology at the time, and which would be fundamentally similar to others in the area. Therefore, one can extrapolate from the scant research available to reconstruct a picture of the industrial landscape of Retreat.

According to Pierce, a bog iron industry historian, the hearth of the furnace was enclosed by a large shed called a morning house. The outer walls of the Jersey furnace were built of native stone, mostly ironstone. Insulating these walls from the inner fiery chamber were layers of mortar, brick, and sand. The fiery chamber itself was lined with fire brick, slate, or some other refractory material (Pierce, 1957).

To acquire the temperatures necessary to melt the ore, dual bellows were employed. The synchronized pair of bellows was operated by a drive shaft that was powered by a water wheel. The wheel was powered by a mill race that was created by damming a stream to create a head of water that could be diverted and directed to the water wheel. This advanced medieval technology was utilized throughout the colonies in the late 18th and early 19th centuries, before the advent of steam. (White, 1966).

The process required that ore, flux and charcoal be apportioned in known quantities and weights and then dumped into the furnace stack. This backbreaking job required numerous workers to run wheelbarrow loads, one after another up a steep planked walkway that led to the top of the furnace. There they would empty their payload into the furnace stack. According to experts, the typical procedure was to run the furnace constantly, day and night, with the only interruptions being mechanical failures or winter freeze. The iron mixture would then be reduced to molten iron. The slag would migrate to the top of the mixture and would be removed before the crucible containing the emptied ore. When the molten iron was released from the crucible through a specially designed opening, it would follow channels dug in the sand. This specific process of forming channels produced refined iron shapes that were locally known as “pigs.” In other cases the molten ore was ladled into molds for cannon balls, fire backs, iron skillets or pots. In any case, this was a physically demanding and dirty process, as was typical in early industrial activities (Braddock-Rogers, 1930; Pierce, 1957; Starkey & Batsto Citizens Committee, 1981)

Again one of Halpert’s key informants was Charles Grant. Grant gives a detailed account of the process.

It took about 24 hours to melt the iron. They set this coal fire in the bottom, kept the draught on till the iron began to melt and run down. Then they shut it off. Let it all melts. After it was all melted that they had a thing they called a true-iron. That was in the bottom of the furnace. They’d drew the true-iron -- let the iron run out. That would run out clear –pretty near clear as water. This run down in a big gutter and there small gutters run off from this. They broke these small pieces off of the gutter after it run off and got cool. When their gutters was all full -- that's what they called runnin’ and a whole “melt” off. That was what they called pig iron. Broke it off in pieces would weigh seventy-five to a hundred pounds.

[The pig iron] Was took then to a forge and drawed out under a forge hammer. The hammer over here at Mary Ann Forge (it lay about 2 miles southeast of Browns Mills) the handle, and the hammer and the “rabbit” weighed 3700. That hammer struck four times a minute. Run by water power. They had a big lake there, cranberry bog now, an old lake one time. They had a big water wheel, and this had some kind of crankshafts raised the hammer. After it got so far, it slipped off and fell. No force just the weight of the hammer. Didn't drop so fur. I should

say about 12 inches. They had to heat the iron over again to pound it out under the hammer into a square. That was the forgermen's job. Sit there with a pair of pincers -- held this iron under, there on the anvil -- drew it out into a square bar. After he got done with it, it was wrought iron.

That wasn't all pure iron. Have to go through another process before they put it in the furnace. They called it a stampin' mill. Onload it off the wagons, have chute run down into the stampin' mill. Throw it down the chute. They had a lot of big hammers pounded up. That was a machine done that. I don't know how but somehow they separated it took out the rest of the dirt and left the iron. Then it went up to the furnace.

After they got done with it, then it was again packed up by the teams and carted to Philadelphia, the most of it. If they wanted to make steel, they had to work it over again several times. I think my grandfather said they had to work that different times seven years to make good tool steel. They didn't make much steel down here. They made the hammer, the handle, everything down here. They had to have a forge to make a new hammer and anvil for a new forge (Halpert, 1937, p. 39-40).

The iron furnace had a tremendous impact on shaping the area. First, it drove future settlement patterns. As the hamlet expanded, houses and farmsteads were built along the two main roadways. The old iron pits or new cranberry bogs were not suitable for development given the seasonal high water table. Also, demands of labor molded or reinforced a strong work ethic and of course, drew attention to the area by investors, who soon made the industrial possibilities of the resources in the pines known to many outside the local region.

Impact on natural systems

The people of Retreat, like those of other regions in New Jersey, were settled by descendants of New England Puritans, Philadelphia, Gloucester, or Burlington Quakers or French Huguenots who migrated into Jersey from the Chesapeake Basin. The field book used by Elizabeth White lists the local people who tagged superior blueberry specimens. The list abounds with names from these Protestant groups. With the exception of the Huguenots, all were of British descent. The book identifies over 30 people associated with the area, giving an insight into intergenerational cultural ties.

New England names listed for Retreat included Beebe, Grover and Wells. Quaker names include Clevenger, Thompson and Haines. The descendants of all the above mentioned were Protestant and descendants of pioneers who took risks in order to immigrate. These were also the names of the people who were residing in the area after the demise of the iron and glass industries. With scant records about the early communities surrounding these mills and furnaces, we know little about the timeline of settlement for these people, but names in deeds and probate records suggest that residents were of British or New England origin (Moonsammy et al., 1987).

Retreat was one of the smaller, but typical, iron furnaces in the area. According to historical accounts, the iron works at Retreat were in operation from 1806 through 1830, and people working at the iron plantation would have been involved in activities similar to those described above. Extrapolating from the data, an assumption can be made that the long hours of work, meager pay scale and kinds of jobs available were also the norm in Retreat. This created social separation by class. Daily wage earners were by far the most numerous people employed at the furnace. Next in hierarchy were the technocrats who performed specialized work, including foremen and iron specialists.

After the furnace closed, it appears that a cotton factory was built using the workers' houses and mill race. This lasted until 1860. The cotton factory was nestled in the village of Retreat, complete with mill pond and mill race, all of which took advantage of the natural resources of the watershed and was based on current technologies. The vernacular architecture of the plantation system contributed to the overall character of the village and cultural landscape (Hough, 1990). Today, all that remains of this area is a small number of various late 18th and early 19th century south Jersey houses, and an abandoned millpond and mill race.

Immediately adjacent to the industrial site are cranberry bogs, which can be reasonably assumed to be the iron ore pits. Also present is a modern road system that traverses through the old village site and over the mill race and stream branch directly corresponding to the one laid out in the early 1800s (Pierce, 1957). Remnants of Horse Heaven Road bisect the road leading to the Retreat factory and can be seen today, which roughly corresponds to the old stage route that was used to carry people from Philadelphia to the Jersey shore. During the early 19th century this road was a major transportation route that cut across the state, forming an important trade route from Retreat to Philadelphia and Philadelphia to the shore.

The settlement of Retreat was named after the iron furnace. The iron industry, the most widely documented and studied industry in the pines, transformed the woods, wherever they occurred. The area around Retreat would be no exception. Retreat took advantage of the road system built to support the forestry industry and sea side commerce. Retreat's resources and industries supplied growing cities on the East Coast, as shipping and trade developed along the Eastern Seaboard.

In a survey of regional furnaces and forges in the Mid-Atlantic by Pierce – an accepted authority on iron plantations – a valuable insight into the workings and character of industrial villages of this region can be gained, offering an insight into the daily lives of the people of Retreat who worked on the plantation (Pierce, 1957).

New Jersey's iron plantations, resembling in particular those of Pennsylvania, are [proto] feudal establishment in all forms self-sufficient. Workers rarely lived more than a stone's throw from their jobs, and they labored almost without letup, save on a few special days when they went hunting or fishing. National holidays often passed unnoticed in the early 1800's, even Christmas and Independence Day. Wives of the workers bought everything at the company store, to which they were more likely to be in debt long before payday. The worker's homes were rude structures. Cooking was usually done at the kitchen fireplace, which was the principal source of heat in the winter. There was little furniture, and what there

was had been roughly built from scrap lumber. Bedrooms were apt to be bare, seldom containing mirrors, tables, wardrobes, or even chairs (Pierce, 1957, p. 67).

Although original accounts of the exact workings of the Retreat study site are not available, there are numerous first and second-hand accounts from Halpert's informants that are available to the researcher. I will extrapolate personal accounts from these interviews in order to help describe the iron industry and life during this period to form an impression of what life was like in Retreat during the industrial boom.

Stacy Bozarth, a descendant of French Huguenots, described to Halpert a furnace at New Hanover, which was five miles outside of Browns Mills. This situation is similar to that of Retreat, which is three miles outside of Vincentown. Together the two examples may offer a reconstructed picture of an active Jersey iron plantation. Responding to the question, "You were to Hanover?" Bozarth replied, "My grandfather, Looker, worked there, made cannon balls and cannons. They used to try cannons there -- shot them up the crick. My mother was born over 90 years ago. Hanover used to be as big as Pemberton -- now there's ham not a piece of board on it big as your hand. Used to have stores, schoolhouse, and everything. Use to seventy five, eighty families lived there -- more too" (Halpert, 1937, p. 22).

Bozarth goes on to report that when he was married, there were still a large number of houses remaining in the village of Hanover. "Of course the furnace was gone when I can remember. All the rest of the buildin's stood there. Carpenter used to have a store there." (Halpert, 1937, p. 27). In Retreat, many houses and structures also survived into the early to late 20th century. The Presbyterian Church located on the study site was originally the school for Retreat. People remember the old Methodist church on the corner of Horse Heaven Road and the foundations of the old workers' houses. These memories correspond to cognitive maps and

together begin to reconstruct a picture of plantation village. These were buildings vacated by the iron industry and provided shelter for those who stayed behind.

Decline of industry

Through the industrial period, the industrial iron plantations were connected to the larger region and, indeed, to world commerce. “The patterns of Pinelands towns, even the architecture of the houses, were derived from general patterns found in England and the Northeast, and the dominant religion, Quakerism, stemmed from the same cultural background” (Monsammy et al., 1987, p 50). What appeared to many outside the community to be wilderness barrens and an inferior people, was in effect a modern landscape formed by the most current technologies, built in large part by people who were members of a non-conformist religion. A new release phase began when the industrial investment and the Quaker-Episcopal elite left the area, and in its wake a woodlands culture arose.

The economy, in large part, was now reliant on extractive reserves found in the secondary successional vegetation of the woods. To what extent these cottage industries existed prior to the iron and glass plantations is difficult to determine; however, it seems reasonable to assume that there were few industrial wage-paying jobs to replace jobs lost with the decline of the iron industry. People probably found a variety of ways to make a living based on the cyclical nature of the woods, including cultivating wild blueberries and cranberries. Local accounts in numerous newspapers from the area provide evidence of the population’s reliance on forest resources. The decline of the Retreat iron furnace (1832) and the later decline of the cotton factory (1855) profoundly influenced the economic health of the area. Many jobs were lost, leaving few opportunities for local employment (Pierce, 1957).

As can be imagined, the landscape began to change quickly. Early successional species like blueberries and cranberries began to colonize the open areas. The lowbush blueberry

(*Vaccinium* spp.) in the high and dry soils and the swamp huckleberry (*Vaccinium corymbosum*) and cranberry (*Vaccinium macrocarpon*) on the low lands began to heal the environmental impacts of the industries, and began to shape a new character of the landscape. In this case the lack of human intervention became the driver of the basin of attraction.

Cranberry Agriculture – From Wild Cultivation to Systematic Agriculture

The decline of the iron industry coincided with the development of the rail system through the pinelands. This promoted thriving cottage industries, among which was the harvesting of berries. The cranberry was the first to be domesticated. Originally wild cranberry and blueberry gathering could be performed by anyone near the resources. The lands were informally open to all. However, as cranberries increased in economic value shortly after the end of the Civil War, owners of the wild meadows began to limit access to these resources, and began to fence off properties. Scientifically designed bogs began to change the character of the landscape, but wild blueberry gathering, along with other cottage industries, continued alongside the development of the cranberry industry. Through local networks, word spread of the new opportunities for wage-paying jobs. A new industrial industry began to take the place of the iron industry and became a major source of economic prosperity.

With the collapse of the iron system, furnaces and forges closed down. Many people were either unemployed or under-employed, and the result was a regional depression. Charles Grant, one of the men interviewed by Halpert, was born in 1861 at the Old Lebanon Glassworks in Chatsworth, New Jersey. His accounts of the industrial period are rare and enlightening. He was interviewed several times during Halpert's study, and the transcribed interviews offer an unusually complete and detailed picture of the iron industry. Halpert recorded the conversations in the vernacular tongue of the informant. Due to the rare nature of this document I present a number of the narratives in long excerpts. The story begins at the end of the iron industry and at

the dawn of the cranberry industry approximately 1840, or, as Gunderson would explain, at the end of the release phase and at the beginning of the reorganization phase (Gunderson & Holling 2002).

According to Grant another interviewee of Halperts, the demise of the iron industry was caused by the rise of the coal and steel industries in western Pennsylvania. Traditional manufacturing of bog iron could not compete, leading to the demise of iron plantations and economic decline. Grant found that some skilled individuals went west with the industry, while many employees remained in the area, using their skills as blacksmiths. Others migrated to the glass factories that were still in business. The skills of charcoaling and attending to fires were virtually the same, and this staved off full depression in the area for a short time.

Railroads

When the glass industries finally closed at the end of the 19th century, total economic collapse was offset by the coming of the railroad. In 1860, the Jersey Central Railroad bisected the Pinelands. Stations in Chatsworth and Woodmanse were established, opening markets to New York and Philadelphia (Figure 4-18). Grant summarizes the variety of opportunities that were available after the decline of the iron and glass industries. He states that during the 1880s, Eph Epton purchased Collier's Mill and converted the mill pond into cranberry meadows. According to Grant, this was a very profitable venture. The first crops brought unprecedented profits. At this time, cranberries were a new specialty crop and growers were beginning to see the possibilities. In some instances, cranberries brought \$40 a barrel in the late 19th century (Halpert, 1937). The following quote is from Charles Grant recorded in November of 1939:

After the railroad went through, thousands of people picked huckleberries every summer. Railroad was finished 1864, and as long as I can remember, they were shipped to New York in half bushel boxes. Most of these people shipped in their own name to merchants in New York. They get a check once a week. Merchants found the boxes. They'd send them empty, get them back full, and send them back again. The stations was all

numbered, Woodmansie was 44 and Chatsworth was 45. The boxes was all numbered and were put off at the stations and you go there and get them yourself. You had your card tacked on each end of the box and sometimes, if your boxes came back right, you didn't have to change them at all. One set of tags would last you, sometimes, if someone didn't steal the boxes. If they stole yours, generally you'd steal somebody else's. They'd say things that they didn't have boxes, I remember that because someone-somebody else took your box. They were made out of rough pine with a handle on top in the middle. There was the first way they had of shipping (Halpert, 1937, p. 102).

In 1859 the iron plantation and cotton mill were sold at auction. Two primary investors bought two large parcels and converted them into cranberry bogs. They used family and local labor and transformed the area. What were previously overgrown bogs and a young regenerating forest became a series of built bogs. The investors took advantage of the natural cranberries and used a water irrigation system based on gravity. The berries were harvested in much the same way as were wild huckleberries (Interview AE1988, Interview HZ 2009, and Interview HT 2009). Although not a focus of this report, government intervention, through extension, helped solve some of the problems of this new form of agriculture.

People also continued to pick wild cranberries and ship them to markets in nearby cities. However, a conflict soon developed between landowners and the cottage industry. The customary tradition of the pinelands allowed locals to gather many of the natural products from the woods and sell them in nearby urban markets. The only exception to this was lumber. Landowners wanted the profits from trees growing on their properties. However, as wild cranberries became commercially more valuable, wild gatherers were discouraged from picking berries on private property (White, 1917a).

The abandoned low-lying areas were perfect for cranberry cultivation. Secondary succession was well underway, and blueberries and cranberries quickly colonized the areas that had been mill ponds, iron pits and forested woods. Blueberries and cranberries were available for the taking. At first, cranberries were gathered where they naturally occurred. According to

Theodore Budd, an important figure in the cranberry industry, the first and early “growers” found “natural bogs” where cranberries grew prolifically. In deeds and literature from the period these were known locally as cranberry meadows. According to Budd, the first known conscious attempt to work a cranberry meadow can be traced back to 1835 when the fad to gather from a cranberry meadow began in earnest. One of the cranberry pioneers, Benjamin Thomas, owned a cranberry meadow in the study area as early as 1835 (Budd, 1897). This was located at Burrs Mill around the old mill pond. During this period, the market price for cranberries ranged between, \$1.50 to \$2.00 per bushel (American Cranberry Growers' Association, 1883). Elizabeth White adds, “There are many, many men who have ceased to depend entirely on the harvests of nature’s planning and have set out cranberry bogs of their own, or who are responsible and trusted assistants of larger cranberry growers, too many from outside a community” (White, 1917a).

The vines were taken from the wild and later hybridized by extension researchers at Rutgers. Wild gathering easily morphed into a more conscious attempt to cultivate the wild resources. The land grant colleges saw helping to bring this valuable commodity out of the woods and into the hands of efficient farmers as part of their mission. Growers of this new agricultural crop formed associations and cooperative marketing strategies in order to share information and learn from individual growers. This endeavor produced employment, local wealth and investment. The new industry also could take advantage of the skills of locals who knew how to use the woods to earn a living.

Local tradition and historical records indicate that this was a typical land use pattern and sequence. The large tracts of land used for the iron and glass plantations form a distinct landscape, which is the primary characteristic of the countryside. Then efficiency and

standardization began to shape the industry. Through trial and error, cranberry growers spread what they had learned to other cranberry growers. Important discoveries, like building dams to flood the bogs in order to control insect infestations and to protect the blossoms from frost, were published and then circulated by the Cranberry Growers Association. Growers also learned that sanding the bogs in winter promoted rapid spring growth of the vines (Beckwith, 1931).

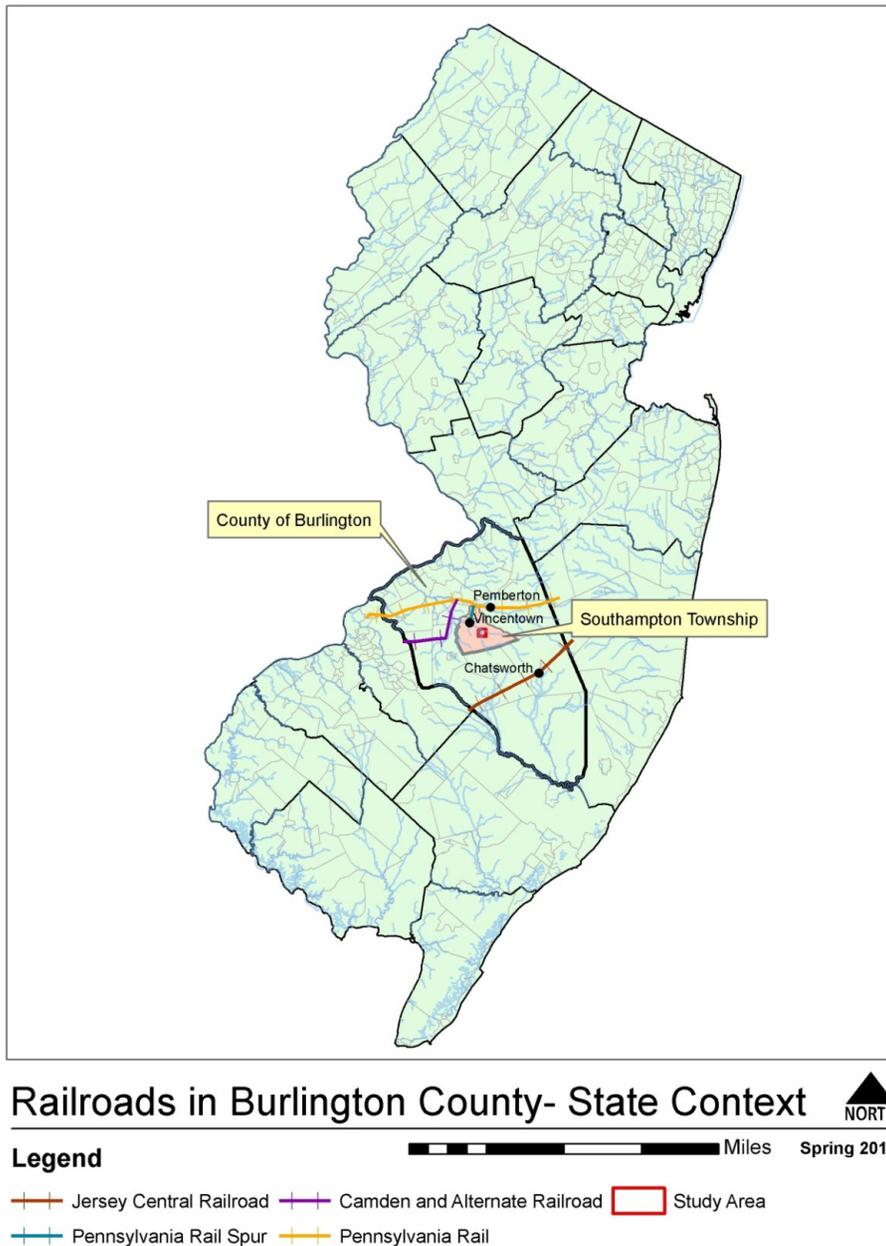
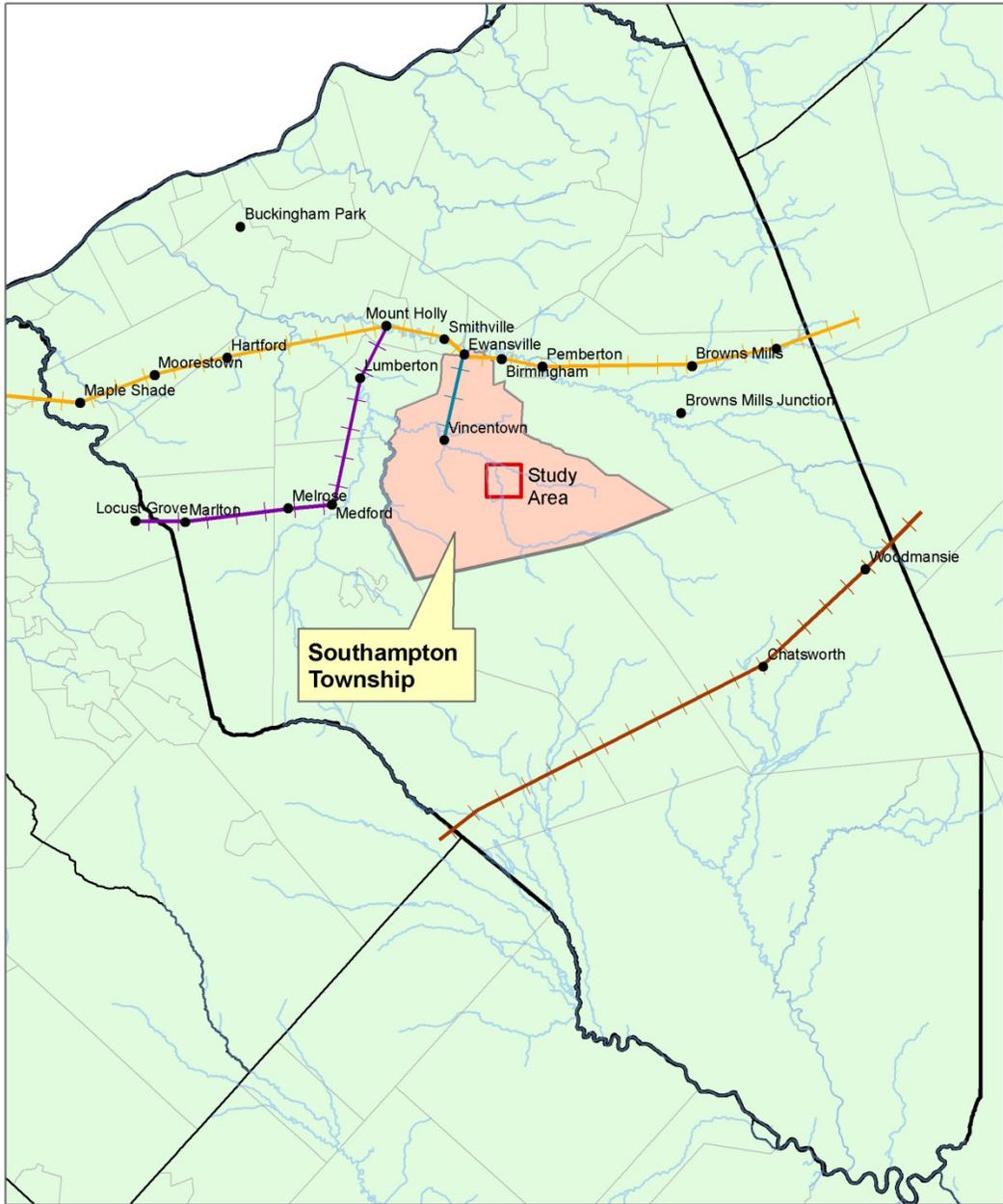


Figure 4-18. Railroads in Burlington County-State Context



Railroads in Burlington County



Legend Miles Spring 2010

- +— Jersey Central Railroad —+— Camden and Alternate Railroad
- +— Pennsylvania Rail Spur —+— Pennsylvania Rail

Figure 4-19. Railroads in Burlington County and Study Area

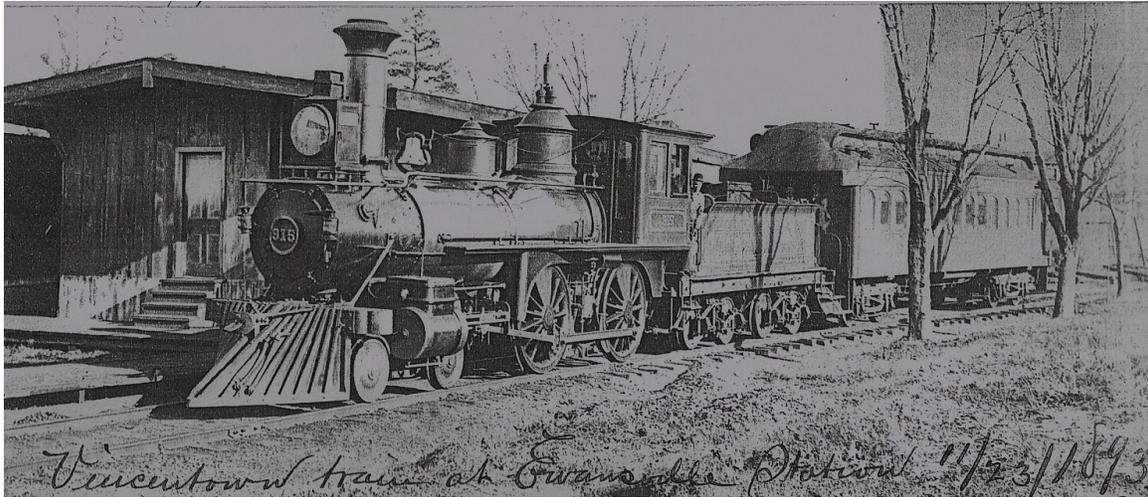


Figure 4-21. Main engine of the Vincentown railroad. Source: Evans scrape book, book 4 p. 82. Burlington County Library, Mt. Holly, New Jersey.

Stacy Bozarth spoke to Herbert Halpert in 1938 and gave this account of cranberry cultivation.

Cranberries come from wild cranberries. They pull the vines and set them out. These glassblowers went too far upland - they didn't have the water -- and they skinned the ground to cut the turf and set them in the bare sand. So even if they did go, they didn't stay, but rotted. You got to set them out in a bog. These bogs all around here are all cultivated bogs. About 1880 they learned to flood the ground to kill everything. Then they just got in, take the logs off and whatever was above the ground, stick the vines in. About that time wages was a dollar a day. About 1890 they were up to a dollar and a quarter a day.

But most of them bogs -- the dams were built, and ditches dug to drain it, vine set out, gates put in -- damnedest, hardest work in the world -- stuck in the mud, shovel stock in, dam mud sticks fast to shovel and he can't get that off -- and all for a dollar a day. You're always wet. Boots get filled. Then this mud that gets on your hands cracks them; they are sore. Grip the shovel handle always keeps your hands sore inside and out. Your undershirts generally wet with sweat. And general thing, when you're done good work, you had a mile or two to walk and your hair froze to death when you get home.

That's the cranberry bog. There ain't no harder work than working on the cranberry bog. It takes a good tough man to stand around the cranberry bog -- you work in gravel and mud. Tools always dull. He can't keep them sharp. What makes your work twice as hard. I've worked at all kinds of work and I don't think there's any harder work. The harder a man works, less wages he gets (Halpert, 1976, p. 29).

Clearly, this was backbreaking work. A large labor pool was needed to transform the landscape from one of industry into one of agriculture. Evidence suggests that the labor came from the unemployed workers of the iron and glass plantations who found that they could earn salaries comparable to those in the iron industry. They were a readily available work force. In the interviews, both historic and contemporary, there is a connection between the present families and the iron and glass industry.

To send the berries to market via the railroad required teams of horses and men to drive the teams. This was the primary means of getting the berries to market, and soon the cottage industry of picking the naturally-occurring berries in the woods had been replaced by cultivated cranberries. This shift, in turn, offered seasonal jobs as well, adding to the income of the unemployed or underemployed.

All sorts of jobs were open to the enterprising individual. Charles Grant, whom Halpert interviewed many times, identified the opportunities open to the people of the pines:

Then after the railroad went through lots of small cedar was trimmed into bean polls and sent up to New York State. Hundred of carloads of the stuff went up to New York State. Another thing, young men in the Pines used to go up in the country (anywhere is where there was farmland, they called the country) and help harvest. Used to get a pretty good pay -- anywhere from a dollar, dollar and half and their board. Farmers generally fed good. Some didn't. About June I used to go strawberrying – dollar and a half, two dollars a day. That was a picnic for us fellas who had worked hard: I was 18 (Halpert, 1937, p. 34).

This was the reorganization phase following the iron and glass industrial decline. Just like the enclosure movement in Scotland, there were winners and losers. The railroad was an economic investment that led to employment, local wealth and the beginning of renewed business health. The Cranberry Growers Association became the venue to educate and distribute educational findings to those interested in the industry. The demand for this local commodity expedited the creation of more bogs with the concomitant flood gates, reservoirs, and packing

houses that today are a major component of the countryside's character. This was the first phase of the reorganization of the landscape.

Blueberry Agriculture

Wild gathering, New Jersey

When the train came through the Pine Barrens in 1863, markets were opened for commodities gathered in the wood. (Figure 4-19). Blueberries, cranberries, moss and Christmas greens were several of the resources gathered for cash including laurel, holy, robin hood, and pine. As these markets grew, the cottage industry of gathering wild cranberries for sale grew and developed into a capital intensive agricultural business. Work in the cranberry business was often supplemented by gathering wild berries, which during the season was more lucrative than working for day wages. Wild gathering and marketing of crops for cash were valuable skills learned during this period, and were precursors to those skills required for the domestication of the blueberry (Hufford, 1986). The wild gatherers also learned the woods and knew where valuable resources could be extracted. This was a family occupation and almost everyone in the family could join in to help support the family.

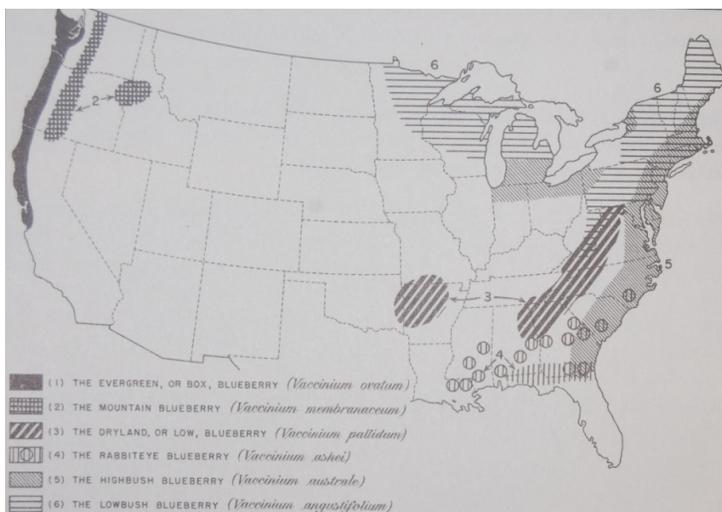


Figure 4-22. Commercially important wild blueberry gathering areas of the US.
Source: (Darrow, 1940).

Concurrently with the domestication of the cranberry, wild blueberries were gathered and sent by train to cities. This did not require capital investment. The ability to live on a successional landscape with much less impact, compared to the iron industry, allowed the forest to develop. Trees began to grow and a canopy began to form. The headlands of the bogs were open to all who wished to participate in this commercial activity, and this became an important cottage industry for the lower economic classes. Stacy Bozarth gave Halpert the following account:

[Wild blueberries were sent to] Merchants in New York would charge you ten cents commission on the dollar, and five cents for carting each box [of blueberries], and the freight onto them was about 15 cents. Price went up and down. When they first come, from July 1-15, bring anywhere from \$3-\$4 a box. Used to be 100 bushels of huckleberries in the woods where there isn't none anyhow now. These Japanese beetles don't do them no good (Halpert, 1976, p. 40).

At the time of the Halpert interviews, 1930, informants describe a lack of wild fruit in the woods. It is assumed that trees had begun to shade out the wild blueberries and cranberries, making them less abundant. Stacy Bozarth, another informant, continues with his explanation of the wild industry.



Figure 4-23. Wild blueberry from Bubbies Hole. Source: Brad W. Thompson

When they first begin, they picked by hand. Pickers all go in the bunch -- didn't have sense enough to spread out and hunt the berries. They'll all take 10 or 12 quarts. That would be a good day's work. 25 or 30 go all in one place -- carry little handle basket and take that full and that would be a days work. Get in the woods and talk, talk, talk. After a while people learn how to get them. I've seen my wife pick 60 quarts, carry them out the woods, put them in the crates, from eight o'clock to 12, four hours. I seen my brother who died this spring, pick 100 quarts in one day.

After they learned how to pick, they made more. At the beginning they got a better price but they had to learn how to pick before they could gather many berries. People often made \$10 a day picking berries. This was after the war (World War I). Seasons used to be longer. When I was big enough to pick, wasn't but a few people known to have picked huckleberries. Made a good living. If a man had a big family, they all go and pick. Kids made 50 to a dollar; women generally picked as much as the man -- three or four dollars. When some of the buyers came around and pay 25 cents a quart all summer. I was a small boy -- not big enough to pick. Most of them took up to Trenton. If they made \$200 in a season, they could live on that good till huckleberries came again. That would be a fair amount for a family to make clear.

We had good seasons and bad seasons. First season I was at Colliers Mill there was nothing else to do only huckleberry. No rain all summer and very dried up. Didn't bring but a dollar and a quarter of great in 1898, big crop of huckleberries -- was a long season. Frost came 15th of October and thousands of bushels still on the bushes nobody ever touched. Bush bent right down to the ground. We sold all that we got down to Chatsworth to a Bridgton cannery -- One dollar and 28 cents a crate -- 32 quarts. Lots of that year gathered six crates, some day, some 10 crates a day for one man. They showed them that year. Didn't bother running them over the cleaner. They clean them at Bridgeton. Lots of people made a lot of money. That was a good year. That was the trouble's; we had one good year next year wouldn't be any. Ain't had a decent crop of huckleberries for 25 years. In the old days there was no cultivated huckleberries. They just get it and started into it now. They set out, and they cultivate them same as they would potatoes or anything else, trim the bushes, spray them, set them off. Huckleberries don't grow on this farmland. It's too sweet. It has to be sour enough (Halpert 1937 p.40).

Wild blueberries called huckleberries were one of several cash crops available to local gatherers. Daniel Thompson, another of Halpert's informants, identified some of the other resources that were found in the woods and commoditized and again found ready markets in the city.

People used to do a good many things in the woods to make a living that they don't do now. In the winter time they used to go out and pull teaberry leaves, sold them by the pint. And spring you go out and pull cranberry vines. Sold them by the barrel. Used to make crates out of birch and cedar. Big crates -- hold 10 bushel, put a lid on it. Sell them for about a dollar apiece in Trenton. We used to gather moss, put in five barrel bales, fill barrels with moss squeeze down in a bail 2 x 2 x 3. Used to ship back to New York. After Huckleberry time, go mossen. It's the first thing to freeze and the last to thaw. A good many people got a good living out of it, and some of the dealers made some money out of it (Halpert, 1937, p. 16).

All that a local needed to do to find work was to look in the woods where blueberries became a thriving business. Berries were picked, sorted and cleaned, then taken to the nearest railroad station. If the picker did not have the means to get the berries to market, a commission man with a horse and wagon would come and take your berries to the train station for a charge (Interview, SI1). Berry gatherers could easily make \$2 a day at a time when laborers in a local sawmill only made \$1 a day. Berry-gathering was so common that it was hard to find people to work on anything besides blueberry picking during the season (Interview, HW1). A typical blueberry picker would rise early in the morning to reach a favorite spot before the summer sun became too hot. Pickers would cover themselves with protective clothing, making sure to limit exposure to the sun. From the late 19th to the early 20th century, women wore bonnets with cedar stays to hold up an exaggerated brim to ensure that the glare of the sun did not hit their face. Women were often accompanied by young children who also worked the swamps, picking wild blueberries. Hand-picking the highbush berries in the wetlands was time-consuming and required quite a bit of patience. Baskets were tied to the waist by belts or over the neck with harnesses, thus freeing up both hands and making the process more efficient.

Male pickers often worked the higher grounds with scopes, gleaning the berries from the lowbush variety. Another common practice, called "knocking," employed a heavy stick that was struck against the bush. It would loosen the berries and send them flying. A blanket or sheet was laid on the ground to catch the berries. The berries were then gathered and emptied into wash

tubs and hauled back to the house, where they were cleaned and sorted, often with the help of children (Interview FBT1, 2006).

At home, families had sorting equipment they used to ready the berries for market. In particular, the berries “knocked” or scoped needed to have the green berries, leaves, and rotted fruit removed before shipment. One common tool was a hand-operated sorting machine. A handmade belt of Brussels carpet was stretched over two wheels placed several feet apart. One end of the conveyor belt was higher than another, forming an incline. A hand crank at one end engaged the belt. Berries were poured onto the belt at the high end and sent down the incline. When the belt moved in reverse direction, the nap of the carpet would catch the rotten berries and leaves and carry them in the opposite direction, thus cleaning the berries. The berries were placed in baskets and loaded into wagons (and later, trucks) and taken to the train station (Interview DWB1, 2009).

Handpicked berries, however, required less attention. If they needed sorting or cleaning, they would be poured onto a rectangular screen held in place by a cedar frame measuring approximately 2’ x 1’. In this way, any green or rotten berries that made their way into the picking basket could be removed (Interview HWZ1, 2009). In general the berries picked by hand were collected in a way that protected the berry. These were the berries that brought the most money in the market.

For over 50 years, this local industry thrived in the Pinelands. Local people knew their environment and had favorite spots for picking. As one picker recalled, “We would get up at sunrise and go over to Bubbies Hole and pick the whole day. Water was up to your waist and you saw snakes sunning themselves in the trees” (Interview FBT1, 1987).

The following entry from two local newspapers further demonstrate the importance of the wild blueberry in the local economy and underscores the local and indigenous resources that were one of the foundations that led to domestication. This was a major force in shaping the emotional and aesthetic connection to the woods. Most of the interviewees were emotionally connected to not only the community but to the woods, the physical container of the community. The following is such a sampling of the many local period accounts of this economic tradition, and again, in these accounts the name huckleberry is used for the highbush blueberry.

“The outlook for a good Huckleberry crop has never been better than it is this season” (Browns Mills, 1914).

“The Huckleberry crop looks to be in pretty good shape and there are prospects of a fair yield” (Retreat, July 8, 1911).

“Reba Bozarth put on her Huckleberry Harness and started out the other day to get some idea of the prospects of a satisfactory harvest. She walked around the woods for about 10 miles and when she came back she said she could eat all the green and ripe berries she had seen in her travels, without feeling any bad effects from overheating” (Retreat July 14, 1911).



Figure 4-24. Local blueberry basket with slots made for the insertion of a harness. Source: Helen Zelley Family archives.

“Thompson Wells, the veteran Huckleberry huckster of this section, has discovered this year that after going over his old rounds at this place, Johnson Place, Canaan and Retreat he has not been able to get the loads that he gathered in previous years by covering half the distance. This gives a fair idea of the short crop” (Retreat, July 8, 1914).

“All the people around here are busy at Huckleberry and some of the natives have neat sounds of the real goods to their credit. H. M. Willits has quit the Huckleberry business and is now working for Charles Rogers” (Chatsworth, 1914).

“Most all the Huckleberry pickers in this section state that they had a very successful season” (Retreat, 1910).

“The Huckleberry crop around here has been very satisfactory and large quantities have been gathered (Chatsworth, 1914).”

“The blueberry crop will be a big one and already large shipments are being made” (Medford, 1910)

“Walter Brown, a farmer and cranberry grower living just out of town took a load of huckleberries to Trenton on Saturday and while on his way from home, his horse became frightened and ran away. Mr. Brown was thrown out of the wagon and sustained serious injuries. He is now under the care of a physician. It is thought he is hurt internally” (Retreat, 1911).

“Large quantities of huckleberries are being gathered in this vicinity and shipments made daily to New York and Philadelphia markets” (Medford, 1910).

The trend to commoditize the blueberry was a national trend, and the crop was important to many rural people due to its economic value. This is best summarized in an article found in *The New England Plowman*:

This [huckleberry] crop has become one of importance to the people of New England; important not so much because of its great money value, but because it opens the field of profit to a class of people who find it very difficult to get employment suited to their capacities; and as it requires no capital to start the business, and as there is no risk of losing anything but time that is of no value, every dollar that is earned in picking berries is so much gain, and gained, too, by a class who really needs the money. Ripening as the berries do during school vacation, the children are really better off picking berries, even if they do not bring them any money; it keeps them busy and teaches them to be industrious; and thus being able to earn money by their own labor it teaches them the value of money, and furnishes them with practical lessons of extending it later in life (Anonymous, 1885, p. 1).

Although the social commentary reveals certain class assumptions of the day, it was still true that gathering wild berries for sale offered children as well as adults the possibility of acquiring cash with little risk of loss associated with accumulating a modest amount of wealth. This was also a venue for social learning based partially on natural resources. It appears that many people began to rely on the profits from this crop, and when the crop was lost there was considerable hardship. Stories abound in the Pines from people whose families relied on the industry and how important it was to the supply of family income.

Early attempts to domesticate the blueberry

Professional organizations, agricultural societies and New York and Massachusetts experimental stations were involved in early experiments with wild blueberries. The early attempts were truncated with little follow-through. Through the literature most authorities cite the abundance of the blueberry in the wild as the main reason little was done to bring this crop into commercial production. Frederic V. Coville, botanist for the USDA's Bureau of Plant Industry, was aware of the early attempts and cited many of these sources in his early works .

Blueberries and their exploitation were very much in the discourse of the American Pomological Society:

The distribution of the blueberry is not confined to a few thousand acres in Maine; but [is found] throughout New England, New York, Pennsylvania, West Virginia, Michigan, and many other states, [where] vast areas which, while bearing a

considerable number of bushes and yielding a profitable return to the few people who make a practice of gathering that wild fruit, are not utilized as they might be. The systematic treatment of the wild lands, as already described, might profitably be extended to many other sections (Munson, 1899, p. 55).

The proceeding also notes that:

There are also large areas, otherwise worthless, which might without doubt be made to yield good returns if in some way a growth of blueberries could be started -- either by setting bushes or by scattering seed. Perhaps this suggestion may be regarded as visionary, but it is quite within the range of possibilities. Another phase of the subject which is worthy of careful attention, is that of domestication of improvement types by selection. Little has ever been attempted in the garden culture of the blueberry. Those satisfactory results might be obtained; however, there is little doubt. The fruit in its wild state is far superior to that of many other cultivated plants, and is very susceptible to the influence of environment (Munson, 1899, p. 57).

The Pomological Society proceedings conclude emphatically: "That the Huckleberry [sic, blueberry] is capable of being greatly improved there can be little doubt; the reason it has not been done is principally because the attention of skilled cultivators has not been directed to it; when it is, in the same effort put forth to improve it as has been to improve the strawberry, no doubt the result will be as satisfactory" (Munson, 1899, p. 57). The conference proceedings also noted that plants were grown from seeds gathered at the Arnold Arboretum, but unfortunately that systematic attention to commercial cultivation had eluded the blueberry. Munson, the guest speaker at the conference, concluded his talk by noting that a valuable resource had not been fully tapped for financial gain. Munson argued that industrial efficiency was lacking in the blueberry industry at the time. He noted also, with frustration, that people in a few states were attempting to cultivate blueberries, and pointed to a farmer in Massachusetts who was making some inroads:

But in Massachusetts several gentlemen have undertaken the cultivation of the blueberry in an amateur way with encouraging results. The fruit sold from the cultivated bushes command nearly double the price of that shipped from the lands. The most promising species for this purpose of cultivation appears to be the highbush blueberry, *Vaccinium corymbosum*. Of the species there are very well

marked varieties which may be perpetuated by division or by grafting. In general, one is perfectly safe in predicting, that within a few years a race of garden blueberries, rivaling in value some of the best of the other small fruits, will be placed before the public and the culture of the blueberry will be as much a matter of course as is that of the blackberry or the raspberry (Munson, 1899, p. 56).

William F. Card, writing in 1903 for the Agricultural Experiment Station of the Rhode Island College of Agriculture and Mechanics in Kingston, R.I., comments on the value of the highbush blueberry: “This valuable plant is perhaps less appreciated in New England than it should be, owing to its abundance in the wild state, which enables people to secure it easily from the fields and swamps” (Card, 1903, p. 106). While Card made sure to mention how difficult it was to domesticate this plant, he did recommend that scientists continue to investigate possible cultural uses given its potential value to agriculture. The article summarized the attempts to domesticate the “huckleberry” in New England, which began with experiments in 1898 and were still in process at the time of his entry in 1903. It identified the problems of propagating the swamp huckleberry [sic, highbush blueberry], and also mentioned the need for the fungus to remain on the roots in order for the plant to survive. The final sentence is particularly interesting: “Perhaps it may be found that this acid condition is one of the essentials to the best development of the fungus associated with its root” (Card, 1903, p. 114).

Another authority in the *Cyclopedia of American Horticulture* (Bailey & Miller, 1869) identifies the *Vaccinium* species that were currently picked in the wild, noting that the blueberry abundantly occurred in nature (Bailey & Miller, 1869). “In the wild state the blueberry was originally worthier of notice than was the blackberry, raspberry or currant, but the natural supply is so abundant that little attention has been given to cultivation (Bailey & Miller, 1900, p. 1890)”. Bailey continues:

In many of the northern and eastern states—particularly in New England, New York, New Jersey, Michigan and the mountain districts of Pennsylvania and West Virginia—there are many thousand acres of land, worthless for agricultural

purposes, which after the pine is removed sent up by the growth of blueberry bushes, folders, poplars, gray birch and by readers. These lands are, for the most part, considered as public property and are recklessly burned over by the responsible parties to promote the growth of the blueberries (Bailey & Miller, 1900, p. 890).

This is just a small sample of early attempts to cultivate the blueberry. Coville could easily access these experiments, observations and prognostications when his attention turned to the cultivation of the blueberry. He cited many of the findings noted above in his original works. Coville began systematic work in the summer of 1905 at his summer house in New Hampshire, work that ultimately led to the domestication of the highbush blueberry. The old abandoned farm was awash in highbush blueberries, the consequence of secondary succession stimulating a wild industry, as in New Jersey. A circular published by the New Hampshire Agricultural Experiment Station concluded that in 1909, 9,866 bushels were harvested in New Hampshire with a total value of \$37,885 (Gourley, 1917). Gourley, writing for the New Hampshire Experiment Station, contended that as the country matured, it would grow to value its native plants. He foresaw New Hampshire as a prime location for a commercial blueberry industry (Gourley, 1917).

Gourley further noted in his article that there was no census detailing the quantity of blueberries produced in the United States, making it difficult to arrive at current wild production figures. He also mentioned that there was no systematic identification of the centers of blueberry production in the U.S. Therefore, we have no accurate information about where blueberries were produced in the wild (Gourley, 1917).

In order to obtain figures for the quantity of blueberries shipped from New Hampshire, Gourley cleverly got a job with the American Express Company. He was able to get a list of towns from which blueberries were shipped as well as the number of bushels shipped. The

subsequent report substantiated this assumption that blueberries were a major cottage industry in New Hampshire at the turn of the 20th century.

The USDA began the scientific work that in 1906 ultimately led to the domestication of the blueberry. The experiments used local talent. This included a member of the local elite, Elizabeth White, who offered her family plantation for the trial experiments. Coville and White knew that they needed to expand the genetic base for the experiments to be a success. White used the social networks of the people who worked on her bogs to spread the word about the experiments and offered financial incentives for people to find superior specimens in the woods. Local knowledge was therefore critical in the domestication of the blueberry. This scientific work reflected the mission of the Land Grant Universities, Experimental Stations and USDA, during this period: to modernize agriculture, to make it efficient and profitable.

The blueberry industry grew from its humble beginnings into a worldwide business with the help and support of the USDA. At the beginning, a consortium of large and small scale farmers were able to band together and form a brand that increased the amount of berries available. Soon advertising and good market strategies placed the blueberry in almost all major cities in the continental US. The USDA became engaged and brought efficiency into the system. Building on local culture and tradition, Coville built his scientific program. This became a driver of another landscape change fueled by the expanded role of bureaucracy. First in cranberries, and then blueberries, the bureaucratic arm of the government promoted efficiency in agriculture.

According to family tradition and written sources, the first time it occurred to Coville that the blueberry could be tamed and added to traditional agriculture was during a stroll in the summer of 1906 (Interview MCTO1, 2008). He was surveying his newly purchased property and observed the numerous stands of highbush blueberries on his and adjoining properties.

According to his son, Frick, “Father was out walking one day and he came upon a highbush field of fair-sized fruit. That was when the thought first came to him. “Why couldn't blueberries be bred and cultivated” (Interview MCTO1, 2008)?



Figure 4-25. Coville and White working on experimental plots at Whitesbog.

Blueberry hybridization



Figure 4-26. Coville Summer House, Greenfield Connecticut. Source: Marie Coville Ortnor Family Archives.

This was the beginning of both Coville's and the USDA's interest in the cultivation of the blueberry, which resulted in experiments in New Jersey that ultimately led to commercial production. Coville had the full support of the USDA in his effort to transform blueberries into a new commercial crop. As a matter of fact, the Department was interested in the use of native plants and the blueberry domestication program was one of many investigations justified in the Department's annual budget.

The role of the usda

One of the major roles of the USDA was to insure a cheap and reliable food supply to support urban growth. The department played a major role in modernizing agriculture. They became a center for agriculture nationally and made sure that discoveries made on the state level would be available to all farmers nationally. This was the first time that there was purposive government intervention aimed at changing agricultural practices or behaviors. Coville, very much a part of this process, used existing resources in the community to create a synergy between USDA and the local community. Not only was this a good strategy, it was efficient. The USDA did not have to purchase the land appropriate for blueberries. They did not need to hire new employees. Through contract, they rented facilities at Whitesbog, which came with project manager and laborers who knew quite a little about working acid soils.

At the time of the domestication of the blueberry, the USDA was a relatively new government entity. The Department of Agriculture was established as the result of agricultural reforms in 1863.

Abraham Lincoln is given credit for the creation of the U.S. Department of Agriculture. On May 15, 1862, he signed into law an Act of Congress establishing the United States Department of Agriculture and Industry" (Baker, 1963). As with most Acts of Congress, a number of events and dramas helped to precipitate legislation. After the southern delegations left Congress on the

eve of the Civil War, the Republicans had full control. This cleared the way for agricultural reform and the creation of a government bureaucracy expressly interested in making agriculture efficient and profitable. This important Act was signed during the Civil War and the institution it created was not unlike other government agencies established during this period in that their founding was made possible in large part by the departure of Southern lawmakers from Congress. They were no longer an obstacle to agricultural reform. This in many respects was the beginning of an expanded government role. The government felt a responsibility to create departments to deal with problems associated with industrialization. One such problem was the need to feed the new immigrants coming to the United States. They were reluctant to leave to chance the national food supply. At this time in history, cities were expanding rapidly and required a cheap and available food supply.

The United States Department of Agriculture, however, was built upon the agricultural traditions and contributions of those engaged in agriculture at the time of the reforms. Initial attempts to settle this country relied on subsistence agriculture based on European farming traditions adapted to the climate and soils of the “New World.” At the time the Department was created, 80% of the country still lived in rural areas, and residents were primarily engaged in agriculture or allied occupations (Palen, 2006).

The beginnings of American agriculture are rooted in the practices and traditions of Northern Europeans when these early groups immigrated to the “New World” they brought with them farming practices related to their ethnic and cultural heritages, as well as the environmental realities of their countries of origin (Woodward, 1933). Native cultural foodways adapted to the New World landscape, creating a new “European agricultural landscape” that responded to not only cultural and ethnic backgrounds, but to new environments as well, forming what would

become American farming. Agricultural practices were handed down through the community and family.

During this period, the ideal of the yeoman farmer was probably forged. Immigrants coming to the United States quickly cleared the land and planted crops. Many of these farmers were able to produce enough crops not only to feed their families but also to begin to accumulate wealth. Although the farming systems were regionally different in the North and South, both were based on a proto-modern economy. The yeoman farmer with his farmstead created an agricultural economy that supported towns, villages and cities in the New World. As the system grew, the need for increased markets and information grew as well. Therefore, throughout the early 19th century, numerous proposals were made to Congress to establish a government bureau or department to supervise agriculture.

The pressure to create such a department grew when the U.S. Department of the Interior was established. Beginning in 1830, farmers' and citizens' groups supported the recommendation that a farm bureau be established within the Department of the Interior. This was a compromise between those who wanted a cabinet level position and those who felt agriculture was receiving undue attention, especially in the face of growing commercial and industrial interests. The debate in Congress revolved around this concern for approximately a decade. The newly founded United States Agricultural Society (1852) continued to pressure the government to create a Department of Agriculture.

Emphasis on agriculture, education, and production pressured the government to establish a land grant college system. A bill establishing a Department of Agriculture passed during the administration of James Buchanan, but was vetoed. The Commissioner of Patents also called for the establishment of a Department of Agriculture, primarily due to the Patent Office's increased

work in support of agriculture (Baker, 1963). By 1861, the Superintendent of Agriculture within the Patent Office formally requested the establishment of a separate department to be

separate and apart from all influences other than those promoted by the highest regard for the public good, unobtrusive and its conduct as in its nature, and having truth for its objects. It should endure untrammelled, and free from all partisan considerations. It should have no section, no latitude, [and] no longitude (Baker, 1963, p. 11).

The government bureaucracy became a tool to change farming practices, to encourage practices based on practical science free from the influences of tradition and politics. Baker was quick to point out that “all civilized nations had fostered agriculture by the installment of boundaries, restrictions upon foreign competition, and educational encouragement which only governments could offer” (Baker, 1963, p.11). Apparently, there was considerable fear about centralization of services due to regional differences between the North and the South. However, with the secession of the South, Republicans were able to establish not only the Department of Agriculture, but also to create the land grant college system (Baker, 1963). This successfully established a bureaucratic agency to address agricultural reform, which soon after was elevated to a cabinet position, which remains the case to this day.

This was the first government attempt to consciously modernize agriculture. Previously, agricultural reform was addressed on the local level. Farming societies could be found in many counties throughout the country and some states even had statewide organizations. One such organization was the Burlington County Farmers Associations, typical of many in the country that brought farmers together to share information and offer advice on farming. What was different in this case was the effort by a government bureaucracy to address a broader constituency of citizens. It was this budding system of government involvement in agriculture that Coville joined in 1886, when he was hired by USDA to join the botanical arm of the department. The establishment of the land grant school, replete with an emphasis on industrial

agriculture and extension, had profound effects on Retreat. The science of cranberry agriculture was perfected at Rutgers, and superior varieties began to replace the wild genotypes that were gathered, propagated and planted. The bogs on the landscape today are a direct result of this science.

Coville's contribution

Colville represented the “second generation” of USDA scientists who brought to their work a strong scientific education based on academic study. He knew how to use the scientific method and was focused on using scientific expertise to solve “practical” agricultural problems. He had previous experience that he brought to the task. His “specialty” was figuring out how to use native or “under-utilized” plants, how to “bring them into” the repertoire of tools available to agriculture. His work with “woks” (*Nuphar polysepala*), his work on grasses in the West, and his botanical expedition into Death Valley all informed his work. Fortuitously, his own land was “overgrown with blueberries”, and given his professional background, he envisioned the possibilities.

Coville, a graduate of Cornell University, came to the USDA in 1893 after a short stint at Cornell teaching botany. Coville was an economic botanist, and his early work included creating a botanical description of the flora of Death Valley and becoming an expert on desert botany. This work led him to the study of plants used by the Kalmath Indians and underscored his interest and that of the department in economic botany (Coville, 1902). He collaborated with the U.S. Department of Forestry and studied the grasses of the arid West with an eye to grazing plants of the National Parks. This led to a management plan for the proper use of grazing on government properties (Sampson & Coville, 1913). However, by the turn of the century, Coville's attention had turned to the cultivation of the highbush blueberry (Coville, 1915).

Coville's eye for economic botany no doubt led him to the hypothesis that the blueberry could be domesticated. In the 1937 *Yearbook of Agriculture*, he unceremoniously stated that "in 1906 I began a series of experiments to learn the fundamental facts in the life history of the blueberry, which might serve as a basis for the possible cultivation of this delicious fruit. It took two years to find that the blueberry plant requires an acid soil" (United States Dept. of Agriculture, 1937).

As retold by Coville's son, the blueberry project began with a single bush while walking over his newly acquired New Hampshire farmstead. He was not the first to have the thought, but he was the first to formally act on the vision. His newly purchased New Hampshire farmstead was an abandoned dairy farm typical of many such farms in New England at the beginning of the 20th century. It had been released from agriculture at the end of the 19th century and the pastures and fields were overrun with wild blueberries. An economic botanist who had traveled the continent looking for wild species that could be brought into agriculture found, at his own back door, a wild crop that might be added to traditional row crop agriculture.

He took horticultural stock back to Washington and the USDA facilities, and in the fall of 1906 began the experiments. He was part of the new wave of scientists who were entering government employment, joining the growing federal bureaucracy. Government bureaucracy was an attempt to organize human behavior and bring rational and intellectual thinking into government policies (Allan, 2008). At the time, this was considered an efficient and rightly ordered use of government power. The government was seen as an institution whose role was to serve the public. The public began to see the federal government as being able to solve local problems, and the second-generation scientists at the USDA were part of this movement and thinking. The bureaucratic scientists at the USDA were driven to apply scientific knowledge to

agriculture in order to make agriculture efficient and profitable, while producing for the country a cheap and reliable source of food. The emphases of the programs were to make all agriculture profitable and to ensure wise use of natural resources. A letter to the editor of *Outlook*, a popular journal of the day, emphasized the new working paradigm in the department. In the article entitled *Help for the Farmer*, (Vrooman, 1916), the Secretary of Agriculture announced to the public that the Department of Agriculture's intentions were to help the small farmer. The emphasis, according to the Secretary, would be on making money and making farming profitable. He states,

Practical agricultural economics is the new ideal, and helping Bill Smith make more money is the new job. To this end the department has been reorganized with a view to bringing farm economics to the fore. An office of markets and rural organization has been established. The office of farm management has been recognized as a part of the Secretary's office. The office of experiment stations has been reorganized as the "state's relations service (Vrooman, 1916, p. 622).

He pledged to make the Department conform to these new ideas and offered a list of programs that met the new criteria. Among the projects listed as examples of helping the farmer make money was the department's blueberry domestication project (Vrooman, 1916).

Rational action based on organization, systematization and well-thought-out approaches was brought to all endeavors. This is a hallmark of modernity and its associated bureaucratic institutions (Allan, 2008). The evidence of this approach to problem solving lies in the annual reports and budgets that spell out the work, what it will cost, what is learned and what can be used to better the condition of farmers. Coville undoubtedly knew from the beginning that there was much to learn from the blueberry. Using lessons he learned from his failed attempts to bring wokus, the traditional food of the Klamath, to commercial production, he was able to extrapolate methods of making blueberry farming successful (Coville, 1902).

The first reports of the progress of the blueberry experiments were published in 1908 as part of the *Annual Reports of the Department of Agriculture*. In order to ensure that the information found in one state could be accessible to people in another, a major role of the new bureaucracy became the dissemination of information. Information is a driver of landscape change, but in this case it was disseminated by the government, not the family or community.

The Federal budgets of the period justifying the use of taxpayer dollars not only tell us how they spent the funds, but what the public could expect from this expenditure. One such example is found in the *Department of agriculture combined record of expenditures during the fiscal year 1909 appropriations for the fiscal year 1910 and expenditure is proposed for the fiscal year 1911* (United States Department of Agriculture, 1910). Although this is an awkward and rambling title, it is nonetheless a very useful document to help understand intentions within the Department of Agriculture. For the year of 1910, \$1,717.25 was appropriated for this study and utilization of wild plants. The justification of expenses for the blueberries written into the budget is as follows, "Experiments in the domestication of the Swamp blueberry, which has been carried on for three years, which have resulted in the working out of the conditions under which this plant may be propagated and grown successfully in pot cultures. The results of these experiments will be published. The prospects for the introduction of the blueberry into cultivation on acid soils, now regarded as little value, are very good" (United States Dept. of Agriculture, 1911a, p. 34).

The domestication of the blueberry is just one of hundreds of attempts by the USDA to modernize agriculture. As stated earlier, the blueberry was gathered in the wild, but sent to market by modern transportation. Gathering was not efficient, but the traditional ways of gathering were influenced by modernization. Blueberries were first gathered by hand, but in the

19th century, gathering was quickened by the invention of the blueberry rake and scope. The rake, with its thin tines, was raked through the branches of the bushes and the berries were gathered in the well of the scope and then deposited in baskets. In New Jersey, a “rocky dump scoop” was invented and used to “knock” the berries from the bush, and they were then caught in the well of the tool, again offering the gatherer a quicker way to obtain the berries. All of this was an attempt to efficiently scope i.e. gather, berries for the ready local market in exchange for cash. Coville was well aware of the various blueberries harvested and methods used in the business, and he saw the need to make hand picking easier, so increasing the size of the berry was therefore foremost in his mind. This would insure efficient harvesting and protect the quality of the berry.

Coville set his mind to the systematic study of the blueberry in order to find the most efficient means to understand all aspects of the species and to use this information to domesticate the species. As a bonus, he found that this would best be accomplished by using lands that had little “commercial” value. The thumbnail sketches within the Reports of the Department of Agriculture chronicle the steps he took to domesticate the blueberry using a state run bureaucracy, the USDA, as the vehicle for agricultural reform.

The USDA offered scientifically trained professionals and support staff to address problems of agriculture. The trained professionals had access to modern scientific facilities. Experiments could now be conducted in the laboratory, greenhouse and test plot. Many professions were on site and could be used or consulted for all types of agricultural experiments. All of the findings of note were published and became part of the public record, another modern characteristic.

From 1906 to 1911 the scientific work that led to the publication, "*Blueberry Culture*" was summarized in reports issued annually by the Bureau of Plant Industry. The first report of the Secretary of Agriculture detailing accomplishments in the blueberry project to date was published by the Bureau of Plant Industry (Anonymous, 1901a) . The 1908 report covered the first two years of experiments and centered on the cultural requirements for the blueberry. Coville found that the blueberry needed acid soils in order to promote a fungal growth that grew in association with the blueberry roots. The mycorrhizal fungus was responsible for nutrient uptake.

By the third year, 1909, Coville learned how to propagate blueberries, and as a result he sent plants to selected individuals and experiment stations. By 1910, full reviews of the findings were published under the title, "*Experiments in Blueberry Culture,*" In this report Coville claimed, "There is a good prospect that the knowledge thus gained will establish the blueberry in field culture and that ultimately improved varieties of these plants will be grown successfully on a commercial scale" (Coville, 1911, p. 87). By the end of 1911, Coville reported on a blueberry plantation in Illinois. The grower had transplanted wild bushes found in the wild and created a blueberry plantation on his property. Coville reviewed the production receipts and then predicted that the new field of blueberry culture would be economically profitable. The plantation owner received \$160 per acre for his efforts. Given that these were unselected bushes, Coville predicted that the selected varieties and the new cultivars would reap even higher profits (United States. Dept. of Agriculture, 1911a).

The example of a blueberry plantation in Illinois showed that this would be a profitable business. The blueberry presented an opportunity for new wealth from a natural resource. It was especially encouraging that this new economic crop would make infertile lands productive.

Now confronting Coville was the need for full scale trials in order to further the advances in the domestication of the blueberry. There is no doubt that the soil requirements needed for the full scale trials were not readily available to Coville, so he began to look for a suitable site for the next phase of the project. Even though the USDA had access to lands around the capital and they were on the coastal plain, it is probable that their soils were more characteristic of those on the Inner Coastal Plain than the soils of the Outer Coastal Plain, which were similar to those in the Pine Barrens. Coville began to search for possible sites. “By the summer of 1909 I had developed the idea that the cranberry region of Cape Cod, Massachusetts, might be a good location for the establishment of an industry of agriculture, and I arranged with Mr. A. D. Makepeace, of Wareham, that I should look over the region, with such a purpose in view. Meanwhile, after correspondence by Coville to Miss Elizabeth C. White of New Lisbon, New Jersey, and a visit to her father’s [cranberry] blueberry bogs at Whitesbog, in March, 1911, Coville concluded that Whitesbog offered better facilities for serious cooperative blueberry field experiments than any other place he had visited. “If I had not received the original letter from Miss White, the first commercial development of blueberry culture would have taken place in Massachusetts, not in New Jersey” (Coville, 1937).

The outside intervention of the USDA aimed at increasing the health of agriculture is an important contributing factor for the domestication of the blueberry. Coville knew from his work with Native Americans that local knowledge can be used to bring new crops to commercial production. He knew the value of reciprocity and co-operation and used it in his work. After he learned the horticultural requirements of the blueberry, he began to look for the appropriate soils and land he needed to begin the field trials. He found the cooperation he needed in Elizabeth White who was actively working on her family’s cranberry plantation.

Elizabeth White

In my zeal to find new ideas for use at The Bog, I was examining each month the list of new publications issued by the United States Department of Agriculture, and sending for any that promised help. I promptly secured "*Experiments in Blueberry Culture*," written by Frederick V. Coville and published in the last months of 1910 (White, 1947b, p. 18).

Elizabeth White played a legitimate role in the domestication of the blueberry. Given the fact that most information was disseminated by the family, White was a trusted source to those who worked for the family business. Large numbers of locals found employment on the bogs and became a venue for social action. White played an important role in disseminating information about the program, as well as playing a role in collecting superior species to be used in the experiments.

Early in 1911 I wrote a letter to the head of the Bureau of Plant Industry, offering the use of our natural blueberry lands, a small amount of money to finance the experiment, and my assistance. My early offer of a little money to carry the expenses of the blueberry experiments was never accepted. But after Dr. Coville became acquainted with the facilities we had to offer, a formal contract was made between United States Department of Agriculture and the firm of J. J. White, to test the very seedlings. By this contract we were to receive \$50 per acre, per year, for four years, for each lot of seedlings that we tested. We were to provide all necessary care, and have all fruit produced except such samples as were needed in Washington. At the end of the four years, for each lot of seedlings, the plants were ours; but we had no right to sell or give away any portion of them without permission from Washington (White, 1947a, p. 19).

Thus began the close relationship between the USDA and Elizabeth White. Early in their cooperation it became clear that they needed additional parent material for the trials. Coville had found two superior specimens in New Hampshire, one a lowbush (Russell) and one a highbush (Brooks). They became the backbone of the genetic material that was used to propagate the seedlings. Together, White and Coville concluded that the expansion of the genetic stock was paramount to the success of the trials and Elizabeth was the person on the ground who would be best for this task. Elizabeth knew that the people who worked on her family bogs could be

recruited to help because they knew first hand where the best highbush blueberries were to be found. People who worked the bogs would most likely be wild huckleberry pickers. Newspapers, interviews and the local popular press all underscore the financial remuneration to the locals who picked wild berries. These were skillful people, and a small stipend of \$1.00 for identifying superior bushes found in the forest enlisted their support. They succeeded in finding a superior collection of specimens for Coville to use in his breeding program.

Elizabeth was an energetic and eager facilitator and was the manager of the project. She did not attend college, but was educated through high school. In some ways she was a radical feminist, the first of a larger group of woman who chose not to marry and instead worked and built a career. Yet, she was also a member of a social class often referred to as the Quaker-Episcopal elite, and reflected the culture and values of that group. She reflects the thinking of the period in certain remarks made in the *Training School Bulletin* (White, 1917a). The Training School was an educational facility for intellectually challenged people, which became Ancora, a hospital for the mentally ill. Her remarks illustrate the Protestant work ethic, stereotypical for this group and elevated into a religious calling. White professes:

I think that nowadays God is making many revelations of his truth to the scientific workers and through practical workers too, who are fitting the bits of truth discovered by the scientists into the everyday scheme of life. It's somewhat like working out an elaborate picture puzzle. The whole is perfectly planned, but there are only disconnected parts of it that mankind has been an able to piece together so as here and there to get an imperfect idea of the design. The scientists are searching for the missing pieces, and with the practical workers are trying to fit them into the parts that already seemed finished. Sometimes new bits will be discovered which obviously requires the rearrangement of quite a section which had seemed properly fitted together, and when the rearrangement is accomplished it is seen that very considerable progress has been made in working out the picture.

Every business and vocation has its place in this great puzzle picture. Members of my family are working on the cranberry section and very important bits are discovered from time to time by scientists in the Department of Agriculture who are working at the same part.

The last few years my attention has been especially drawn by the little corner of the puzzle where the blueberry fit in. No one had paid any attention to this corner till a scientist at Washington about 10 years ago began to hunt for bits that belong there. He found a number of pieces that fit together so nicely that he felt sure the group was a part of the great picture and published a bulletin about them (White, 1917a, p. 59).

It is clear that she knew how to work with the local population to further the goals of the project. At the time of the experiments she knew intimately the people who worked for her on the bogs. She also knew that they were part of a larger woodland community that could be called upon in the experiments. The Whites personally knew the people who worked for them and could tap the social learning and woodlands education that was so necessary to the experiments.

“When father and I read the bulletin we believed that the group of blueberry bits would fit into the group of cranberry bits on which we had been working, and tried it there. So far it seems to fit perfectly. Then we saw that the piney had a piece that belonged along with the others. Their knowledge of the woods and swamps enables them to locate the exceptionally fine wild blueberry plants which bear berries of a size and quality surpassing anything we dreamed of six years ago. As the blueberry corner is more perfectly worked out I believe the pieces contributed by the “Pineys” will be found most essential to the perfection of the whole” (White, 1917a, p. 62).

It is clear in her account that for White, business and vocation were part of God’s grand plan. Not only was God’s work occurring in his wilderness, but together, scientists, practical workers and even the “Pineys” were taming God’s forest for human purpose. Of course one cannot help but see connections between finding the creator in the taming of wilderness. With the guidance of Elizabeth White and the help of the government, the “piney’s” would be ushered into the Promised Land. Of course, the Promised Land was a land based on efficiency and the market economy, thanks in part to the new movement within the federal government that brought

efficiency and profit to all. No longer would the piney need to wander the wilderness to find manna falling from heaven. He would be able to finally use the plow to tame the wilderness for his purposes. The Protestant work ethic abounds in this account, which melds vocation and avocation into one religious purpose in which the community is engaged.

White, also a member of this cultural group, promoted stability and legitimacy in the breeding program. Using her prior experience of cranberry culture and her work with local people, she solidified her role as project manager. By using the social learning of her employees, she established a business relationship with her workers. The social learning was important to the success of the program and ultimately local wealth was increased, which helped the large cranberry growers and brought a number of the working class into the business.

People were accustomed to working with White and her family. The family was locally prominent. It may also be that her gender, in a rural agricultural setting where women were known to assume male roles when males were unavailable, may have lessened the possible reluctance to working for a woman in a prominent position. In essence, she was known in the community and was a perfect buffer between the formal and bureaucratic professionalism of the civil servant. This is no doubt why the legend of Elizabeth White lives, while the life work of Coville is often lost or forgotten. Both she and the woodsman knew the cultures and traditions first hand and were well acquainted with investments associated with resources of the Pines. She offers an insight into the traditional knowledge of the local resident who was not formally taught, but was nonetheless an expert. Cultural practices associated with resource extraction were generations old, handed down by the family and community. White's remarks published in the blueberry plant catalogue in 1918, spoke about the importance of the local gatherers. The mere

mention of this group of people attests to the respect she had for their skills and knowledge, even though she was from a different class and a different educational background.

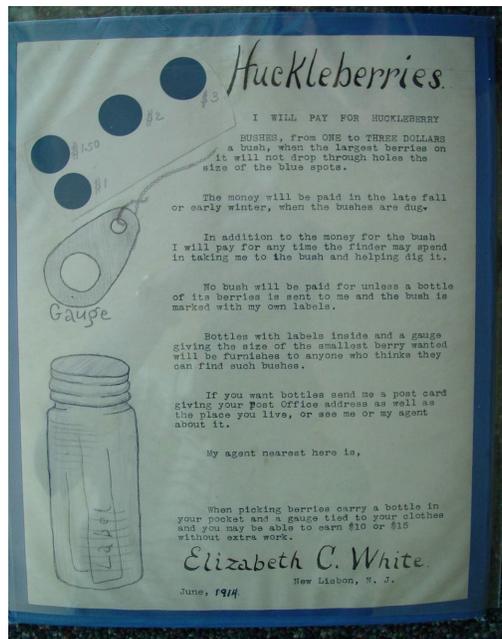


Figure 4-27. Directions for tagging bushes to be used in the experiments. Source: Marie Coville Ortner Family Archives.

She typed directions for the proper marking and handling of the blueberry specimens which she posted in the communities throughout the pinelands. She apparently found that they were not a successful method of disseminating project information. She addressed this problem in the blueberry catalogue published by White & White (1918) when she writes,

the typed directions that I furnished were of little use except as an aid in formulating my own ideas, but this was because of the readers' lack of training in that direction rather than lack of native intelligence. When they get into the woods and swamps, I am the one who reads hauntingly, and an imperfect understanding, and must rely implicitly on my piney guy. I have never ceased to wonder how they do it. We will leave some little traveled woodland road for a less traveled path; and we will leave that behind and take me around some thicket where all the bushes look alike to me; then my guide will say, 'that their Bush was right around here, that's the tree I broke; -- there it is now', and they will show my little labels, some of them carefully covered up at the base of the stem so that no one may find and move them (White & White, 1918, p. 7)

The hunt for the superior blueberries was announced by word of mouth. It was so successful that in one full season over 60 bushes were tagged and brought into the experiments at Whitesbog. Elizabeth, speaking through the training school Bulletin to an urban audience, gives us a glimpse of the community at that time. "In the thinly settled pine country people know very intimately the doings of all their neighbors, 1, 2 or 5 miles away; much more intimately than you know the doings of most of your neighbors only a block away" (White, 1917a, p. 59).

White, a longtime resident of the region, was familiar with the traditional occupation of wild berry picking and many of these seasonal workers would work the bogs during cranberry picking season. She was also aware that other large cranberry farmers had similar connections with local people who lived around their bogs, picked wild blueberries, and worked for them during the season. In effect, the watersheds of this section of the Pines would be today referred to as a "cultural landscape," that is, a community tightly bonded through work, family and sense of place. This aspect of the domestication project must not be underestimated, for it was this communication network within the community that was the key to finding and collecting the wild species used in the experiments. Blueberry pickers were known to walk miles in the woods each day. That would translate to visiting thousands of plants in the course of a day while picking the wild fruit that they in sold in Philadelphia and New York. White realized that it was possible to design a method for pickers to easily identify superior bushes in the field, which could later be transplanted to Whitesbog and used in the trials. The dollar, equivalent to a day's pay, was the incentive to become involved.

According to White, in 1912 three bushes were selected, followed by an additional 20 plants in 1913 (White & White, 1918). They were then moved to the bogs. By 1913, the field methods for locating and removing the plants from the wild were systematized, but due to an

early, severe frost, wild crops were destroyed. The following summer of 1914, 60 plants were identified and moved (White, 1919). Altogether, approximately 100 superior wild specimens were collected under White's direction. From these stocks, Coville would use his scientific methods to improve the supply. White included in the article detailed notes on planting, propagating and cultivating the blueberries during the trials. She also identified other management practices, such as irrigation methods, and identified insects that threatened the selected bushes. She learned her job so well she became an expert in the process. She was able to select several superior bushes from wild stock that could be sold and begin early cultivation. White always remained aware of the key role of the pickers. In an early plant catalogue, she pays them a fitting tribute.

Clearly, three factors were essential to the successful cultivation of the wild blueberry. The winning trio consisted of the USDA scientist Fredrick Coville, cranberry plantation manager Elizabeth White, and the local woodsmen who worked the wild blueberry patches in the pine woods. This was a good use of talent.

Although the above statement regarding the "three essential factors" may seem striking in its simplicity, it must be remembered that government agencies were in many ways a new concept. The land grant system was not yet a generation old and agricultural reform was still in its infancy. The department was in its infancy and was just beginning to expand its programs and services at this time. Being able to acquire land and staff outside of the capital area was outside the fiscal reach of the department. To successfully domesticate the blueberry, all three factors came together and were interdependent. As a result, White began to sell the improved stock to local people interested in blueberry cultivation. They, in turn, began to plant their own fields and as a result the industry was launched.

Piney's of Retreat

One hundred bushes that met White's requirements were identified by eight local woodsmen and women and transferred to Whitesbog. Florence Beebe found her bush on the fringe of one of Theodore Budd's cranberry bogs. She was born in 1897. Her mother was a Bozarth, a large local family descended from Huguenots, and her father was a Beebe, whose family migrated into New Jersey from New York State. Her grandmother Beulah Shin, who married her grandfather, George Washington Bozarth, was descended from Quakers. The family has been living in Burlington County for over 300 years.



Figure 4-28. Florence Beebe in front of a typical pinelands house. Source: Hellen Zelly family archives.

Florence Beebe was taught to pick berries by her mother and she began picking at a very early age. She was 17 years old when she found and tagged a bush used in the trials. Florence, known locally as Florie, was the youngest of four children in her family. The family lost their father in an accident, so her contribution to the family income was very important. All of her brothers and sisters picked blueberries during the season. She attended school to the eighth grade and later in life, after marrying, she entered the blueberry business. With her four sons, she managed a 20-acre blueberry patch. She and her family became the 23rd member to join the

cooperative. She had been taught gardening by her mother, and she remained an avid gardener until her death in 1989. She reported that she had at one time or another gathered pine cones and moss for sale. She worked on Budd's Bog planting cranberries and turfing bogs. It was only a few short years before she was involved in the new blueberry industry. Mitchell Thompson, her husband, was elected to membership in the co-op in 1934 and was assigned the number 23. Here, a small scale farmer was involved with the new specialty crop just 18 years after the first shipment of berries were sent off and sold to the Hudson Day Line, a luxury paddle boat that ferried people on the Hudson. Mitchell Thompson also supplemented the family income by running a saw mill. He made cedar shingles, cedar fence poles, shipping crates and pine paneling. Businesses such as Thompson's sawmill relied on indigenous materials and cultural customs learned through parents. As a result, the family began to make a regular continuous salary, based on investments associated with natural resources that were linked to social learning by the family.

Joseph Clevenger also tagged a bush on Budd's Bog and he, too, had been picking berries with his family from his earliest years. He was 35 years old when he tagged the bush. He later went into the blueberry business and his grandson Daniel Clevenger became a major source for blueberry propagation. He and his family, along with his brother and wife, would cut the whips, i.e., young vigorous branches and place them in peat moss per the instructions that Coville laid out in his second blueberry publication, *Direction for Blueberry Culture* (Coville, 1915). Danny Clevenger's mother was a Beebe and a nephew to Florence Beebe. Florie Beebe Thompson got her whips from her brother who was the foreman at Budd's Bog and was in charge of producing the necessary stock for planting their blueberry fields.

John J. Wells was another local who was active in the wild industry and later became a small-scale grower as well. In 1937 he was supporting his family on three acres of blueberries (Interview, BEM1). He knew blueberries and cranberries well. He and his children would pick wild berries and take them to the train station in Vincentown. His grandfather had bought the old cotton mill and furnace and began cultivating cranberries. The site proved to be too close to the Rancocas Creek, which ran through the property, often flooding the bogs in the spring and doing considerable damage to the vines. He was never able to regulate the water, so he abandoned the cranberry industry. The land changed hands and was later developed. John A. Wells planted roughly three acres, and his name is first mentioned in the 1937 minutes of the Tru-Blue Cooperative (Interview GSW1, 2008). Wells was one of many growers who invested in the new industry, which began to usher a whole new class of people into the middle class.

In 1937, he was paying four cents a pint to have this crop picked. One local informant who worked on his patch said he would pick for a nine-hour day and was able to pick 120 pints and clear \$4.80, which was very good money for a thirteen year old boy. In this case, the informant was helping his family by bringing in money. They had lost their father and needed every cent to help their mother make ends meet (Interview BEM, 2009). The blueberry quickly became a source of income, especially for school-aged children who often worked alongside their mother generating income for their family. This generated local wealth, which at that time was spent locally. The Wells example is again just one of the hundred or so examples of how the industry moved from the large to the small grower within a few years.

Vincentown and Pemberton, the two closest villages, had a number of commercial businesses that benefited from the profits made in the blueberry industry. Blueberry and cranberry season saw an influx of people coming into the Pines to pick the crops. These people

would then often stop at a local store before going home. Therefore, berries became a major generator of wealth.



Figure 4-29. Wells family. Source: Hagerthy family personal archives.

Daniel Thompson lived in Retreat and was a local character who was often chronicled in the gossip column of the *Mt Holly Herald*. He was known for frequently changing jobs, often lacking cash to support himself. There is not much known about Daniel Thompson, but there is more information available for his uncle, Daniel Thompson, another veteran blueberry picker who lived at Johnson Place, a settlement four miles from Retreat. The original blueberry baskets for both Daniel and his wife, Mary Clevenger Thompson, remain in the family. It is safe to assume the tradition of working in the woods was transmitted to Daniel Thompson through the family process of socialization. He learned how to use the resources of the woods to forge a living. The family and community were venues for social learning, and the wood was the tangible setting for the cultural transmission of the woodland culture. This Elizabeth knew, and the project relied on this woodlands culture and built upon the trust between her and the locals. This network was based on personal connections between employer and employee and between

families and neighbors, all of whom were able to spread the word of the new industry with its promising possibilities for the generation of wealth.

There were a number of trusted social networks and institutions used for recruiting people to join in the blueberry project. One major “institution” was the Cranberry Growers Association and the cranberry plantation. Cranberry plantations, by the time of the USDA trials, were a solid economic engine that supported the business health of the community and a venue for social interaction. They were also businesses that employed a number of full-time positions, as well as many part-time employees. The cranberry plantation also performed another role. Because it employed a large numbers of locals, this became a venue for pinelands community interaction. People from Retreat, as well as several other villages or settlements in the pines were employed at the bog. Here people learned about the doings in nearby communities, and before the telephone, this was how word traveled through the pinelands. There are also a number of stories about people meeting their spouses on the bogs. Working together allowed one to get to know an individual and forge relationships. What was learned on the bogs was taken to the individual’s neighborhood. This became an effective means for communication.

The cranberry growers were the primary force behind creating new markets for the cultivated blueberry. They were the first to invest in the new industry. This added to their wealth and it also evened out the labor force. They were able to hire more full time employees. First the employees propagated, planted and farmed the new crop of blueberries. They put out more and more fields while they waited the three years to harvest the first crop. In the spring, weed management was necessary. Given that blueberries do not have root hairs, they are not efficient in nutrient and water uptake. Hand-hoeing keeps weeds from competing for available nutrients and water. During late June, the berries would ripen and the picking would begin. This process

required field bosses, packing house help, and people to transport the berries to market. At the end of blueberry season, cranberry season began. The plantation had to be made ready for the onslaught of pickers who would set up camp on-site and pick the crop. Full-time people maintained the bogs.

At the end of cranberry season, it was time to begin pruning the blueberry plants. By adding an additional crop to the cranberry plantation, not only did the grower have a stable work force, he began to have highly skilled people who knew the industry from top to bottom. Another important skill learned on the bog was knowledge of the horticultural requirements of the blueberry. Employees learned proper planting procedures. They also learned how to propagate and prune the bushes. This added to the skill they already possessed, picking. As the new industry developed at the hands of large-scale cranberry growers, local people, many of whom owned their properties, began to clear “patches” in the woods that bordered their houses. Land that was all but worthless began to increase in value, creating local wealth within the pinelands communities. They would plant newly propagated materials on these patches.

Local lore has it that many of the materials were taken or given to them by the cranberry growers. According to one informant, canes were cut from the bushes from Budd’s Bog in the dead of winter and were placed in the requisite propagating medium as described by Coville (1910) in *Directions for Blueberry Culture*. Many of the local people would have learned the procedure at the bogs during the early period of blueberry investment. With this skill base, they could work on other cranberry or blueberry farms, or perhaps go into the new blueberry business. It became clear after the first shipment that the large cranberry growers would have to begin to direct their attention to marketing. The Cranberry Growers Association was the first in the area to be formally recruited for the new industry. Coville addressed them at their annual gathering in

New Brunswick, NJ on Saturday, January 23, 1915. Coville gave an illustrated lecture on blueberry cultivation. He began the address by stating “After eight years of experimentation the culture of the blueberry is now about to take its place among the established agricultural industries” (American Cranberry Growers, 1915, p. 5.). He continued by stressing that they, the cranberry growers, were in a unique situation to take up this new industry. They had the required soils on lands that were unproductive presently, access to the urban markets, a geographic location that would provide an early market that would not compete with the New England crop, a superior wild stock that could be propagated and planted, and harvesting equipment that lay idle at the time of the blueberry harvest.

It appears that many of the growers took his advice and began to invest in the new industry. The organizing meeting for the establishment of the Blueberry Growers Association was started in 1929 by seven cranberry growers who would soon have a large crop to market. They constructed bylaws and began to elect members into the cooperative. By the annual meeting of 1934, there were 54 members duly elected.

In 1928 the first major crop marketed by the Association was sold for \$42,575.49. This was produced by 19 members. By 1934 the membership had risen to 54 and blueberry sales had more than tripled. The crop was sold for \$144,838.60, this in just six years (Tru-blu, 1929).

It did not take long for the cultivated blueberry to begin to transform the landscape. Although the large cranberry farms were the first to enter the industry, by 1930 small farmers were being elected and by 1937 much of the membership consisted of small growers. However even collectively they did not out-produce the large growers. Yet the cooperative bylaws mandated that each grower had one vote, leading to active campaigning for one of the five

directors' seat. A few years later the number of directors' seats was increased to seven which appears to have balanced the number of large growers to that of the small growers.

The project quickly began to take on a life of its own. By the 1940's, the cultivated blueberry began to be of interest to growers in other states. Shortly after the coop began national sales, there were major crops developed in North Carolina and Michigan. Tru-Blue, which became the Association's brand, could be found in many of the nation's urban centers. The cooperative took an active role in marketing the brand and advertising the qualities of the cultivated crop. This was done by the members who were charged a percentage of their gross sales for advertising and marketing. The coop consulted advertising firms in Philadelphia which began the task of making the brand, Tru-blue, a household name. Yet several questions remain. What made this an agricultural success? Why was it so successful in recruiting small landowners into the industry? What were the drivers of landscape change?

Table 4-6. Utilization of New Jersey blueberries 1950-1956 Fresh Sales. Source: Doehlert (1956c)

Year	Total Production Thousand trays	Quantity Sold thousand trays	Average Price dollar per tray
1950	775	555	\$2.85
1951	990	680	\$2.75
1952	964	934	\$2.95
1953	1288	888	\$3.15
1954	1600	1000	\$3.02
1955	1638	1148	\$2.95
1956	1170	850	\$3.45

My model purports that there are linkages between economic health, cooperation and local resources. I found that the blueberry pickers were socialized into a woodlands culture and knew how to use local resources to earn a living. This underscores the importance of the family and social learning. The cranberry bogs are even today a prominent feature contributing to the character of the countryside. The bog is also a venue for social learning. Local workers on the

bog were taught how to propagate and plant cranberries and blueberries. Cooperation, social learning and use of local knowledge were critical in building the new blueberry industry.

First, there was a trusted organization, the Department of Agriculture. It was a solid bureaucracy and, as an organization, its employees were determined to solve human problems. At this time, the USDA did not shy away from working with indigenous or rural people who were not well-educated in the formal sense. They understood that cultural traditions and learning can be used to solve a problem. Mutual respect and trust built upon one success after another.

The government was also not averse to selecting one person to receive the benefits of their initial findings. This allowed them to immediately work in the community and with the community, which in turn offered an incentive to those willing to take a risk. As a result, the Whites were in on the ground floor and early profits. They made large sums on crop production and plant sales during the initial intervention, and an additional benefit derived to the community. Employees of the Whites learned firsthand how to propagate and grow blueberries. This was akin to a paid internship and mentoring program. The workers went back to their homes and neighborhoods and spread the word of the success of the new industry. They built a new set of skills that could lead to the generation of more wealth. This was a very effective means to transmit the science and horticultural requirements of blueberry production to community members who were at the time not the best readers. They learned and observed firsthand how to grow the crop and this added to their knowledge, which included harvesting skills learned from their experiences with the wild blueberry, still an active industry in the early days of domestication. This built upon a skill base that could effectively lead to opportunities for generating wealth or opportunities for the creation of new jobs.

White also acted as a “translator” and a go-between. She knew the culture first hand, mainly because she was a part of it, and she was familiar with the number of small towns and settlements in the region. She used existing cranberry equipment to haul the berries back to Whitesbog. During her travels, she worked with the locals who had tagged a bush in order to find the superior specimens. In this way she came in contact with a number of local berry pickers, which one would assume led to extended conversation. There was time to talk and to transmit information and no doubt both parties learned and benefited. This also relieved Coville of these tasks so he could continue his work in Washington. I do not believe he would have been the most appropriate person to work with the locals. Each time he visited Whitesbog and worked in the field taking measurements or performing experiments, he wore a tie. This was typical of scientists of his period; however, his could easily have intimidated a worker who was not accustomed to this formality. He also may not have had the patience to work with the minutiae associated with the project. This he left to White, who grew in experience and became an excellent day-to-day project manager.

The dissemination of information was handled in an informal way. By working in the community and hiring people to be a part of the project, communication spread informally to all the small villages within the pines. Active, engaged and socially adapted to the woods, the community became the underpinning of the project. In New England, wild blueberry gatherers often had to often pay stumpage fees to the landowner before entering their property for berry gathering. This reduced the number of people on a site and also formed a different relationship between the landowner and the blueberry picker. It seems reasonable to assume that White was able to argue in favor of having Coville pick the pinelands for his trials. Coville, an economic botanist, would have known the benefits of using local knowledge and traditions. Building upon

local knowledge and involving the community in meaningful ways was the foundation of the success for the efficient implementation of the project. Coville implemented this methodology in all of his previous work, most obviously in his work with Native Americans. Today the Smithsonian has a rare collection of baskets he bought from Native Americans. This attests to his economic and botanical roots. He was interested in how they used grasses and rushes in their work and he collected as many different variations as he could.

As mentioned earlier, the cranberry grower provided “paid training” for all of the workers. Because this was a new industry that could use infertile soils, the local person had an opportunity to participate in the new industry. Not much capital was necessary. What was needed was labor to clear the fields and plant the blueberries. The work ethic was a crucial social characteristic that led to many a success story. The locals also learned how to grow cranberries. They had experience with turfing and building bogs that could be applied to blueberry cultivation. This prior experience proved useful, if not critical, to their success. They had experiences in propagation and planting the bogs. They just did not have the capital to go into the cranberry business, but at the time of the introduction of the blueberry, cranberry growing had become a capital intensive business and was not available to those of meager means.

The majority of the local residents in the pines owned their own house or cabin, often with surrounding lands. The blueberry immediately made this land more valuable and useful. The capital expenditure was greatly reduced, and getting into blueberries relied more on the labor of the family in many cases. This generated new wealth as people either cleared the land for the new industry or sold it to someone wishing to enter the business. Together with the learned experiences on the cranberry bog, small scale farmers knew firsthand what to expect, and their self-sufficiency was high. As a result, many wild gatherers went into the business. Over a period

of several years, they witnessed the industry growing and in many instances were part of the labor force that made it grow.

Coville was clear from the beginning that the crop only grows best when planted in acid soils. The newly inducted small farmer did not have to worry about soil conditions. The plant they were cultivating was directly related to specimens that were collected only a short distance from their fields. They had the knowledge needed to be successful. Many of these local families began to make profits that could support their families. The nature of the work allowed for their children to go to school. During the important harvest, children were off school. Pruning, planting and weeding could wait. Children could work after school and on the weekends and still get the work completed. These families no longer continued with the other types of wild gathering, so the children could not only go to school, but there was money to ensure that they would have the appropriate school attire.

Families who did not have access to land to farm the new crop could still come and pick at harvest time. Coville was cognizant of the fact that the size of the blueberry was directly related to the labor required to pick the berry. With the hybridized berries, pickers could make good money during the early years of the specialty crop. Many people living in the pines today remember when they picked blueberries and used the money for school clothes and supplies and were able to go on class trips, just like the students in the larger towns circling the pines.

What is apparent in this study are two fundamental facts that led to the success of this government intervention. First, the material wealth of the community was meager as compared with the material wealth today. Blueberry money could go a lot further and support a variety of family needs. This incentive was a major attraction of small landowners to the industry. In

blueberries, family income was directly proportional to the labor they could invest, and the more labor put into it, the more potential for reaping benefits.

The second fact is the voracious work ethic of these industry pioneers. They were accustomed to working long hours in a day. The work day was traditionally nine or ten hours, not counting the time it took to walk from home to work. Given the low wages of the time for the common laborer, about \$1.00 a day, this opportunity to get out of low-wage labor that would not lead to savings or advancement, was significant. By being their own boss and using the market strategies of the co-op, pickers had the potential to join the middle class. Not only were they working for themselves, they also saved the time needed to walk from home to work.

All this occurred in a traditional, self-contained community. People were socialized to help their neighbors. They were socialized to value the community. All aspects of life occurred within your neighbor's scope of vision, leading to a shared feeling of place. This was your safety net, and it was respected and valued, and bolstered your sense of trust. You knew who in the community might be a good partner in your new business venture, leading to an increased sense of self efficacy. Coville was right when he stated in his address to the Massachusetts Horticultural Society in 1916 that,

The introduction of the blueberry into regular agriculture has a much more profound significance than the mere addition of one more agricultural industry to those already in existence. Blueberries thrive best in soils so acid as to be considered worthless for ordinary agricultural purposes. Blueberry culture, therefore, not only promises to add to the general welfare through the utilization of the land almost valueless otherwise, but it offers a profitable industry to individuals land-owners in districts in which general agricultural conditions are especially hard and unpromising, and it suggest the possibility of the further utilization of such lands by means of other crops adapted to acid conditions (Vrooman, 1916, p. 106).

The blueberry fields at Retreat

The first blueberry fields in Retreat were planted by the Budds. They propagated their own stock and used the locals who worked on their bogs to plant the new fields. A few years later, small landowners began to clear and plant blueberry fields. They were planted on the margins of the cranberry bogs where the water could not be properly managed for state-of-the-art cranberry cultivation. Slowly small landowners began to set out their plants. Some required extensive vegetation removal, and other areas were already open fields. Together with family labor, many small farmers joined the new industry (Bowman, 1941). One informant reported that you could not find a new whip on the newly planted blueberry fields at Budd's Bog. It seems new whips were cut from the bushes and used to propagate stock. According to this account, people had learned firsthand on the bog and began to replicate this process on their own properties. Soon the landscape was transformed into a larger agricultural landscape as new blueberry fields began to appear on the landscape. This transformed the economic landscape of Retreat (Figures 4-30, 4-31).

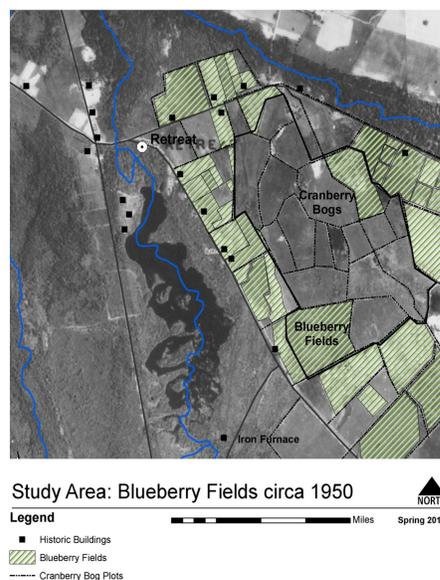
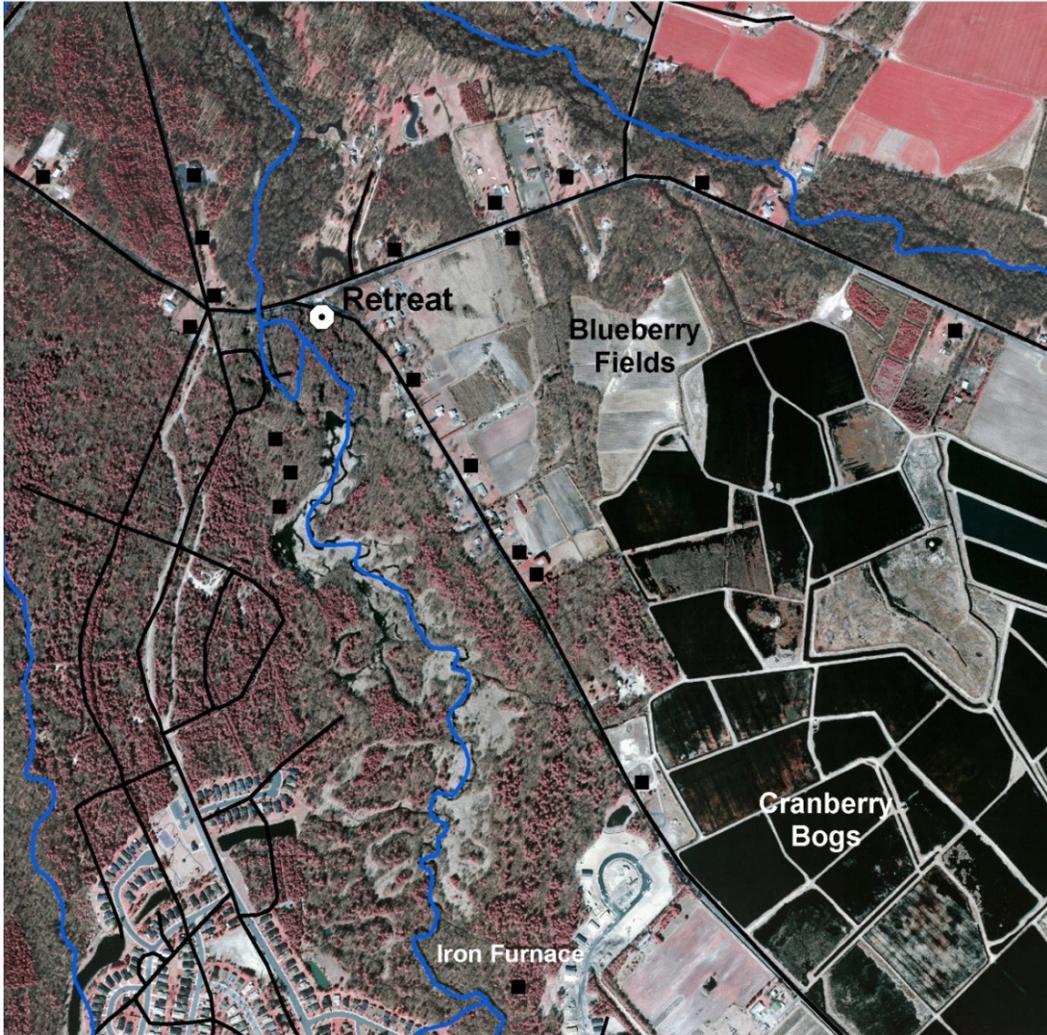


Figure 4-30. Study Area: Blueberry Fields circa 1950



Study Area: Existing Cranberry and Blueberry Fields  NORTH

Legend

■ Historic Buildings

 Miles

Spring 2010

Figure 4-31. Study Area: Existing Cranberry and Blueberry Fields 2009

Thematic Analysis

After review of the evidence, I concluded that the introduction of the blueberry as a cultivated crop in the Pinelands provided a case appropriate for study of the drivers of landscape

change. Based on pre-dissertation research, I hypothesized that the outcome – landscape transformation – respected the landscape and fostered and supported community development. The focus of the research was centered on the long-term evolution of the landscape and the causal linkages in a theoretical model in order to isolate the variables that led or drove sustainable landscape change. The case was examined for several reasons. First, the earlier landscape transformations of the Pine Barrens fit well into the theoretic prospective of Matthews & Selman (2006). Their model has been used successfully to study landscape transformation. It was hypothesized *a priori* that this new crop introduction was potentially an environmentally and socially compatible landscape transformation, and might offer insights into the drivers resulting in a sustainable landscape. Also, it was an example of a government intervention that had an important community development component. The analysis of the data illustrated the following points:

Built-Cultural Capital

Structures that give relative degree of character to parts of the countryside

1. Available low and moderate cost housing abandoned by the iron and cotton plantations and sold at auction was an incentive for people to stay in the area after the iron and glass industries failed.
2. Many of the houses that were present during the time of the early industries are occupied today.
3. Housing were made of local materials and with local labor using old vernacular housing types based on English precedents, which were energy efficient and could be built at little monetary cost.
4. The settlement pattern was based on the early iron industry which was a feudal system using millponds as the source of power. The mill pond flooded the low lying areas, thus necessitating the roads and structures to respond to the remaining higher land and environmental constraints of the site.
5. The roads were built in relationship to the industrial activity as they related to regional and international markets.

6. Subsistence agriculture allowed for flexibility in the pursuit of additional income-generating possibilities.
7. The hydrologic cycle could easily be manipulated with local labor and available technology, creating additional cultivatable land and a visible manifestation on the landscape.

Land use that give relative degree of character to parts of the countryside

1. The area of agricultural production was fashioned out of worthless land by manipulation of the hydraulic cycle.
2. Communities were connected by narrow woodland roads that were either logging or early transportation routes through the woods.
3. Previous industrial activities formed the bases for the settlement pattern.
4. New landforms developed based on new economic activities, which were visible, and they began to transform the earlier industrial site into a new landform.
5. The fall of industrial activity with its release on the adjacent natural resources resulted in a landscape transformation.
6. The reorganization phase began with the release of the woods from the constant disturbance of industrial activities.
7. New landforms were designed within the constraints of the natural resource base stabilizing the natural system.
8. Manipulation of the understory by local residents kept the understory in early successional vegetation which had economic value.
9. Previous industrial activity had profound impacts on the natural system, which was a visible characteristic of the country side.

Human Social Capital

Networks that underlie trust

1. People and communities were connected to each other through relationships developed at work.
2. Neighbors were often related.
3. Communities had a shared sense of identity.
4. People in the region had a shared sense of identity.
5. People knew intimately the daily activities of their neighbors.

6. “Neighborhoods” were often formed by distances that could be walked in one day’s time.
7. Families had an important role in shaping the economic opportunities of their children.
8. The large employers played an import role in the local economics, and they were also viewed as part of the local community, even though the workers were not living on company property.
9. Subsistence agriculture and wild gathering gave the worker a degree of economic independence.
10. Families were an economic unit, and all members participated in the family’s economic pursuits.

Level of education

1. The life skills needed to survive in this community were transmitted by the family.
2. The large-scale employers offered job opportunities that also taught marketable and transferable skills
3. The value of labor as an extension of pride was taught in the family and was reinforced in the community.
4. If people went to school, they most often only attended through the 5th grade.
5. Between WWI and WWII the state began to systematize education, resulting in regional schools replacing the one-room school house.
6. Church school was an important instrument in literacy.

Economic Capital

Opportunities for the generation of wealth

1. Investment in incoming-generating opportunities for small land owners required little monetary investment, but relied heavily on an investment of labor.
2. Families were economic engines that were accustomed to generating wealth.
3. Large landowners were always looking for a way to increase profits.
4. The railroad opened up the area to outside markets and prompted economic development.
5. Market economies and urban growth stimulated agricultural business.
6. Large agricultural employers were in a favored position to take a lead in the growth of industrial agriculture.

7. The US government was an important resource for economic expansion of agriculture, and provided technical assistance to the large and small farmers.
8. Through efficiency and organization, agricultural systems began to change from subsistence pursuits into industrial agriculture.
9. Specialty crops demanded higher prices than conventional crops.
10. The stabilization of labor and the efficient use of equipment and under-utilized lands led to efficient and profitable industrial activities.

Opportunities for the generation of jobs

1. New industries required more labor, resulting in the generation of jobs.
2. The new industry required a new skill base and was a venue to teach these new skills, which were transferable.
3. Jobs that paid good wages attracted people to the industry.

Investments that is associated at least partly with natural and cultural characteristics

1. The US government played an important role in the expansion of an industry by intervening in agriculture.
2. Cooperative work can be very productive if the right circumstances are present.
3. Government technology together with local support and local buy-in are necessary for successful interventions.

Emerging themes

1. Changing expectation of what constitutes a meaningful job changed over a period of time.
2. Inflation and increased expectations for material things have increased over time.
3. In 1900 very young children were considered an appropriate source of labor.
4. This was a transition phase from the use of animal power into the era of machine power based on fossil fuels.
5. The USDA was a trusted government agency.
6. Leadership played an important role in the blueberry program.
7. Sense of place played a role in people staying in the area.
8. Fossil fuels were initially not a significant factor in this industrial pursuit.

9. Modernization affects human expectations and change behaviors.
10. The Protestant work ethic was a significant behavioral force in the Pine Barrens community.
11. Threats of an agricultural collapse increased the willingness to risk and try new economic pursuits.
12. In 1900 agricultural jobs could compete financially with other non-agricultural jobs.
13. The WWII surplus might have been an economic factor in the development of new economic pursuits.
14. Social networks were an organizing force in the community.
15. Cranberry bogs owners became leaders in the introduction of the crop.
16. Cyclical jobs may have produced an environment that increased a person's ability to take economic risks.

Research Question

What Interactions Among Ecological/natural, Human/social, Built/cultural and Natural Capitals Explain the Adoption of the Blueberry into Agriculture in the Retreat Area of New Jersey Between 1800-1950?

Availability of Cheap Land with Suitable Soils.

The availability of cheap or underutilized land with the appropriate soils to grow blueberries was of fundamental importance to the successful adoption of the crop into commercial agriculture. Both cranberry growers and small landowners did not have to invest large sums of money to obtain the necessary land for cultivation. In most instances, the land was already owned and was unproductive.

The primary resource needed for farming of any kind is land with suitable soils for the crops that are to be grown. Coville was well aware of the importance of inexpensive land (Coville, 1911). He specifically noted in his first bulletin that the land on which blueberries best grew was presently virtually worthless land. Large and small landowners in and around Retreat

owned these worthless lands, and with the help of the government and the availability of new blueberry horticultural stock, an enterprising individual could go into the new business with little capital expense incurred.

Social Networks Were Compatible and Important in the Success of the Project.

The social networks in the pinelands centered on the home, church, community and work. An important network formed on the cranberry bog. The local bog was in many ways the center of community interaction. People walked from several villages encircling the cranberry bogs to find work. Friendships occurred, and this was often the site of social gatherings. For instance on Budd's Bogs people from Johnson Place, Sooy Place, Bozarthtown, Tabernacle and Retreat were all drawn together. Many people found their respective spouses on the bogs. The work community became an important component of the blueberry project.

Social networks were an important community asset in Retreat that was an important linkage to the success of the government program to launch a new industry. "In small rural settings, there are relatively few groups for people to join, and most of these memberships are strongly influenced by family. We tend to join the same groups as members of our families do. In these social settings, the family is the primary structure for social organization, and families tend not to move around much. So there are likely to be multiple generations present" (Allan, 2008). This was certainly the case for Retreat. A child in retreat attended the same church and school, and often followed in the same work as his parents or grandparents. Because of the inter-generational nature of rural communities, people in Retreat join groups because of organic motivations that are naturally or organically connected to the group. And most of these groups are based on family ties. This kind of community contains people who are very much alike. They will draw from the same basic group influences and culture, and the group will possess a compelling ability to sanction behavior and bring about conformity (Allan, 2008). The

overwhelming conformity that is culturally contrived by living and working within an intergenerational community cannot be overemphasized. This community structure would lead to the vast acceptance and cooperation by the local woods people to get involved with a government outsider and local cranberry grower. Once Elizabeth White took on the project, it took on legitimacy.

A Government Agency Contributed Sound Scientific Advice that Lessened the Risk of Failure.

Government resources were used to domesticate the wild blueberry. The resources included scientific knowledge, greenhouses, scientific equipment and paid staff, all focused on responding to agricultural problems. This investment of time and money was well above the reach of the people in the pines. Given the current distrust of government, one would believe that bureaucracy has been with us for thousands of years. Yet the USDA was a relatively new government organization whose mission was to rationalize and “routinize” the various workings within agriculture. Humans are social creatures who group for comfort and security, and have organized into different social formations which are not particularly efficient. One such social organization is the family, and the family was extremely important to the people of Retreat. They had been connected genetically for many generations and could have strengthened this bond by supporting each other through the various economic upheavals that impacted the pineland region. This would have been one of the first times that the people of Retreat came into contact with a government program, so again the role of Elizabeth White cannot be underestimated. White was the one who “routinized” the collection of the superior blueberry specimens and systematized the collection and retrieval of the stock back to Whitesbog.

Mentoring Relationships Were Established with Local Cranberry Growers.

The skill base of the people in Retreat was compatible with the requirements of the new industry. A strong work ethic was key to establishing new fields. People living in the pines were accustomed to long hours of work. Eight to ten hour shifts, not including the time to walk to and from work, were common.

Employees learned firsthand how to propagate and plant the crop. By default this resulted in on-the-job training that was paid. The cranberry bog by default became a blueberry training facility. Locals who were employed on the bogs were put to work clearing fields and propagating blueberry plants, based on plant breeding by the USDA. Then the plants were put in the field, weeded, pruned and maintained for three years before the first crop was harvested. During this early period, the blueberry plant science spread throughout the region, and soon people began planting small fields of their own. Whether a generous bog owner gave some cuttings to his employees or they pocketed a few each day, blueberry cultivation spread to small landowners, many of whom worked on the bogs at some point in their careers.

The literature abounds with examples of on-the-job training programs and how they can be bridges from unemployment and underemployment into a waging-paying job. The most successful programs are those which are paid and provide mentoring by experienced individuals (Zuberi, 2004). Moreover, we know that people are influenced by family, peers and the perceived ease with which they can accomplish a new task or endeavor (Ajzen & Fishbein, 1980). The cranberry grower, in this case Theodore Budd, taught his employees the different skills needed in order to plant a blueberry field. So in a short time people who were interested in the new business and perhaps already had needed blueberry land learned firsthand how to grow blueberries.

The program was compatible with cultural norms (Green & Haines, 2002). Incentives were offered to gain local knowledge and buy-in. Incentives were offered to engage local people in the collection of wild blueberry stock for the blueberry field trials. The \$1.00 stipend paid for each bush tagged, was the equivalent of a day's pay. This involved people in the program, and alerted the public to the new industry. Picking, sorting and selling blueberries was an important economic activity and ingrained in the culture. The local people were an obvious population to involve in the blueberry experiments. The people were also connected to the natural cycles of the pines, and had used the resources for subsistence for generations. This is an excellent example of building human capital (Green & Haines, 2002).

Sense of Place.

Sense of place was an important force at work keeping a significant number of people in the pines after the decline of the iron and glass industry. Historic interviews and scant documentation insinuate that people were reluctant to leave a place to which they were deeply attached. Sense of place played an important role in the study site and for the matter throughout the Pine Barrens. It was argued earlier that the population in the Pine Barrens was drawn there by the industries which offered jobs. What is not so clear is why people stayed after the industries declined. The woods became the foundation of the social world for the residents (Shamai & Ilatov, 2005). Throughout the narratives and historic literature the people of the pines were attached to the area. Romantic and emotional associations are found in the stories and folk songs collected well into the 20th century. The place became the loci of day-to-day social interactions. Through this process meaning became attached to social phenomena (Stedman, 1999).

The sense of place in the pines was socially constructed in the minds of the residents. The major aspects that together formed a sense of place were the unique woodland setting, the

material culture of cedar houses, bogs and woodland roads, together with shared meanings and values. The three components, setting, objects and definitions, and social setting together form sense of place (Marsden, et al., 2003).

Another important aspect of sense of place in Retreat is genealogical attachment (Gieryn, 2000). This connects the individual to the extended family, and in the case of Retreat, this is an associate family history. This forms rich family histories and stories which are passed down from one generation to another. People in the area married those from other local families, strengthening the attachment. One could hypothesize that this strong attachment to place and family would dissuade an individual to leave the area once the jobs of the iron and glass industries closed.

Some authors of sense of place argue that it is experiences more than environment that attaches one to place. Taun for example argues, “Spaces become places as they become imbued with meaning through lived experiences” (Taun 1977, p. 672). For him sense of place is exclusively socially constructed. Yet I would argue in the case of Retreat and the Pine Barrens in general that the physical environment is a prominent component of sense of place. Recent work by a renowned scholar on the subject of place, Richard Stedman (1999), argues that the physical environment has been undervalued in its contribution to creating sense of place. Sack (1997) agreed with his argument, and furthers the understanding by suggesting that culture links nature and social relationships, and through this process a sense of place is formed. Given the unique natural setting and social setting of the small crossroads of Retreat, this seems an ample explanation of the importance of sense of place in keeping many longtime residents in the area as the job opportunities went elsewhere.

Appropriate Leadership Was Found at all Levels of the Intervention. Governance, Bureaucracy and Leadership Were Legitimate and Accepted by the Community.

Coville, White and her fieldsmen were the leaders who implemented the program. Coville taught White how to be a good project manager and what he needed for his work. White organized local people to find the necessary stock through her field agents in Chatsworth and Pemberton. Most people worked with familiar faces or at least with people who were very much like themselves. For example, Coville could be somewhat intimidating. He was over six feet tall and never in the field without a tie. By using a field agent appointed by White, the local woodsmen worked with a person very much like themselves. Non-titular leadership networks were very important to the success of the project. Cranberry growers were local leaders who opened their lands to people to gather wild blueberries. They were also the leaders who started the new industry.

The USDA used what today would be considered an asset-based approach to policy. The asset-based model used by the government identified various stakeholders and brought them into the program. Identification of important stakeholders is often neglected in present day planning and leads to various problems. Another model often utilized is a needs-based approach, which does not take into account how to help people help themselves. The needs-based approach addresses material needs of the target group but neglects the more important aspect of helping people break the cycle of poverty (Arefi, 2004).

The asset-based approach targets groups that have two critical components: strong cohesion and interconnectedness. They are viewed as important aspects of social networks needed to make social change. Interconnectedness is the strength of the relationship between the government and the targeted population, while cohesion is how the targeted population as a whole sees the problem or project before them.

Top-down policies are often short-lived, and local communities are skeptical of such policies. Failed policies are often due in part to not connecting to the people you wish to serve. The USDA intervention was capacity-focused development before there was a term for this community development approach (Kretzmann & McKnight, 1992).

Women Played an Organizing Role in the Community.

Women throughout the pines played organizing roles in the community. Women organized church suppers, charity for the poor, and were often the only medical help to be found locally. In some ways, Elizabeth White was following in a similar tradition, and her role as organizer would not have seemed unusual or odd. In particular, Quaker women were skilled organizers and knew how to run a meeting. From the beginning of Quakerism, each Monthly Meeting or congregation performed its business as a group. This was and still is called Meeting for Business. Also from the beginning, but not currently, men and women ran separate business meetings for two important reasons. First the meeting was aware that women would defer to men in discussion making. Secondly, if a man was imprisoned for his religious beliefs, a woman would need to know how to run the business at the meeting and at the home. So from the earliest times through 1930, business meetings were held separately, and women learned how to organize and problem solve (Bacon, 1986). Also, throughout this country women have organized through Woman's clubs and community service organizations, and have often not been given acknowledgment of their accomplishments. Elizabeth White was no exception. She was a woman who knew how to organize, but what made her unusual was the sphere in which she chose to work. The press books of letters at the USDA are filled with letters from many farmers who had questions and inquiries. She was one of the few women to write, and the cooperative agreement she struck with the government was unprecedented.

A Ready Market Was Already Established for the Improved Blueberry Crop.

Blueberries were not new to people in the US and Europe. Blueberries were commercially available as early as the mid 1800s (Munson, 1899). Consumption of blueberries grew as the cities expanded. This was not an introduction of a new food into one's diet. The literature abounds with examples of wild gathering of blueberries and the importance of their economic value. There was little risk, therefore, that the cultivated blueberry would not have found a ready cash market.

CHAPTER 5 DISCUSSION

Introduction

Presently land planners, policy advocates and environmentalists know all too well that people have changed and sculpted the landscape from time out of mind. With each new technology the impacts quicken the speed of change, which in turn impact natural and social systems (Burgi et al., 2004). Given the environmental consequences of the ever-changing human footprint, it has become important if not critical to understand the human processes that drive landscape change.

Using social ecological systems theory (SES) as represented by an agent-based model, the social-ecological context of the environment can be identified and dissected in order to identify the individual components that together form landscape change (Ndubisi, 2002). This theoretical perspective was utilized in this dissertation and the findings prove its utility. Agent-based modeling is a relatively new analytical method of social science. The models were first designed as computer simulations to represent complex social systems and to accurately as possible denote the way the holistic system works in the environment. These models were designed to be precise. *A priori* the researcher was required to hypothesize how the social systems operated, in order to identify the variables that would be included in the exacting computer simulation.

In order to build upon framework of the ABM proposed by Selman and Matthews used in this research and sharply contrasting to the quantitative approach just mentioned, I implemented a qualitative-grounded theory case study approach (Figure 2-4). In this holistic approach unidentified variables can emerge during data collection and analysis and expand the model. In essence, by engaging in this process, I was able to build upon the model by adding one

new capital construct along with numerous variables and dimensions (Shoemaker et al., 2009). This work enhanced the description of the blueberry in New Jersey. As a result, a variable representing sense of place and governance was added to social/human capital and in essence strengthened the model's explanatory utility. In addition, I found that a construct for outside influences, which can exert important forces on individual human ecological systems, was absent from the model. This too was added to the model. However, before detailing these additions to the model and adding to theory, a detailed description of the model's exemplary explanatory rigor is in order.

Cultural Context

The Model as a Method to Construct a Cultural History

I used the Matthews/Selman model to construct a cultural landscape narrative. I demonstrated that data gathered scientifically can be used in historic research, which allows the researcher to document a cultural history by including the description of the people who lived on the land. This resulted in a social history. Consequently, history is often a neglected resource in landscape and policy planning (Marcucci, 2000). This model and approach has the ability to carefully answer why things change over time.

Holistic Snapshot of the Cultural Context

Perhaps, the most important aspect and use of the theory and model used in this research was its ability to expose the cultural context of a landscape descriptively. This was accomplished by placing an equal emphasis and importance on the inquiry of the social system as compared to the typical myopic emphasis on natural systems analysis (Wood & Handley, 2001). Social systems analysis is often neglected in environmental land-use planning and policy. Although this research can stand alone as an example of the use of a theory to answer a specific research question, it is difficult if not impossible to contemplate the potential applications of this research

to planning, design and policy. The big picture, social context, is often poorly studied and under-represented in government policies and land-use planning (Allan, 2008). Many project teams are not sufficiently staffed with social scientists or their equivalent, and therefore, there is an imbalance in research findings and an inaccurate representation of linkages between social and natural systems (Adhikari & Goldey, 2010). However, cultural background does matter and does influence behavior, and the neglect of social science in planning and design can lead to project failure or under performance (Aranzabal et al., 2008; Johann, 2007; Matthews & Selman, 2006). The use of the ABM presented in this research is a remedy to this acknowledged failure.

The cultural intricacy of a group or area under study offers clues to individual decision making processes (Olsson et al., 2007). “Scholars recognize the socio-cultural environment as one of the most influential factors that explains how culture affects behavior” (Olsson et al., 2007). Relatively little systematic research has been done to examine the relationship between culture, behavior, and the physical environment in connection to natural resource management. Current approaches for managing ecosystems fails in many instances to link social forces that could be used in the preservation of socio-ecological systems (Matthews et al., 2007). This methodological approach accommodates a large number of theoretical constructs in order to account for behaviors related to health, safety, politics, marketing, decision making and power structures to name only a few. Within the social process of a group lie the potential seeds for social change.

Social Context

“Social capital, as defined by its principal theorists... consists of those features of social organization such as networks of associations, high levels of interpersonal trust and norms of mutual aid and reciprocity, which act as resources for individuals and facilitate collective action” (Lochner et al., 1999, p. 260). By identifying the social organization and measuring the ability

for people to help one another, you can predict certain social outcomes. “Social learning is learning that occurs when people engage one another, sharing diverse perspectives and experiences, in order to develop a common framework of understanding and basis for joint action” (Lochner et al., 1999, p. 260). Social systems were identified in this research, and technics used to identify social systems can easily be replicated in other landscape research. The most successful government programs are often linked to social systems within the community that in turn builds strong community cohesion. By understanding the social context, the research has a window into community networks. This is a valuable resource needed to orchestrate social change and can lead to exciting socio-environmental research and problem solving (Arefi, 2004). Top down programs are often short lived and, communities are often reluctant to participate and skeptical of such policies, which are linked to the lack of community participation and trust (Field et al., 2003). The utilization of an ABM can skillfully identify social resources in contemporary human socio-ecological systems.

By analyzing the large view, it is possible to identify both conscious and unconscious behaviors of the actors simply by observation (Kurz, 2002). For instance, in the case study presented, it was immediately observed that the residents possessed a deeply honed, subsistence skills set, related to the woods. The skills were not formally acquired through schools or workshops, and many people in the area had an undervalued view of their skills, especially as contrasted to the people in the adjacent towns and cities outside the pines (Halpert, 1937). Upon observation it is clear, that, although they are not conscious of their special skills, they had a skill base that was economically valuable and one lacking by Coville and White (Wood & Handley, 2001). Therein lays the potential to tap local knowledge for purposeful gain.

Many authors argue that a weakness in planning results from poorly applied social theory (Harpham et al., 2002). That, in fact, the study of community, as the bases for understanding the functions of neighborhood, is often weak and lacking in current planning and design. Authors argue that by using social information, as identified by using this or similar models in public policy, one promotes a different model for social intervention (Ballet et al., 2007). This is critically needed today. This new understanding begins by gaining a broader view of the socio-ecological system under investigation. SES theory offers a wide perspective, incorporating a comprehensive approach, which integrates a multiplicity of influences, that impact behavior (Robinson, 2008).

Today, social scientists are able to describe and predict behavior using a number of theoretical models. Of particular note is the theory of Planned behavior (TPB) and its earlier version, the Theory of Reasoned Action (TRA) (Fishbein & Ajzen, 2010). According to the TPB, the central determinant of an individual's behavior is the intention to engage in a particular behavior. Then in turn, the behavioral intention, which purports to predict an individual behavior or response is further, dissected into three components: attitudes or beliefs, subjective norms, and perceived behavioral control. Beliefs are internally held concepts and attitudes about behavior. Subjective norms are what others think of the behavior and how much the actor is influenced by this behavior (peer pressure). Finally according to TPB, the individual's perception of the difficulty or ease of performing the behavior is the last component of behavioral prediction. This theory goes beyond just identification of the direct components of the behavior (Ajzen & Fishbein, 1980). It purports to theorize about what factors or variables shape the foundation of the behavior. The beauty of this model is its flexibility to be adapted to other theoretical

approaches, adding an important interpretation of human behavior as it relates to landscape change (Tress & Tress, 2009).

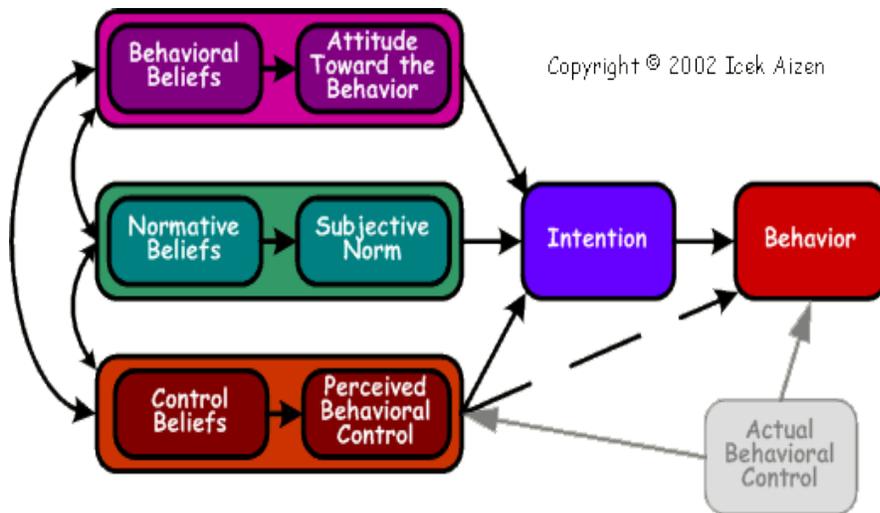


Figure 5-1. A Model of the Theory of Planned Behavior and Reasoned Action. Source: Aizon & Fishbein (2002).

An example of the concept can be drawn from the research findings of the individuals under study. It was proven that local residents of the pines were confident in finding and selling wild blueberries. Presumably they believed they could pick and market cultivated blueberries. Furthermore, given the work experience on the bogs, they also believed that they could prorogate and plant a field of blueberries. Their personal experiences complimented this notion as well. The normative belief, or what others thought of this new venture, was reinforced by the community’s acceptance of the new industry. As more and more people talked about the new industry and as people began to see others making good money from the earliest fields, the stronger the normative belief became. It may also be assumed that important elites, Coville and White, further supported and encouraged people to enter into the blueberry business. The community response added to people’s confidence, “I can do this”, which motivated people to engage in this new behavior. As this example denotes, the data gathered, using the framework of the model can easily be plugged into this theory, therein gaining insight into behavior and

behavioral intention. Understanding behavior is the first step in consciously changing behavior. This theory is mentioned in this work because of its proven ability to understand why and what are the constructs that form intention to behave in certain ways and can be a compliment to ABM's, and go a long way to explain or predict behavior. The TPB is an important useful theory and germane to policy makers and land use planners and should be used with ABM's to predict and understand behavioral intentions.

Social Networks

The model proved to succinctly identify social-networks. For instance, working relationships on the local cranberry bog became a social network. More importantly this job taught skills to the people laboring on the bogs resulting in social learning. As stated above, one learned how to grow cranberries and blueberries, which was a critical component of work on a bog in the 1920's. Although one learned how to grow cranberries given past experiences of planting the industrial bogs, most workers would not have the resources to go into this profitable business. It was capital intensive. However, with blueberries, that was not the case. Workers learned on the job how to propagate and plant blueberries, and together with their previous knowledge of wild gathering, they knew how to package and market the crop.

The employment on the cranberry bog brought together people from a number of communities that would not necessarily have had a reason to mix socially. The bog then became a method for innovation diffusion. The innovation diffusion was further transmitted throughout the community as people went back to their respective communities. Soon blueberry patches began to spring up throughout the woods. While humans are often viewed as external to the ecosystem in biology and ecology this ignores a major source of impacts on natural systems. The inclusion of social systems analysis is very rarely mentioned in conjunction with systems theory research. This finding is valuable information for planners and policy makers. The innovative

approach puts people back in their environment, together with human behavior social networks and communities. Adding social science to the analysis provides a robust understanding of the system, and new knowledge is often gained (Ingegnoli, 2002; Wiens & Moss, 2005).

As mentioned earlier, social processes played a large role in land-use change, and the model used accurately identified social and cultural patterns. Some patterns were identified *a priori*; others arose as new themes during the analysis. Before the research was begun, it was generally accepted that many local people worked on the cranberry bog. What arose during research was a further understanding of this employment, which turned out to be in fact a social network formed on the bogs. The employment drew people from a number of communities. This was an important finding. Scholars, ecological planners and designers continue to see an urgent need to construct new methods that emphasize an integrated ecology (Redman et al., 2004). Integrated ecology explicitly uses human decisions, cultural institutions and economic systems to manage and conserve natural resources (Steiner, 1991). Social landscape analysis is concerned with the spatial distribution of interrelated social variables in a given biophysical setting along with their relationships with specific natural systems. This model proves to be an efficient and systematic means to this end. (Field et al., 2003).

During data collection, I hypothesized that social learning, work ethic, and close-knit communities were important and drove landscape change. This was confirmed during research and analysis and demonstrates how individual variables impacted change. Social networks, it was found, reinforced the acceptance of a new land use, and this was seen as critical to the success of the USDA project. All too often, policy planners do not sufficiently research social networks or social patterns prior to policy implementation, which often leads to project failure. This further proves the explanatory rigor and utility of this approach. By modeling the entire

system in a holistic fashion, one can disaggregate a myriad of variables; thereby one can identify and explain particular components of landscape change.

On the other hand, when one aggregates social factors, one can see how some social forces work in tandem with the natural system to drive land use change. The example of the social networks on the cranberry bogs together with community ties and family connections, worked as an important venue for dissemination of information. Religious networks were also a potential important social network for the exchange of information, but as one source said, “At revival meetings more souls are made than saved” indicating that this network was perhaps purely social” (Halpert, 1937 p. 14). This is an example of how the model is capable of measuring various forces working within a system. Originally, I had thought religious networks would be an important mechanism used for information dissemination, but it proved not to be the case. This example further proves the utility of the approach by the model’s ability to identify the degree to which a force is at work within the landscape.

The Use of the Model to Identify Stakeholders

The rudimentary identification of stakeholders *a priori*, does not in itself adequately identify the various voices in a given community. The agent-based model (ABM) methodology presents a unique opportunity to explore and understand a given region before any program implementations are undertaken; therein it can have a profound ability to identify those voices, which are hard to hear and are often underrepresented. In this research, identification of social networks was critical in identification of stakeholders in the community.

By using an agent-based model, I was able to identify a number of social processes, which could have been easily lost in other investigative approaches. By analyzing social process one is able to identify local leaders, community interests, and individual power relationships. The model identified local leaders and cultural norms and assessed local skills and knowledge in

correlation to the natural system. This would in turn be true today, stakeholders can be identified by implementing this model into contemporary research.

Themes That Emerged During Research

Sense of Place

During research and analysis, several new themes were identified, which were not included in the original model of Matthews and Selman. One of the major themes identified was sense of place. Sense of place played a critical role in keeping people connected to the landscape after the economic demise of the iron industry. Researchers have a very good understanding of sense of place, yet it is often under used in policy and land-use management decisions (Jorgensen & Stedman, 2001). Sense of place is missing from most landscape ecology models even though we know it is a determinate of the intention of people to stay connected to their area (Cuba & Hummon, 1993). I identified sense of place as the overall impression a person perceives about the landscape. The degree to which people are connected to the landscape is associated with their combined attachments to nature and the cultural system in which they live (Reid, 2009). This can be measured and described and has been noted in many prior research reports. The components of place are many. They include location, personal involvement in a place, experiences of place, cultural myths, rituals and symbols, for example (Marsden, et al., 2003). Together this creates a complex association within a particular locality or region forming a cognitive understanding of what the individual thinks about a region or place (Gieryn, 2000).

Although it is easy to think of the Pine Barrens as a single coherent entity, that is not the case. This was especially true prior to the advance of the automobile when places like Retreat, Johnson Place, Burrs Mills, and Chatsworth had their distinct qualities. The cranberry bog seems to have had a homogenizing effect on the culture by bringing communities together. The data establishing this effect surfaced during the interviewing phase of the project. Informants had

slightly different impressions of their respective community and why it was different from adjacent communities. Although informants had a common understanding of the Pine Barrens, which they generally referred to as the woods, they were still significant differences voiced about their community or neighborhood. In this case the neighborhood included the adjacent woods. And from this intimate knowledge of neighborhood, people knew where the best berries were to be found in their general area (Beatley & Manning 1997). By using the (ABM) model, I was able to discern gradients of differences.

More importantly, sense of place can be a strong indicator of willingness to stay in a certain region or location, even when economic or social conditions began to change (Whittlesey, 1925). Place is central to the social world (Hidalgo & Hernandez, 2001). Attachment to place is a core concept in sense of place literature. It includes sentiments and emotions (Eisenhower et al., 2000). Place attachment is symbiotically linked to sense of place. Relationships formed by people experiencing culture and shared values form symbols and meaning often known only to the group. This behavioral tendency strengthens both sense of place and place attachment. It cannot be overemphasized that sense of place grounds people in the community. And in the case study presented, knowing how the community was organized and functioned was an important component of the success of the USDA project. Consequently the model provides the possibility of gaining valuable insights into the intimate workings, values, shared meanings, and symbols of a landscape by identifying and measuring the sense of place of a given area.

Outside Influences a New Capital

Perhaps the most important finding in the research was the absence of a construct that represented outside influences, which in part influenced landscape change. Landscape is an open system (Antrop, 1998). The model used in this research provided a snapshot in time which did

not adequately reflect or measure outside influences either natural or social, which were impacting the system under study. Landscapes are composed of complicated association of forces occurring at different times and at different scales. Geologic processes work in a different timescale than do human behaviors or acts (Marcucci, 2000). In order to identify the magnitude of pressure acting upon the agents of this model, a new capital is required. This construct allows a mechanism to identify the outside forces in order to judge the potential influences acting on a system, which can predict the system's potential likelihood to change or remain resilient. Obviously a tornado or an earthquake would immediately change a landscape. That is easy to discern and observe. Harder to understand and isolate are the frequencies and magnitudes of change imparted by natural trends and other social phenomena. Climate change is an example of a current natural trend that is exerting itself on landscapes slowly and inexorably. Social forces can include government interventions and social movements. Trends are amorphous and hard to identify, however it is possible for them to be identified and measured in some fashion, and they need to be included in the model (Buechler, 1995).

An example of a potential outside force working at the time of the introduction of the blueberry was the outside influence of capitalism and market economies. For the most part local residents living in the woods, pejoratively called "Pineys", were living a subsistence lifestyle. This livelihood was augmented by cash earned in berry picking and working on the bogs. It is very interesting that this area was 30 miles from Philadelphia, an early capitalist and mercantile powerhouse. Was this just a matter of time for the market forces working in the region to influence and change the subsistence woodlands economy? By adding a construct for outside influence, variables of this nature, social movements, national trends, political thoughts and

influences, can be predicted and measured, adding to the explanatory utility of the enhanced model.

Governance

It is easy to see that the US government is an outside force. The USDA was a critical component of the success of the program. The USDA, then in its early years as a bureaucracy, was committed to finding efficient and profitable crops to introduce to the American farmer. Their goal was to supply a cheap, safe and available food source to the growing country. The role of bureaucracy, and people's attitudes towards the acceptance of bureaucracy, were important drivers of landscape change. This outside force culminated in practical suggestions of how to efficiently and systematically cultivate blueberries (Crowley, 1926). This was technical assistance, a critical first step. Today with a distrust of government and an ingrained notion that government does not work for the citizen, people may not be as inclined to trust the government as was the case in this study (Plummer & Armitage, 2007). The model can help with identification and measurement of these types of social processes.

Governance and bureaucracy affect all layers of human social systems (Allan, 2008; Wood, 2008). They have profound implications on landscape change. They are also social trends and social movements exerting influences on land-use change. The researcher must also take into consideration forms of governance. This variable includes titular government leadership as well as informal leadership mechanisms (Costanza et al., 1999). It also includes local leadership networks that are often difficult for outsiders to identify (Rubin & Rubin, 1986). Again, the model was able to differentiate between the different leadership types, which were working together (Duda, 2003). Coville and White are an example of successful public/private partnership. However, White also had local contacts that proved valuable to the government's initiative. It appears that very few of the locals knew Coville or worked with him during the time

he was at Whitesbog. Therein, the locals involved with the project did not have to work first hand with a college educated scientist whose mannerism could have been off putting. The model has the ability to identify leadership types and therein match leadership styles to people in the community, another important consideration and use of the model, with the potential to help existing governance systems work together for mutual goals. (Hughes et al., 2007; Kallis et al., 2009). Making existing governance systems work together for mutual goals is another important consideration and use of the model.

As government becomes increasingly involved in intervening in human-induced problems, understanding leadership is critical to the success of programs (Dumler, 2009). Variables that represent governance may include government and non-government agencies, interventions and policies, as well a leadership networks at the community and neighborhood level (Table 5-2). Variables also have entities' for local, state and federal agencies that could potentially drive landscape change. Conflict and collaborative relationships are other important variables that need to be added. Are people in the system working for stability, or are conflicts so severe that they disrupt the system? This is important to know when crafting land use policy.

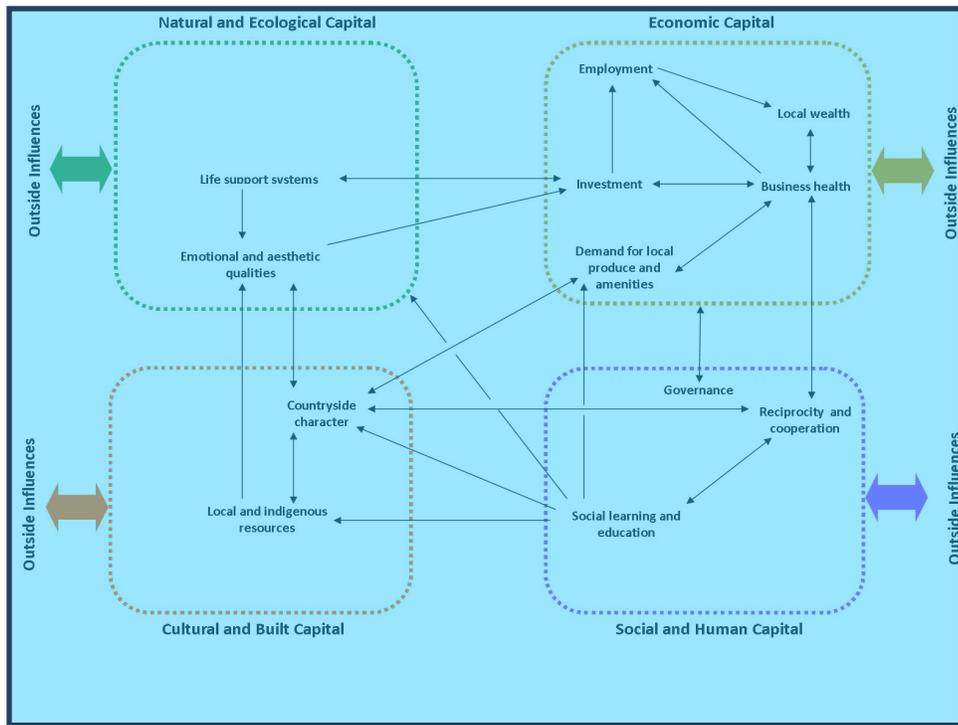
The leadership style of Elizabeth White was simpatico with local residents. She managed the day-to-day operations during the field trials. She was an unconventional woman who took to the day-to-day operations of her father's cranberry bog. This was, in a sense, a marker of social change in progress, forming an unconventional role for a woman of her social and economic status. Today she would be considered a radical feminist (Bacon, 1989). She lived with her private secretary, June Vale, on the bogs, in a house, (Sun-in-give), that she designed. This was highly unusual for the time. Her family homestead was in the adjacent village of New Lisbon,

where the family lived in a large federal farmhouse with numerous staff, including, chamber maids, cooks, laundress, and chauffer along with numerous grounds keepers.

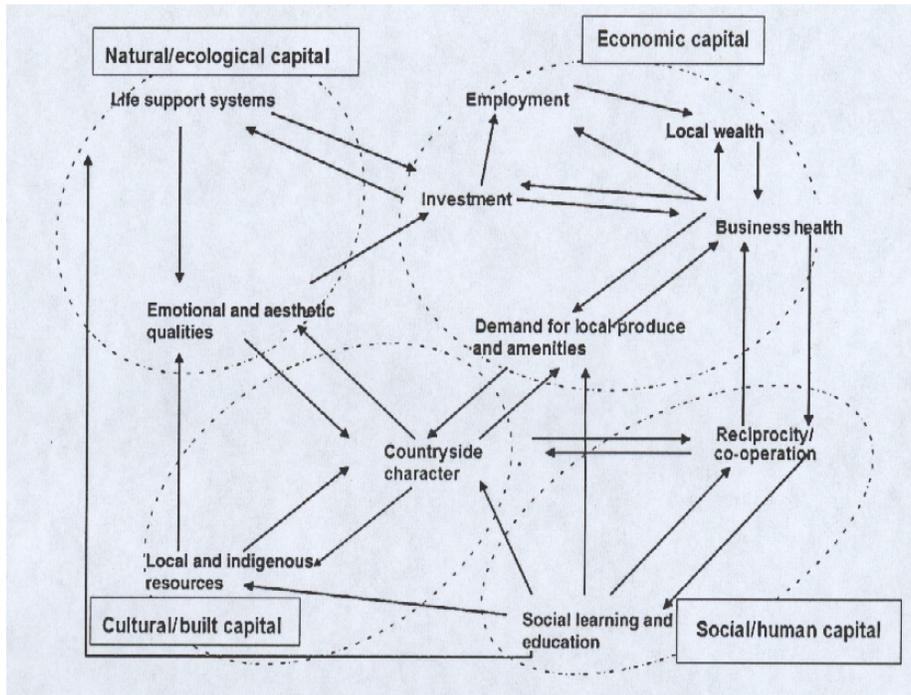
It appears that the men did not mind working for a woman, and moreover she was well respected by the community. Was this acceptance part of changing norms, or was this a left-over of Quaker values or simply a rural tradition? To know and identify the social context is an important component of land-use intervention, and the model presented in this research can isolate these important variables.

Below is the enhanced model in juxtaposition to the original model as proposed by Matthews and Selman and used in this case study. Following the Figure 5-2 is Table 5-1, including the insertion of the proposed new construct, along with dimensions and variables.

As stated early human populations will continue to build and develop for an increasing human population and they will impinge on natural and cultural systems. We, however, have the ability to develop in ways that do not totally degrade and disregard natural process and impact the resources that support life. A new thinking in development is to develop in a way that is sustainable. This new philosophy is being implemented in landscape architecture and agriculture wherein the concept of sustainability is becoming more broadly understood and accepted. Also as people become more aware of the ecosystem services provided by the landscape, it is hoped that there will be a renewed emphases on environmental protection. This case study chronicles the steps that lead to a holistic understanding of the drives of landscape change including a renewed understanding of the social and cultural variables that in effect drive change. Landscape architectural professionals, engineers and policy makers have attempted to understand how and by landscapes change. Perhaps beginning with Ian McHarg, John Lyle and Rachael Carson a



A.



B.

Figure 5-2 A. Sense of Place: Proposed models additions based on the work of Matthews and Selman (2006). B. Sustainable landscape model by Matthews and Selman (2006).

Table 5-1. The Hypothesized Variables for the Matthews/Selman Theoretical Framework.

Type of Capital	Dimensions	Variables	Source of Information
Ecological-natural	Life support system underlying biodiversity and natural resources	Average temperature (summer high and winter low) Soil type Aquifer Naturally occurring wetlands High water table Areas suitable for blueberries	Existing Maps (USGS & Others)
*Outside influences Ecological-natural	*Influences of natural forces at work on the natural system within the study area	*Climate change *Natural disasters *Geologic forces	*Climate records *Weather records *Geologic reports
Built –cultural	Structures that give relative degree of character to parts of the countryside		Existing maps Existing maps Existing maps to locate, pictures Historic photos, interviews, direct observation
	Land uses that give relative degree of character to parts of the countryside	Agricultural lands (including blueberry fields) Woodlands Settlement pattern	Existing maps Existing maps Existing maps, direct observation
	Cultures and traditions associated with particular areas	“Pre-blueberry” activities based on natural resource extraction (cranberry, charcoal, moss) Wild blueberry harvesting Anglo-Saxon heritage	Interviews, archival materials (newspapers, government publications, literature review) Existing maps & literature review, genealogies
*Outside influences- built cultural	*Influences of national or international trends	*Mass culture	
Human-social	Networks that underlie trust	Kin Neighbors	Interviews, census records Interviews, newspapers
	Institutions that underlie trust	Church School	Interviews, archival data Interviews, archival data
	Potential for social learning with familiar and tangible settings	Shared labor (tasks) Shared sites for labor	Interviews, archival data, literature Interviews, existing maps
	Level of education and skills	Previous experience with natural resource based production activities Formal education	Interviews, literature Interviews, archival

Table 5-1. Continued

Type of Capital	Dimensions	Variables	Source of Information
*Outside influences on human social system	*Influences on human social system	*Mass movements Government policies Cultural change	
	*Sense of Place	*Place attachment	
	*Governance structures	*Formal leadership *Informal leadership	*National elected officials *State wide elected officials *County commissioners *Local governing structures *Influential families *Community Groups *Civic leaders
Economic	Opportunities for generation of wealth	Resource-based businesses	Interviews, archival, literature
* Outside influences on economics	Opportunities for generation of jobs	Cranberry plantations Ancillary work for cranberries	Interviews, government publications
	Investments that are associated at least partly with natural and cultural characteristics	USDA Cooperatives (cranberry, blueberry)	Interviews, archival data, government publications Interviews, archival data
	*Influences from outside economic forces	*Change in monetary system Economic depression or recession New technologies New industries	

* Denotes the proposed capital, dimension, variable and source of information added to the model of Matthews and Selman.

new consciousness is being formed. Planners and landscape architects are looking for better and efficient processes, which can aid them in their work.

This research demonstrates a theoretical process, which enhances our understanding of socio-ecological process, by understanding the vectors of human imprints on the land, using a systematic method. Design professions and policy planners need strategic approaches and ABM's are an important tool that can be used to this end. This model proves to be useful in

attempts to analyze the social components of landscape systems. Specifically, this research demonstrates that there are proven approaches, to understanding the dynamic economic and social elements within a human system, which drive landscape change. It provides a methodological approach that broadens understanding of human systems' impact on landscape change. The next step is to use the information identified in models to craft solutions for the many environmental problems that face us today, which are tailored to the social conditions on the ground.

CHAPTER 6 CONCLUSION

At the time of the introduction of the blueberry, the area under study was slowly climbing out of the economic decline caused by the demise of the iron and glass industry. The people who remained, only had the resources of the woods to fill the economic void. The case study presented is an example of economic development in the wake of a declining industrial economy. This research has important contemporary implications. Economic development, which protects natural lands, is important today as more and more land is being sacrificed to development, which often disrupts rural communities and natural systems that serve valuable ecosystem services.

The natural lands and cultural landscapes of this country are very important to us all because they support life. First and foremost they fulfill biological needs by providing the basics: water to drink, air to breathe, and food to eat. Natural lands and rural landscapes enhance the quality of the environment by tempering extremes in climate, reducing erosion and flooding by holding soil in place, and slowing storm water when it rains (Sauer & Andropogon Associates, 1988). The forests and fields clean the air, water, and soil by filtering particles out of the air and soil and trap sediments before they enter rivers and streams. In an unobtrusive way, the natural lands and rural communities of this country are extremely important for lessening the environmental impacts of a highly developed country.

Although humans depend on natural lands to survive, people have controlled, reshaped and destroyed these lands as a means of supporting life for thousands of years. Over the last millennium this control of nature has greatly changed the natural lands of the world, evidenced by the landscapes that stretch from the east to the west coast. The natural rural farmlands are the natural capital for the next generation. Finding suitable development and economic strategies is

paramount to protecting the lands that support life (Arendt, 1999). Social ecological systems analysis is an important tool in this pursuit.

Natural and rural lands have been recognized as important not only for lessening environmental impacts but have also been historically touted for their restorative and medicinal qualities. This philosophy first surfaced in the 19th century when people began to notice how fast the country was changing. The rapidity with which natural lands and their resources were being depleted was startling to many writers, philosophers, and planners. Downing, Olmstead, and Emerson noted how the wilderness was disappearing at a rapid and alarming rate. They commented on the unprecedented growth of cities, which is ever more alarming today. They associated poverty, disease, and overcrowding with urbanization due to the loss of natural lands. In the wake of progress came polluted rivers, unhealthy tenements, poverty, and disease, again still a troubling trend.

Natural systems have been prescribed for the ills of the country. People were encouraged to go to natural areas and find solace, peace, and redemption in the land. This notion reflects an ancient belief that green pastures restore health and still waters restore the soul. Beginning with Central Park natural lands were reestablished in the city to offset the effects of urbanization. Parks with carefully designed natural areas were planned and implemented throughout the country in hopes of saving mankind for itself. It is important therefore to protect and enhance natural processes in the wake of continual pressure to build and develop. The blueberry case study points to another approach to economic development that can work within the natural system.

We will continue to build and develop for a population that is ever increasing. We also need to feed the growing population as well as others in the world who cannot feed themselves.

However, we do not need to continue to build and develop in ways that totally degrade and disregard natural process and impact people negatively. Green architecture and sustainability are new philosophies being implemented in landscape architecture and agriculture wherein the concept is becoming more broadly understood and accepted.

Progressive landscape architectural professionals, engineers, and policy makers are attempting to understand how and why landscapes change. They are searching for sustainable designs that can both solve human needs while protecting the environment. Environmental and sustainable design specifically respects people and their cultural practices. The research presented is an attempt to more fully understand human involvement on the land by using a systematic method. This method can be implemented to solve human problems while also protecting important ecosystem services. Social science methods used in a strategic approach to design is often lacking in present day landscape architecture and planning. This model may prove to be useful in attempts to analyze the social components of successful landscape systems.

Planning and landscape architectural professionals, engineers and policy makers have attempted to understand how and why landscapes change but have traditionally neglected social science findings and understandings. Social science unfortunately is infrequently used in policy and land-use projects. It is more accurate to say the bulk of the research has been focused on human environmental impacts on natural systems while neglecting behavioral change theories.

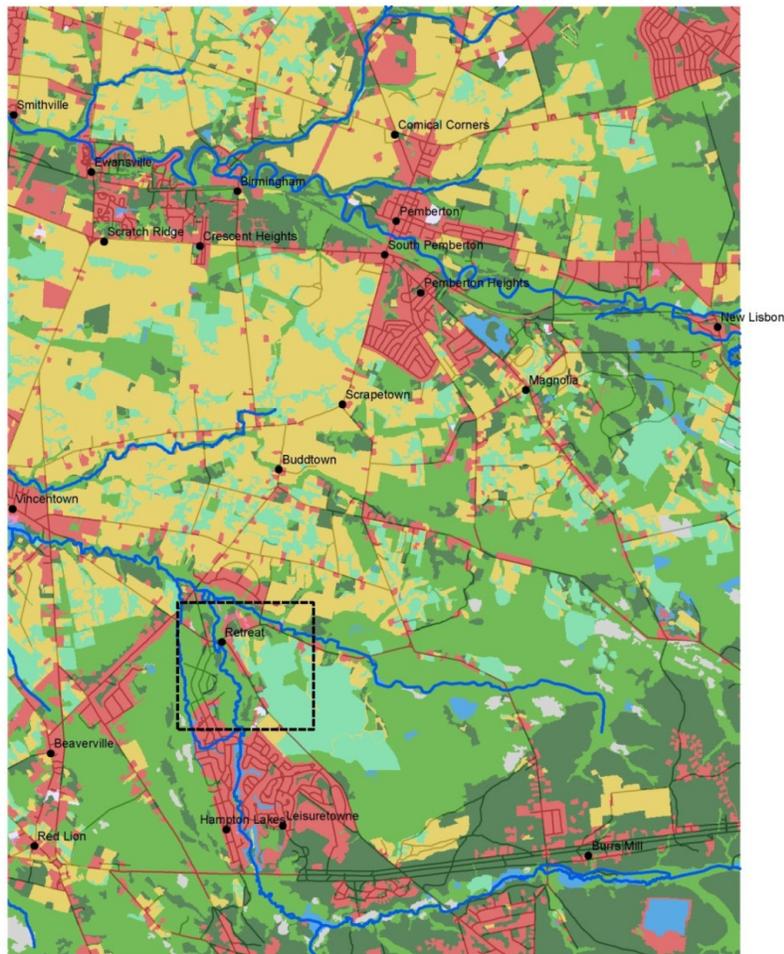
Contemporary studies have focused on the negative impacts on water systems, plants, and animals, especially as they are tied to environmental health. This has been a systems approach with emphasis focused on the interactions between abiotic and biotic forces. People, on the other hand, have not been critically studied in policy and design applications and, they, are the major drivers of change on any given landscape. It is my hope that this research will bring us closer to

crafting a method that can address human behavior as it relates to protecting social and ecological systems. All that remains of the blueberry farms in Retreat today are three small family fields, which today are “pick your own” farms. At the height of the early blueberry period, there were more than 12 small farmers along with the Budd’s who cultivated over 100 acres on their Retreat property. Today the blueberry production in Retreat is approximately less than 50 acres, and the farms, again are primarily “pick your own.” This trend occurred throughout the blueberry production area in Burlington County, which once was the major blueberry production area for the country.

Shortly after the introduction of the blueberry into agriculture, in the 1930’s, a cure was found for the cranberry false blossom disease. During this period the price of blueberries remained stable and rose only a few cents per pint over the 1930’s and 1940’s. It was still a specialty crop although it began to lose its status as more people entered the business (Woodroff, 1933). Blueberries remain a labor intensive crop today. At the beginning of blueberry cultivation cranberry, growers were able to even out their labor supply by adding blueberries to their crops. Growers utilized equipment that was not being utilized at the time and offered people employment from spring through fall, with the largest need for pickers occurring at the beginning of July for blueberries and at the end of September for cranberries. With the industrialization of cranberries and the use of chemical farming to control for diseases many fewer people were needed on the cranberry bog in order to grow larger and larger crops while saving large labor costs due to mechanization.

Beginning in the late 1950’s through the 1960’s, the cranberry industry aggressively became mechanized. Machinery was developed that could wet harvest the berries. The stereotypic paddle wheel picker and the vista of a bog cover in red gold replaced the hand scoped

berries, lessening the need for large picking crews, therein saving money. This enabled growers to avoiding the need to get employees from the volatile city neighborhoods of Philadelphia, which were at that time experiencing violence and social network disruptions. With the clever marketing of Ocean Spray, cranberries began to increase in price. Together with the ease in harvesting and the increased prices cranberry going to growers, they began to take out their blueberries and replace them with the highly profitable cranberry.



Map 6: Land Use of Study Area in 2002 

Legend

 Study Area	 Urban	 Atlantic White Cedar
 Agricultural Wetlands	 Forested Wetlands	 Managed Wetlands (Urban)
 Agriculture	 Open Water	
 Forests and Undeveloped Lands	 Lands in Transition	

 Miles Spring 2010

Figure 6-1. Land-use of the Study Area.

In contrast blueberry, harvest remains a labor intensive endeavor. Even though there are machines to mechanically pick blueberries, the varieties of blueberries present years ago did not ripen evenly and, requiring at least one, if not two hand pickings, before it was cost effective to machine pick the remainder of the crop. Also, the blueberry picking machines battered the berries, which had vibrated the berries off the bush, then collecting them in bins and, in turn, dumped into a sorting apparatus. This method of harvest often did considerable damage to the berry by rubbing the blue waxy substance, “bloom”, off of the berry, therein leaving the farmer with an inferior product. As a result the berries were sold in bulk at substantially lowered prices. The need for outside labor continued for the fresh fruit market, which is still primarily the case today.

The loss of large growers, who were originally primarily cranberry growers, left the blueberry business and the blueberry cooperative failed as a result. By reducing the volume of berries on the market the volume needed to make the cooperative profitable was lost. There was no longer a large supply of berries going to market from fields in Burlington County. The Tru-blu cooperative was not able to make the change from large scale production to the specialty market based on small sustainable farms, which has gradually become a profitable niche market. The people left on the board of the blueberry cooperative were for the most part not forward thinking.

In 1970s, the industry moved south to Hammonton, New Jersey, where berries are grown mostly by third generation Italian Americans. This area was originally settled by Italians who took up crop farming and later began to invest in blueberries. Large acreages were planted. As the labor problems became more difficult for the farmer to manage the more the berries on these farms were picked with large mechanical harvesters and sold as fresh fruit. Mechanically picked

blueberries lost considerable quality when the berry was machine picked and market prices went down.

In 2007, there were 76 growers in Atlantic County and 84 in Burlington County, according to the Atlantic City Press. Burlington County accounts for the larger number of growers and Atlantic County accounts for the largest acres in production (Procida, 2010). Today, there are 7,700 acres of blueberries grown in New Jersey, 6,100 acres in Atlantic County as compared to 1,200 acres in Burlington County (Procida, 2010).

In response to the large labor pools needed to pick the Atlantic County crop, the US Department of Labor has focused attention on the blueberry growers by investigating labor practice violations. The common problems cited are, migrant housing, including overcrowding, sanitation, incomplete employee records, child labor abuses, and minimum wage violations (Procida, 2010). These ironically were the same charges leveled against the Whites in the 1930s. In 2007, 31 farms were fined in Atlantic County, mostly among the large blueberry growers, demonstrating rather vividly that blueberry production is still a labor intensive agricultural pursuit.

Heavy fines have been levied for overcrowding, unsanitary toilets and floors, and poor facilities including a lack of cooking facilities as well as a lack showering facilities. Overcrowding is a constant violation. Ironically, these allegations ironically are similar to the conditions the original Italian workers found when they were first brought from the city to the large cranberry plantations. This interesting progression from Italian bog workers to blueberry field owner is the part of the blueberry history in New Jersey, which was not covered in this study and is the obvious progression for future inquiry.

The venerable blueberry is gaining in popularity given its acknowledged high anti-oxidant contents (Procida, 2010). It seems that there will continue to be a market for blueberries whether machine or hand-picked , and by looking back there may be lessons to learn about small family farms, sustainability, and landscape resilience that can be applied today (Gunderson, 2000).

APPENDIX A
SOILS TAKEN FROM BURLINGTON COUNTY SOILS SURVEY

As shown in Figure 4-5, page 82, thirty three soil types were identified using GIS Arc View and soils data from the New Jersey Department of Environmental Protection. The following descriptions of the soils on the study site are taken from the descriptions of soils type found in the Soil Survey of Burlington County New Jersey. The data was augmented by field observations. 10% of the soils series types were visited to insure accuracy. The following soil description will include hydrologic and vegetation associations.

Adelphia Series

The Adelphia series consists of loamy soils that contain moderate amounts of glauconite. These soils have a fluctuating water table and are moderately well drained. In undisturbed areas when rainfall is normal, the water table will generally begin to rise in October and reaches its peak of about 2 feet from the surface in December. It fluctuates near this peak until April, when it starts to drop. From July to October the water table is below a depth of 5 feet.

Adelphia soils have moderately slow to moderate permeability and are readily drained by open ditches and under drains. Surface drainage also is needed in some areas. These soils have high or moderately high available water capacity. Organic matter content is moderate, and a natural fertility is moderately high. Vegetation associated with Adelphia soils is a hardwood forests and consists mostly of red oak, white oak, scarlet oak, black oak, hickory, beach, ash, yellow-popular, and sweetgum.

About 80 to 90% of the acreage of Adelphia soils has been cleared and drained for crops. In many areas, however, drainage is not deep enough to permit the use of modern farm machinery. Better drainage is needed for high-value crops than for general crops. The crops

grown on Adelpia soils include small grains, corn, soybeans, hay, and pasture, which are general crops, and tomatoes, potatoes, fruit, nursery stock, and sod, which are high-value crops.

Alluvial Land/ Fluvaquents

Alluvial Land and Fluvaquents consists of areas where the soil material or so variable that mapping units cannot be placed in the series. Instead, the areas are described as Alluvial Land. This land has icons only high water table that is controlled by the adjacent stream. The water table is at the surface and the winter and, except during extreme drought, it drops only about a foot in the summer. The soil material is rapidly permeable, low and fertility, and extremely acid. Where the land is drained, the available water capacity is low in the sandy areas but is high in the mucky areas.

The native vegetation varies. Atlantic white-cedar grows in the mucky areas, and pitch pine, red maple, black gum, gray birch, and sweet bay magnolia grow in the sandy areas. Some of this land has also been cleared and planted in cranberries or blueberries.

Atsion Series

The Atsion Series consists of poorly drained, dark gray sandy soils that formed along the border of swamp and the bottoms of some circular depressions in the outer Coastal Plain. These soils are also on extensive terraces at Jason to the Molokai, bats though, and wading rivers. The terraces contain numerous narrow and intermediate streambeds.

Atsion soils have a high water table and warm late in the spring. Also when drained they have a low available water capacity. When the water table is low enough to permit percolation, permeability is moderately rapid. These soils have moderate organic matter content and low fertility. Atsion soils are very strongly acid in most places.

Native vegetation on Atsion soils is a stand of pitch pine and scattered scrub oak trees and a dense under story of highbush blueberry, sheep laurel, sweet pepper bush, gallberry, and

greenbrier. Where they are drained, these soils are suited to causal blueberries in cranberries. Blueberries are grown more extensively on Atsion soils than on any other kind of soil and Burlington County.

In the management of Atsion soils for blueberries, the water level in summer is controlled at about 2 feet below the surface by subsurface drainage and the use of ditches. Also, the cropland is smooth to prevent surface ponding and to prepare the field for the heavy over the row harvesters.

Buddtown Series

The Buddtown soils are moderately well drained and are composed of loamy eolian deposits and loamy fluviomarine deposits. The soils are moderately permeable and the available water capacity is moderate. The soils are extremely acid and have a depth to the seasonal high water table: 18 to 42 inches.

Colemantown Series

The Coleman town series consists of poorly drained, dark-olive or dark greenish-gray soils that are prominently mottled. The subsoil is highly glauconite. Because the soils are nearly level and are in low position, they receive large quantities of water as runoff and as underground seepage from the slopes above. These soils need surface and substratum drainage if they are to be farm. Although under drains work too slowly to be of much benefit to the surface layer, either under drains or open ditches can be used to drain the substratum. Coleman town soils have a high available water capacity. Organic matter content and natural fertility are high. The soils generally are very strongly acid and require large amounts of lime.

The native vegetation on Colemantown soils are hardwood forests consisting of mostly pin oak, willow oak, swamp white oak, southern red oak, sweetgum, beach, white ash, hickory, elm, red maple, and blackgum trees. The understory of arrowwood, spicebush, and poison ivy is dense.

About three fourths of the acreage of Colemantown soils has been cleared for crops. Adequate drainage and ditch maintenance are of the utmost importance.

Collington Series

The Collington series consists of well-drained, loamy soils that contain moderate amounts of glauconite. The subsoil contains more clay than the surface layer, and is generally olive. These soils occur in high positions and have slopes of 10%. They formed in marine deposits.

Collington soils have a high available water capacity and moderate organic material content. Permeability is moderately low in the subsoil and moderate in the substratum. These as soils are moderately high infertility, and they respond well to added fertilizer. Except for the soils have been lined, these soils are very strongly acid.

The native vegetation is a hardwood forests that consists of red oak, yellow popular, hickory, ash, and beach and understory of viburnums. Most of the acreage of Collington soils has been cleared for crops. These soils are well suited to fruit, vegetables, corn, small grains, soybeans, hey, and pasture. Most of the potatoes in this county are grown on these soils.

Downer Series

The Downers series consists of well-drained soils that, in most places, have a light sandy loan subsoil over a sandy or substratum. The subsoil contains no glauconite. Downer soils are moderately permeable and have a low available water capacity. They seldom, if ever contain excess of free water. They are low in organic manner content and fertility.

The native vegetation on down her soils is a hardwood forests that consists mostly of black oak, white oak, scarlet oak, chestnut oak, and hickory and scattered pitch, short leaf, and Virginia pines. Except where management is good, Downer soils are not well-suited to crops. They are poorly suited to hay, pasture, and corn. High value crops need irrigation. Irrigated

sweet corn and other early vegetables are commonly grown. These soils are fairly well suited to non-irrigated sweet potatoes, pumpkins, and cantaloupes if rainfall is normal. Downer soils are very strongly acid and require addition of lime at short intervals.

Evesboro Series

Evesboro series consists of deep, loose, excessively drains sands. Where the surface layer is bleached, it is gray and less than 6 inches thick. Evesboro soils are in high positions and are nearly level.

Evesboro soils are rapidly permeable in most places, but they have moderately rapid permeability where the surface layer is fine sand. Evesboro soils have a low water available capacity. They are very strongly acid, low in fertility, and low organic material content.

The native vegetation is a forest of mixed oaks and pitch pine. Where wildfires have been severe, the forest consists of pitch pine, scrub oak, and blackjack oak. Few areas of this soil have been cleared for farming. They are too droughty to be suitable for most crops, though peaches, sweet potatoes, and small fruits can be grown if the soil is managed properly.

Fallasington Series

The Fallasington series consists of nearly level fine sandy loams that are greenish colored and distinctly mottled. These soils are poorly drained, and some areas are ponded in late in the winter.

Fallasington soils are moderate in fertility and available water capacity. They are moderately high in organic matter content. Except where they have been heavily lime, these soils are very strongly acid. Generally, they are saturated six to eight months of the year and the water table drops below 3 feet in the summer.

The native vegetation is a hardwood forest consisting of pin oak, willow, swamp white oak, blackgum, and red maple. The understory is dense and consists of highbush blueberry, sheep laurel, gallberry, sweet pepperbush, bayberry, and greenbrier.

In most places these soils have been cleared and are used mostly for corn, soybeans, pasture, hay, and late planted vegetables. Where they are planted to blueberries, a system that controls the water level is highly desirable. Fallasington soils are not suited to alfalfa, fruit, asparagus, or other vegetables that cannot withstand wetness.

Freehold Series

The Freehold series consists of well-drained, sandy and loamy soils that have a moderately high or high available water capacity. These soils were formed in glauconite marine deposits, and contain small amounts of glauconite. Freehold soils are moderately or moderately slowly permeable. Except where they have been heavily limed, Freehold soils are very strongly acid.

The native vegetation is a fast-growing forest of red oak, white oak, scarlet oak, yellow poplar, beach, and hickory. Freehold soils are well suited to crops and are the most extensively farmed soils in the county. These soils are well-suited to fruit, vegetables, grain, hay, pasture, nursery plants, and cultivated side.

Galloway Series

Galloway soils are coarse-textured, siliceous, unconsolidated sediments that have been reworked by wind. The Galloway series consists of deep, nearly level and gently sloping sandy soils that have a fluctuating water table that is moderately high in late winter. These soils are moderately well drained are somewhat poorly drained. Unlike most of the soils in the county, they have almost as much clay in the surface layer as in the underlying layers. These soils form on terraces adjacent to the Delaware River and in the outer coastal plain.

The native vegetation on these soils in the outer coastal plain are primarily pines. In the outer coastal plain only a small acreage of Galloway soils has been cleared for crops. The farmed acreage is used mostly for sweet corn, sweet potatoes, pumpkins, and cantaloupe.

Holmdel Series

Holmdel soils consists of moderately well-trained are somewhat poorly drained sandy and loamy soils. These soils contain small amounts of glauconite, and were formed by marine deposits that contain the material. They have a moderately high seasonal water table. Holmdel soils are moderate or moderately slow in permeability, and they have a moderately high or high available water capacity. Fertility is moderate to moderately high. Where soils have not been drained, the water table fluctuates. When rainfall is normal, the water table starts to rise in October reaching its peak late in winter or early spring, and drops to a depth of more than 5 feet by June.

The native vegetation is a forest consisting mostly of red oak, white oak, scarlet oak, yellow poplar, beach, and hickory. In some poorly drained areas, however, the vegetation consists of pin oak, willow, sweet gum, and southern red oak. Common shrubs are viburnum and spicebush. In most places, farmed Holmdel soils have been drained by open ditches or under drains and planted in crops. Typical crops include corn, soybeans, small grains, hay, pasture, fruit, vegetables, and nursery plants.

Keansburg Series

The Keansburg series consists of very dark colored, nearly level soils that are very poorly drained and received much runoff water from the slopes above. These soils have developed in marine deposits that are mostly marine in origin but that have been redeposited in other places. The prominently mottled olive gray subsoil is moderately coarse textured and contains small to

moderate amounts of glauconite. These soils occur at the bottom of large circular depressions and along streams, especially at the headwaters.

Keansburg soils are moderately permeable and have a moderately high available water capacity. They dry out in late spring and are late in warming. In their normal conditions, these soils are saturated 8 to 10 months of the year.

The native vegetation is a hardwood forest that consists mostly of pin oak, willow, swamp white oak, red maple, sweet gum, patch, beach, and holly, and there are a few yellow poplar and southern red oak. The understory consists of viburnum, spicebush, highbush blueberry, bayberry, and Greenbrier.

Were actually drained, these soils are used for soybeans, corn, pasture, hay, small grains, blueberries, and later vegetables. They are not suited to alfalfa and fruit. Drainage is needed if these soils are to be farmed. These soils are moderately fertile and are high in organic matter content. Unless they have been lined, these soils are very strongly acid.

Kresson Series

The Kresson series consists of somewhat poorly drained soils that contain large amounts of glauconite. These soils are high in natural fertility, and added fertilizers do not leach readily. Kresson soils are generally very strongly acid, and large additions of lime are needed to correct the condition. In places, the substratum is only slightly acid or nearly neutral. Organic matter content is low in the loamy sand and is moderate in the loamy fine sandy loam.

The native vegetation is a hardwood forest consisting of mostly oak, hickory, beach, ash, red cedar, and Virginia pine. Virginia pine or red cedar is normally the first to seed in old fields. Crescent soils are well-suited to general crops and are usually used for growing vegetables, corn, soybeans, small grains, and hay.

Lakehurst Series

The Lakers series consists of deep, loose, moderately well or somewhat poorly drained sandy soils that have a bleached horizon seven or more inches thick. The soils formed in coarse water laid deposits on the Outer Coastal plain. They are the most expensive soils of Burlington County.

Lakehurst soils are very strongly acid and very low in fertility. Added fertilizers leach readily. The content of organic matter is very low. Because the soils are loose, they are subject to soil blowing and, on slopes, to water erosion. The fluctuating water table in the soil starts to rise in about October, rises to about 2 feet from the surface by late in winter or early in spring, and drop shortly after spring. Since plants use more water in summer than in other seasons, this water table is of value only to deep rooted plants. A considerable acreage of Lakehurst soils was cleared and cultivated about 100 years ago, but little of it remains in active agriculture.

Lakewood Series

The Lakewood series consists of deep, loose excessively drained soils that have a bleached horizon seven or more inches thick. Lakewood soils have rapid or moderately rapid permeability and low or very low available water capacity. They are low in organic matter and fertility. Added fertilizers leach readily. These soils are very strongly acid. They are subject to wind erosion.

The native vegetation is a forest consisting of pitch pine, black oak, and white oak. Where wildfires have been severe, vegetation has reverted to pitch pine, scrub oak and blackjack oak. Where wildfires have been most severe, the trees are dwarfed; they grow less than 5 feet high, though they are 50 or more years old.

Several thousand acres of these soils originally were cleared for farming, but nearly all of this acreage has reverted to woodland. Crop yields were so low that cultivation was abandoned.

Manahawkin Series

Manahawkin soils are mucked soils composed of organic deposits underlain with sandy fluviomarine sediments. Manahawkin muck occurs on level lowland flats and is often forested. Dominant vegetation includes Atlantic white cedar, bald cypress, pitch pine, red maple, black, sweet gum, swamp chestnut oak, water oak, smooth alder, northern white cedars, and sweet bag magnolia. The understory is highbush blueberry, sweet pepperbush, leather leaf, gallberry, arrowwood, greenbrier, American holly, ferns, sages, grasses and mosses. Some areas are cultivated in cranberries and blueberries.

Marlton Series

The Marlton series consists of nearly level to sloping, moderately well drained to well-drained soils that contain large amounts of glauconite. These soils occur in high positions. They formed in marine deposits and contain large glauconite. When these soils are moist and the clays are swelled, permeability is moderately slow on the surface layer, slow in the subsoil, and moderately slow in the substratum. Permeability is more rapid in summer when the soil cracks from shrinking. These soils have a high available water capacity. These soils also are moderate in organic matter content and high in fertility.

The native vegetation is a hardwood forest consisting of mostly red oak, white oak, willow, hickory, yellow poplar, ash, beach, red cedar, and Virginia pine. Abandoned fields contain scattered red cedar. These soils are mostly cleared for crops. But only a small acreage is irrigated. They are mostly used for dairy farming or for growing grain. The most common crops are corn, soybeans, small grains, hay, and pasture, though tomatoes and pumpkins are also grown places.

Mullica Series

The Mullica series consists of deep, very poorly drained soils that formed in acid, moderately coarse textured Coastal Plain sediments. They are found in low, wet areas that receive runoff from the surrounding soils. Slope generally is less than 1%. They are found on the landscape with Hammonton, Woodstown, and Fallsington soils. The soil is suited to cultivated crops and pasture if drained. Potential productivity is moderate. The seasonal high water table limits the soil for most urban uses.

Pemberton Series

The Pemberton series consists of nearly level or gently sloping soils that have a thick, very sandy surface layer and mottled fine sandy loam subsoil. These soils are mostly moderately well drained, but some areas are somewhat poorly drained. Pemberton soils formed in a material containing small amounts of glauconite. This material originally was marine deposits, but is thought to have been redeposited by wind. This is because it is much more common on the south side of streams than on the north side and because it lacks gravel in the substratum.

Permeability of the Pemberton soils is moderate to rapid in the surface layer, moderate in the subsoil, and moderately rapid in the substratum. Available water capacity is low. The water table starts to rise about October and reaches its peak, 2 feet below the surface in late winter, and drops again to a depth of more than 5 feet by June. These soils are low in organic content and very low in fertility. Added fertilizers leach readily.

The native vegetation of these soils is a hardwood forest consisting of mostly oak, hickories, and scattered Virginia pines. Virginia pines invade idle fields and occupy the site for many years before the hardwoods are reestablished. About three fourths of this acreage has been cleared for crops. It is used most extensively for irrigated high-value vegetables such as sweet

corn, onions, carrots, and tomatoes. Small grains, soybeans, hey, are grown and a small acreage of this soil type is used for pastures.

Sassafras Series

The Sassafras series consists of well drained, moderately coarse textured soils formed in water laid deposits that contain little or no glauconite. Although the surface layer and the subsoil have the same textural class, the subsoil contains more clay than the surface layer. The substratum is very sandy and contains large amounts of gravel in places. These soils are mostly nearly level or gently sloping, though they have slopes of 5 to 10% in some places.

Sassafras soils are moderately permeable. The available water capacity, organic matter content and fertility are moderate except where the surface layer is loamy sand. The loamy sand has moderately low available water capacity and fertility and low organic matter content.

Sassafras soils are very strongly acid unless heavily limed.

The native vegetation is a hardwood forest consisting mostly of red oak, white oak, black oak, scarlet oak, hickory, beach, yellow poplar, and scattered Virginia pine. Pines are more abundant in the outer coastal plain than in the inner coastal plain, and they seed readily in abandoned fields.

In the end inner coastal plain, nearly all areas of Sassafras soils have been cleared for farming. High-value vegetables are grown under irrigation, but now much of the area is being developed for residential, commercial, and industrial uses.

Shrewsbury Series

The Shrewsbury series consists of nearly level, wet, mottled gray soils that contain small to moderate amounts of glauconite. These soils are poorly drained that occur in low positions where they receive much surface and substratum water from the higher slopes. They formed in redeposited marine materials.

In their natural condition, Shrewsbury soils are saturated 6 to 8 months of the year. Normally water is about 4 feet below the surface in the summer. The water table starts to rise in September, reaches a depth of 1 foot by November, and remains at that level until it starts to drop in April. When the soils are drained the water table does not remain high for long periods of time. These soils are moderately permeable. They are moderately fertile and moderately high in organic matter material.

In area where the variant soil series consists of fine sandy loam, ironstone forms in the subsoil. This variant is nearly level and occurs in low positions where the water table is high.

The native vegetation is a hardwood forest consisting of lowland species such as willow, pin oak, swamp white oak, ash, beach, hickory, sweet gum, and red maple. The understory is viburnum, spicebush, elderberry, and greenbrier.

When drained, Shrewsbury soils are suited to corn, soybeans, small grains, hay, pasture, blueberries, and late vegetables. Irrigation is seldom needed. These soils are not well-suited for the cultivation of alfalfa and fruit.

Tinton Series

The tension series consists of well drained, gently sloping to strongly sloping soils having a thick sandy surface layer over glauconitic fine sandy loam subsoil. Underlying layers are sand, fine sandy loam, and loamy sand. These soils form a narrow band, particularly on the south side of major west flowing streams such as the Rancocas Creek, where it appears that sand has been redeposited over glauconitic soils like the Freehold series. These soils occupy high positions.

Probability of a Tinton soils is moderately rapid, and available water capacity is low or very low, depending on the depth of the sand. The surface soil is loose and subject to wind erosion. Organic matter content and fertility are very low.

The native vegetation is a hardwood forest consisting of mostly oaks, hickories, and Virginia pines. Virginia pines readily seed in idle fields and occupy soil for some time before the hardwoods are again dominant. Crops are restricted to pumpkins, cantaloupes, grapes, peaches, and sweet potatoes, but these do not grow well.

Urban Land

This land type consists of cut and fill areas, most of which have been developed for residential, commercial, industrial use or for multilane highways. During the development, the original soil horizon was destroyed in at least 70% of the area.

Westphalia

The Westphalia series consists of well drained, nearly level or gently sloping, sandy and loamy soils. These soils formed in the thick Kirkwood marine deposits, which consist mostly of fine and very fine sands. Some of these soils were transported by water or wind. They occur on high positions in the county. And probably because of the high percentage of uniformly fine sand, these soils are moderately slow in permeability. The available water capacity is high for the fine sandy loam and moderate for the loamy fine sand. Organic matter content is moderate for the fine sandy loam and low for the loamy fine sand. Westphalia soils are moderately fertile.

In most places the native vegetation is a mixed hardwood forest consisting of northern red oak, southern red oak, scarlet oak, white oak, black oak, yellow poplar, holly, beach, hickory, and scattered Virginia pines. In places yellow poplar or beach going nearly pure stands. Virginia pine, we see denial feels it occupies a site for some time before the hardwoods become established.

This acreage has been cleared for crops. The crops grown include corn, soybeans, small grains, pasture, hay, fruit, vegetable, starch restocked, and sixed. Most high-value crops are irrigated.

Woodstown Series

The Woodstown series consists of moderately well drained, sandy and loamy soils that are nearly level or gently sloping. These soils are nearly level in 70% of the acreage. They formed in water laid material and generally occur below the Sassafras and above the Fallsington soils. Woodstown soils have a fluctuating water table that rises to a depth of about 2 feet late in winter.

Sound soils have moderately slower moderately perm ability and moderate available water capacity. When rainfall is normal, the water table starts to rise in October, reaches its peak of about 2 feet from the start surface late in winter, and drops again to a depth of more than 5 feet in the summer. In drained areas the water table rises to about 2 feet from the surface only after heavy rains, and then it drops rapidly. Organic matter content is moderate or low, depending on the texture of the surface layer. The loamy soils are moderate infertility, and sandy soils are moderately loud. Here geishas needed for high-value crops. These soils can be drained by open ditches or under drained. Although Woodstown soils are naturally very strongly acid, and heavily lined farmed fields at acidity has been reduced.

Udorthents

Very deep, excessively drained to moderately well drained soil areas that have been altered by cutting and filling. Mainly located in and adjacent to urban areas, highways, and borrow areas. Slopes are mainly 3-15%, but range from 0-25%, with steeper slopes on the sides of the unit.

APPENDIX B
ERICACEAE SUBFAMILY VACCINIOIDEAE

The genus *Vaccinium* L. is classified as being a member of the plant family Ericaceae. The heath family is found throughout the world and includes over 4100 species (Judd 2007). The family has recently been circumscribed to include eight sub-families of which Vaccinioideae is one. The Vaccinioideae are distinguished by the presence of a tissue that easily disintegrates on the underside of the anther. It is also characterized by a base chromosome number of 12, with polyploidy commonly occurring in this subfamily. The *Vaccinium* are a member of the tribe Vaccinieae, a clade, is characterized by a number of features, including anther tubes, inferior ovaries and fleshy, beautifully colored fruits (i.e., berries or drupes).

Vaccinioideae and Vaccinieae are found throughout Europe and Asia as well as the New World. Genera are often identified by anther characteristics and careful characterization of the corollas. Species are delimited on the basis of morphology of stamens, corollas, fruits, and leaves.

Genus

The genus *Vaccinium* Linnaeus contains approximately 450 species. Camp was the first to describe population structure and possible biological species for the genus (Camp, 1945). Vander Kloet (1988), on the other hand, could not find evidence to support many of the suggested species delineations. Consequently, he merged many previously identified species, drastically reducing the number of species recognized in North America. His conclusions were based on substantial field work as well as herbarium research (Vander Kloet 1988, 2009) Vander Kloet today is considered the authority on *Vaccinium*; however, much confusion and many questions remain among professionals regarding the delineation of species within this genus.

In his book, *The Genus Vaccinium in North America*, (1988) Vander Kloet noted that *Vaccinium* occupies both stable and unstable sites. Many of the unstable sites, such as mines, farm fields and forested woodlands, were made unstable by human disturbance, and human activities, thus, favor a greater number of these plants. Many areas of the East Coast, which had been disturbed first by Native Americans and later by Europeans, provided the perfect environment for *Vaccinium*, a secondary successional species.

By contrast, the stable sites are generally mountainsides where *Vaccinium* found small niches on soils not easily vegetated by other species. In either case, the berries are tasty, ranging from tart to sweet and varying in form from oval to short and squat.

Section

The genus *Vaccinium* is further delineated by section. Currently, according to Vander Kloet (1988) there are approximately nine sections recognized within *Vaccinium*. *Vaccinium corymbosum* is a member of the section *Cyanococcus*. The Latin name “*Cyanococcus*” can literally be translated as “blue berry.” This is not the only plant in the world with blue-hued berries, however, so other distinguishing features are needed for identification. Section *Cyanococcus* comprises nine to twelve species, with no consensus on the actual number of valid species. An important diagnostic feature of the section is the wart-like or varicose features of the twigs and stems of the plant (Vander Kloet, 1988, 2009). These features are visible on the wood of the current season. The buds are dimorphic and covered with scales and occur together on each twig or stem. They are easily distinguished by their size; the floral buds are much larger. In this study, I will follow the treatment of Vander Kloet (1988, 2009), who recognizes the following nine species in this section:

Vaccinium angustifolium is a deciduous lowbush blueberry that forms dense colonies of shrubs about 25 cm in height. They spread by rhizomes. The leaves are elliptical and the

underside of the leaf is glabrous and waxy or sometimes pubescent. Margins of the leaves are serrated. The berry is blue with a waxy coating or shiny and black. This species has a northern range generally extending from northern Canada to southern New Jersey. It also grows in parts of the Appalachian Mountains a little farther south, since the mountain climate is somewhat cooler than the coastal plain.

Vaccinium myrtilloides is a deciduous lowbush blueberry that is somewhat taller than *Vaccinium angustifolium*. It can reach almost 60 cm in height. It also uses rhizomes to spread laterally, forming dense colonies. This species has an entire margin that distinguishes it from *V. angustifolium*. The range of *V. myrtilloides* is somewhat smaller, occurring on the eastern coast extending from Maine to Canada.

Vaccinium boreale is a low shrub that is 10-15 cm in height and can look almost vine-like. The leaves are deciduous. The rhizomes are on or near the surface and the berry is blue and waxy. This species has a limited northeastern range. “Populations occur as far north as Quebec, Labrador, Newfoundland, Cape Breton and the Gaspé Peninsula, and south to mountain summits in Maine, New Hampshire, Vermont, and New York” (Vander Kloet, 1988, p. 63). Its range was probably heavily influenced by glaciers that formed over North America and Europe, surviving on nunatacks and migrating back to North America when the glaciers retreated.

Vaccinium darrowii is an evergreen species of southern origin and is native to Alabama, Florida, Georgia, Louisiana and Mississippi. This shrub can grow to 1.2 m tall and has a simple oval leaf that comes to a sharp point. Its leaves are waxy and bluish in color. The persistent sepals form an unusual crown to the berry and this feature, along with the bush's waxy leaves and evergreen condition, make this species easy to identify.

Vander Kloet traces the origins of *Vaccinium darrowii* to an ancient relative of the section *Cyanococcus* that “emigrated from South America using the Proto-Antilles (which later

became the Greater Antilles) as stepping stones. During the Tertiary Period section *Cyanococcus* invaded the sand dunes, relic sand dunes, and pine forest flatwoods of Florida where the evergreen and diploid *Vaccinium darrowii* thrives” (Vander Kloet, 1988, p. 46). Over geological time, this stem species evolved into the array of species occurring on the East Coast. It is from this group that the highbush blueberry developed, becoming the species known today.

Vaccinium hirsutum is a deciduous shrub that grows from 1.2-1.6 m tall and is distinguished by the hairs on its leaves and berries. The plant is extremely pubescent, a feature that is diagnostic for this species. The berry is black, glandular-pubescent and rarely glabrous.

Vaccinium myrsinites is similar in many ways to *Vaccinium darrowii*; however, its range is limited to Florida, South Carolina, Georgia and Alabama. The leaves are a simple elliptical shape and the margin sometimes slightly curves under, forming a revolute margin. They have glandular hairs on the lower surface, unlike *Vaccinium darrowii*, which lacks these hairs. The fruit is a black shiny berry. Neither the fruit nor the receptacles are waxy.

Vaccinium palladium is approximately 60 cm feet tall. It is a deciduous shrub that grows by spreading rhizomes. The dark green leaves are oval to broadly elliptical with serrated margins, and the underside is pubescent. The colors of the leaves are dark green and the margins are serrated. The plant's range extends from Minnesota through southern Ontario to Maine, and then south to Georgia, Alabama, and Arkansas. It tends to thrive in dry environments. As a result, the species can survive in open forests (savannas) as well as along rocky ledges and abandoned farm fields. The berries are blue and glaucous to dull and are rarely shiny black.

Vaccinium tenellum is a 1.2 m tall shrub that spreads by rhizomes and grows in colonies forming dense stands. The leaves are elliptical with a small spreading margin towards the ends of the leaf. The leaves also have glandular-hairs. The berry is black and shiny and often has a poor flavor.

Vaccinium corymbosum ranges in height from 1.5-4 m, forming a large crown and this tall stature immediately distinguishes it from all the other member of section *Cyanococcus*. Vander Kloet has relegated all highbush blueberries into this one species, and it thus exceptionally diverse.

APPENDIX C
INTERVIEW INSTRUMENT

Screening

- A. Do you raise blueberries now? _____ Yes _____ No
B. Have you or anyone in your family ever raised blueberries? _____ Yes _____ No
C. Have you or anyone in your family ever been involved in the blueberry business?
_____ Yes _____ No

If **NO** to all three questions, terminate interview

If **YES** to any – Was the land (their involvement) connected with Retreat – If **YES** go to Part II.

Social Capital & Social Networks

- What are your earliest memories of Retreat? What kinds of things make Retreat a special place for you? I'm interested in anything that makes it special for you from the people to the countryside.
- How is Retreat different today from how it was before?
- Does much of your family still live around Retreat?

If **YES** – Do you think any of those people would be willing to talk to me?

MAKE CONTACT LIST

If **NO** – When did they start moving away?

Why did they move away?

- Do you know where your family came from when they immigrated to America?

England
Scotland
Wales
Ireland

PROBE – Do you know what part of (England, Scotland ...) your family came from?

- How far back does your family go in this area?

PROBE -- Do you know when the first SURNAME settled in Retreat?

- Do you know why your people ended up in Retreat – what made this seem like a good place to settle for them?
- Does anybody in your family talk about the iron furnace in Retreat?
- Did someone from your family work there? Yes NO
- By 1900 or so, how big was the (SURNAME) family in this area? Was yours one of the big families around here?

- How much land did the (SURNAME) family have?

- How did they use the land?

MAKE LIST

To your knowledge, did your family's land have any cranberry bogs on it? Yes
 No

SOCIAL NETWORK

- Compared to other families around here, do you think your family got along well and helped each other a lot or were they more independent-minded?

- If they work well together

Can you tell me the kinds of things that your family did together to support the family – things like gathering blueberries or sharing food and such?

- If they didn't work well together

What were some of the difficulties that kept your family from working together more?

- Does much of your family still live around Retreat? Yes No

If **YES** – Do you think any of those people would be willing to talk to me?

CONTACT LIST

If **NO** – When did they start moving away?

Why did they move away?

- Were there other families around here that your family was close to? Yes
 No

Who were they?

Where did they live?

- Do you know how your family got to know them?

Church School Work Proximity Informal gathering places
 Social events other

- Do you know anything about the kinds of things they did together? Yes
 No

c. Coop b. U-pick c. Individual market

- What did you have to do to get the land ready for blueberries?
- When did you quit raising blueberries? _____ (Year)
- Did anyone take over the blueberry operation? _____ Yes _____ No

If **YES**,

Family member _____

Outsider _____

- Why did you get out of the business?

Retired _____

Not profitable _____

APPENDIX E
COMPREHENSIVE DATA COLLECTION INSTRUMENT

Type of Capital	Dimensions	Variables	Source of Information
Ecological-natural	Life support system underlying biodiversity and natural resources	Average temperature (summer high and winter low) Soil type Aquifer Naturally occurring wetlands High water table Areas suitable for blueberries	<p>(GP) Only acid soils should be used for blueberry production. "It is time and money well spent if a suitable field can be obtained" (Beckwith & Coville, 1931p. 3).</p> <p>(GP) Blueberries only thrive in acid soils (Beckwith, 1931)</p> <p>(GP) They include the need for acid soils, together with well-drained soils which have a moderate amount of soil moisture throughout the growing season (Pitt & Hoagland, 1942)</p> <p>(PP) "God has distributed his little berry so freely over the state for us to appreciate its excellence and the possibilities of improvement" (Munson, 1899, p. 57).</p> <p>(PJ) "Nature is very liberal in our Jersey pines, and provides valuable harvests from crops which no man ever planted. Sphagnum moss and Christmas greens are shipped by the carload. Wild huckleberries by the trainload, and there are still wild cranberries."(White, 1917b, p. 58)</p> <p>(H) One can only imagine the soil erosion and habitat disruption that resulted from this industrial landscape (Stilgoe, 1982).</p> <p>(PJ) That the Huckleberry is capable of being greatly improved there can be little doubt; the reason it has not been done is principally because the attention of skilled cultivators has not been directed to it; when it is, in the same effort put forth to improve it as has been to improve the strawberry and the great, no doubt but the result will be as satisfactory.</p> <p>(PS) "What will doubtless the reason for this apparent neglect is largely due to the abundance and excellence of the wild plants. There seemed to be no reason for the exertion incident cultivation in order to procure a liberal supply of fruit" (Munson, 1899, p. 56).</p> <p>(PJ) "Doubtless the reason for this apparent neglect is largely due to the abundance and excellence of wild plants. There seems to be no reason for the exertion incident to cultivation in order to procure a liberal supply of fruit" (American Pomological Society, 1899, p. 56).</p> <p>(PS) "The Blueberries in Commerce. In many of the northern and eastern states there are thousands of acres of land, utterly</p>

			<p>worthless for agricultural purposes, which after the pine is removed, send up an abundant growth of blueberry bushes, alders, poplars, gray birch, etc. and which, by proper management may, it is believed, be made to yield a handsome profit to its owners” (W. M. Munson, 1899, p.57).</p> <p>(GP) “As our country becomes older, more and more attention will be given to the value of our native plants as a source of food” (Gourley, 1917).</p> <p>(GP) “The blueberries of American have been strangely overlooked alike by horticulturists and by historians; yet there are no less than six or seven distinct species which furnish fruit of considerable value, and as many more which, though of less importance, furnish fruit which may be eaten” (American Pomological Society, p. 57).</p> <p>(GP) “The whole market supply comes from wild bushes”(Crowley, 1926)</p>
Built - cultural	Structures that give relative degree of character to parts of the countryside	<p>Built bogs</p> <p>Transportation lines (roads, rail)</p> <p>Houses (illustrative)</p> <p>Agricultural production & processing facilities</p>	<p>(I) The train played a vital role in economics of the region</p> <p>(I) Cranberry packing houses are a dominant element on the landscape blueberry acreages were Relatively small 8-30 acres and were often solely set out by individual families</p> <p>(I) The cranberry packing house was a noticeable structure on the landscape that most people remember</p> <p>(I) The cotton mill made underwear and sox</p> <p>(I) The iron furnace made cannon balls the size of pool balls</p> <p>(I) When I was young they were still making charcoal</p> <p>(I) After the civil war cranberry production changed from local gathering into a thriving business.</p> <p>(HI) “Most of the houses around here were log cabins. Of course it was weatherboards outside” (Halpert, 1937).</p> <p>(HI) “The frame of a house down in the Pines as a general thing was made out of pine. All the boards used in the house was pine: doors, floor boards, sheathing; and outside, the weather boards and roof was cedar. They didn’t use much paint” (Halpert, 1937).</p> <p>(HI) “Most all families had a few chickens-anywheres from a dozen to two dozen hens, and a rooster” (Halpert, 1937).</p> <p>(HI) “The houses was fairly good- built more for comfort than to look at. Hardly ever was painted. They were generally two stories high, two rooms down and two up. Had a stairway went from the kitchen, generally</p>

			<p>boxed in with a closet underneath” (Halpert, 1937).</p> <p>(HI) “These people that made charcoal, when they went in a piece of timber, generally built cabins out of pine logs. They was mostly one room affairs, about twelve by sixteen. After they got the timber cut off, they’d leave these cabins stand there” (Halpert, 1937).</p> <p>(HI) “...because they raised their own potatoes, sweet potatoes, and dried beans- raise beans and dry them when they got ripe, and put them away for the winter.. Each one of them, most, had a garden in the summer time- an acre, tow acres. Raised cabbage, beets, potatoes, sweet potatoes, beans, squashes, punkin and cucumbers” (Halpert, 1937).”</p> <p>(I) The false blueberry disease hit cranberries hard during the 1920’s followed by 3 years of severe drought</p> <p>(GP) “The land should be so ditched that the water level can be kept at least a foot below the surface of the ground during the growing season” (Coville, 1911).</p> <p>(GP) “At present the custom is to set the plants in rows 8 feet apart and the plants 4 feet apart in the rows” (Beckwith & Coville, 1931).</p> <p>(GP) “The blueberry cooperative ships 95% of the berries produced in New Jersey” (C. Beckwith & Coville, 1931).</p> <p>(P) “This cranberry meadow had no convenience in the way of dams or stream to flow or irrigate, but they looked fine and remained healthy for many years until they were destroyed by the vine-worm, which I think was near the close of the 60’s” (Budd, 1897).</p>
	<p>Land uses that give relative degree of character to parts of the countryside</p>	<p>Agricultural lands (including blueberry fields) Woodlands Settlement pattern</p>	<p>(I) I learned to skate on the bog in front of the house</p> <p>(GP) Bogs are laid out in low swampy areas by clearing off the forest and building dikes, drainage ditches, and flood gates. Flooding usually begins late in November, and the plants remain under water until early spring” (Lee, 1924, p. 47).</p> <p>(I) Blueberry patches were planted after a clearings was made in the woods.</p> <p>(I) We planted our blueberries on an abandoned cranberry bog.</p> <p>(I) The Wells’ lived on “Retreat Road” now known as Big Hill Road.</p> <p>(I) Tar Kill Road was where the Jersey devil lived.</p> <p>(I) My father used a rocky dump to knock blueberries.</p> <p>(I) The first fields were set out with rows eight</p>

			<p>feet apart and the bushes in the row were set out at 4 feet apart (Beckwith & Coville, 1931).</p> <p>(H) “Through the industrial period, the iron communities were connected to the larger region and, indeed, to world commerce. “The patterns of Pinelands towns, even the architecture of the houses, were derived from general patterns found in England and the Northeast, and the dominant religion, Quakerism, stemmed from the same cultural background” (Moonsammy et al., 1987).</p> <p>(H) Also in Retreat, nestled between the stream and swamps, were an iron forge, cotton factory, mill pond and mill race, all of which took advantage of the natural resources of the watershed. Bog iron, wood for charcoal and water power fueled this early industrial village, which supported the needs of nearby urban centers (Pierce, 1957).</p> <p>(N) The outlook for a good Huckleberry crop has never been better than it is the season.</p> <p>(N) The Huckleberry crop looks to be in pretty good shape and there are prospects of a fair yield.</p> <p>(H) “New Jersey's iron plantations, resembling in particular those of Pennsylvania, are feudal establishment. Workers rarely lived more than a stone's throw from their jobs, and they labored almost without letup, save on a few special days when they went hunting or fishing. National holidays often passed unnoticed in the early 1800's, even Christmas and Independence Day. Wives of the workers bought everything at the company store, to which they were more likely to be in debt long before payday. The worker's homes were rude structures. Cooking was usually done at the kitchen fireplace, which was the principal source of heat in the winter. There was little furniture, and what there was had been roughly built from scrap lumber. Bedrooms were apt to be sparsely furnished seldom containing mirrors, tables, wardrobes, or even chairs" (Pierce, 1957).</p> <p>(N) Strawberries are about done for and huckleberries are next in the market.</p> <p>(N) “Reba Bozarth put on her Huckleberry Harness and started out the other day to get some idea of the prospects of a satisfactory harvest. She walked around the woods for about 10 miles and when she came back she said she could eat all the green and ripe berries she had seen in her travels, without feeling any bad effects from overheating”</p>
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			<p>(Retreat, 1911, July 8, p.5)</p> <p>(N) “Thompson Wells, the veteran Huckleberry huckster of this section, has discover this year that after going over his old rounds at this place, Johnson Place, Canaan and Retreat he is not been able to get the loads that he gathered in previous years by covering half the distance. This gives a fair idea of the short crop” (Retreat, 1911, July 8, p.5).</p> <p>(N) All the people around here are busy at Huckleberry Union and some of the natives have neat sounds of the real goods to their credit, (Retreat, 1911 a, pp.5).</p> <p>(N) “H. M. Willits has quit the Huckleberry business and is now working for Charles Rogers” (Retreat, 1911 a, pp.5).</p> <p>(N) Most all the Huckleberry pickers in this section state that they had a very successful season.</p> <p>(N) “The Huckleberry crop around here has been very satisfactory in large quantities have been gathered” (Retreat, 1911 a, pp.5).</p> <p>(N) The blueberry crop will be a big one and already large shipments are being made.</p> <p>(N) Walter Brown, a farmer and cranberry grower living just out of town took a load of huckleberries to Trenton” (Chatsworth, 1914, pp. 9).</p> <p>(N) Large quantities of huckleberries are being gathered in this vicinity and shipments made daily to New York and Philadelphia markets” (Chatsworth, 1914, pp. 9).</p>
	<p>Cultures and traditions associated with particular areas</p>	<p>“Pre-blueberry” activities based on natural resource extraction (cranberry, charcoal, moss) Wild blueberry harvesting Anglo-Saxon heritage</p>	<p>(I) My grandparents worked for Budd’s where they learned about the new blueberry industry</p> <p>(I) All the women worked</p> <p>(GP) “Wild blueberries and huckleberries grow extensively in the open wooded section. Harvesting these berries is an important industry, thousands of bushels being picked and shipped to market annually” (Lee, 1924, p. 48).</p> <p>(I) We went to Medford to help friends of the family pack cabbage</p> <p>(N) Mrs. Brewer, wife of Daniel Brewer, together with three children and her mother-in-law, or along the road picking huckleberries.</p> <p>(HI) “After the railroad went through, thousands of people picked huckleberries every summer. Railroad was finished 1864, and as long as I can remember, they were shipped to New York in half bushel boxes. Most of these people shipped in their own name to merchants in New York. They get a check once a week” (Halpert, 1937).</p>

			<p>(HI) “[wild blueberry picking] Twenty-five or thirty [pickers] go all in one place- carry a little handle basket and pick that full and that would be a day’s work. Get in the woods and talk, talk, talk. After a while people learned how to get them. I’ve seen by wife pick sixty quarts, carry them out of the woods, put them in the crates, from eight o’clock to twelve, four hours” (Halpert, 1937).</p> <p>(HI) “William Torrey, they always called him Tarry, done more for the common people in New Jersey than any man they had in Jersey. He got the right of way for a railroad and built it and made a market for almost everything there was in this part of Jersey. After he got the railroad through, people picked huckleberries and shipped them into New York. There was no market around here for huckleberries. People only picked what they wanted to eat. After that railroad went through, thousands of people picked huckleberries every summer. Railroad was finished in 1864” (Halpert, 1937).</p> <p>(N) Walter Brown, a farmer in cranberry grower living just out of the town took a load of huckleberries to Trenton on Saturday (Chatsworth, 1914)</p> <p>(N) “Freeholder George V. Bozarth, of Chatsworth, has a rattlesnake’s skin taken from the largest rattler killed in that section of the pines within many years. The snake was killed at Governor’s Hole, long famed as a home of rattlesnakes, by Jesse Estelow, who was picking huckleberries when he discovered the reptile basking in the sun” (Chatsworth, 1914, pp. 9).</p> <p>(N) “Benjamin Farrow, aged, 78, an old resident of West Creek, drop dead on Monday, the 10th in his own doorway. He just returned from blueberry picking” (New Jersey Mirror)</p> <p>(N) Large quantities of huckleberries are being gathered in this vicinity and shipments made daily to New York and Philadelphia markets.</p> <p>(HI) “There was two seasons in the year to get moss. Start in the spring when the frost come out of the moss- it was the first thing to freeze and the last thing to thaw out” (Halpert, 1937).</p> <p>(HI) “A little of it went to Philadelphia; most of it went to New York. Shipped it by carload. If you had good moss, two good men could make ten bales a day. We got seventy five cents a bale - that was the average price” (Halpert, 1937).</p>
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			<p>(PJ) "I knew that this could best be done (find the superior stock) with the aid of our people from the Pines who made a business of picking huckleberries. During the season they visit thousands of plans in the course of each day's work, and it would be a simple matter for them to mark for me the occasional exceptionally fine bush they found" (White & White, 1918, p.7)</p> <p>(GP) "The amount charged for the privilege of taking blueberries varies in different sections. In some sections there are practically no restrictions on the land and the public my help themselves. In other places there is a set price for a pasture, little account being made of the actual acreage in it. Various cases may be cited for comparison sense no standared rate can be given, In one section \$35 per person was paid for the privilege of taking a 30 acre pasture. In the same neighborhood \$10 was paid for an 100 acre pasture on which there was a fair stand of berries" (Gourley, 1917).</p> <p>(N) "The owners of pasture lands where these berries are growing wild have inaugurated a tax, thereby controlling the supply of the berry in certain cases, charging each individual so much per season to have the privilege of picking as much as one would" (Lowe, 1905).</p> <p>(PJ) "Those who hold title to the land and pay taxes seldom lay any claim to these [wild] crops. No one is considered to be stealing when he picks wild huckleberries or wild cranberries on another's man's lands, but is counted as a thief if he cuts and sells firewood or cedar timber from land he does not own" (White, 1917, p. 58).</p> <p>(GP) "Wild blueberries and huckleberries grow extensively in the open wooded sections. Harvesting these berries is an important industry, thousands of bushels being picked and shipped to market annually" (Lee, 1924).</p> <p>(N) "If you live in a blueberry section-New England- or along the Atlantic Seaboard, you probably like to go out and gather wild blueberries" (Anonymous, 1893, pp. 15).</p> <p>(P) Prior to 1800, the farmers, who then lived principally on the products of their own hands, looked forward with pleasure for their annual huckleberry gatherings, about the first of august, in the Jersey Pines and which was a general round-up of the farmers to get together after their harvests were garnered. And many a young man has met for the first time the young lady that</p>
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			<p>afterwards became his companion for life at these gatherings.</p> <p>(N) "The outlook for a good Huckleberry crop has never been better than it is the season" (Browns Mills, 1914, pp. 10).</p> <p>(N) "The Huckleberry crop looks to be in pretty good shape and there are prospects of a fair yield" (Retreat, 1911b, pp. 6).</p> <p>(N) "Strawberries are about done for and huckleberries are next in the market" (Retreat, 1911b, pp. 6).</p> <p>(N) "Reba Bozarth put on her Huckleberry Harness and started out the other day to get some idea of the prospects of a satisfactory harvest. She walked around the woods for about 10 miles and when she came back she said she could eat all the green and ripe berries she had seen in her travels, without feeling any bad effects from overeating" (Retreat, 1911a, pp. 5).</p> <p>(N) "Thompson Wells, the veteran Huckleberry huckster of this section, has discover this year that after going over his old rounds at this place, Johnson Place, Canaan and Retreat he is not been able to get the loads that he gathered in previous years by covering half the distance. This gives a fair idea of the short crop" (Retreat, 1914, pp. 8).</p> <p>(N) "All the people around here are busy at Huckleberry Union and some of the natives have neat sounds of the real goods to their credit" (Chatsworth, 1914, pp. 9).</p> <p>(N) "H. M. Willits has quit the Huckleberry business and is now working for Charles Rogers. Most all the Huckleberry pickers in this section state that they had a very successful season" (Retreat, 1911a, pp. 5).</p> <p>(N) "The Huckleberry crop around here has been very satisfactory in large quantities have been gathered" (Browns Mills, 1914).</p> <p>(N) "The blueberry crop will be a big one and already large shipments are being made" (Browns Mills, 1914, pp. 10).</p> <p>(N) "The outlook for a good Huckleberry crop has never been better than it is the season" (Browns Mill, 1914, pp. 10)</p> <p>(HI) "Always been wild huckleberries and cranberries in the woods [and] farms here. They'd go from one thing to another. I've been "coaling" twice myself. Lots of people [even] my father used to "coal" for a living. They'd first burn it in a pit. Then they'd take it to kilns and reburn. They'd buy a piece of timber; if there was pine on it, these charcoal burners would buy it" (Halpert, 1937, p. 22).</p> <p>(HI) "I've worked on farms for 75 cents a day</p>
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			and my board. My daddy, years back, said he used to get only 50 cents a day” (Halpert, 1937, p. 22).
Human-social	Networks that underlie trust	Kin Neighbors	<p>(I) My grandparents wanted their children to go into the blueberry business</p> <p>(PJ) “By association with my neighbors and our helpers in the home, on the farm and at the Cranbury bog, I have had every opportunity to know intimately many of the people in a limited section of the pines” (White, 1917a, p. 60).</p> <p>(PJ) “The R.F.D. reaches surprisingly remote spots, old Hanover, among others” (White, 1917b).</p> <p>(HI) “They’d have a house warming then, and the neighbors and people would all come and they’s all bring them something-some kind of present. Some bring towels, some bring glasses, tin ware, maybe a cradle, doll babies- something like that, always bring something for a joke- but always bring useful stuff too, dishes and stuff like that” (Halpert, 1937).</p> <p>(PJ) “Nature is very liberal in our Jersey pinelands and provides valuable harvesting crops which no man ever planted. Sphagnum moss and Christmas greens are shipped by the carload. Wild huckleberries by the trainload, and there are still wild cranberries. Those who hold title to the land and pay taxes on it seldom lay any claim to these crops, but do value the pine and cedar timber. No one is considered to be stealing when he picks wild huckleberries or wild cranberries on another man's land, but is counted as a thief if he cuts and sells firewood or Cedar timber from when he does not own” (Rose, 1942, p. 18).</p> <p>(N) “Miss White’s faded memorandum book contains a fine collection of old English names- Harding, Adams, Dunfee, and the like” (Rose, 1942, p. 19).</p> <p>(PC) “Here I would like to pay tribute to the pine people who have assisted me to locate these plants. The typed directions that I furnished were of very little use except as an aid in formulating my own ideas, but this was because of the readers’ lack of training in that direction rather than lack of native intelligence. When we get in the woods and swamps, I am the one who reads haltingly and with imperfect understanding, and must rely implicitly on my piney guide. I have never ceased to wonder how they do it” (White & White, 1917a, p. 60).</p>

			<p>(PJ) “In the thinly settled pine country people know very intimately the doings of all their neighbors, one, two or five miles off; much more intimately than you know the doings of most of your neighbors only a block away” (White, 1917b).</p> <p>(HI) “Them fellows in the woods-wasn’t one out of twenty five could read or write. Some could read and some couldn’t write, some write and couldn’t read” (Halpert, 1937).</p>
Institutions that underlie trust	Church School		<p>(N) “[Elizabeth White] College training might have upset her partnership with the man who tamed the hitherto wild blueberry” (Rose, 1942).</p> <p>(PJ) “The piney children are educated or not educated under the same public-school system of New Jersey as are your children” (White, 1917b, p. 18).”</p> <p>(HI) ““Oh yes, there was hundreds of old people couldn’t read and write. It wasn’t their fault” (Halpert, 1937).</p> <p>(HI) “[Jeanette Bozarth Harris] I started to school when I was eight years old. I went to the fifth grade” (Halpert, 1937).</p>
Potential for social learning with familiar and tangible settings	Shared labor (tasks) Shared sites for labor		<p>(I) The whole family set out the blueberries and helped clear the field.</p> <p>(HI) “[wild blueberry picking] Twenty-five or thirty [pickers] go all in one place- carry a little handle basket and pick that full and that would be a day’s work. Get in the woods and talk, talk, talk. After a while people learned how to get them. I’ve seen by wife pick sixty quarts, carry them out of the woods, put them in the crates, from eight o’clock to twelve, four hours” (Halpert, 1937).</p> <p>(HI) “If a man had a big family, they’d all go and pick. Kids made fifty cents or a dollar; women generally pick as much as the men- three or four dollars” (Halpert, 1937).</p> <p>(HI) “All the youngsters and half the old people would go out to a dance. Either have a dance floor or a big building where they could dance- it’d be on the bogs” (Halpert, 1937).</p> <p>(HI) “As a general thing, the girls and fellows would meet on cranberry bogs- they’d all picked cranberries. They allus picked on the bogs but nights they’d go somewhere and dance. People you know didn’t travel around like they do nowadays. You’d take young people livin’ maybe four or five miles apart, they’d never seed one another without they went on these bogs” (Halpert, 1937).</p>

			<p>(HI) “They’d make a hog-killing day. Then four or five families, sometimes more, would kill all their hogs- all that was fit to kill. They’d all help each other. One would be a sort of butcher, others scrape, one take entrails out. Woman, they’d all det in the house and they called it ‘ridin’ the belly’- take the fat off the entrails. Woman who knows how to do that can take the fat off one hog’s entrails in about five to ten minutes” (Halpert, 1937).</p> <p>(HI) “When they got done [hog killing] this dinner would always be ready. They’s have the biggest room in the house and have all the tables they could set in there and the people of the whole community would be there. They’d all come and eat the hog-killin’ dinner. All people in the community was invited too, whether they had hogs or not they was all invited” (Halpert, 1937).</p> <p>(HI) “Pretty near every night would be story night or riddle night or somebody’d bring ‘cordion or violin or some kind of piece of music to play. This would be in winter time-long nights” (Halpert, 1937).</p>
	Level of education and skills	Previous experience with natural resource based production activities Formal education	<p>(I) My dad only had a 4th grade education</p> <p>(I) My dad cut lumber part time, knocked blueberries part time and worked for the Budd’s</p> <p>(PJ) “The typed directions that I furnished were of very little use except as an aid in formulating my own ideas, but this was because of the reader’s lack of training in that direction rather than lack of native intelligence” (White & White, 1918).</p> <p>(PJ) “Their piney knowledge of the woods and swamps enables them to locate the exceptionally fine wild blueberry plants which bear berries of a size and quality surpassing anything we dreamed of six years ago” (White, 1917b).</p> <p>(HI) “The great trouble in the Pines was so many people that didn’t have education. Smart people but they couldn’t read nor write” (Halpert, 1937).</p> <p>(PP) “Elizabeth White did not go to college but did finish high school” (Rose, 1942, p. 18).</p> <p>(PJ) “There are honest men of enterprise who are making a good living for themselves and families by buying up the moss and huckleberries gathered by their neighbors and selling them at a profit (in addition to those of their own gathering) in some special market, thus organizing in some degree the mossing and huckleberry picking of their own neighborhood” (White, 1917a, p. 59).</p>

Economic	Opportunities for generation of wealth	Resource-based businesses	<p>(I) Most of the community was involved in wild blueberry cultivation.</p> <p>(I) Children helped with the wild gathering</p> <p>(I) Part time jobs was the standard way of making a living, cutting wood, blueberries, cranberries, moss</p> <p>(GP)The expense of clearing the fields is partially offset by selling the lumber which is removed (Beckwith & Coville, 1931).</p> <p>(H) “The iron industry of the Pinelands at its height in the early 1800’s required vast amounts of resources. For example, up to 6,000 cords of wood per year were needed to produce the 12,000 bushels of charcoal required for each individual furnace” (Pierce, 1957, p. 134).</p> <p>(HI) “People used to do a good many things in the woods to make a living that they don’t do now. In the winter time they used to go out and pull teaberry leaves, sold them by the pint. In the spring used to go out and pull cranberry vines. Sold by the barrel. Used to make dish creates out of birch and cedar. Big crates-hold ten bushel, put a lid on it. Sell them for about a dollar a piece in Trenton. We used to gather moss, put in “five barrel bales”, five barrels of loose moss squeezed down in a bale 2x2x3. Used to ship that to New York” (Halpert, 1937).</p> <p>(GP) “The yields of the fields at Elkhart Indiana which were planted with unselected blueberry bushes was studied and it was found that an acre produced in 1911 2,266 quarts and averaged \$292.44 per acre” (Coville, 1911, p. 137).</p> <p>(GP) “The yields of the fields at Elkhart Indiana which were planted with unselected blueberry bushes averaged \$321 per acre” (Coville, 1915b).</p> <p>(GP) “It is customary to have pickers camp on the mountain throughout the picking season and they get two thirds of the berries picked, the owner receiving on third. The way it is usually handled is for the owner to sell all the berries and then prorate the pickers two thirds from the net returns after all costs of marketing are deducted” (Gourley, 1917).</p> <p>(GP)In 1930 Burlington County had 90 acres of cultivated blueberries in production (Pitt & Hoagland, 1942).</p> <p>(GP) In 1930 Burlington County produced 94,720 quarts of cultivated blueberries (Pitt & Hoagland, 1942).</p> <p>(GP) In 1940 Burlington County produced 525,845 quarts of cultivated blueberries (Pitt & Hoagland, 1943)</p> <p>(GP) In 1940 Burlington County had 420 acres</p>
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			<p>of cultivated blueberries in production (Pitt & Hoagland, 1943).</p> <p>(PJ) “In March of 1911, Mr. Coville send[t] me from Washington a few blueberry plants, seedlings of the best bush, the “Brooks,” he had up to that time located in New Hampshire. He visited the plantation from time to time and in this way and by correspondence kept me advised as to the progress of his experimental work in Washington. When in 1914 it became desirable for the Department to try in the field a large number of hybrid seedling blueberry plants, the testing ground was rented at Whitesbog and since then we have co-operated on an extended scale with the Department of Agriculture, as represented by Mr. Coville, in its experiments in blueberry culture” (White, 1947; White 1917a).</p> <p>(GP) “Whitesbog is a section of New Jersey from which thousands of bushels of wild, high-bush, or swamp huckleberries as they are called locally, are marketed each year” (McFarland, 1921).</p> <p>(GP) In 1941 the value of the crop picked in only three states where the blueberries are grown (New Jersey, North Carolina and Michigan) amounted to \$7000,000 (Wyman, 1941).</p> <p>(GP) Theodore H. Budd and Joseph J. White are listed as suppliers of horticultural varieties of <i>Vaccinium corymbosum</i> (Wyman, 1941).</p> <p>(GP) “One of the most promising districts for blueberry culture is the cranberry region of New Jersey, for ideal soil occurs in conjunction with an early maturing season and excellent shipping facilities to the markets of Philadelphia, New York, and Boston” (Coville, 1915b).</p> <p>(PJ) 13 northern growers sold horticultural varieties of <i>Vaccinium corymbosum</i>.</p> <p>(GP) 1908 There is every reason to believe that blueberries can be cultivated.</p> <p>(GP) The berries form on 7 year old plant (1917). sold for .24 a quart, 117.3 bushels per acre and \$1,280 per acre (Coville, 1915b).</p> <p>(GP) “In 1944 an acre yielded 305 trays at an average price of \$3.10” (Doehlert, 1956b, p. 16).”</p> <p>(GP) “The heaviest charge against the industry is the cost of producing rooted plants of selected varieties” (Coville, 1915b).</p> <p>(GP) “If the land to be used bears timber and brush, the clearing is expensive” (Coville, 1915a).</p> <p>(GP) “At Whitesbog 6 cents per court has been</p>
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			<p>paid for the last few years “ (Coville, 1926, p. 26).</p> <p>(GP) “An informal agreement of co-operation resulted. In 1913 this was replaced by a formal contract, the object of which was to provide suitable conditions for a field test of the blueberry hybrids produced in the course of the experiments at Washington, D.C.” (Coville, 1915b, p. 2).</p> <p>(GP) “Furthermore, cultivated blueberries are, for the present at least, distinctly a luxury crop. They have sold at from twenty to sixty cents a quart the average price for 1934 being about thirty cents; while wild berries sold mostly at 10-20 cents a quart” (Bailey & Franklin, 1935).</p> <p>(GP) In 1935 there were 500 acres of blueberries produced in New Jersey (Bailey & Franklin, 1935).</p> <p>(GP) In 1920 Whitesbog produced 117 bushels per acre and sold at .34 cents a quart for a total of \$1,280 per acre.</p> <p>(GP) Blueberries can generate between 300-600 per acre.</p> <p>(GP) In 1934 the average price for a quart of blueberries was 30 cents.</p> <p>(GP) In 1931 95% of the New Jersey blueberry crop was sold through the Blueberry Cooperative (Beckwith & Coville, 1931)</p> <p>(GP) Economic revolution in agriculture that will add to the well-being of the farmer.</p> <p>(GP) The annual value of the blueberry crop from the wild is from \$1 million-\$1,500,000. The (GP) The value of the cultivated crop in 1938 was about \$400,000” (Darrow, 1940).</p> <p>(GP) The value of this year's crop for instance is estimated to be at least \$2 million. But there is only one commercial blueberry plantation in the entire country, and with the exception of the fruit raised upon it, all of the blueberries in the country are picked from wild bushes (Darrow, 1940).</p> <p>(GP) “Following the Civil War there was a great expansion of the Cranbury Industry” (Doehlert, 1956b).”</p> <p>(GP) “New Jersey [cranberry] production continued to increase gradually into the early 1920's. Successive crops of 200,000 barrels or more were produced in 1922, 1923 and 1924” (Doehlert, 1956a).</p> <p>(GP) “ The growing of cultivated blueberries promises to become an important industry in this part of the State, especially in view of the fact that they flourish on soils that have little value for the other crops commonly grown in this region” (Lee,</p>
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			<p>1924).</p> <p>(GP) “One of the growers in the area has estimated that the cost of clearing cranberry land and developing a bog, from the time the timber is cut until a full crop matures, is about \$300 per acre” (Lee, 1924).</p> <p>(C) Rubel plants 12 to 18 inches high at Twenty-five Dollars (25\$) each</p> <p>(C) “Our contract with the Government authorizes us to use a portion of the propagating material from all desirable hybrid plants, and we are pushing ahead with the propagation of these hybrids as fast as circumstances permit, but the spring of 1920 will be the earliest possible date at which any of the hybrid plants can be offered for sale” (White 1918 p. 7).</p> <p>(GP) “In many of the northern and eastern states there are thousands of acres of land, utterly worthless for agricultural purposes, which after the pine is removed, send up an abundant growth of blueberry bushes, alders, poplars, grey birches, etc. and which, by proper management may, it is believed, be made to yield a handsome profit to their owners” (American Pomological Society, 1899, p.55).</p> <p>(GP) In 1916 the USDA specifically mentions economic and social betterment as a goal of the department. It specifically mentions the domestication of the blueberry as an example.</p> <p>(GP) Development of a system of blueberry culture which opens the way to the profitable use of acid soils....</p> <p>(GP) “The growing of cultivated blueberries promises to become an important industry in this part of the state, especially in view of the fact that they flourish on soils that have little value of the other crops commonly grown in the region” (Lee, 1924, p.19).</p> <p>(GP) “Cultivated blueberries are being grown on a plantation at Whitesbog, about 4 miles east of Browns Mills. About 25 acres are set out to cultivated blueberries. About 1000 bushels of berries were harvested this season and marketed at a price about 50% higher than those obtained for wild berries” (Lee, 1924, p. 22).</p> <p>(GP) “According to the census of 1920 there were grown in 1919 in Atlantic, Ocean, and Burlington Counties, 7,172,719 quarts of cranberries on 6,011 acres of bog. Burlington County in 1919 produced about 73 per cent more cranberries than Ocean</p>
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			<p>and Atlantic Counties” (Lee, 1924, p.26).</p> <p>(PP) "This crop has become one of importance to the people of new England; important not so much because of its great money value, but because it opens the field of profit to a class of people who find it very difficult to get employment suited to their capacities; and as it requires no capital to start the business, and as there is no risk of losing anything but time that is of no value, every dollar that is earned in picking berries is so much gain, and gained, too, by a class who really need it" (Anonymous, 1901, p. 1).</p> <p>(PJ) "Ripening as the berries do during school vacation, the children are really better off picking berries, even if they do not bring them any money; it keeps them busy and teaches them to be industrious; and us being able to earn money by their own labor it teaches them the value of money, and furnishes them with practical lessons of extending it" (Anonymous, 1885, p. 1).</p> <p>(PJ) "Years ago there were thriving industrial communities gathered all through the pines, supported chiefly by the smelting of local bog iron ore, by means of charcoal made from the pine trees. The discovery of the possibility of more economically smelting the bountiful iron ore of Pennsylvania with coal struck the death blow to these industrial communities in the New Jersey pines, even though the death was a lingering one" (White, 1917a, p 43).</p> <p>(PJ) Theodore H. Budd; Pemberton, New Jersey is listed as "Northern grower selling horticultural varieties of <i>Vaccinium corymbosum</i>" (Wyman, 1941, p. 31).</p> <p>(PJ) In 1941 the blueberry crop picked in New Jersey, North Carolina and Michigan) was valued at \$700,000" (Wyman, 1941, p. 31).</p> <p>(GP) "During the season of 1930, New Jersey berries could be found in eight of the principle wholesale markets in the northeastern United States" (Coville, 1915b).</p> <p>(PP) "In New Hampshire the picking of blueberries has come to be an important industry in many of the country towns. Whereas a few years ago, farmers thought the blueberry crop of no account, and allowed perfect freedom in gathering the fruit, many growers a blueberry pastures now charge "stumpage" at the rate of two cents per quart, and the blueberry field is regarded with as much concern as the apple orchard " (Pomological Society, 1899, p. 58).</p>
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			<p>(GP) “New Jersey production of cranberries continued to grow beginning in the 1920’ and by 1924, 2000,000 barrels of cranberries were produced” (Doehlert, 1956a)</p> <p>(GP) “Blueberry culture, therefore, not only promises to add to the general welfare through the utilization of land almost valueless otherwise, but it offers a profitable industry to individual land-owners in districts in which general agricultural conditions are especially hard and unpromising, and it suggest the possibility of the further utilization of such lands by means of other crops adapted to acid conditions” (Coville, 1911).</p> <p>(GP) “The annual expenses for weeding, cultivation, and irrigation were about \$20 per acre. The cost of picking was 5 cents a quart. The general cost of maintenance of the equipment was about \$2 per acre per year, the crates and boxes being used repeatedly. The computation includes an estimated annual charge of \$12 per acre for interest \$2 for taxes, and \$4 for depreciation or sinking fund” (Coville, 1915b).</p> <p>(GP) “During the season of 1930, New Jersey berries could be found in eight of the principal wholesale markets in northeastern United States. The surprising quality of the cultivated fruit assures it a prominent and permanent place in all the markets” (Beckwith & Coville, 1931).</p> <p>(GP) In 1944 1600 hundred acres were harvested at an average yield of \$1513 per acre. In 10 years 5000 acres were harvested at an average yield of \$4400 per acre (Doehlert, 1956a).</p> <p>(GP) Six species of wild blueberries are picked and marketed in the US accounting for annual sales of over \$5,000,000 (Darrow, 1940).</p> <p>(GP) “In the case of cultivated blueberries, the new industry has already become well established. Started in a purely experimental way not many years ago, the industry has expanded until cultivated blueberries now occupy a very considerable acreage, and in 1928 represented a crop value of about \$60,000. The acreage under this crop is rapidly expanding and may be expected to become a source of large income to many growers” (Beckwith & Doehlert, 1933).</p> <p>(N) Within five years in 1916, she sold the first crop from named sorts</p> <p>(N) “Last year more than \$600,000 worth of Tru-Blu berries were marketed -\$400,000</p>
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			<p>originating in New Jersey, and about \$100,000 each in North Carolina and in Michigan. Nearly 90 per cent of all cultivated blueberries are sold through the co-op, growers who had seen the new blueberries and heard of their success in the markets flocked to Miss white to obtain bushes for themselves. She had all of the named varieties and the skill to propagate young plants, and had no alternative but to launch Whitesbog in the nursery business. Since that time it has been headquarters for most of the nursery stock for the entire country” (Rose, 1942, p.52).</p> <p>(N) “Former waste lands are now yielding 10,000 bushels of the blueberry which a few years ago were found only in wild state” (Anonymous, 1931, pp.7).</p> <p>(P) “Prior to 1850 cranberries sold from \$1.50 to \$2.00 per bushel” (Budd, 1897).</p> <p>(P) “It had been proven that with the turf cleaned off of an acre of pine land and set with cranberry vines it would, in a few years, produce 100 bushels of cranberries a year, and bring \$4.00 to \$5.00 per bushel, which would make \$400 to \$500 per acre produced from one acre that was formerly worthless (Budd, 1897)”.</p> <p>(P) [Theodore Budd] “I caught the fever in the spring of 1859, and it was a bad case from the start. It has stayed with me nearly forty years, but must say I have decidedly less of it now than any other time since I first contracted it” (Budd, 1897).</p> <p>(P) “As I mentioned before, I commenced to put out cranberry vines in 1859, sold my first berries, 350 bushels, in 1862, to Selser Brothers, for \$4.50 per bushel” (Budd, 1897, p. 6).</p> <p>(P) “While the net proceeds arising from the marketing of our berries is far from what we would like it to be, we may be thankful that we have fared much better than growers of ordinary of farm crops; and if we were to compare our condition with theirs we certainly would have little excuse to complain, but rather rejoice that our condition is not like unto theirs” (Budd, 1897, p. 3).</p> <p>(P) [Coville] “After eight years of experimentation the culture of the blueberry is now about to take its place among the established agricultural industries” (Coville, 1915b)</p> <p>(P) “The cranberry growers of New Jersey are in a specially favored situation to take up this new Industry. They have in the first</p>
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			<p>place the acid peat and sand soil that the blueberry, like the cranberry, requires for its most successful growth. They have ready access to the Philadelphia, New York and Boston markets. They are far enough south to insure an early market for their product and avoid the competition of the main New England and late Canadian wild crop. They have the equipment which is idle at the season of the blueberry harvest. They have excellent wild stocks from which to select superior large-berries productive plants for propagation as cultivated plants” (Coville, 1915b)</p> <p>(P) “Wild cranberry land used to sell for ten cents an acre in Southern New Jersey, while at present it is worth \$800 an acre” (Cranberries.1874, p.1)</p> <p>(P) “ Much has been done by the Cranberry Growers’ Association during its short existence, on promoting the interest of growers of this fruit by searching out the enemies they have to contend with, determining the proper remedy, as well as taking steps for regulating market, and selling both at home and in Europe. The growers, by uniting in a common interest, will save thousands of bushels of berries formerly lost, and many thousand dollars added to the profits from this culture” (Cranberries, 1874, p.1).”</p> <p>(HI) “One summer the buyers came around and paid twenty-five cents a quart all summer. I was a small boy then- not big enough to pick. If they made two hundred dollars in a season beside their living, they could live on that good till huckleberries cam again. That would be a fair amount for a family to make clear” (Halpert, 1937).</p> <p>(HI) “In 1898, big crop of huckleberries-was a long season. Bushes bent right down to the ground. We sold all that we got down in Chatsworth to Bridgeton cannery- dollar and twenty-eight cents a create- thirty-two quarts. Lots of them that year gathered in crates, some eight, some ten crates a day for one man. They shook them that year” (Halpert, 1937).</p> <p>(HI) “Lots of people made a lot of money pickin’ huckleberries. That was the trouble; we have one good year and next year wouldn’t be any. That’s the trouble even today. You can’t depend on them. Aint’ been a decent crop of huckleberries for twenty-five years. In the old days there was no cultivated huckleberries. They’d just getting’ started into it now” (Halpert, 1937).</p>
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	<p>Opportunities for generation of jobs</p>	<p>Cranberry plantations Ancillary work for cranberries</p>	<p>(R) “Hand hoeing and hand weeding close about the plants is expensive. Often, it is postponed or neglected because of shortage of help, pressure of other work, or unfavorable weather” (Doehlert, 1937).</p> <p>(GP) 1927 blueberries sold for 17 cents a quart and were picked for 6 cents a quart.</p> <p>(GP) A skillful picker picking a high producing bush can pick 100 quarts a day earning a total of \$ 6.00 (Coville & Florida Dept. of Agriculture, 1926).</p> <p>(HI) “When they used to pick cranberries by the bushel, general price was fifty cents. Some pickers could go on the bog and make good money- two or three dollars a day” (Halpert, 1937).</p> <p>(GP) Blueberry cultivation was labor intensive and required planting and hand hoeing (Beckwith & Coville, 1931).</p> <p>(N) “People then could be hired to pick them at four cents a quart. Does he not remember the wagons that came with their load of berries to go to market-not this sort but plump large globes of blue”(Beckwith & Coville, 1931)</p> <p>(HI) “[Alfred Budd] They had some cranberry bogs – very few them days. They didn’t work on the bogs then like they do nowadays. Nowadays they almost cultivate them” (Halpert, 1937).</p> <p>(N) “A great many of the piney people, incidentally, work today in the cultivated berry fields. The pickers, however, are mostly women and children who come to work by bus from near-by towns. Woman also pack, and paste on the Cellophane covers, while boys slide the boxes into crates and nail them together” (Rose, 1942, p. 11).</p> <p>(N) “Base pay this year was five and a half cents a quart, with bonuses and extras. A picker with nimble fingers earns from five to six dollars a day, rushing tray after tray of sun-warmed blue fruit to the fore-woman for another punch on her tally card” (Rose, 1942, p. 55).</p> <p>(GP) Cranberry growing has developed to a point where it is the most important small fruit industry in the state. In spite of this, 90% of the good cranberry land in the state is in a wild condition. The market for the product is excellent. It is evident that this is one of the special branches of agriculture that has to a large degree been neglected in New Jersey (Beckwith, 1931; Lee, 1924).</p> <p>(GP) Blueberry cultivation offers economic opportunity to people with acid soils that to</p>
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			<p>this point have been (Coville & Florida Dept. of Agriculture, 1926).</p> <p>(GP) “But to be safely on the side of conservative, let us figure the price at only 10 cents per quart for the next ten years. Even at this low price and figuring on the basis of the above conservative estimate of yield, a blueberry orchard will bring the owner a n income of from \$300 to \$600 an acre, beginning with the fifth year’s crop, while the third and fourth year’s crop yield incomes of 180.00 and \$240.00 per acre, respectively” (Coville & Florida Dept. of Agriculture, 1926).</p> <p>(GP) “There are also large areas, otherwise worthless, which might without doubt be made to yield good returns if in some way a growth of blueberries could be started -- either by setting bushes or by scattering seed. Perhaps this suggestion may be regarded as visionary, but it is quite within the range of possibilities” (American Pomological Society, 1899, p. 58).</p> <p>(N) “Managing and building an enterprise of this magnitude—there are as many as 200 nimble-fingered pickers working the blueberry orchards from June to August—would seem a full-time chore, but not for Miss White” (Rose, 1942, p. 18).</p> <p>(HI) “At the beginning they got a better price but they had to learn how to pick before they could gather many berries. People often made ten dollars a day pickin’ berries. That was after the War.</p>
	<p>Investments that are associated at least partly with natural and cultural characteristics</p>	<p>USDA Coops (cranberry, blueberry)</p>	<p>(GP) “Selection was started by offering a price for wild blueberry bushes with extra-large berries. This stimulated a search of the swamps within 20 miles of Whitesbog, and those who picked the berries for market brought in many samples of fine fruit. Between 1911 and 1916 100 bushes were purchased, with berries five-eight of an inch or more in diameter; two had berries fully three quarters of an inch across” (McFarland, 1921).</p> <p>(PC) “When the breeding work reached a point where it was desirable to try plantings in the field, the Department of Agriculture contracted for trial grounds at Whitesbog. Under the terms of contract , Joseph J. White Inc., has the right to half of the propagating material from all desirable government seedlings there tried, but agrees not to propagate for sale and hybrid not approved by the department“ (McFarland, 1921).</p>

			<p>(PC) “The berries marketed from Whitesbog up to 1921 were all from plants under trial, consequently they were much inferior in size and quality to those of the Whitesbog varieties, yet they were eagerly purchased at from 30 to 60 cents per quart, wholesale. After deducting transportation and commission charges, the 1919 crop of 300 bushels sold for an average price of about \$10 per bushel, the 1920 crop of 500 bushels at an average price of about \$12.50 per bushel. The latter amounted to 300 bushels, only half a normal crop, but even so demonstrates possibilities for Blueberry culture” (McFarland, 1921).</p> <p>(N) “Washington—the plant raisers of the [US] Department of Agriculture have been able to develop blueberries almost the size of Concord grapes, it has awakened interest in this popular fruit. The department experiments have extended over several years, and this year the surplus have been such as to warrant the prediction that the way has been opened up for a new industry and for a new use of land in many portions of the country in growing of a crop that in many places will pay more liberally than any other now cultivated” (Darrow et al., 1940)</p> <p>(N) “The value of this year’s crop for instance is estimated to be at least \$2 million. But there is only one commercial blueberry plantation in the entire country, and with the exception of the fruit raised upon it, all of the blueberries in the country are picked from wild bushes” (Darrow et al., 1940)</p> <p>(N) “The big point in the larger sized fruit is the greater ease with which it can be picked. It is both tedious and expensive to pick the small berries not was well know, the cost of this on item being about one half to two thirds of the market price. In addition to this, the larger berries will present a better appearance and, no doubt sell for a larger amount at retail” (White & White, 1918).</p> <p>(GP) “There is perhaps no native fruit in our state that offers such opportunity for improvement as the blueberry and certainly none that compare with it at the present time in economic value” (Gourley, 1917).</p> <p>(N) “Dr. Frederick V. Coville, who has just received a high award from the Massachusetts Horticultural Society for his achievements in the plant world, is a botanist with an eye for the practical” (Woodroof, January 1931).</p> <p>(N) “The United States Department of</p>
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			<p>Agriculture is interesting itself in the question of cultivating blueberries, and in a recent bulletin give a few of the know fact in regard to it” (Anonymous, 1901, p. 4).</p> <p>(N) “The Department of Agriculture intends to help the small farmer. The emphasis will be on making money and by making farming profitable. Practical agricultural economics is the new ideal, and helping Bill make more money is the new job. To this end the department has been reorganized with a view to brining farm economics to the fore” (Vrooman, 1916, p. 106).</p> <p>(N) [USDA] “Development of a system of blueberry culture which opens the way to the profitable use of acid soils” (Vrooman, 1916).</p> <p>(GP) “The experiments looking toward the domestication of the swamp blueberry, which have been carried on for the past three years, have now reached a point where it is possible to outline with definiteness the conditions under which this plant may be propagated and grown successfully in pot cultures” (Coville, 1915b; Coville, 1911a).</p> <p>(GP) “Meanwhile, experiments in the field culture of these plants have been begun, as well as cooperation with various individuals and experiment stations for the same purpose “ (United States. Dept. of Agriculture, 1911a)</p> <p>(GP) “There is good prospect that the application of the knowledge thus gained will establish the blueberry in field culture and that ultimately improved varieties of these plants will be grown successfully on a commercial scale” (United States. Dept. of Agriculture, 1910)</p> <p>(GP) [The unimproved blueberry plantation at Elkhart, Ind.]“The plantation has been very productive and profitable, the net profits this year being a little more than \$160 per acre” (United States. Dept. of Agriculture, 1911).</p> <p>(GP) “The investigations in economic and systematic botany and range work have been continued under the direction of Mr. F.V. Coville. The search for other and still better wild stocks continues, the largest berries having been found in the pine barrens of New Jersey and in North Carolina” (United States. Dept. of Agriculture, 1912)</p> <p>(GP) “Plants are brought into commercial bearing five years from seed. Berries</p>
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			<p>nearly seven-eighths of an inch in diameter have been grown in the greenhouse, and many thousands of promising hybrids are now in cultivation” (United States. Dept. of Agriculture, 1914)</p> <p>(GP) “The cooperative work of the blueberry plantation at Whitesbog, N.J. has been continued with highly satisfactory results, and initial plantings at the cranberry station at East Wareham, Mass., have been made in cooperation with the Massachusetts Agricultural Experiment Station. Blueberries thrive best in soils so acid as to be considered worthless for ordinary agricultural purposes. Blueberry culture, therefore, offers a profitable industry to individual landowners in districts in which general agricultural conditions are especially hard and unpromising and suggests the possibility of further utilization of acid lands by means of other special crops” (United States Dept. of Agriculture, 1916).</p> <p>(GP) “About 15,000 hybrid blueberry plants produced in the greenhouses at Washington have been grown to fruiting age in the cooperative blueberry plantation at Whitesbog, 4 miles east of Browns Mills, in the pine barrens of New Jersey. From these plants four have been selected and placed in the hands of nurserymen for propagation and distribution. The first of the selected hybrids will be on sale in the spring of 1921” (United States Dept. of Agriculture, 1920).</p> <p>(GP) “A report entitled “Experiments in Blueberry Culture,” by Mr. Frederick V. Coville, has been prepared and is now in press as Bulletin No. 193 of this Bureau. There is good prospect that the application of the knowledge thus gained will establish the blueberry in field culture and that ultimately improved varieties of these plants will be grown successfully on a commercial scale”(United States. Dept. of Agriculture, 1911)</p>
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Emerging Themes

- Time consuming hand labor was the families most important asset
- “[Whitesbog] Here, in little wooden cottages provided by Miss White, live the hundreds of Italians, Negroes, Portuguese, “Pineys” and Cape Verde Islanders who cultivated and harvest the fragrant fruit. The miniature city has its own post office, its general store, a

day nursery for the workers' exuberant infants, and even two outlying "suburbs"- Florence and Rome- for a number of Italian pickers (HOLT, 1941).

- Innovated approaches to wild blueberry gathering
- My family lived on \$400.00 a year
- People held a number of part time jobs
- Children are an important component of the family economics
- This was a transition phase between animal power and machine power
- Kids worked at an early age
- The most important investment for the family venturing into the blueberry industry was family time and labor
- Average acreages was between 10 and 20 acres
- WW II surplus was used in the blueberry business
- "Since 1911, blueberry improvement has been studied in an orderly way by the cooperation between the Bureau of Plant Industry in the Federal Department of Agriculture and the firm of Joseph J. White Inc., New Lisbon, New Jersey" (McFarland, 1921).
- Outside labor was used when the fields came into full production
- "During the 1920's the false blossom disease became widespread. The disease and insect problems, followed by three successive summer droughts in 1921-1931 and the depression of the 1930's, resulted in heavy abandonment of low yielding acreages. After a sharp decline during the 1920's and early 1930's New Jersey production has continued at a relatively stable level during the last 20 years, averaging about 85,000 barrels annually" (Doehlert, 1956a).
- Large numbers of foreigners from near-by cities, principally Philadelphia, are employed. Berries are picked with a cranberry scoop or by hand (Lee, 1924).
- "Prices range from \$6.50 to as high as \$18 a barrel of 100 quarts; in 1919 the average price obtained for the whole crop was about \$7.50 per barrel."
- "Along about 1924 the false blossom disease hit everybody a staggering blow. Small people went under years before—hiring labor, etc." (Halpert, 1937).
- "There was always a moving in and out in the Pine region. It was never a static condition. It was a general tendency to have the more ambitious boys and girls go where there were more varied opportunities" (Halpert, 1937).
- "Those that were less ambitious wouldn't tear away from the environment they really liked" (Halpert, 1937).
- "There was much more isolation in the old days" (Halpert, 1937).
- Women played an important role in community organizing.
- Government leadership was crucial in the development of the blueberry.
- Local leadership by the cranberry growers and especially Elizabeth White were important in transferring the science and possibilities of blueberry culture.
- People learned the possibilities of blueberry production while working on the large cranberry plantations.
- Cranberry false blossom disease followed by 3 years of successive drought occurred during the formative years of the blueberry industry.
- Role of Elizabeth White as an organizer she brought together a remarkable collection of selected wild blueberry plants.

- “Beyond her uncanny business sense and drive she is filled with a native, intuitive knowledge of the plants that grow in New Jersey’s strange, half-forgotten bog country” (Rose, 1942, p. 18).
- “She has never left her plants for more than a few days, excepting one trip abroad” (Rose, 1942, p. 18).
- Generation of wealth was closely connected to the resources of the woods.
- Local people were allowed to harvest resources from other people’s property.
- “I think that nowadays God is making many revelations of His truth through the scientific workers, and through the practical workers too, who are fitting the bits of truth discovered by the scientists into the everyday scheme of life. The scientists are searching for the missing pieces, and with the practical workers are trying to fit them to the parts that already seem finished” (White, 1917b).
- “Are we not all feeble-minded as compared to the Master Mind which planned the great picture we are working so incompetently to piece together” (E. C. White, 1917b).
- “Years ago there were thriving industrial communities scatted all through the pines, supported chiefly by the smelting of the local bog iron ore by means of charcoal made from the pine trees. The discovery of the possibility of more economically smelting the bountiful iron ore of Pennsylvania with coal struck the death blow to these industrial communities in the Jersey pines, even though the death was a lingering one” (White, 1917b).
- “About ten years after the Civil War, about 1875, them roads around Pemberton, Buddtown, that part of the country where they had cranberry bogs would be alive with tramps. They estimated one fall that right in the that neighborhood, all through there, there was ten thousand tramps. The most of them tramps was old soldiers—the majority of them. They picked by hand, there wasn’t no scoops. After they got done pickin’ cranberries, they’d pull out for the cities” (Halpert, 1937).

APPENDIX F
HYPOTHETICAL CAUSAL LINKS WITH IN A CULTURAL LANDSCAPE DATA

Ecological Capital

Dimension: Life support system underlying biodiversity and natural resources

Variables: Average temperature (summer high and winter low), Soil type, Aquifer, Naturally occurring wetlands, High water table, Areas suitable for blueberries

Text Data

"Only acid soils should be used for blueberry production. "It is time and money well spent if a suitable field can be obtained (Beckwith & Coville, 1931 p. 3).

Blueberries only thrive in acid soils (Beckwith, 1931).

The false blueberry disease hit cranberries hard during the 1920's followed by 3 years of severe drought.

They include the need for acid soils, together with well-drained soils which have a moderate amount of soil moisture throughout the growing season (Pitt & Hoagland, 1943, p. 2).

"(1879) God has distributed his little berry so freely over the state for us to appreciate its excellence and the possibilities of improvement" (Cunningham, 1955 p. 153).

"Nature is very liberal in our Jersey pines, and provides valuable harvests from crops which no man ever planted. Sphagnum moss and Christmas greens are shipped by the carload. Wild huckleberries by the trainload, and there are still wild cranberries" (White, 1917b p. 42).

One can only imagine the soil erosion and habitat disruption that resulted from this industrial landscape (Stilgoe, 1982).

"That the huckleberry is capable of being greatly improved there can be little doubt; the reason it has not been done is principally because the attention of skilled cultivators has not been directed to it; when it is, in the same effort put forth to improve it as has been to improve the strawberry and the grape, no doubt the result will be as satisfactory" (Anonymous, 1885 p. 1).

"What will doubtless the reason for this apparent neglect is largely due to the abundance and excellence of the wild plants. There seemed to be no reason for the exertion incident cultivation in order to procure a liberal supply of fruit" (Munson, 1899, p. 157).

"Doubtless the reason for this apparent neglect is largely due to the abundance and excellence of wild plants. There seems to be no reason for the exertion incident to cultivation in order to procure a liberal supply of fruit" (American Pomological Society, p. 56)

"They include the need for acid soils, together with well-drained soils which have a moderate amount of soil moisture throughout the growing season" (Pitt & Hoagland, 1943, p. 2).

"The Blueberries in Commerce. In many of the northern and eastern states there are thousands of acres of land, utterly worthless for agricultural purposes, which after the pine is removed, send up an abundant growth of blueberry bushes, alders, poplars, gray birch, etc. and which, by proper management may, it is believed, be made to yield a handsome profit to its owners" (W. M. Munson, 1899b p. 58).

"As our country becomes older, more and more attention will be given to the value of our native plants as a source of food" (Gourley, 1917 p. 4).

“The blueberries of American have been strangely overlooked alike by horticulturists and by historians; yet there are no less than six or seven distinct species which furnish fruit of considerable value, and as many more which, though of less importance, furnish fruit which may be eaten” (American Pomological Society, p. 54).

“The whole market supply comes from wild bushes” (United States. Dept. of Agriculture, 1909 p. 61).

Built- Cultural Capital

Dimension: Structures that give relative degree of character to parts of the countryside

Variable: Built bogs, Transportation lines (roads, rail), Houses (illustrative), Agricultural production & processing facilities.

The train played a vital role in economics of the region.

Cranberry packing houses are a dominant element on the landscape.

Blueberry acreages were grown on relatively small 8-30 acre patches and were often solely set out by individual families.

The cranberry packing house was a noticeable structure on the landscape that most people remember.

The cotton mill made underwear and sox and was located at “Twin Bridges”.

The iron furnace made cannon balls the size of pool balls and had a large hall with a bowling alley on the second floor.

When I was young they were still making charcoal and my Dad would show me this place off of Hog Heaven Road where charcoal was made and pointed out how it impacted the growth of the forest. You can still see it today if you go back there and look.

“Most of the houses around here were log cabins. Of course it was weatherboards outside” (Halpert, 1937 p. 245).

“The frame of a house down in the Pines as a general thing was made out of pine. All the boards used in the house was pine: doors, floor boards, sheathing; and outside, the weather boards and roof was cedar. They didn't use much paint” (Halpert, 1937 p. 197).

“Most all families had a few chickens- anywheres from a dozen to two dozen hens, and a rooster (Halpert, 1937 p. 141).”

The chickens were kept in chicken coops.

“The houses was fairly good- built more for comfort than to look at. Hardly ever was painted. They were generally two stories high, two rooms down and two up. Had a stairway went from the kitchen, generally boxed in with a closet underneath” (Halpert, 1937 p. 147).

“These people that made charcoal, when they went in a piece of timber, generally built cabins out of pine logs. They was mostly one room affairs, about twelve by sixteen. After they got the timber cut off, they'd leave these cabins stand there....because they raised their own potatoes, sweet potatoes, and dried beans- raise beans and dry them when they got ripe, and put them away for the winter.. Each one of them, most, had a garden in the summer time- an acre or two acres. Raised cabbage, beets, potatoes, sweet potatoes, beans, squashes, punkin and cucumbers” (Halpert, 1937 p. 145).

“The land should be so ditched that the water level can be kept at least a foot below the surface of the ground during the growing season” (F. V. Coville, 1911 p. 120).

“At present the custom is to set the plants in rows 8 feet apart and the plants 4 feet apart in the rows(C. Beckwith & Coville, 1931 p. 5)”.

The blueberry cooperative ships 95% of the berries produced in New Jersey” (C. Beckwith & Coville, 1931).

“This cranberry meadow had no convenience in the way of dams or stream to flow or irrigate, but they looked fine and remained healthy for many years until they were destroyed by the vine-worm, which I think was near the close of the 60’s” (Budd, 1897 p. 3).

Dimension: Land uses that give relative degree of character to parts of the countryside

Variables: Agricultural lands (including blueberry fields), Woodlands, Settlement pattern,

Text Data

I learned to skate on the bog in front of the house

“Bogs are laid out in low swampy areas by clearing off the forest and building dikes, drainage ditches, and flood gates. Flooding usually begins late in November, and the plants remain under water until early spring” (Lee, 1924 p. 479).

Blueberry patches were planted after a clearings was made in the woods.

Large blueberry plantations were planted on abandoned bogs and savannah lands surrounding the bogs.

We planted our blueberries on an abandoned cranberry bog.

The Wells’ lived on “Retreat Road” now known as Big Hill Road.

Tar Kill Road was where the Jersey devil lived and cut through the woods to Burrs Mill.

My father used a rocky dump to knock blueberries. He held two of them in each hand.

The first fields were set out with rows eight feet apart and the bushes in the row were set out at 4 feet apart (Beckwith & Coville, 1931).

“Through the industrial period, the iron communities were connected to the larger region and, indeed, to world commerce. “The patterns of Pinelands towns, even the architecture of the houses, were derived from general patterns found in England and the Northeast, and the dominant religion, Quakerism, stemmed from the same cultural background” (Moonsammy et al., 1987 p. 50).

Also in Retreat, nestled between the stream and swamps, were an iron forge, cotton factory, mill pond and mill race, all of which took advantage of the natural resources of the watershed. Bog iron, wood for charcoal and water power fueled this early industrial village, which supported the needs of nearby urban centers (Pierce, 1957).

“New Jersey's iron plantations, resembling in particular those of Pennsylvania, are feudal establishments. Workers rarely lived more than a stone's throw from their jobs, and they labored almost without letup, save on a few special days when they went hunting or fishing. National holidays often passed unnoticed in the early 1800’s, even Christmas and Independence Day. Wives of the workers bought everything at the company store, to which they were more likely to be in debt long before payday. The worker’s homes were rude structures. Cooking was usually done at the kitchen fireplace, which was the principal source of heat in the winter. There was little furniture, and what there was had been roughly built from scrap lumber. Bedrooms were apt to be sparsely furnished seldom containing mirrors, tables, wardrobes, or even chairs” (Pierce, 1957, p. 67).

Dimension: Cultures and traditions associated with particular areas

Variables: “Pre-blueberry” activities based on natural resource extraction (cranberry, charcoal, moss), Wild harvesting, Anglo-Saxon heritage.

Text Data

strawberries are about done for and huckleberries are next in the market.

The huckleberry crop around here has been very satisfactory in large quantities have been gathered.

The Huckleberry crop looks to be in pretty good shape and there are prospects of a fair yield.

The blueberry crop will be a big one and already large shipments are being made.

Walter Brown, a farmer and cranberry grower living just out of town took a load of huckleberries to Trenton.

Large quantities of huckleberries are being gathered in this vicinity and shipments made daily to New York and Philadelphia markets.

All the women worked during cranberry season and the kids would be dropped off after school at the packing house.

H. M. Willits has quit the huckleberry business and is now working for Charles Rogers.

The outlook for a good huckleberry crop has never been better than it is the season. This suggests that there were large colonies or openings in the forest where blueberries could thrive.

Most all the Huckleberry pickers in this section state that they had a very successful season.

All the people around here are busy at huckleberrying and some of the natives have neat sounds of the real goods to their credit.

Thompson Wells, the veteran huckleberry huckster of this section, has discover this year that after going over his old rounds at this place, Johnson Place, Canaan and Retreat he is not been able to get the loads that he gathered in previous years by covering half the distance. This gives a fair idea of the short crop.

Reba Bozarth put on her huckleberry harness and started out the other day to get some idea of the prospects of a satisfactory harvest. She walked around the woods for about 10 miles and when she came back she said she could eat all the green and ripe berries she had seen in her travels, without feeling any bad effects from overheating.

“Wild blueberries and huckleberries grow extensively in the open wooded section. Harvesting these berries is an important industry, thousands of bushels being picked and shipped to market annually (Lee, 1924 p. 480).”

We went to Medford to help friend's of the family pack cabbage

Mrs. Brewer, wife of Daniel Brewer, was picking huckleberries together with her three children and her mother-in-law when she was struck by an automobile while picking along the road.

William Torrey, they always called him Tarry, done more for the common people in New Jersey than any man they had in Jersey. He got the right of way for a railroad and built it and made a market for almost everything there was in this part of Jersey. After he got the railroad through, people picked huckleberries and shipped them into New York. There was no market around here for huckleberries. People only picked what they wanted to eat. After that railroad went through, thousands of people picked huckleberries every summer. Railroad was finished in 1864.

Walter Brown, a farmer and cranberry grower living just out of the town took a load of huckleberries to Trenton on Saturday.

Freeholder George V. Bozarth, of Chatsworth, has a rattlesnake's skin taken from the largest rattler killed in that section of the pines within many years. The snake was killed at Governor's Hole, long famed as a home of rattlesnakes, by Jesse Estelow, who was picking huckleberries when he discovered the reptile basking in the sun.”

“Benjamin Farrow, aged, 78, an old resident of West Creek, drop dead on Monday, the 10th in his own doorway. He just returned from blueberry picking.”

“Large quantities of huckleberries are being gathered in this vicinity and shipments made daily to New York and Philadelphia markets.”

“There was two seasons in the year to get moss. Start in the spring when the frost comes out of the moss- it was the first thing to freeze and the last thing to thaw out (Halpert, 1937 p. 199).”

“A little of it [moss] went to Philadelphia; most of it went to New York. Shipped it by carload. If you had good moss, two good men could make ten bales a day. We got seventy five cents a bale - that was the average price (Halpert, 1937 p. 199).”

"I knew that this could best be done (finding the superior stock) with the aid of our people from the Pines who made a business of picking huckleberries. During the season they visit thousands of places in the course of each day's work, and it would be a simple matter for them to mark for me the occasional exceptionally fine bush they found (E. C. White & White, 1918 p. 7)(White, 1916 page 5)."

"Whitesbog is a section of New Jersey from which thousands of bushels of wild, high-bush, or swamp huckleberries as they are called locally, are marketed each year (McFarland, 1921 p. 10)."

"(New England) The amount charged for the privilege of taking blueberries varies in different sections. In some sections there are practically no restrictions on the land and the public may help themselves. In other places there is a set price for a pasture, little account being made of the actual acreage in it. Various cases may be cited for comparison since no standard rate can be given, In one section \$35 per person was paid for the privilege of taking a 30 acre pasture. In the same neighborhood \$10 was paid for a 100 acre pasture on which there was a fair stand of berries (Gourley, 1917 p. 10)."

"The owners of pasture lands where these berries are growing wild have inaugurated a tax, thereby controlling the supply of the berry in certain cases, charging each individual so much per season to have the privilege of picking as much as one would like (Lowe, 1905 p. 1)."

"Those who hold title to the land and pay taxes seldom lay any claim to these [wild] crops. No one is considered to be stealing when he picks wild huckleberries or wild cranberries on another's man's lands, but is counted as a thief if he cuts and sells firewood or cedar timber from land he does not own". (White, 1917p. 47)

"Wild blueberries and huckleberries grow extensively in the open wooded sections. Harvesting these berries is an important industry, thousands of bushels being picked and shipped to market annually" (Lee, 1924 p. 480).

"If you live in a blueberry section-New England- or along the Atlantic Seaboard, you probably like to go out and gather wild blueberries" (The blueberry passes from its wild state. 1934 p. 11).

"Prior to 1800, the farmers, who then lived principally on the products of their own hands, looked forward with pleasure for their annual huckleberry gatherings, about the first of August, in the Jersey Pines and which was a general round-up of the farmers to get together after their harvests were garnered. And many a young man has met for the first time the young lady that afterwards became his companion for life at these gatherings."

"The outlook for a good huckleberry crop has never been better than it is this season"(Browns mills. 1914 pp. 11).

"The huckleberry crop looks to be in pretty good shape and there are prospects of a fair yield" (Retreat. 1911 p.4).

"Strawberries are about done for and huckleberries are next in the market" (Retreat. 1910 pp. 3).

"Reba Bozarth put on her huckleberry harness and started out the other day to get some idea of the prospects of a satisfactory harvest. She walked around the woods for about 10 miles and when she came back she said she could eat all the green and ripe berries she had seen in her travels, without feeling any bad effects from overeating" (Retreat. 1911 pp. 4).

"Thompson Wells, the veteran huckleberry huckster of this section, has discovered this year that after going over his old rounds at this place, Johnson Place, Canaan and Retreat he is not been able to get the loads that he gathered in previous years by covering half the distance. This gives a fair idea of the short crop" (Retreat. 1911 pp. 5).

"All the people around here are busy at huckleberrying and some of the natives have neat sounds of the real goods to their credit" (Retreat. 1911 pp. 5)."

"H. M. Willits has quit the huckleberry business and is now working for Charles Rogers. Most all the huckleberry pickers in this section state that they had a very successful season" (Retreat. 1911 pp. 6).

"The huckleberry crop around here has been very satisfactory in large quantities have been gathered"

(Browns mills.1914 pp. 12).

“The blueberry crop will be a big one and already large shipments are being made (Browns mill.19149).”

“The outlook for a good Huckleberry crop has never been better than it is the season” (Browns mill.1914 pp. 6)

”Always been wild huckleberries and cranberries in the woods [and] farms here. They’d go from one thing to another. I’ve been “coaling” twice myself. Lots of people [even] my father used to “coal” for a living. They’d first burn it in a pit. Then they’d take it to kilns and reburn. They’d buy a piece of timber, if there was pine on it, these charcoal burners would buy it” (Halpert Interviews p. 22).

”I’ve worked on farms for 75 cents a day and my board. My daddy, years back, said he used to get only 50 cents a day.”

Human Social Capital

Dimension: Networks that underlie trust

Variables: Kin, Neighbors

My grandparents wanted their children to go into the blueberry business

“By association with my neighbors and our helpers in the home, on the farm and at the cranberry bog, I have had every opportunity to know intimately many of the people in a limited section of the pines (White, 1917a p. 42).”

“The R.F.D. reaches surprisingly remote spots, old Hanover, among others” (White, 1917a, p. 59).

“They’d have a house warming then, and the neighbors and people would all come and they’d all bring them something-some kind of present. Some bring towels, some bring glasses, tin ware, maybe a cradle, doll babies- something like that, always bring something for a joke- but always bring useful stuff too, dishes and stuff like that” (Halpert, 1937 p. 153).

“Nature is very liberal in our Jersey pinelands and provides valuable harvesting crops which no man ever planted. Sphagnum moss and Christmas greens are shipped by the carload. Wild huckleberries by the trainload, and there are still wild cranberries. Those who hold title to the land and pay taxes on it seldom lay any claim to these crops, but do value the pine and cedar timber. No one is considered to be stealing when he picks wild huckleberries or wild cranberries on another man's land, but is counted as a thief if he cuts and sells firewood or cedar timber from when he does not own” (White, 1917 p. 42).

“Miss White’s faded memorandum book contains a fine collection of old English names- Harding, Adams, Dunfee, and the like” (Rose, 1942 p. 55).

“Here I would like to pay tribute to the pine people who have assisted me to locate these plants. The typed directions that I furnished were of very little use except as an aid in formulating my own ideas, but this was because of the readers’ lack of training in that direction rather than lack of native intelligence. When we get in the woods and swamps, I am the one who reads haltingly and with imperfect understanding, and must rely implicitly on my piney guide. I have never ceased to wonder how they do it (White & White, 1918 p. 7).

“In the thinly settled pine country people know very intimately the doings of all their neighbors, one, two or five miles off; much more intimately than you know the doings of most of your neighbors only a block way” (White, 1917a p. 59).

“Them fellows in the woods-wasn’t one out of twenty five could read or write. Some could read and some couldn’t write, some write and couldn’t read” (Halpert, 1937 p. 129).

Dimension: Institutions that underlie trust

Variables: Church, School

Text Data

(N) “[Elizabeth White] College training might have upset her partnership with the man who tamed the hitherto wild blueberry” (Rose, 1942 p. 19).

(PJ) “The piney children are educated or not educated under the same public-school system of New Jersey as are your children” (E. C. White, 1917a p. 59).

(HI) ”Oh yes, there was hundreds of old people couldn’t read and write. It wasn’t their fault” (Halpert, 1976, p. 137).”

(HI) “[Jeanette Bozarth Harris] I started to school when I was eight years old. I went to the fifth grade” (Halpert, 1976, p. 244).

Dimension: Potential for social learning with familiar and tangible settings

Variables: Shared labor (tasks), Shared sites for labor

Text Data

The whole family set out the blueberries and helped clear the field.

“[Wild blueberry picking] Twenty-five or thirty [pickers] go all in one place- carry a little handle basket and pick that full and that would be a day’s work. Get in the woods and talk, talk, talk. After a while people learned how to get them. I’ve seen my wife pick sixty quarts, carry them out of the woods, put them in the crates, from eight o’clock to twelve, four hours” (Halpert, 1937).

“If a man had a big family, they’d all go and pick. Kids made fifty cents or a dollar; women generally pick as much as the men-three or four dollars” (Halpert, 1937 p. 131).

“All the youngsters and half the old people would go out to a dance. Either have a dance floor or a big building where they could dance- it’d be on the bogs” (Halpert, 1937 p. 156).

“As a general thing, the girls and fellows would meet on cranberry bogs- they’d all picked cranberries. They allus picked on the bogs but nights they’d go somewhere and dance. People you know didn’t travel around like they do nowadays. You’d take young people livin’ maybe four or five miles apart, they’d never seed one another without they went on these bogs” (Halpert, 1937 p. 156).

“They’d make a hog-killing day. Then four or five families, sometimes more, would kill all their hogs- all that was fit to kill. They’d all help each other. One would be a sort of butcher, others scrape, one take entrails out. Woman, they’d all do it in the house and they called it ‘ridin’ the belly’- take the fat off the entrails. Woman who knows how to do that can take the fat off one hog’s entrails in about five to ten minutes” (Halpert, 1937 p. 141).

“When they got done [hog killing] this dinner would always be ready. They’d have the biggest room in the house and have all the tables they could set in there and the people of the whole community would be there. They’d all come and eat the hog-killin’ dinner. All people in the community was invited too, whether they had hogs or not they was all invited” (Halpert, 1937 p. 143).

“Pretty near every night would be story night or riddle night or somebody’d bring ‘cordion or violin or some kind of piece of music to play. This would be in winter time-long nights” (Halpert, 1937 p. 137).

Dimension: Level of Education

Variables: Previous experience with natural resource base, production activities, formal education

Text Data

Most of the community was involved in wild blueberry cultivation.

Children helped with the wild gathering.

Part time jobs was the standard way of making a living, cutting wood, blueberries, cranberries, moss.

Economic Capital

Dimension: Opportunities for generation of wealth

Variable: Resource-based businesses

“The expense of clearing the fields is partially offset by selling the lumber which is removed” (Beckwith & Coville, 1931 p. 5).

“The iron industry of the Pinelands at its height in the early 1800’s required vast amounts of resources. For example, up to 6,000 cords of wood per year were needed to produce the 12,000 bushels of charcoal required for each individual furnace” (Pierce, 1957 p. 134).

“People used to do a good many things in the woods to make a living that they don’t do now. In the winter time they used to go out and pull teaberry leaves, sold them by the pint. In the spring used to go out and pull cranberry vines. Sold by the barrel. Used to make dish creates out of birch and cedar. Big crates-hold ten bushel, put a lid on it. Sell them for about a dollar a piece in Trenton. We used to gather moss, put in “five barrel bales”, five barrels of loose moss squeezed down in a bale 2x2x3. Used to ship that to New York” (Halpert, 1937).

The yields of the fields at Elkhart Indiana which were planted with unselected blueberry bushes was studied and it was found that an acre produced in 1911 2,266 quarts and averaged \$292.44 per acre (Coville, 1911).

“The yields of the fields at Elkhart Indiana which were planted with unselected blueberry bushes averaged \$321 per acre” (Coville, 1915 p.16).

“(New England) It is customary to have pickers camp on the mountain throughout the picking season and they get two thirds of the berries picked, the owner receiving on third. The way it is usually handled is for the owner to sell all the berries and then prorate the pickers two thirds from the net returns after all costs of marketing are deducted” (Gourley, 1917 p. 8).

“In 1930 Burlington County had 90 acres of cultivated blueberries in production” (Pitt & Hoagland, 1943b p. 331).

“In 1930 Burlington County produced 94,720 quarts of cultivated blueberries” (Pitt, Hoagland, New Jersey, & Dept. of Agriculture, 1943a332).

“In 1940 Burlington County produced 525,845 quarts of cultivated blueberries” (Pitt, Hoagland, 1943, p. 332).

In 1940 Burlington County had 420 acres of cultivated blueberries in production (Pitt, Hoagland, 1943, p. 332).

“In March of 1911, Mr. Coville send[t] me from Washington a few blueberry plants, seedlings of the best bush, the “Brooks,” he had up to that time located in New Hampshire. He visited the plantation form time to time and in this way and by correspondence kept me advised as to the progress of his experimental work in Washington. When in 1914 it became desirable for the Department to try in the field a large number of hybrid seedling blueberry plants, the testing ground was rented at Whitesbog and since then we have co-operated on an extended scale with the Department of Agriculture, as represented by Mr. Coville, in its experiments in blueberry culture” (White, 1917 p.4).

“In 1941 the value of the crop picked in only three states were the blueberries are grown(new Jersey, North Carolina and Michigan) amounted to \$7000,000” (Wyman, 1941 p. 29).

“Theodore H. Budd and Joseph J. White are listed as suppliers of horticultural varieties of *Vaccinium corymbosum*” (Wyman, 1941 p. 31).

“One of the most promising districts for blueberry culture is the cranberry region of New Jersey, for ideal soil occurs in conjunction with an early maturing season and excellent shipping facilities to the markets of Philadelphia, New York, and Boston” (Coville, 1915b p. 2).”

13 northern growers sold horticultural varieties of *Vaccinium corymbosum*.

1908 There is every reason to believe that blueberries can be cultivated.

“The berries from a 7 year old plant (1917) sold for .24 cents a quart, 117.3 bushels per acre and \$1,280 per acre” (Coville, 1926 p. 29).

“In 1944 an acre yielded 305 trays at an average price of \$3.10(C. A. Doehlert, 1956b p. 18).”

“The heaviest charge against the industry is the cost of producing rooted plants of selected varieties” (Coville, 1926 p. 29).

“If the land to be used bears timber and brush, the clearing is expensive” (Coville, 1926 p. 29).

“At Whitesbog 6 cents per court has been paid for the last few years” (Coville, 1926 p. 29).

“An informal agreement of co-operation resulted. In 1913 this was replaced by a formal contract, the object of which was to provide suitable conditions for a field test of the blueberry hybrids produced in the course of the experiments at Washington, D.C.” (Coville, 1915b p. 2).

“Furthermore, cultivated blueberries are, for the present at least, distinctly a luxury crop. They have sold at from twenty to sixty cents a quart the average price for 1934 being about thirty cents; while wild berries sold mostly at 10-20 cents a quart” (Bailey & Franklin, 1935 p. 17).

In 1935 there were 500 acres of blueberries produced in New Jersey (Bailey & Franklin, 1935, p. 18).

In 1920 Whitesbog produced 117 bushels per acre and sold at .34 cents a quart for a total of \$1,280 per acre.

Blueberries can generate between 300-600 per acre.

In 1934 the average price for a quart of blueberries was 30 cents.

“In 1931 95% of the New Jersey blueberry crop was sold through the Blueberry Cooperative (Beckwith & Coville, 1931 p. 7).

“The annual value of the blueberry crop from the wild is from \$1 million-\$1,500,000. The value of the cultivated crop in 1938 was about \$400,000” (Darrow et al., 1940 p.2).

“The value of this year's crop for instance is estimated to be at least \$2 million. But there is only one commercial blueberry plantation in the entire country, and with the exception of the fruit raised upon it, all of the blueberries in the country are picked from wild bushes” (Darrow, 1940, p. 8).

“After the railroad went through, thousands of people picked huckleberries every summer. Railroad was finished 1864, and as long as I can remember, they were shipped to New York in half bushel boxes. Most of these people shipped in their own name to merchants in New York. They get a check once a week” (Halpert, 1976, p. 128).

“Following the Civil War there was a great expansion of the Cranbury Industry” (Doehlert, 1956b p. 17).

“New Jersey [cranberry] production continued to increase gradually into the early 1920's. Successive crops of 200,000 barrels or more were produced in 1922, 1923 and 1924” (C. A. Doehlert, 1956a p. 17).

“The growing of cultivated blueberries promises to become an important industry in this part of the State, especially in view of the fact that they flourish on soils that have little value for the other crops commonly grown in this region” (Lee, 1924 p. 480).

“One of the growers in the area has estimated that the cost of clearing cranberry land and developing a bog, from the time the timber is cut until a full crop matures, is about \$300 per acre” (Lee, 1924 p. \$480).

“Rubel plants 12 to 18 inches high at Twenty-five Dollars (25\$) each” (White 1918 p. 7).

“Our contract with the Government authorizes us to use a portion of the propagating material from all desirable hybrid plants, and we are pushing ahead with the propagation of these hybrids as fast as circumstances permit, but the spring of 1920 will be the earliest possible date at which any of the hybrid plants can be offered for sale” (White 1918 p. 7).

“In many of the northern and eastern states there are thousands of acres of land, utterly worthless for agricultural purposes, which after the pine is removed, send up an abundant growth of blueberry bushes, alders, poplars, grey birches, etc. and which, by proper management may, it is believed, be made to yield a handsome profit to their owners” (American Pomological Society, p. 57).

In 1916 the USDA specifically mentions economic and social betterment as a goal of the department. It specifically mentions the domestication of the blueberry as an example.

Development of a system of blueberry culture which opens the way to the profitable use of acid soils....

“The growing of cultivated blueberries promises to become an important industry in this part of the state, especially in view of the fact that they flourish on soils that have little value of the other crops commonly grown in the region” (Lee, 1924 p. 480).

“Cultivated blueberries are being grown on a plantation at Whitesbog, about 4 miles east of Browns Mills. About 25 acres are set out to cultivated blueberries. About 1000 bushels of berries were harvested this season and marketed at a price about 50% higher than those obtained for wild berries” (Lee, 1924 p. 480).

“According to the census of 1920 there were grown in 1919 in Atlantic, Ocean, and Burlington Counties, 7,172,719 quarts of cranberries on 6,011 acres of bog. Burlington County in 1919 produced about 73 per cent more cranberries than Ocean and Atlantic Counties” (Lee, 1924 p. 479).”

"This crop has become one of importance to the people of new England; important not so much because of its great money value, but because it opens the field of profit to a class of people who find it very difficult to get employment suited to their capacities; and as it requires no capital to start the business, and as there is no risk of losing anything but time that is of no value, every dollar that is earned in picking berries is so much gain, and gained, too, by a class who really need it” (Anonymous, 1885, p. 1).

(PJ)"Ripening as the berries do during school vacation, the children are really better off picking berries, even if they do not bring them any money; it keeps them busy and teaches them to be industrious; and us being able to earn money by their own labor it teaches them the value of money, and furnishes them with practical lessons of extending it” (Anonymous, 1885, p. 1)”.

“Years ago there were thriving industrial communities gathered all through the pines, supported chiefly by the smelting of local bog iron ore, by means of charcoal made from the pine trees. The discovery of the possibility of more economically smelting the bountiful iron ore of Pennsylvania with coal struck the death blow to these industrial communities in the New Jersey pines, even though the death was a lingering one”(1917, p. 43).

“Theodore H. Budd; Pemberton, New Jersey is listed as “Northern grower selling horticultural varieties of *Vaccinium corymbosum*” (Wyman, 1942, p. 31).

“In 1941 the blueberry crop picked in New Jersey, North Carolina and Michigan) was valued at \$700,000” (Wyman, 1942, p. 31).

“During the season of 1930, New Jersey berries could be found in eight of the principle wholesale markets in the northeastern United States“ (Coville, 1926 p. 3)

“In New Hampshire the picking of blueberries has come to be an important industry in many of the country towns. Whereas a few years ago, farmers thought the blueberry crop of no account, and allowed perfect freedom in gathering the fruit, many owners of blueberry pastures now charge “stumpage” at the rate of two cents per quart, and the blueberry field is regarded with as much concern as the apple orchard” (Pomological Society, 1899, p. 58).

“New Jersey production of cranberries continued to grow beginning in the 1920’ and by 1924, 2000,000 barrels of cranberries were produced” (Doehlert, 1956a p. 47).

“Blueberry culture, therefore, not only promises to add to the general welfare through the utilization of land almost valueless otherwise, but it offers a profitable industry to individual land-owners in districts in which general agricultural conditions are especially hard and unpromising, and it suggests the possibility of the further utilization of such lands by means of other crops adapted to acid conditions” (Coville, 1911 p. 123).”

“The annual expenses for weeding, cultivation, and irrigation were about \$20 per acre. The cost of picking was 5 cents a quart. The general cost of maintenance of the equipment was about \$2 per acre per year, the crates and boxes being used repeatedly. The computation includes an estimated annual charge of \$12 per acre for interest \$2 for taxes, and \$4 for depreciation or sinking fund” (Coville, 1915b p. 16).

“During the season of 1930, New Jersey berries could be found in eight of the principal wholesale markets in northeastern United States. The surprising quality of the cultivated fruit assures it a prominent and permanent place in all the markets” (Beckwith & Coville, 1931 p. 3).

“In 1944 1600 hundred acres were harvested at an average yield of \$1513 per acre. In 10 years 5000 acres were harvested at an average yield of \$4400 per acre” (C. A. Doehlert, 1956).

Six species of wild blueberries are picked and marketed in the US accounting for annual sales of over \$5,000,000 (Darrow, 1940).

“In the case of cultivated blueberries, the new industry has already become well established. Started in a purely experimental way not many years ago, the industry has expanded until cultivated blueberries now occupy a very considerable acreage, and in 1928 represented a crop value of about \$60,000. The acreage under this crop is rapidly expanding and may be expected to become a source of large income to many growers” (Beckwith & Doehlert, 1933 p. 3).

“Last year more than \$600,000 worth of Tru-Blu berries were marketed -\$400,000 originating in New Jersey, and about \$100,000 each in North Carolina and in Michigan. Nearly 90 % of all cultivated blueberries are sold through the co-op, growers who had seen the new blueberries and heard of their success in the markets flocked to Miss White to obtain bushes for themselves. She had all of the named varieties and the skill to propagate young plants, and had no alternative but to launch Whitesbog in the nursery business. Since that time it has been headquarters for most of the nursery stock for the entire country (Rose, 1942 p. 55).”

“Former waste lands are now yielding 10,000 bushels of the blueberries which a few years ago was found only in the wild state” (Anonymous , 1931 p. 7).

“Prior to 1850 cranberries sold from \$1.50 to \$2.00 per bushel” (Budd, 1897 p. 3).

“It had been proven that with the turf cleaned off of an acre of pine land and set with cranberry vines it would, in a few years, produce 100 bushells of cranberries a year, and bring \$4.00 to \$5.00 per bushel, which would make \$400 to \$500 per acre produced from one acre that was formerly worthless (Budd, 1897 p. 3).”

[Theodore Budd owner of the cranberry plantation on the study site]” I caught the fever in the spring of 1859, and it was a bad case from the start. It has stayed with me nearly forty years, but must say I have decidedly less of it now than any other time since I first contracted it”

“As I mentioned before, I commenced to put out cranberry vines in 1859, sold my first berries, 350 bushels, in 1862, to Selser Brothers, for \$4.50 per bushel” (Budd, 1897 p. 3).

“While the net proceeds arising from the marketing of our berries is far from what we would like it to be, we may be thankful that we have fared much better than growers of ordinary farm crops; and if we were to compare our condition with theirs we certainly would have little excuse to complain, but rather rejoice that our condition is not like unto theirs (Budd, 1897 p. 5).”

[Coville] “After eight years of experimentation the culture of the blueberry is now about to take its place among the established agricultural industries” (Coville, 1915a p. 5).

“The cranberry growers of New Jersey are in a specially favored situation to take up this new industry. They have in the first place the acid peat and sand soil that the blueberry, like the cranberry, requires for its most successful growth. They have ready access to the Philadelphia, New York and Boston markets. They are far enough south to insure an early market for their product and avoid the competition of the main New England and late Canadian wild crop. They have the equipment which is idle at the season of the blueberry harvest. They have excellent wild stocks from which to select superior large-berries productive plants for propagation as cultivated plants” (Coville, 1915a p. 5).

“Wild cranberry land used to sell for ten cents an acre in southern New Jersey, while at present it is worth \$800 an acre” (Cranberries.1874 p. 1).

“ Much has been done by the Cranberry Growers’ Association during its short existence, on promoting the interest of growers of this fruit by searching out the enemies they have to contend with, determining the proper remedy, as well as taking steps for regulating market, and selling both at home and in Europe. The growers, by uniting in a common interest, will save thousands of bushels of berries formerly lost, and many thousand dollars added to the profits from this culture” (Cranberries.1874 p. 1).

“One summer the buyers came around and paid twenty-five cents a quart all summer. I was a small boy then- not big enough to pick. If they made two hundred dollars in a season beside their living, they could live on that good till huckleberries came again. That would be a fair amount for a family to make clear” (Halpert, 1937 p. 131).

“In 1898, big crop of huckleberries-was a long season. Bushes bent right down to the ground. We sold all that we got down in Chatsworth to Bridgeton cannery- dollar and twenty-eight cents a create- thirty-two quarts. Lots of them that year gathered six crates, some eight, some ten crates a day for one man. They shook them that year” (Halpert, 1937 p. 132).

“Lots of people made a lot of money pickin’ huckleberries. That was the trouble; we have one good year and next year wouldn’t be any. That’s the trouble even today. You can’t depend on them. Aint’ been a decent crop of huckleberries for twenty-five years. In the old days there was no cultivated huckleberries. They’d just getting’ started into it now” (Halpert, 1937 p. 132).

Dimension: Opportunities for generation of jobs

Variable: Cranberry plantations, Ancillary work for cranberries

Text Data

“Hand hoeing and hand weeding close about the plants is expensive. Often, it is postponed or neglected because of shortage of help, pressure of other work, or unfavorable weather” (Doehlert, 1937 p. 3).

My grandparents worked for Budd’s where they learned about the new blueberry industry.

1925 blueberries sold for 17 cents a quart and were picked for 6 cents a quart” (Coville, 1926, p. 31).

“A skillful picker picking a high producing bush can pick 100 quarts a day earning a total of \$ 6.00” (Coville, 1926, p. 31).

“When they used to pick cranberries by the bushel, general price was fifty cents. Some pickers could go on the bog and make good money- two or three dollars a day” (Halpert, 1937 p. 133).

Blueberry cultivation was labor intensive and required planting and hand hoeing (Beckwith & Coville, 1931).

“People then could be hired to pick them at four cents a quart. Does he not remember the wagons that came with their load of berries to go to market-not this sort but plump large globes of blue?”

“[Alfred Budd] They had some cranberry bogs – very few them days. They didn’t work on the bogs then like they do nowadays. Nowadays they almost cultivate them” (Halpert, 1937 p. 224).

“A great many of the piney people, incidentally, work today in the cultivated berry fields. The pickers, however, are mostly women and children who come to work by bus from near-by towns. Woman also packed, and paste on the cellophane covers, while boys slide the boxes into crates and nail them together” (Rose, 1942 p. 55).

“Base pay this year was five and a half cents a quart, with bonuses and extras. A picker with nimble fingers earns from five to six dollars a day, rushing tray after tray of sun-warmed blue fruit to the fore-woman for another punch on her tally card” (Rose, 1942 p. 55).

“Cranberry growing has developed to a point where it is the most important small fruit industry in the state. In spite of this, 90% of the good cranberry land in the state is in a wild condition. The market for the product is excellent. It is evident that this is one of the special branches of agriculture that has to a large degree been neglected in New Jersey” (Beckwith, 1931; Lee, 1924).

Blueberry cultivation offers economic opportunity to people with acid soils that to this point have been unproductive” (Coville, 1926).

“But to be safely on the side of conserveativism, let us figure the price at only 10 cents per quart for the next ten years. Even at this low price and figuring on the basis of the above conservative estimate of yield, a blueberry orchard will bring the owner an income of from \$300 to \$600 an acre, beginning with the fifth year’s crop, while the third and fourth year’s crop yield incomes of 180.00 and \$240.00 per acre, respectively” (Coville, 1926 p. 31).

“There are also large areas, otherwise worthless, which might without doubt be made to yield good returns if in some way a growth of blueberries could be started -- either by setting bushes or by scattering seed. Perhaps this suggestion may be regarded as visionary, but it is quite within the range of possibilities” (American Pomological Society, p. 59).

“Managing and building an enterprise of this magnitude—there are as many as 200 nimble-fingered pickers working the blueberry orchards from June to August—would seem a full-time chore, but not for Miss White” (Rose, 1942 p. 19).

“At the beginning they got a better price but they had to learn how to pick before they could gather many berries. People often made ten dollars a day pickin’ berries. That was after the War.”

Dimension: Investments that are associated at least partly with natural and cultural characteristics

Variables: USDA, Coops (cranberry, blueberry)

Text Data

“Selection was started by offering a price for wild blueberry bushes with extra-large berries. This stimulated a search of the swamps within 20 miles of Whitesbog, and those who picked the berries for market brought in many samples of fine fruit. Between 1911 and 1916 100 bushes were purchased, with berries five-eight of an inch or more in diameter; two had berries fully three quarters of an inch across (McFarland, 1921 p. 10).”

After the civil war cranberry production changed from local gathering into a thriving business.

“When the breeding work reached a point where it was desirable to try plantings in the field, the Department of Agriculture contracted for trial grounds at Whitesbog. Under the terms of contract , Joseph J. White Inc., has the right to half of the propagating material from all desirable government seedlings there tried, but agrees not to propagate for sale and hybrid not approved by the department (McFarland, 1921 p. 11).”

“The berries marketed from Whitesbog up to 1921 were all from plants under trial, consequently they were much inferior in size and quality to those of the Whitesbog varieties, yet they were eagerly purchased at from 30 to 60 cents per quart, wholesale. After deducting transportation and commission charges, the 1919 crop of 300 bushels sold for an average price of about \$10 per bushel, the 1920 crop of 500 bushels at an average price of about \$12.50 per bushel. The latter amounted to 300 bushels, only half a normal crop, but even so demonstrates possibilities for Blueberry culture” (McFarland, 1921 p. 16).

“Washington—the plant raisers of the [US] Department of Agriculture have been able to develop blueberries almost the size of Concord grapes, it has awakened interest in this popular fruit. The department experiments have extended over several years, and this year the surplus have been such as to warrant the prediction that the way has been opened up for a new industry and for a new use of land in many portions of the country in growing of a crop that in many places will pay more liberally than any other [crop] now cultivated (Profit in blueberries say farming experts.1912b p. 19).

“The value of this year’s crop for instance is estimated to be at least \$2 million. But there is only one commercial blueberry plantation in the entire country, and with the exception of the fruit raised upon it, all of the blueberries in the country are picked from wild bushes (Profit in blueberries say farming experts" 1912a p. 19).”

“The big point in the larger sized fruit is the greater ease with which it can be picked. It is both tedious and expensive to pick the small berries now so well know, the cost for this one item being about one half to two thirds of the market price. In addition to this, the larger berries will present a better appearance and, no doubt sell for a larger amount at retail” (Profit in blueberries say farming experts.1912 p. 19).”

“There is perhaps no native fruit in our state that offers such opportunity for improvement as the blueberry and certainly none that compare with it at the present time in economic value” (Gourley, 1917 p. 3).

“Dr. Frederick V. Coville, who has just received a high award from the Massachusetts Horticultural Society for his achievements in the plant world, is a botanist with an eye for the practical” (Two berries for one.1931 p. 16).

(“The United States Department of Agriculture is interesting itself in the question of cultivating blueberries, and in a recent bulletin give a few of the know fact in regard to it” (Growing blueberries.1901 p. 4).”

“The Department of Agriculture intends to help the small farmer. The emphasis will be on making money and by making farming profitable. Practical agricultural economics is the new ideal, and helping Bill make more money is the new job. To this end the department has been reorganized with a view to bringing farm economics to the fore” (Vrooman, 1916 p. 106).

[USDA] “Development of a system of blueberry culture which opens the way to the profitable use of acid soils” (Vrooman, 1916 p. 106).

“The experiments looking toward the domestication of the swamp blueberry, which have been carried on for the past three years, have now reached a point where it is possible to outline with definiteness the conditions under which this plant may be propagated and grown successfully in pot cultures (United States. Dept. of Agriculture, 1894; 1910 p. 289).”

“Meanwhile, experiments in the field culture of these plants have been begun, as well as cooperation with various individuals and experiment stations for the same purpose” (United States. Dept. of Agriculture, 1910 p. 290).

“There is good prospect that the application of the knowledge thus gained will establish the blueberry in field culture and that ultimately improved varieties of these plants will be grown successfully on a commercial scale” (United States. Dept. of Agriculture, 1910 p. 305).

[The unimproved blueberry plantation at Elkhart, Ind.] “The plantation has been very productive and profitable, the net profits this year being a little more than \$160 per acre” (United States. Dept. of Agriculture, 1911 p. 286).

“The investigations in economic and systematic botany and range work have been continued under the direction of Mr. F.V. Coville. The search for other and still better wild stocks continues, the largest berries having been found in the pine barrens of New Jersey and in North Carolina” (United States. Dept. of Agriculture, 1912 p. 438)”.

“Plants are brought into commercial bearing five years from seed. Berries nearly seven-eighths of an inch in diameter have been grown in the greenhouse, and many thousands of promising hybrids are now in cultivation” (United States. Dept. of Agriculture, 1913 p. 128).

“The cooperative work of the blueberry plantation at Whitesbog, N.J. has been continued with highly satisfactory results, and initial plantings at the cranberry station at East Wareham, Mass., have been made in cooperation with the Massachusetts Agricultural Experiment Station. Blueberries thrive best in soils so acid as to be considered worthless for ordinary agricultural purposes. Blueberry culture, therefore, offers a profitable industry to individual landowners in districts in which general agricultural conditions are especially hard and unpromising and suggests the possibility of further utilization of acid lands by means of other special crops” (United States Dept. of Agriculture, 1916 p. 148).

“About 15,000 hybrid blueberry plants produced in the greenhouses at Washington have been grown to fruiting age in the cooperative blueberry plantation at Whitesbog, 4 miles east of Browns Mills, in the pine barrens of New Jersey. From these plants four have been selected and placed in the hands of nurserymen for propagation and distribution. The first of the selected hybrids will be on sale in the spring of 1921” (United States Dept. of Agriculture, 1920 p. 171).

“A report entitled “Experiments in Blueberry Culture,” by Mr. Frederick V. Coville, has been prepared and is now in press as Bulletin No. 193 of this Bureau. There is good prospect that the application of the knowledge thus gained will establish the blueberry in field culture and that ultimately improved varieties of these plants will be grown successfully on a commercial scale (United States. Dept. of Agriculture, 1910 p. 305)

Emerging Themes

My family lived on \$400.00 a year

People held a number of part time jobs

Children are an important component of the family economics

This was a transition phase between animal power and machine power

Kids worked at an early age

The most important investment for the family venturing into the blueberry industry was family time and labor

Average acreages was between 10 and 20 acres

WW II surplus was used in the blueberry business

“Since 1911, blueberry improvement has been studied in an orderly way by the cooperation between the Bureau of Plant Industry in the Federal Department of Agriculture and the firm of Joseph J. White Inc., New Lisbon, New Jersey (McFarland, 1921 p. 6)

Outside labor was used when the fields came into full production

During the 1920's the false blossom disease became widespread. The disease and insect problems, followed by three successive summer droughts in 1921-1931 and the depression of the 1930's, resulted in heavy abandonment of low yielding acreages. After a sharp decline during the 1920's and early 1930's New Jersey production has continued at a relatively stable level during the last 20 years, averaging about 85,000 barrels annually” (Doehlert, 1956a p. 17).

APPENDIX G
INSTRUMENT FOR RECORDING HISTORIC DATA

Citation:
Location:
Picture:

Built \Cultural

Structures that give relative character to countryside

(Bogs, roads, rail, houses, agricultural production and processing facilities and other)

Landuse the give relative character to the country side

Agricultural lands, Woodlands, settlement, patterns

Cultures and traditions associated with particular areas

“Pre-blueberry” activities based on natural resource extraction

(Cranberry harvesting, charcoaling, mossaing, wild blueberry harvesting, Anglo Saxon heritage and other)

Economic/Natural

Opportunities for generation of wealth

(Resource-based businesses)

Opportunities for generation of jobs

Investments that are associated at least partly with natural and cultural characteristics

(Coops, cranberry, blueberry)

Human/Social

Networks that underlie trust

(Kin, neighbors)

Institutions that underlie trust

(Church, school, other)

Potential for social learning with familiar and tangible settings

(Shared labor (tasks), shared sites for labor, general store, social gatherings)

Level of education and skills

(Previous experience with natural resource based production activities,
Formal education)

Historic Data Instrument 4
Instrument for Recording Historic Data

Citation:

Location:

Built \Cultural

Structures that give relative character to countryside

(Bogs, roads, rail, houses, agricultural production and processing facilities and other)

Landuse the give relative character to the country side

Agricultural lands, Woodlands, settlement, patterns

Cultures and traditions associated with particular areas

“Pre-blueberry” activities based on natural resource extraction

(Cranberry harvesting, charcoaling, mossaing, wild blueberry harvesting, Anglo Saxon heritage and other)

Economic/Natural

Opportunities for generation of wealth

(Resource-based businesses)

Opportunities for generation of jobs

Investments that are associated at least partly with natural and cultural characteristics

(Coops, cranberry, blueberry)

Human/Social

Networks that underlie trust

(Kin, neighbors)

Institutions that underlie trust

(Church, school, other)

Potential for social learning with familiar and tangible settings

(Shared labor (tasks), shared sites for labor, general store, social gatherings)

Level of education and skills

(Previous experience with natural resource based production activities,
Formal education)

Emerging Themes:

Summary:

APPENDIX H METADATA

Map Metadata: Coastal Plains

File Name: Retreat_soils_Clip

Description

Keywords

Theme: soil survey, soils, Soil Survey Geographic, SSURGO, survey

Theme: environment

Place: Burlington County, New Jersey

Description

Abstract

Please note:

Completed county soils data sets were downloaded from the Natural Resource Conservation Service (NRCS) Soil Data Mart (<http://soildatamart.nrcs.usda.gov>), as ARCINFO coverages. These coverages were projected from New Jersey State Plane Meters to New Jersey State Plane Feet by the NJDEP, and attributed as described in "The Metadata Notes Concerning the NJDEP Production Process" listed in the data quality section (Process Step) of this file. For any questions regarding the NJDEP production process, please refer to listed responsible NJDEP process contact.

This document is based on original county metadata files available at the Soil Data Mart. Users are encouraged to review those metadata files for county specific information.

Only a few attributes from the complete soil data base have been added to these shapefiles. Complete Microsoft Access county data bases can be downloaded from the Soil Data Mart site (<http://soildatamart.nrcs.usda.gov>).

This data set is a digital soil survey and generally is the most detailed level of soil geographic data developed by the National Cooperative Soil Survey. The information was prepared by digitizing maps, by compiling information onto a planimetric correct base and digitizing, or by revising digitized maps using remotely sensed and other information.

This data set consists of georeferenced digital map data and computerized attribute data. The map data are in a 7.5 minute quadrangle format and include a detailed, field verified inventory of soils and non-soil areas that normally occur in a repeatable pattern on the landscape and that can be cartographically shown at the scale mapped. A special soil features layer (point and line features) is optional. This layer displays the location of features too small to delineate at the mapping scale, but they are large enough and contrasting enough to significantly influence use and

Map Metadata: Land Use

File Name: w19lu02_Clip

Description

Keywords

Theme: land use/land cover, watersheds, watershed management areas, wetlands, impervious surface, change analysis, wma, water quality, Anderson, Cowardin, NJDEP

Theme: planningCadastre

Theme: njfw_lulc

Place: New Jersey, NJ, WMA

Temporal: 2002, 1995, 1997

Description

Abstract

ADVISORY:

This metadata file contains information for the 2002 Land Use/Land Cover (LU/LC) data sets, which were mapped by Watershed Management Area (WMA). There are additional reference documents listed in this file under Supplemental Information which should also be examined by users of these data sets.

The 2002 LU/LC was created by comparing the 1995/97 LU/LC layer from NJ DEP's geographical information systems (GIS) database to 2002 color infrared (CIR) imagery and delineating areas of change. Work for this data set was done by Aerial Information Systems, Inc., Redlands, CA, under direction of the New Jersey Department of Environmental Protection (NJDEP), Bureau of Geographic Information System (BGIS). LU/LC changes were captured by adding new line work and attribute data for the 2002 land use directly to the base data layer. All 1986 LU/LC polygons and attribute fields were removed from this update, however, all 1995/97 LU/LC polygons remain in this data set, so change analysis can be undertaken from this one layer. The classification system used was a modified Anderson et al., 2002 classification system. An impervious surface (IS) code was also assigned to each LU/LC polygon based on the percentage of impervious surface within each polygon as of 2002 and 1995/97. Minimum mapping unit (MMU) is 1 acre.

As stated in this metadata record's Use Constraints section, NJDEP makes no representations of any kind, including, but not limited to, the warranties of merchantability or fitness for a particular use, nor are any such warranties to be implied with respect to the digital data layers furnished hereunder. NJDEP assumes no responsibility to maintain them in any manner or form. By downloading this data, user agrees to the data use constraints listed within this metadata record.



Purpose

Map Metadata: Counties of New Jersey, New Jersey State Plane NAD83

File Name: nj_counties

Keywords

Theme: boundaries

Theme: njfw_boundaries

Theme: county, counties, boundary, boundaries

Place: New Jersey, NJ, Atlantic County, Bergen County, Burlington County, Camden County, Cape May County, Cumberland County, Essex County, Gloucester County, Hudson County, Hunterdon County, Mercer County, Middlesex County, Monmouth County, Morris County, Ocean County, Passaic County, Salem County, Somerset County, Sussex County, Union County, Warren County, USA

Description

Abstract

This data set is a spatial representation of counties in New Jersey. Counties were aggregated from the New Jersey Office of Information Technology, Office of Geographic Information Systems Municipalities of New Jersey (nj_munis) data set using the DISSOLVE command in ArcGIS ArcInfo 9.2. Spatial accuracy was improved upon from earlier data by integrating features that are coincident with boundaries from other high quality source data sets. This data set is temporally accurate to May 2008. An update is anticipated in July 2009 with the concurrent release of a seamless parcel data set for 19 of 21 counties in New Jersey.



Purpose

To provide basic jurisdictional information. This data set was developed to produce the most accurate delineation of county boundaries achievable from existing data sources.



Supplementary Information

Spatially referenced data were derived from the following GIS layers to build the municipal boundaries this data set is derived from. They include:

Delaware Geological Survey - New Jersey/Delaware boundary data

New Jersey Department of Agriculture, State Agricultural Development Committee,

Farmland Preservation Program - preserved farmland boundary data from property surveys

New Jersey Department of Environmental Protection, Green Acres Program - open space boundary data from property surveys

New Jersey Department of Environmental Protection, Bureau of Geographic Information Systems - New Jersey/New York boundary data for Ellis Island

New Jersey Department of Environmental Protection, Bureau of Geographic Information Systems - hydro (stream) centerline data

Map Metadata: Municipalities of New Jersey, New Jersey State Plane NAD83

File Name: nj_munis

Keywords

Theme: boundaries

Theme: njfw_boundaries

Theme: municipal, municipality, municipalities, village, borough, town, township, city, county, counties, boundary, boundaries

Place: New Jersey, NJ, Atlantic County, Bergen County, Burlington County, Camden County, Cape May County, Cumberland County, Essex County, Gloucester County, Hudson County, Hunterdon County, Mercer County, Middlesex County, Monmouth County, Morris County, Ocean County, Passaic County, Salem County, Somerset County, Sussex County, Union County, Warren County, USA

Description

Abstract

This data set is a spatial representation of municipalities in New Jersey. Spatial accuracy was improved upon from earlier municipalities data by integrating features that are coincident with municipal boundaries from other high quality source data sets. This data set is temporally accurate to May 2008. An update is anticipated in July 2009 with the concurrent release of a seamless parcel data set for 19 of 21 counties in New Jersey.



Purpose

To provide basic jurisdictional information. This data set was developed to produce the most accurate delineation of municipal boundaries achievable from existing data sources.



Supplementary Information

Spatially referenced data were derived from the following GIS layers to build municipal boundary lines. They include:

Delaware Geological Survey - New Jersey/Delaware boundary data

New Jersey Department of Agriculture, State Agricultural Development Committee,

Farmland Preservation Program - preserved farmland boundary data from property surveys

New Jersey Department of Environmental Protection, Green Acres Program - open space boundary data from property surveys

New Jersey Department of Environmental Protection, Bureau of Geographic Information Systems - New Jersey/New York boundary data for Ellis Island

New Jersey Department of Environmental Protection, Bureau of Geographic Information Systems - hydro (stream) centerline data

New Jersey Department of Environmental Protection, Bureau of Geographic Information Systems - land use/landcover data

Map Metadata: State of New Jersey, New Jersey State Plane NAD83

File Name: nj_state

Keywords

Theme: boundaries

Theme: njfw_boundaries

Theme: boundary, state, three mile limit, 3 mile limit

Place: New Jersey, NJ, New York, NY, Pennsylvania, PA, Delaware, DE, Hudson River, Kill Van Kull, Raritan Bay, Ellis Island, Liberty Island, Shooters Island, Atlantic Ocean, Delaware Bay, Delaware River, Mid-Atlantic, USA

Description

Abstract

This data set is a spatial representation of the State of New Jersey. Spatial accuracy was improved upon from earlier state boundary data by integrating features that are coincident with the state boundary from other high quality source data sets. This data set is temporally accurate to May 2008. An update is anticipated in July 2009.



Purpose

This data set was developed to produce the most accurate delineation of the state boundary achievable from existing data sources.



Supplementary Information

Spatially referenced data were derived from the following GIS layers to build municipal boundary lines. They include:

Delaware Geological Survey - New Jersey/Delaware boundary data through the Delaware River

New Jersey Department of Environmental Protection, Bureau of Geographic Information Systems - New Jersey/New York boundary data for Ellis Island

New Jersey Department of Environmental Protection, Bureau of Geographic Information Systems - land use/landcover data delineation for the New Jersey/New York boundary for Liberty Island

New Jersey Department of Environmental Protection, New Jersey Geological Survey - New Jersey/New York boundary data for the northern border of New Jersey, and New Jersey/New York boundary data through the Hudson River, Kill Van Kull and Raritan Bay, and New Jersey/Delaware boundary data through Delaware Bay

New Jersey Office of Information Technology, Office of Geographic Information Systems - New Jersey/Pennsylvania boundary data, and Atlantic Coast "Three Mile Limit"



Map Metadata: Roads

File Name: Roads

Description

Keywords

Theme: Roads, Census 2000, TIGER/Line, NJDEP, Addresses, TIGER

Theme: transportation

Theme: njfw_transport

Place: Burlington County, New Jersey

Temporal: 2000

Description

Abstract

This data contains 2000 TIGER Road information at the County Level for the State of New Jersey. It was obtained from the U.S. Census Bureau's web site. Census 2000 Roads was derived from the Redistricting Census 2000 TIGER/Line files for each county in New Jersey. The Line features for County Road File layers are identified by the abbreviation lka .

TIGER is an acronym for Topologically Integrated Geographic Encoding and Referencing.

The Census 2000 TIGER/Line files are an extract of selected geographic and cartographic information from the Census TIGER data base. The Census 2000 TIGER/Line files consist of line segments representing physical features and governmental and statistical boundaries. The boundary information in the TIGER/Line files are for statistical data collection and tabulation purposes only; their depiction and designation for statistical purposes does not constitute a determination of jurisdictional authority or rights of ownership or entitlement.

TIGER, TIGER/Line, and Census TIGER are registered trademarks of the U.S. Census Bureau. ZCTA is a trademark of the U.S. Census Bureau.

Purpose

This data was created by NJDEP to facilitate GIS analysis.



Supplementary Information

The Following is an excerpt from the TIGER/Line(TM) Files document, 1992; Appendix E; Census Feature Class Codes (CFCC). A copy of this document has been provided in the download zip files.

Definition

Map Metadata: Map 1 Soil Classifications

File Name: Retreat_soils_Clip

Description

Keywords

Theme: soil survey, soils, Soil Survey Geographic, SSURGO, survey

Theme: environment

Place: Burlington County, New Jersey

Description

Abstract

Please note:

Completed county soils data sets were downloaded from the Natural Resource Conservation Service (NRCS) Soil Data Mart (<http://soildatamart.nrcs.usda.gov>), as ARCINFO coverages. These coverages were projected from New Jersey State Plane Meters to New Jersey State Plane Feet by the NJDEP, and attributed as described in "The Metadata Notes Concerning the NJDEP Production Process" listed in the data quality section (Process Step) of this file. For any questions regarding the NJDEP production process, please refer to listed responsible NJDEP process contact.

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Only a few attributes from the complete soil data base have been added to these shapefiles. Complete Microsoft Access county data bases can be downloaded from the Soil Data Mart site (<http://soildatamart.nrcs.usda.gov>).

This data set is a digital soil survey and generally is the most detailed level of soil geographic data developed by the National Cooperative Soil Survey. The information was prepared by digitizing maps, by compiling information onto a planimetric correct base and digitizing, or by revising digitized maps using remotely sensed and other information.

This data set consists of georeferenced digital map data and computerized attribute data. The map data are in a 7.5 minute quadrangle format and include a detailed, field verified inventory of soils and non-soil areas that normally occur in a repeatable pattern on the landscape and that can be cartographically shown at the scale mapped. A special soil features layer (point and line features) is optional. This layer displays the location of features too small to delineate at the mapping scale, but they are large enough and contrasting enough to significantly influence use and management.

Map Metadata: General Spatial Reference Information

(Referenced from the "Counties of New Jersey, New Jersey State Plane NAD83" shapefile)

Horizontal coordinate system

Projected coordinate system name: NAD_1983_StatePlane_New_Jersey_FIPS_2900_Feet

Geographic coordinate system name: GCS_North_American_1983

Details

Map Projection Name: Transverse Mercator

Scale Factor at Central Meridian: 0.999900

Longitude of Central Meridian: -74.500000

Latitude of Projection Origin: 38.833333

False Easting: 492125.000000

False Northing: 0.000000

Planar Coordinate Information

Planar Distance Units: survey feet

Coordinate Encoding Method: coordinate pair

Coordinate Representation

Abscissa Resolution: 0.000328

Ordinate Resolution: 0.000328

Geodetic Model

Horizontal Datum Name: North American Datum of 1983

Ellipsoid Name: Geodetic Reference System 80

Semi-major Axis: 6378137.000000

Denominator of Flattening Ratio: 298.257222

Altitude System Definition

Resolution: 0.000100

Encoding Method: Explicit elevation coordinate included with horizontal coordinates

Bounding coordinates

Horizontal

In decimal degrees

West: -75.587324

East: -73.890300

North: 41.358658

South: 38.897170

Map Metadata: State Rivers

File Name: stateriv.shp

Description

This data shows New Jersey state rivers and streams.

Data storage and access information

File name: stateriv

Type of data: vector digital data

Location of the data:

- \\ad.ufl.edu\ifas\FYCS\Users\bradwt12\Disertation\GIS\River_Streams\stateriv.shp

Data processing environment: Microsoft Windows XP Version 5.1 (Build 2600) Service Pack 3; ESRI ArcCatalog 9.3.0.1770

Accessing the data

Size of the data: 5.323 MB

Data transfer size: 5.323 MB

Constraints on accessing and using the data

Details about this document

Contents last updated: 20100108 at time 14513100

Who completed this document

Standards used to create this document

Standard name: FGDC Content Standards for Digital Geospatial Metadata

Standard version: FGDC-STD-001-1998

Time convention used in this document: local time

Metadata profiles defining additional information

- ESRI Metadata Profile: <http://www.esri.com/metadata/esriprof80.html>

Spatial

Bounding coordinates

Horizontal

In decimal degrees

West: REQUIRED: Western-most coordinate of the limit of coverage expressed in longitude.

East: REQUIRED: Eastern-most coordinate of the limit of coverage expressed in longitude.

North: REQUIRED: Northern-most coordinate of the limit of coverage expressed in latitude.

South: REQUIRED: Southern-most coordinate of the limit of coverage expressed in latitude.

In projected or local coordinates

Left: 193624.000000

Map Metadata: Surficial Geology

File Name: Retreat_geology

Description

Keywords

Theme: geoscientificInformation

Theme: geology, surficial, contacts

Theme: NJDEP, NJGS

Place: State of New Jersey

Stratum: earth surface

Temporal: 2004

Description

Abstract

This geographic information system (GIS) data set shows the extent of surficial geologic materials in New Jersey. Surficial materials are the unconsolidated glacial, river, wetland, windblown, marine, estuarine, and hillslope sediments and weathered rock materials that overlie bedrock and Coastal Plain formations and that are the parent material for agronomic soils.



Purpose

To depict the extent of surficial geologic materials across the State of New Jersey. It contains information for assessing and protecting aquifers, assessing water quality, and providing a framework for evaluating hazards and resources. It was prepared in cooperation with the U. S. Geological Survey (USGS) National Geologic Mapping Program.



Supplementary Information

Digital compilation of geologic data sets by Ronald S. Pristas. Authors Notes: Enlargement of the data to more detailed scales than specified could result in registration errors. If information is needed at more detailed scales, please contact the New Jersey Geological Survey to determine the status of detailed mapping.



Links to graphics describing the data

- Statewide color graphic depicting surficial geologic contacts. For reference purposes only. (JPEG): <http://www.state.nj.us/dep/njgs/>

Map Metadata: Black White Blueberry Locations

File Name: black_white_blueberry_locations.shp

Description

Shows locations of existing blueberry fields within Burlington County.

Procedure

Used US topographic map for base.

Digitized areas based on interviews and Elizabeth White's Field Book.

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BIOGRAPHICAL SKETCH

Brad W. Thompson was born and lived on the edge of the New Jersey Pine Barrens for most of his life where his family raises blueberries from the early days of the industry. Upon graduating high school, he attended Shippensburg University and received a Bachelor of Arts and Master of Art degrees. He then attended the University of Pennsylvania and received Master degrees in Landscape Architecture and Regional Planning.

Upon graduation Brad served as park planner for the Municipality of Cherry Hill, NJ. There he designed and implemented over 30 park renovations and installations. During his tenure in Cherry Hill he directed the historic programming at Barclay Farmstead and historic house museum and park site. He also was instrumental in stabilizing and preserving Croft Farm, another historic farmstead owned by the township that later became the cultural arts center for the community.

After leaving Cherry Hill Brad joined the Academy of Natural Science in Philadelphia and became the project manager for the Academy's work on the Fairmount Park's Natural Resources and Environmental Education Project. This work culminated in a 7-volume management plan for the park.

Before acceptance into the doctoral program of interdisciplinary ecology at the University of Florida, Brad taught environmental science and environmental issues at Philadelphia University.