AN ANALYSIS OF PLANNED COMMUNITIES IN COASTAL REGIONS OF SOUTH CAROLINA FOR SUSTAINABLE DESIGN FEATURES

by

ROBERT EARLE MOTTERN, III

(Under the Direction of Sarah Georgia Harrison)

ABSTRACT

The coastal regions of South Carolina contain a rich diversity of vibrant ecosystems that provide invaluable services such as, producing oxygen, absorbing carbon dioxide, filtering water, purifying air, and providing wildlife habitat just to name a few. Sadly, many coastal ecosystems including; salt marsh, isolated wetlands, and upland forests, are at risk due to poorly planned land development. A more sustainable approach to urbanization having less impact on ecosystems is necessary to accommodate predicted increases in human population and preserve biodiversity and quality of life standards. Fortunately, South Carolina is home to a number of progressive planned developments, yet some questions remain regarding their levels of actual sustainability. Six planned communities in coastal regions of Charleston and Beaufort counties were analyzed for their levels of sustainable effectiveness. A set of sustainable land development principles that address environmental integrity, economic vitality, and social equity were applied to the case study sites. Findings revealed that few of these planned communities are optimally addressing all of the ten principles of sustainability, however, most of the principles were addressed to some degree.

INDEX WORDS: sustainable development, smart growth, South Carolina coastal region

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by

ROBERT EARLE MOTTERN, III

BS Horticulture, Clemson University, 1992

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ROBERT EARLE MOTTERN, III

Major Professor: Georgia Harrison

Committee: Alfie Vick
Jim Porter
Chet Thomas

Electronic Version Approved:

Maureen Grasso
Dean of the Graduate School
The University of Georgia
December 2006

DEDICATION

Dedicated to my parents who instilled in me an appreciation of the garden, and to my wife Lizzy, whose never-ending support and encouragement guided me through this process.

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TABLE OF CONTENTS

Page

LIST OF MAPS

Page

LIST OF CHARTS

Page

LIST OF FIGURES

Page

CHAPTER 1

INTRODUCTION

Sustainable development is defined in the 1987 report *Our Common Future* as; “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (World Commission on Environment and Development 1987). This method of development offers answers for using land that accommodates people in an ecologically respectful manner. The World Commission report drew attention to the fact that economic development often leads to a deterioration, not an improvement, in the quality of people’s lives, by having a drastic, irreversible impact on surrounding ecosystems. Therefore, economic development must occur in a sustainable manner to maintain and possibly restore quality of life standards. This thesis focuses on the sustainable integrity of master planned communities on the coast of South Carolina. The study sheds light on conventional urbanization and its negative impact on the valuable ecological diversity of this region and it investigates the quality of sustainable features included in more progressively planned developments. Sustainable development benefits economic, social, and environmental factors but it must be done properly and at a level of consistency to be effective. A set of principles developed by Jim Heid, an authority on sustainable planned communities, was used to measure the effectiveness of sustainable design in six progressively planned developments in Beaufort and Charleston counties.

Coastal ecosystems influence and are influenced by natural forces and human activity. Evolving over millennia in response to natural forces, dynamic ecosystems were able to support life for an abundance of species; however, over a short period of time, human activity has altered many ecosystems, serving fewer and fewer species. Historically, coastal ecosystems have born much of the burden of degradation and today the altering of natural systems continues as burgeoning urbanization jeopardizes the life-sustaining compensation natural systems provide. South Carolina predicts to add another million people by 2025 and a third of these people are expected to locate in coastal counties (Farris 2003). Land use patterns must change in order to accommodate this influx of people and incorporating sustainable land use concepts is the only solution, if surrounding natural systems are to be saved. Some forms of sustainable development have garnered much praise and many projects have become quite successful; but other planned communities touting progressive design still cling to wasteful practices. To guide the future of sustainable growth an assessment process is suggested for developers and city planners, to judge whether a community plan integrates appropriate sustainable features that strengthen community ties, provide economic opportunity, and protect valuable surrounding natural resources.

Two-thirds of South Carolina lies within the Atlantic Coastal Plain, a relatively flat area of land stretching down the east coast that was once covered by the Atlantic Ocean thousands of years ago. An area of the coastal plain extending from the beach to about 70 miles inland, is referred to as the Outer

Coastal Plain. This area is rich in ecological diversity. An assortment of forested and wetland communities exist here and like all ecosystems, the roles they play are vitally important to the ecological integrity of the region.

The forests include a variety of communities – longleaf pine flatwoods, dry open woods, bottomland hardwoods, and cypress-tupelo swamps. These forests benefit both biodiversity and humans by filtering air, trapping sediments, slowing runoff, reducing erosion, improving water quality, reducing point and non-point source pollution, sequestering carbon, supporting diverse plant and animal communities, and by providing healthy revitalizing recreational opportunities for people. The largest threat to coastal plain forests is wide-spread urbanization, resulting in the loss of forest communities and the fragmentation of remaining forested acres. Negative effects of forest destruction include – loss of biodiversity, loss of natural habitat, reduction in air and water quality, increased erosion, encroachment of invasive species, reduction of forest management, increased life and property losses to wildfire, changes in recreational opportunities, and immense losses in economic value (Southern Forest Research Partnership 2006).

Wetlands are defined by many terms – marshes, swamps, bottomlands, peatlands, and bogs. In general, wetlands are lands where water saturation is the dominant factor determining the nature of soil development and types of plant and animal communities living in the soil and on its surface (Porcher 2001). In South Carolina coastal wetlands occupy over 500,000 acres (Beaufort County Government 2002). The biome includes a rich diversity of plants and animals

that thrive in these fresh and saltwater environments. The dominant plant species for coastal salt marshes is cordgrass, *Spartina alterniflora*, which occupies most of the identifiable salt marshes along the US east coast (Tiner 1993). Freshwater marshes are not subjected to salt and are among the most diverse wetland plant communities in the continental United States (Tiner 1993). The interconnected root systems of these wetland plants anchor the soil as water levels fluctuate and distribute sediment. Healthy marshes provide food and shelter to many mammals, birds, fish and invertebrates, resulting in one of the most significant ecological and productive natural communities on earth (Cox 2003). Wetlands provide many benefits to mankind as well – they mitigate floods and droughts, filter pollutants, prevent erosion, retain and distribute sediment, act as barriers to storms, provide abundant recreational opportunities, and supply habitat for 90% of southeastern commercial fish species (Vernberg 1996). Human industries such as seafood, tourism, and residential development are dependent upon healthy wetlands both for their ability to produce and sustain life and for their ability to transform pollution into less toxic materials (Kearney 1999).

Unfortunately, the majority of human activity has not displayed much respect for the benefits of natural resources. Historically, coastal regions have been favored sites of colonization, commerce, and industry. As these areas became colonized, economic and strategic concerns were the motivation to heavily modify wetlands. They were drained in an effort to eradicate mosquitoes, were often filled to increase habitable land, and their wildlife was over-exploited. The expansion of tourist beaches has also resulted in abuses of coastal wetlands

stemming from filling or from indirect factors of air and water pollution. The cumulative impacts of these modifications result in the destruction of vast acres of wetlands through eutrophication and pathogenic contamination, alterations of aquatic life processes, and reduction in productivity and overall habitat quality. Because of human neglect, coastal wetlands today are one of the most endangered ecosystems in North America (Kearney 1999).

The 1960's environmental movement exposed the peril of industrial water and air pollution, yet the widespread concept of sustainable development would not gain a foothold for many more years. A predecessor to the sustainable design movement made quite an impact on coastal resort development in the late 1950's. The concept, initially dubbed "nature-based resort development", was the initiative behind Sea Pines Plantation, the first planned community on Hilton Head Island, South Carolina (Danielson 1995). Sea Pines became a highly successful model of development, embracing nature rather than subduing it. This approach established a development pattern not only for the remainder of Hilton Head, but influenced many future resort properties along the coast of South Carolina, Georgia, Florida, and beyond (Danielson 1995).

In 1987, nearly thirty years after construction began at Sea Pines, the World Commission on Environment and Development's report "Our Common Future", detailed the rapid pace of consumption and destruction of the world's natural resources and provided initial warnings about the consequences of current development practices reaching an irreversible point of degradation.

The message of “Our Common Future” infused academic design-build society. In the 1990’s many books and scholarly reports were written on the subject of sustainable design and early in the twenty-first century the concept finally emerged in the current fabric of progressive developments along the coast of South Carolina. Even though conventional materials and methods still occupy the majority of the land development industry, rising energy costs, limited land, and negative ecological impacts are weighing on outdated building and zoning policies. Social and economic issues are also supporting the need for more sustainable forms of development. In response to demand, many developers over the last 15 years have created admirable communities that follow sustainable principles, but other alleged progressively designed developments lack fundamental sustainable features. Assessments are needed to judge the effectiveness of sustainable features in past and current progressively planned communities. Such assessments can provide information for developers, landscape architects, and city planners to realize inadequacies and to improve upon new sustainable technology for future projects. Jim Heid, a consultant on sustainable planned communities, has provided a set of principles in *Greenfield Development without Sprawl: The Role of Planned Communities* (Heid 2001). This publication advocates a set of smart growth guidelines that can act as confirmation for the social, economic, and environmental success of a planned development.

This thesis will attempt to explain the valuable and imperiled ecological diversity of South Carolina’s coastal region and discuss how the area has been

impacted by conventional land use practices. Alternative design options that serve both human and biological interests will be discussed; then a set of sustainable principles will be applied to evaluate six progressively planned communities in Charleston and Beaufort counties.

CHAPTER 2

POPULATION AND LAND USE TRENDS ON THE SOUTH CAROLINA COAST

Coastal regions around the world have always been centers for the development of civilization; the pattern is no different in this country. Native South Carolinians generally built villages on bluffs overlooking bottomlands, rivers, and marshes for access to water, rich soils, and game (Edgar 1998). Every major water system in the state was occupied by native people, a similar model continued with the European colonization of this country. The proximity to water courses provided people with the means for sustenance, transportation, and commerce.

This formula still holds true today with coastal areas maintaining prime real estate status (Fig. B.3). Over half of the population in this country live within fifty miles of the coast and fourteen of the nation's twenty largest cities lie in the same area (Culliton 1998). In South Carolina, the coastal population is rapidly expanding. From 1990 to 2000 the coastal population increased by nearly 150,000 and national projections support this trend. Through the year 2015, over half the growth in the nation is expected to occur along the coast, an increase of 28 million residents (Culliton 1998).

Population statistics have been used routinely to judge the magnitude of human impacts on the environment. Scientists have noted environmental impact is a function of population, affluence, and technology. Most research points to

human impacts on coastal ecosystems growing faster than the rate of population growth (Beach 2002); however, this observation can be misleading and may only partially determine the environmental health. Other factors must be taken into account, such as activities of residents, where they live, and modes of transportation. Development patterns can also form misleading generalizations about environmental impact. Large houses on large lots may retain much of the natural vegetation and topography but more roads, infrastructure, and land are consumed in the process. Compact urbanization, infill, redevelopment and locating new development next to existing neighborhoods are the preferred choices to reduce negative environmental impacts. These favored methods of transportation and development have yet to become the standard choices in coastal regions of South Carolina.

According to the Federal Highway Administration, the number of miles Americans have driven annually over the past twenty years has outpaced population growth by a factor of four (Fig. B.1). A majority of this increasing rate of travel is due to, until recently, cheap fuel. From 1971 to 1991, fuel economy in cars increased 60% and gasoline prices (adjusted for inflation) decreased 30% (Vernberg 1996). This desire for driving led to additional roads that connected to less expensive land away from urban centers, resulting in a society whose residents spend much of their day in a car. Since 1988, the population of South Carolina has risen 18%, while vehicle registrations have increased 32% and vehicle miles traveled increased by 42% (Urban Land Institute 2003). The negative human health implications resulting from high concentrations of

automobiles include, smog-related medical problems, sedentary lifestyles, and less time spent with family members. Auto dependence also equates to more fuel burned and more pollution reaching the air and water. This pollution eventually reaches our coastal ecosystems degrading habitat and our quality of life.

The trend for driving is only part of the consumptive picture in coastal regions. The population along the coast is wealthier than the rest of the nation. In 1994, eighteen of the top twenty wealthiest counties in the nation were coastal counties (Culliton 1998). Affluence on the coast generally results in increased land consumption, boating activities, and overall resource use. For example, in 2004, the National Marine Manufacturers Association (NMMA) ranked South Carolina ninth nationally in the number of boats registered with a total of 397,458, nearly ninety-five boats per one thousand residents (NMMA 2004). Boating activities can result in non-point source pollution such as trash, oil, fuel, cleaning agents, sewage, and types of hull paint. Even small amounts of pollution become a problem when they accumulate over time. Boating pollutants in the water and sediment affect marine life and human health. They may reduce the availability of quality seafood, raise health care & dredging costs and affect industries that need clean water, including, tourism, fishing and water sports. Some pollutants change water chemistry, making sediment contaminants easily absorbed by marine life. Pollution makes marine animals less able to survive other stresses (Connell 2003). Manufacturing, using and disposing of boating

products and equipment all contribute to the reduced quality of coastal ecosystems.

Signs of expansion and urbanization are clearly recognized when one drives around perimeters of coastal cities and towns. Strip malls, retail outlets, convenience stores, car dealerships, and numerous subdivision entrances are all common features lining the roads. Much of this urbanization may be termed sprawl, defined by the Sierra Club as "the expansion of low-density, automobile-dependent development that occurs at the fringe of the urban landscape" (Sierra Club 2006). By isolating land uses without transportation alternatives, sprawl forces long car trips to schools, centers of employment, stores, and community activities. This pattern of development seems to be repeated everywhere, turning our towns and cities into generic forms and reducing our sense of place.

Even more troubling is the rate at which this expansion is occurring (Fig. B.2). According to the U.S. Department of Agriculture's National Resources Inventory (NRI), developed land in the contiguous U.S. increased by 25 million acres, or 34%, between 1982 and 1997 (NRI 2001). This amount of urbanization equals one quarter of all the land developed since European colonization (Beach 2002). U.S. population, from 1982 to 1997, only grew at a rate of 15%, thus land consumption grew at double the rate of population expansion. By 2025, 58 million more people are expected to live in the U.S. If land consumption continues to grow at the current rate, 68 million more acres of land will be converted from natural or rural to suburban uses (NRI 2001).

The population of coastal land areas tend to grow more rapidly than the rest of the nation, driven primarily by tourism and second home markets. Nationally, 6% of Americans own second homes. South Carolina has an estimated 70,000 seasonal homes (ULI 2004). The market for second home sales is expected to peak between the years 2007 to 2014 with the pending retirement of baby boomers. This population is one of the prime markets for resort real-estate investments; many of them will consider coastal communities. South Carolina is the nation's second largest coastal resort tourism state behind Florida, attracting eighteen million visitors a year. South Carolina ranks third, behind Florida and California, as a golf and tennis destination (ULI 2003). Many of these visitors become investors purchasing condominiums, town houses, or second homes, continuing to fuel the thriving development industry. Not even the devastating Hurricane Hugo in 1989 could cool the sizzling rate of coastal growth in South Carolina. From 1980 to 1990, Census Bureau figures show coastal counties grew 20%, nearly twice the statewide pace (*The State* 2006). In the next decade, while the state's population swelled another 15%, coastal counties boomed a combined 23%. Census Bureau estimates through July 1, 2006 show the state's population has grown another 6% since 2000 while the coastal counties have grown 8.5% (*The State* 2006).

Rapid growth is not only limited to beach resorts. The Charleston area, which supports not only a vibrant tourism and retirement economy, but also large medical centers, universities, and shipping and manufacturing industries, is also seeing its share of brisk land consumption. From 1973 to 1994, the urban area

of Charleston expanded from forty-five thousand acres to 160,000 acres, a 250% increase while the population grew at a more modest rate of only 40% (Beach 2001). Charleston is expected to continue its rapid pace of growth with some predictions of 800,000 people by the year 2030 from the current 105,000 (Allen and Shou 2000). This burgeoning expansion will consume land far into adjacent counties and will no doubt have considerable environmental implications.

CHAPTER 3

ECOLOGICAL SYSTEMS IN COASTAL REGIONS OF SOUTH CAROLINA; VALUES AND VULNERABILITIES

South Carolina is blessed with an exceptionally diverse range of ecosystems that support an equally rich amount of biodiversity. John Nelson, the director of the state herbarium at the University of South Carolina, has identified nearly 70 individual plant communities within the state's boundaries (Nelson 1986). South Carolina, nearly half the size of its neighbor to the south, contains 85% of the plant diversity found in Georgia. With 50% less land than North Carolina, the Palmetto state displays 75% of the plant diversity found in the Tar Heel state (Porcher 1996).

This wealth of biodiversity is a product of unique land formation, location, and climate. The state is divided into three physiographic provinces, the Blue Ridge Province, the Piedmont Province, and the Atlantic Coastal Plain Province. Only a small portion of the Blue Ridge Province is found in the northwest corner of South Carolina. In geological terms, these mountains are considered high relief, reaching elevations of 3,000 feet, but to the lay person, they are quite subdued compared to the western Rocky Mountains. The southern end of the Blue Ridge Mountains escaped devastation in the last ice age, thus the biodiversity of this area was protected and continued to thrive and evolve. The Piedmont Province is made up of foothills and gentle rolling terrain between the

Blue Ridge and the coastal plain. “Piedmont” literally means “foot of the mountain” (Porcher 1996). The area is dissected by many small streams and the soils consist mostly of red clay. The Atlantic Coastal Plain Province occupies nearly 65% of the land area in the state and is about 150 miles wide, extending from the Atlantic coast to the eastern edge of the Piedmont (Porcher 1996). The coastline is approximately 180 miles long and the province is divided into four regions; sand hills, inner coastal plain, outer coastal plain, and maritime strand (Map A.1).

The physical position of the South Carolina coastal plain on the continent is significant, being subjected to two major climactic forces. The northeastern part of the coastal plain is slightly influenced by a mid-Atlantic climate while the southeastern part of the coastal plain is influenced by a semi-tropical Florida climate (Porcher 1996). These factors result in a wide variety of soil types, moisture availability, and temperature extremes, promoting a diverse ecological richness throughout this region.

Discussed in the previous chapter, population trends are booming in the Atlantic coastal plain and rapid urbanization is jeopardizing many of the natural resources and supporting systems in this region. This chapter will focus on the value and vulnerability of ecosystems in the areas receiving the most impact from urbanization, the outer coastal plain and maritime strand.

Maritime Strand

The maritime strand is a narrow ecozone adjacent to the Atlantic Ocean. Communities include the beach, dunes, maritime forest, and salt marsh. This

ecozone is a harsh environment with poor, sandy soils; saturated, peaty soils; salt water; salt spray; seasonal flooding; constant wind; high heat and humidity; and infrequent, yet powerful, tropical and winter storms. Due to these environmental extremes, plant and animal diversity is limited. However, a small number of species have adapted well to the salty setting and a select few have thrived in the environmental extremes that have excluded their less tolerant competitors.

The beach and dune communities are the most affected by urbanization of coastal areas. It is doubtful millions of tourists would flock to this region if these wide, flat, sandy beaches did not exist. The beaches support plenty of human recreation and rehabilitation, but no plant life exists until you reach the area above the high tide line at the base of the dunes. The plants species here are dominated by common sea oat, *Uniola paniculata* (Porcher 1998). The sea oats on South Carolina beaches are protected by law for one reason - they facilitate the building of sand dunes (Porcher 1998). These natural formations are the first line of defense against the destructive force of storm surges and storm waves caused by summer hurricanes and winter storms. Dunes have been damaged by development activity in the past; but most municipal beach communities are now very cognizant of the benefits dunes provide and have encouraged dune restorations with sea oat plantings and boardwalks to protect the fragile dune systems.

Maritime forests occupy barrier islands and barrier shores of the coast just behind the dune zone. Here plant species are a hardy band of salt-tolerant,

evergreen trees and shrubs with few herbaceous plants (Porcher 1998). Typical plants are live oak, cabbage palmetto, wax myrtle, red bay, red cedar, and loblolly pine. Maritime forests are literally shaped by the salt spray-laden wind. Vegetative growth facing the ocean frequently is burned by saltspray and sculpted by on-shore winds to produce a stunted vegetational growth pattern. Plants on the leeward side, protected by the windward vegetation, grow to their fullest species specific expression. The result is a wind pruned effect that molds tree canopies into a flattened appearance. Wind sheared maritime forests also act as a defense mechanism for barrier islands by shielding high winds and stabilizing soil during storm events. By preventing erosion, and providing habitat for other species, these trees protect valuable coastal property.

Barrier islands are considered biodiversity “hot spots” for both resident and migratory birds, mammals and other vertebrates (Albers and Albers 2003). Many resident wading birds use these island forests for roosting and raising young. The islands are also important stop-overs for migratory songbirds traveling between winter locations and summer breeding grounds. There is growing anecdotal eveidence that barrier islands also act as refuges for mammals such as otter, mink, bobcat, raccoons and opossum whose populations are declining on the mainland from hazards such as dogs, cats, and cars (CCL 2006).

Human activity has altered the ecological functioning of many barrier island maritime forests in the state. Since colonial times forests were extensively timbered and in the last 40 years resort and beach cottage development has

altered or destroyed “second growth” of maritime forests on many barrier islands. People are willing to pay premium prices for ocean front property; unfortunately, this property normally exists within the fragile maritime forest zone. Development has a substantial negative impact on the ecology of barrier islands. A report from the University of Georgia confirms this, “As barrier islands are developed the impacts caused by small scale construction of home sites, roads, bridges, and septic fields, may alter the environment to such an extent that natural hydrologic and ecological processes are no longer possible” (Albers and Albers 2003).

There are no state laws in South Carolina protecting barrier islands from development; however, the state does regulate coastal activity that affects beach management, freshwater wetlands protection, and water quality management. The South Carolina Coastal Council is the regulatory agency with jurisdiction over all tidally influenced areas. Certification decisions are made based on the policies in the South Carolina Coastal Zone Management Plan (Brooks 1996). Development pressure is increasing upon many small (less than 20 acres) barrier and marsh islands; in fact, current legislative action in the South Carolina General Assembly is pending regarding bridge access to many of these islands (CCL 2006). As the UGA report mentioned, when access is granted to these small pockets of refuge, the delicate systems that support these islands are placed in jeopardy.

Salt marshes occur behind barrier islands in estuaries which regularly flood from daily tidal fluctuations. One of the dominant species found in the salt marsh, is smooth cordgrass, *Spartina alternifolia*. Cordgrass occupies the

majority of salt marshes along the east coast (150,000 acres in South Carolina) and even though this community is essentially comprised of a single plant species, it is one of the most productive communities in the world (Tiner 1993). Cordgrass supports a complex food network that is the basis for the popular seafood industry. It is estimated 90% of fish and shellfish that make up the commercial seafood industry spend all or part of their life cycles in the salt marsh (Vernberg 1996). *Spartina* has a very dense root system which stabilizes the soil even during strong storms. This attribute becomes extremely valuable during hurricanes and winter squalls because salt marshes are able to dissipate the energy of storm surges (Porcher 1998). Salt marshes also act as purifying mechanisms, filtering water as it passes through before being discharged into the ocean. *Spartina* produces oxygen and removes pollutants from water, such as nitrates, phosphates, and heavy metals (Patrick 1996). Oyster reefs are also important in the filtering process by removing pollutants and processing certain chemicals by transforming them into less harmful materials (Vernberg 1996). Salt marsh estuaries also provide abundant nondestructive recreational opportunities that support tourism.

Salt marsh estuaries were once thought of as wastelands and mosquito factories that spread malaria. Because they were thought to have little value they were often drained and filled. Only recently have we realized their importance. The degradation of marshes continues, not by draining or filling, but by pollution from urbanization, agriculture, and various industries. As coastal populations increase along the coast, the ability of salt marshes to sustain myriad

activities and conflicting uses will increasingly become impaired. The cumulative impacts of human activity will be significant and may interfere with the natural processes of the marsh system preventing the ecosystem from maintaining a balance (Vernberg 1996).

Outer Coastal Plain

The outer coastal plain extends from the maritime strand inland about seventy miles (Porcher 1996). The land form is characterized by gentle rolling hills of sandy soil on the western side that release into broad, flat, loamy, savannas adjoining the maritime strand. The waters are free of salt; however, many of the rivers and wetlands are influenced by tidal activity. William Bartram, the foremost eightenth century naturalist of the Southeastern U.S., explored the coastal plain of South Carolina in 1773 and poetically depicts the ecosystem in one of his accounts, “thus secure and tranquil and meditating on the marvelous scenes of nature, as yet unmodified by the hand of man” are “unlimited, varied, and truly astonishing” (Bartram 1996).

At the time of Bartram’s explorations, ecological diversity was abundant in this region. He noted a wide variety of animal species of which many are no longer associated with this region such as, buffalo, bears, panthers, wolves. Fish abounded in the waters, with 70 species found in freshwater and 160 species in saltwater, and it has been debated that there were more species of birds found in South Carolina than any other state (Edgar 1998). Since Bartram’s visits, well over 400 species have been observed in the state (Carolina Bird Club 2006). Supporting this abundance of life were astounding forests and wetland systems.

Pristine forest communities included longleaf pine, oak-hickory, bottomland, and cypress-tupelo swamps. Many of these forest canopies well exceeded 100 feet tall and trunk diameters of six to ten feet would have been common (Vileisis 1997). The land beneath the canopies varied from open park-like settings to impenetrable thickets. Many rivers flowing from the mountains consolidate here into slow moving, meandering, water courses that frequently overflow their banks, supplying vast bottomland areas with nutrient rich sediments from the upstate. Biodiversity thrives in this dynamic variety of ecological networks fostering singular habitats and species, some found nowhere else in the world (Porcher 1998).

The region once displayed a sizable portion of the majestic longleaf pine, *Pinus palustris*, forest community. William Bartram noted the wonder of these trees in his book *Travels,* "A magnificent grove of stately pines, succeeding to the expansive wild plains we had a long time traversed, had a pleasant effect, rousing the faculties of the mind, awakening the imagination by its sublimity, and arresting every active, inquisitive idea, by the variety of the scenery" (Bartram 1996). Other plant explorers indicated that as few as 50 pine trees per acre to as many as 160 made up a stand in these virgin forests, some of which may have attained an age of 500 years (Trendell, et al. 2000). The longleaf pine forests once occupied over 140,000 square miles, (90 to 100 million acres) throughout the Southeast from southern Virginia to east Texas but now only about 3% of the original acreage remains (FWS 2006). The 97% complete loss of the longleaf ecosystem is one of the most severe on earth dwarfing the 13 to

25% loss of the Amazon rain forest (Earley 2004). In South Carolina, ecologists believe that upwards of 95% of all the uplands of the coastal plain were once dominated by longleaf pine (Porcher 1998). In 1996 only 369,000 acres remained in the state (Trendell, et al. 2000). Regarding “old growth” virgin stands, it is estimated that there are less than 10,000 acres remaining scattered in small pockets through Florida, Mississippi, and Georgia (Trendell, et al. 2000). The forests have been lost almost exclusively to human exploitation and suppression of natural fire regime.

Even though the longleaf community has relatively few tree species, according to the Joseph W. Jones Research Center in south Georgia, certain pristine ecozones of this plant community are the most biologically diverse in North America (JWJC 2003). This ecological richness is due to a paradoxical relationship of fire and water. The semi-tropical climate of the southeast fosters the development of copious thunderstorm activity. Lightening strikes ignite fires that sweep through the forest killing most of the woody plant species; however, a thick, corky, layer of bark protects longleaf from all but the hottest of these fires. Historically, experts believe that fires may have burned through the vast longleaf forests every 1 to 3 years (Porcher 1998). Longleaf grows in a variety of ecozones but the longleaf pine savanna is where the brilliant plant diversity is found. In this community fairly level topography and nondraining subsoil causes a perched water table during wetter periods of winter and spring (Porcher 1996). During the dry summer and fall seasons the frequent fires may limit the tree canopy to longleaf pine but create prime conditions on the forest floor that

support a myriad of herbaceous plants. Wiregrass, *Aristida stricta,* dominates the ground layer but mixed within this airy grass is a collection of herbaceous plants that rival the diversity of the richest South American rainforest (Earley 2004). Thirty species per square meter is not uncommon and in the Green Swamp, a longleaf preserve in North Carolina, over 40 herbaceous plant species per meter have been documented (Earley 2004). These plants have dense rhizomatous root systems that remain protected when fire sweeps across the forest floor. Once fire eliminates shrubs and hardwood seedlings, the herbaceous plants flourish in the absence of light competition, resprouting quickly to form a brilliant understory wildflower garden. Stunning floral displays frequently include orchids, lilies, carnivorous plants, blazing star, lupines, composites and many other exceptionally rare and beautiful species. Many threatened and endangered animal species also rely on the open longleaf forest habitat maintained by frequent fire.

The outer coastal plain has been dramatically affected by human encroachment, resulting in fragmentation and destruction of a majority of the forested ecosystems. Golf resorts, housing developments, and sprawling retail centers are being built at a rapid pace. This rate of urbanization is expected to continue with predictions of the south's 13 states losing over 12 million acres of forest to urbanization in the next 20 years (Pittman 2001). Urbanization also results in fire suppression which converts the open park-like longleaf forest to impenetrable thickets of undergrowth. Because of habitat loss, 18 terrestrial animal species are either declining, threatened, or endangered (Trendell, et al.

2000). The red-cockaded woodpecker is probably the best known of the group. Other animals include gopher tortoise, indigo snake, flatwoods salamander, eastern diamondback rattlesnake, and bobwhite quail. There are 191 rare plant species associated with the longleaf wiregrass community, 61 of these are on state or federal threatened or endangered lists (Trendell, et al. 2000). Unless the pattern of human disturbance and destruction is curbed, remaining longleaf ecosystems will continue to decline and many of the threatened species will be lost.

The longleaf pine was a major source of economic benefit for the South. In the mid 1600's great fortunes were made in the Naval Store industry which supplied pine tar for waterproofing ships. In the late 1800s the price of lumber increased and another economic windfall was realized in the timber industry which lasted until the last great stands of longleaf pine were exhausted in the 1930s. Pine tar and lumber were the two major forest products however; there were also other valuable products that impacted the colonists' daily lives. Turpentine was one of these products; it was distilled from pine resin and was used for making soap, paint thinner, and roofing pitch tar. But the most appealing aspect was its medicinal qualities (Porcher 1996). Used as an antiseptic, people rubbed turpentine oil on their joints to relieve rheumatic disorders and the spirits were inhaled to alleviate bronchial ailments (EMA 1998). Even today the medicinal properties of turpentine oil are valued in veterinary science and for human use as one of the ingredients found in *Vicks VapoRub* (Vicks 2006).

E.O. Wilson, in his book “The Diversity of Life”, speaks of the unknown realm of species and their potential medicinal benefits to mankind that have yet been discovered in the rain forests, oceans, and other ecologically rich locations around the world (Wilson 1992). The diversity of longleaf pine ecosystem has provided answers to address past human needs and many more answers may still exist in the remaining complex longleaf ecosystem.

Trees may have been the single most impressive feature in the landscape for the first English colonists and plant explorers. This should not be surprising since there are only twelve species of trees in all of the British Isles, and there are over 100 in South Carolina (Edgar 1998). A quote from one early visitor read: “This Country hath the Oak, Ash, Elm, Poplar, Beech, and other sorts of useful Timber that England hath, and divers sorts of lasting Timber that England hath not, as Cedar white and red, Cypress, Locust, Bay and Laurell, equal to the biggest Oaks are large Mirtles, Hickery, black Walnut, and Pynes big enough to Mast the greatest ships, and divers other sorts, which I cannot enumerate” and the “variety of brave Oaks as Eye can behold, great Bodies tall and streight from sixty to eighty foot, before there be any boughs” (Edgar 1998).

These early visitors may have been observing trees in the bottomland forest. This forest type dominates the floodplains which flank river systems above tidal zones. Floodplains act as sponges, absorbing overflow of rivers during periods of extensive rainfall (Cross 2004). Just like all wetlands, these riparian forests are important components in the purification of water, flood control, and aquifer recharge. The plant communities are adapted to fluctuating water levels

and their success is due to the constant availability of moisture and rich alluvial soils. Rivers deposit sediments and nutrients carried from upper portions of the state. These productive soils of the bottomland forests have supported some of the tallest canopies in the world (NPS 2006).

The two main plant communities are bald cypress-tupelo swamps and bottomland hardwood forests. Bottomland forests occupy areas that are flooded on a temporal basis while cypress-tupelo swamps are found in more permanently flooded wetlands. Unfortunately, these forest systems have also succumbed to the usual list of human encroachments in the form of draining, logging, road building, agriculture, pine plantations, and pollution as a result of urbanization.

Primeval bottomland forests once numbered over 24 million acres from the Chesapeake Bay to East Texas (Cross 2004). In South Carolina, there were once 1.2 million acres and now only approximately 12,000 acres of old growth remain (Cross 2004). In the mid 1800's some logging of bottomland forest was taking place, but the Civil War arrested that activity until the early 1880's when wealthy northerners and able southerners envisioned the potential riches in the seemingly endless expanses of southern forests. The Federal Government also was inclined to assist the South as the region began to reconstruct, by passing the Timber Act of 1888, which sold off 5.7 million acres of federal lands in five southern states (Vileise 1997). State governments also got into the act of selling forested swamp land, some of it as cheap as $.25 an acre (Vileise 1997). With this type of incentive, large tracts of swamp land were bought up by timber companies. Technological advances of steam powered band saws and narrow-

gauge railroads, combined with high wages for labor, expedited the harvest. What was once thought of as an inexhaustible supply was exhausted by the mid 1920's. As in all extractive industries, the economic benefits lasted only as long as the natural resource lasted.

South Carolina is the only state fortunate to hold the last remaining virgin bottomland forest in the nation which can be explored at the Congaree National Park just east of Columbia. The park contains over 22,000 acres, with 11,000 acres of protected virgin bottomland forest (NPS 2006). Even though many plant and animal species of this community have been lost to human activity, this environment still boasts examples of the former brilliant, widespread bio-diversity. Over 700 plant species have been documented, 75 of which are trees. Birdwatchers have counted 167 species of birds that frequent the park throughout the year (Cross 2004). The forests are also home to an abundance of animal species, too many to list.

The Bald cypress-tupelo gum swamp, the other major lowland forest community, is dominated by the namesake species; bald cypress, *Taxodium distichum*, and tupelo gum, *Nyssa aquatica* (Porcher 1996). Continual presence of water limits plant diversity yet the most is made of every opportunity available. Distinct microhabitats exist in unique environments on floating logs and in the canopies of trees. One example, the green-fly orchid *Epidendrum conopsum*, grows on broad branches of cypress, oak, and other hardwoods, and is the only epiphytic orchid in the southeast outside tropical regions of Florida (Porcher 1996).

The majority of these southeastern forests were timbered from the late 1800's to 1930's but oddly enough, South Carolina is again fortunate to be the only state to have a pristine example of this last remaining plant community. The Francis Beidler Forest in Four Holes Swamp is a registered National Landmark and is the only virgin cypress-tupelo swamp in the world (TNC 2006). Located about 60 miles inland from Charleston, the forest is approximately 12,500 acres with more than 1,800 acres of ancient trees, some dating back a thousand years (TNC 2006). Bald cypress reaching heights over one-hundred feet with twelve foot diameters can be observed. Francis Beidler acquired this forest in the 1890's to protect it from the rampant destruction by timber companies. The forest is now available to the public and is owned and managed in a collaborative effort between the Nature Conservancy and the Audubon Society.

The benefits of these forests are numerous and fall into four categories: social, communal, economic, and environmental. We like trees around us because they make us feel pleasant, serene, restful, and tranquil. Forests provide countless recreational and spiritual renewal opportunities, and hospital studies have revealed patients recover faster when given views of trees outside their hospital windows. Social attachment to venerable, old trees is common with trees often being memorialized. Two examples are the "Angel Oak" in Charleston and here in Athens "The Tree That Owns Itself". The communal bond with trees is strong because of their size and form; trees often create an identity or support a sense of place for cities and regions. After all, what would Charleston or Savannah be with out their live oaks, magnolias, and palmettos?

Economic value is derived from many angles. Energy efficiency for buildings is much improved when surrounded by deciduous trees that provide shade in summer and solar warming in winter. Evergreen trees that buffer or redirect winds also save energy. Trees are important factors in storm water abatement which may make more government funding available for municipalities through grants and other sources (National Pollutant Dishcarge Ellimination System 2006). As a renewable resource, trees provide billions of dollars of economic value for many industries. However, the impact of trees is not always about the products they provide, it is about the services they render. Natural and urban forests provide immeasurable benefits such as moderating the climate, stabilizing soil, purifying air, filtering and conserving water, sequestering carbon, and harboring wildlife. Studies at the University of Georgia Coweta Research Station have shown that forested land produces more water, cleaner water, and a more evenly paced flow of water than non-forested land. As humans continue to occupy more and more land, it is vital that we acknowledge the amenities provided by forest communities because if urbanization is left unchecked these amenities may fail, resulting in a greatly diminished quality of life.

The integrated network of wetlands in the coastal plain and the benefits they provide are equally as critical as healthy forest systems. South Carolina contains over 4.1 million acres of wetlands of which 89% are freshwater (Dahl 1999). In the Outer coastal plain, wetlands are numerous and diverse. There are over 500,000 acres of tidal influenced wetlands in the region (Beaufort County Government 2002). There over 300,000 acres of isolated wetlands

(Duncan 2003) and the majority of 2.5 million acres of bottomland hardwood forest are found in the coastal plain (Dahl 1999).

Of the tidal influenced wetlands in the state, approximately 350,000 acres are considered brackish to freshwater (Porcher 1998). Freshwater marshes are located at points up river in tidal estuaries and are not subjected to salt. These tidal freshwater wetlands are among the most diverse wetland plant communities in the continental United States (Tiner 1993). Healthy marshes provide food and shelter to many mammals, birds, fish and invertebrates, resulting in one of the most significant ecological and productive natural communities on earth (Cox 2003).

Many of these wetlands once existed as ancient cypress-tupelo gum swamps adjacent to rivers, but were clear-cut in the 18th and 19th centuries as lumber and the growing of rice became highly profitable. The Santee River delta system is one such example at the north end of Charleston County. This 20 square mile delta system, the largest on the east coast, once supported part of the fantastically lucrative rice culture in South Carolina (Edgar 1996). Cleared swamps were diked into systems of large fields, while daily tides supplied fresh water to flood the rice crop. Rice fields occupied approximately 150,000 of the 350,000 acres of the freshwater tidal zones in the state (Porcher 1998). Thousands of acres of rice field impoundment networks are still clearly visible from aerial photographs. These land works have had lasting ecological implications on coastal plain wetlands.

Isolated wetlands have no clear connection to rivers and other surface waters, yet they are an important component of the integrated watershed system, providing many valuable ecological functions (Duncan 2003). These wetlands, commonly referred to as Carolina bays, are geological formations of unknown origin that are only found in the coastal plain of North and South Carolina and Georgia. They are shallow depressions that vary in depth from 3 to 20 feet and they vary in length from a few hundred yards to several miles. The bays generally have an elliptic shape and are always oriented in a northwest-southeast direction (Porcher 1998). Many theories have been postulated about the source of these formations but none have proven how they were actually created, thus their origin remains shrouded in mystery.

What is known is that these wetlands contain unique plant communities. Carolina bays act as basins collecting rainfall and may have long or short hydroperiods based on their size and depth. The slow draining, mineral-poor soils are composed primarily of highly acidic peat sometimes ten feet deep or more with an underlying base of clay (Porcher 1998). Peat is able to hold moisture for long periods of time resulting in a unique plant pallet of dense vegetation. Where water is held in long durations, swamps of pond cypress, *Taxodium ascendens*, and a variety of bay trees such as sweetbay, red bay, and loblolly bay may develop. In the shallower bays, herbaceous plants such as pitcher plants, Venus' fly trap, and a variety of orchids, are found. These rare plants are endemic to these environments, many are threatened. Carolina bays act as an oasis for wildlife. These are excellent locations for bird enthusiasts and

they harbor many rare animals such as the endangered black bear and Pine Barrens tree frog (Porcher 1998). Some 40 other amphibians depend on these isolated wetlands for survival including a number of state and federally protected species (Duncan 2003).

Isolated wetlands also play an important role in hydrological and water quality maintenance functions by storing water, filtering pollutants, abating floodwaters, and recharging groundwater supplies. These wetlands store precipitation during dry seasons, providing a water source for plants and wildlife. Retained waters are slowly released contributing to stream flow and reducing flood potential. Significant contributions to local and regional water quality are also performed by removing pollutants, retention and recycling of nutrients, and the trapping of sediments. These functions are vital in protecting water quality, especially in the coastal plain where many isolated wetland systems are integrally connected to productive estuaries (Duncan 2003).

Significant impacts have altered or destroyed many isolated wetlands. Pine plantations, agriculture, and urbanization are the main culprits resulting in the destruction of these ecosystems (Dahl 1999). Of the 4,000 Carolina Bays present in South Carolina, no more than 400 to 500 remain in a relatively undisturbed state (Duncan 2003). The Nature Conservancy and the South Carolina Heritage Trust program have been urgently trying to save bays. Some that have been protected and are available for public use, include; Lewis Ocean Bay Heritage Preserve, Woods Bay State Park, and Cathedral Bay Heritage Preserve. However, intense development pressure has increased on many of

the unprotected isolated wetlands since they have recently been redefined as non-jurisdictional and are no longer regulated under Section 404 of the Clean Water Act (Duncan 2003). Unless state regulations are able to maintain the former strict permitting process of the federal laws, these glorious wetlands will remain in jeopardy.

All the forest ecosystems and wetlands previously discussed, are hydrologically and ecologically connected within the watershed. They provide an immeasurable resource that simply cannot be reproduced by man. They are vital in maintaining the integrity of coastal plain ecosystems, adjoining water bodies, and groundwater aquifers that are essential in maintaining biodiversity and our quality of life. This fact must be part of every decision people make regarding land use. The following example, although not in South Carolina, illustrates this point perfectly.

In1989 New York City came to the realization that the services healthy ecosystems provide were extremely important. The city was faced with a water quality dilemma-either spend between $6 and $8 billion dollars on a new water treatment facility and $500 million annually in operating cost, or spend $1.5 billion restoring the watershed (Cunningham 2002). Historically, New York City had always been envied for having some of the best quality drinking water in the country and credit for this amazing resource was attributed to the healthy watershed. The Catskill / Delaware watershed comprises over 2,000 square miles of rural and forested countryside which produced 1.8 billion gallons of pure water daily for New York City (90% of its supply) and surrounding communities

(Cunningham 2002). Due to continued urbanization, poor agricultural practices, failing waste water systems, and many other reasons, the watershed quality degraded.

New York City made a choice to restore the watershed. Coalitions were developed with farmers, the forest service, private land owners, municipal wastewater facilities, industries, NGOs, and universities. One of the main goals of the program was to secure approximately 350,000 acres of undeveloped sensitive land by fee title purchase or conservation easement (Environmental Protection Agency 2006). This goal was based on the theory that uncontaminated ecosystems would provide most of the water cleansing processes. In May of 1997, the program went into effect and has been considered a success. Over 70,000 acres of water purifying forests have been acquired and 96% of commercial farms have enrolled in agricultural best management programs (EPA 2006). New waste water treatment plants have been installed, nutrient reduction strategies have been implemented, stream management programs are in place, and many other water quality protection programs are functioning. The definitive premise for restoring the watershed was based upon the knowledge that healthy ecosystems provide the essential services that sustain all life at no cost, and when given the opportunity will continue to do so.

Now is the time for South Carolina to decide how to proceed concerning ecosystem preservation and how new development will integrate with existing natural systems. The state is very fortunate to maintain an immense diversity of

relatively healthy, functioning, ecosystems. However, according to many experts, the cumulative effects of conventional forestry, agriculture, and urbanization have had significant negative impacts on the overall quality of the natural systems in this state (Dahl 1999). Historically, forestry and agriculture were the main perpetrators of ecosystem alteration but rapid urbanization is now the main concern. Many environmental leaders recognize the value these precious natural resources provide, represented by the successful preservation of the Francis Beidler Forest, Congaree National Park, and Lewis Ocean Bay Heritage Preserve. The desire to protect additional natural resources and quality of life for residents has also been acknowledged in the recently published smart growth initiative "Growing by Choice or Chance; Strategies for Quality Growth in South Carolina" (Urban Land Institute 2004). This document is the first step in addressing areas of concern to protect natural resources and accommodate predicted levels of population increase. Hopefully it will continue this dialogue of sustainability, because urbanization will certainly continue to occur and it must happen with an overall strategy that guarantees the continued health of the state's valued ecosystems.

CHAPTER 4

DEFINING SUSTAINABILITY AND ITS APPLICATION IN THE BUILT ENVIRONMENT

Fifty years ago, plans were crafted for a resort development that would set the standard for future high-end development along the southeastern coast. The development was Sea Pines Plantation on Hilton Head Island. Charles Fraser was the visionary behind this revolutionary new land development concept. Charles, the son of a Georgia timber baron, had a dream for nearly 5,000 acres of land owned by his father's company on the southern end of Hilton Head. Inspired by the careful planning at California's Pebble Beach and Georgia's Sea Island, Charles envisioned this barrier island of wide, sandy beaches, charming live oaks, and towering longleaf pine forests, as a resort community embracing the glorious natural setting rather than dismissing it. Sea Pines was the predecessor of the nature-based resort beach community. This concept that was far ahead of its time, and played an early role in the initial stages of sustainable planning and design.

Today, the concept of sustainable development is becoming more accepted by community leaders, designers, and the general public, however, this concept has many meanings for many people. The individual terms, sustainable and development have clear meanings but how they are applied varies widely. "Sustainable" implies forever, perpetual, renewal, restoration, and inexhaustible. "Development" suggests growth, expansion, increasing yields, and movement.

The two terms seem opposed when placing them in the context of urbanization, but if applied to natural systems, they are a perfect match. Ecosystems grow, expand, increase yields, renew, and restore while providing a healthy environment for inhabitants without producing pollution or waste. The critical inhabitants of these ecosystems are human beings. Traditionally, although this is rapidly changing, ecologists have studied systems excluding man, and humans have always considered themselves as somehow divested and detached from ecosystems (Lyle 1999). Humans have been and always will be integral, interacting components of ecosystems at every level, and in order to deal adequately with these systems, it is only right for people to live within the parameters of ecological boundaries.

When the phrase sustainable development is applied to the built environment, it implies livable, inspiring, enduring, and equitable places where the quality of life and the long-term quality of human existence will be enhanced rather than depleted (Porter 2002). Other perspectives include - “reducing energy use in cities and creating a smaller, more compact urban fabric interspersed with productive areas to collect energy, grow crops for food, fiber, and energy, and recycle wastes; sustainable communities acknowledge environmental constraints from limited ground water and wetlands to global climate change”; and “sustainable communities work to live within physical and biological limits” (Porter 2002). These are all reasonable definitions and although no one wants to show a lack of commitment to such a key issue, there remains much debate over the exact interpretation of sustainable development. Critics

claim, “The concept is hamstrung by foggy definitions, a paucity of measurement criteria, a boring image, and often unperceivable results” which makes for a poor guide for business and government decision-making on a day-to-day basis (Cunningham 2002). The challenge to sustainability is that it is not a single movement or approach. Definitions are as varied as the communities and interests that deal with the issues. Regardless of claims by critical pundits, the phenomenon of sustainable development efforts from global leadership to grassroots organizations continues to gain momentum.

In the 1987 report, *Our Common Future*, the World Commission on Environment and Development, presented the first harmonious definition of sustainable design; “Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (World Commission on Environment and Development 1987). Sustainability was further defined at the Rio Earth Summit in 1992, also known as the United Nations Conference on Environment and Development. At this summit, three broad entities of sustainability were established; social equity, economic prosperity, and environmental integrity. These are based on the notion that environmental issues often originate from human behavior. Pollution, wasting energy, and misuse of natural resources, directly result in environmental degradation. Economic growth that leads to a wider separation of wealthy and poor often leads to an urban underclass mired in poverty, beset by crime, poorly nurtured by public services, and separated from job opportunities (ULI 2000).

Striving for sustainability is the only way to correct these ills wrought by short-sited human behavior.

Environmental educator David W. Orr suggests there are two seemingly opposing alternatives to attaining sustainability; one is based on technology and the other ecology (Van Der Ryn and Cowan 1996). The technology approach implies all problems can be solved with a technological or market driven answer, such as, technical advances that clean the environment, more economic growth, freer market access, and capital inflow. The ecological approach advises that we alter our lifestyles to solve current patterns of poor resource management. We must rethink; agriculture, transportation, shelter, energy use, urban design, resource use, forestry, the significance of nature, and our personal values. Even though the two positions seem opposed, they have similarities and do observe a common point; there is a limit to the earth's fragile resources, and to avert a global calamity these resources must be intelligently maintained. However, we can not arrive at sustainability from a singular approach. It should be an integrated approach involving as many solutions as possible to improve the quality of life through better design.

In this country, sustainable development has been the battle cry in the war against sprawl. The following excerpt from *Suburban Nation,* a book by Andres Duany, Elizabeth Plater-Zyberk and Jeff Speck, captures the essence of this problem. "As you creep along a highway that was widened just three years ago, you pass a sign that reads: COMING SOON: NEW HOMES! Already the bulldozers are plowing down trees, and a thin layer of mud oozes onto the

road…..Over the years you have seen a lot of forest and farms replaced by rooftops, but these hundred acres were left unscathed, by the whim of a wealthy owner. Now the owner has passed on, the children have cashed out, and the property has fallen victim to the incessant pressures of growth…..It will be sprawl: cookie cutter houses, wide, treeless, sidewalk-free roadways, mindlessly curving cul-de-sacs, a streetscape of garage doors" (Duany, et al. 2000). Sprawl does not end with the subdivision; it continues to consume larger parcels of land in the form of strip malls, retail outlets, "big box" chain stores, and sterile office parks, among barren seas of paved, treeless, parking lots. All of these vices are linked by limited number of collector streets and obtrusive freeways and interstates.

The Sierra Club defines sprawl as "the expansion of low-density, automobile-dependent development that occurs at the fringe of the urban landscape" (Sierra Club 2006). It began after the Second World War and was an outgrowth of invention by architects, engineers, and land planners. Beginning as a way to solve the demands of community building in a consistent, organized manner, it became the bane of urban expansion. Sprawl isolates land uses and lacks transportation alternatives, forcing long car trips to schools, centers of employment, stores, and community activities. It consumes land at a rapid pace, pollutes air and water, exacerbates social inequity, contributes to inner city decay, confines us to our cars causing massive traffic problems, and costs taxpayers heavily in infrastructure expansion and maintenance for these services and facilities.

Zoning laws have played a large role in supporting the spread of sprawl (Whyte 1968). Initially, zoning laws protected people by mandating polluting industries to out-lying locations, away from residential areas. This model was justified; however, municipalities soon began zoning all land uses, exceeding the original purpose of the law. Large parcels of land were segregated into specific uses, retail away from residential, light commercial away from retail, heavy commercial away from light commercial, and industrial was pushed to the outer limits of the county. This isolation of uses prevents organic growth of communities, requiring people to travel long distances for their daily needs. Frequently, residential zoning does not overlap with commercial districts preventing mixed use opportunities. Lot size has historically been based on what the local citizens can afford resulting in land consuming, oversized properties (Whyte 1968). Fortunately, land management tools for smart growth plans are becoming more popular, such as easements, transferable development rights, land trusts, and overlay zoning districts.

SIX FUNDAMENTAL RULES OF HISTORIC URBANIZATION

The concept of smart growth in this country is a phenomenon that followed well established European patterns of development. Early examples of smart growth took the form of planned cities, which have been part of the American scene since colonial times. William Penn laid out the plan for Philadelphia in 1682 and 50 years later James Oglethorpe presented his unique garden oriented design for Savannah. The revolutionary founding fathers of this country also had a deep appreciation for urban planning and appointed Pierre L'Enfant to design

our nation's capitol in 1791. Many of today's urban planners realize that some of the best examples of sustainable design can be found in the charming assortment of historic communities up and down the eastern seaboard. Boston, Annapolis, Williamsburg, and Charleston have all been praised for their enduring, successful urban fabric. Current urban planning experts have deduced six fundamental rules that distinguish these historic models from today's sprawl, they are: the city center; the five minute walk; the street network; narrow versatile streets; well-blended mixed use; and special sites for special buildings (Duany, et al. 2000).

CITY CENTER

The city center is the location for commerce, culture, religion, and governance. It is a place for casual socializing and business. It can take the form of various scales such as the heart of the city, community, or neighborhood. Centers provide daily necessities for local patrons, and can act as points of reference for visitors not familiar with the terrain. Many historic city centers take the form of village squares, enclosing or fronting prominent government buildings. Colonial Williamsburg may be the best example with its regimented central grounds enclosing the Capitol at the end of Duke of Gloucester Street. Other centers take on more unique forms. Savannah may be the most notable with its charming garden squares throughout the city grid. These green squares form a bond uniting, local residents, daily workers, and seasonal tourists. The Market in Charleston is another historic, centrally located site, beloved for its antiquated architectural surroundings and its sweetgrass basket weavers.

THE FIVE MINUTE WALK

The concept of the five minute walk is fairly simple; a local resident should not have to walk more than five minutes to reach the basic necessities of daily life. A five minute walk equates to a quarter-mile in distance for the average person. Short walks are preferred especially in cities with challenging hills (i.e. San Francisco); however, living, shopping, and employment, can occur in the same building, which was routinely the case in historic districts of Boston or Philadelphia before the automotive age. Shop merchants frequently lived in apartments above their store and rented out living space, if it was available. A few employees assisted in operating the store and many of the local residents would stop in each day for essentials. Today, walking reduces our dependence on cars, prevents pollution, and provides most of us with a convenient form of much needed exercise.

STREET NETWORK

Streets connect us to desired locations; when planned efficiently, they provide a pleasant traveling experience. Traditional grids, webs, or other predictable street patterns usually have many connecting points, presenting numerous alternative routes. When traffic is heavy during morning and evening rush hours, these traditional street networks provide travelers with many choices to avert areas of heavy traffic volume. This contrasts with the majority of despotic road systems designed in suburban areas of today. Isolated subdivisions are filled with dead end cul-de-sacs feeding into collector streets.

These streets merge into highways, and pack traffic into congested, smog-ridden, freeways with almost no truly functional alterate routes to avoid these not-so super highways.

VERSATILE STREETS

When an adequate amount of commercial and collector street connections are available, local residential streets do not need to as wide as are typically found in today's standard subdivision. The local neighborhood street is a space where automobiles and pedestrians directly compete, especially when no provision for sidewalks is made. Wide streets account for higher rates of speed, even though the posted speed limits are much lower and many studies have shown that narrow streets reduce the perceived scale of the streetscape for drivers, psychologically influencing them to drive slower (Russ 2002). Cities in Europe have been experimenting with reducing traffic volume and speed for decades. This underscores the concept based on pedestrians sharing an equal right with vehicles to use the full width of the street (Lennard 2006). Many European traffic calming devices have been adopted here in the states, including; traffic circles, traffic islands, raised pedestrian crosswalks, and traffic lanes paved with cobblestones (Lennard 2006). Other methods include: on street parallel parking, separate bike lanes, tree shaded streets, split-traffic lanes, and buildings close to the street. Each method alleviates traffic and helps to slow speed, while contributing to a more pedestrian-friendly environment.

MIXED USE

Ill-fated zoning laws contribute to sprawl by isolating land use (Whyte 1968). Contrary to this archaic, single-use zoning is the concept of mixed use. Mixed use is a complex blend of residential, commercial, and green space, but despite this complexity it is not a design free-for-all. Zoning rules do apply to maintain the proper scale of buildings, their relationship to the street, and style of the architecture to maintain a sense of place (Duany, et al. 2000). All buildings within a block connect to create a feeling of enclosure for the public realm of streets and sidewalks. Commercial businesses are located on street level, providing many opportunities for social interaction. Residential space is located in apartments above with many windows and balconies casting a watchful eye on the street and sidewalk below. Eyes on the street create a sense of security and strong community bonds (Lennard 2006). Sidewalks are wide, and parking is handled on the street, in hidden parking garages, or in lots behind buildings. Plazas and green spaces are tucked between buildings providing pleasant access to parking lots. These important areas are also located in front of restaurants and other shops providing shade and a welcoming atmosphere. The proximity of living, working, and socializing in a tight urban fabric reduces car trips and creates a convenient and hospitable public environment.

SPECIAL SITES

The final fundamental rule in the battle against sprawl is creating urban focal points to display special buildings and monuments. Court houses, churches, statues, and other prominent structures should all receive the attention

they deserve by their proper placement in the community. These civic features represent the city's identity and aspirations. When sited appropriately, the city achieves a physical structure, one that both manifests and supports its social structure.

CURRENT FORMS OF SUSTAINABLE LAND DEVELOPMENT

Many historic cities, villages, and neighborhoods, effectively provide a wide range of development solutions for the built environment that could be termed sustainable. These historic examples have been emulated and reconfigured into a variety of novel labels such as; new urbanism, traditional neighborhood development, green development, transit-oriented development, and conservation subdivision. They all basically fall under the designation of smart growth. Smart growth seeks to identify common ground where developers, environmentalists, public officials, citizens, and financiers can find ways to accommodate growth. The process is driven by participation from members of all these groups. The goal is consensus on development issues. Compact, mixed-use developments are promoted, offering high quality living and working environments. A variety of transportation options, especially walking and biking, are encouraged as alternatives to automobile exclusivity. A blend of home sizes is available, with priority given to existing architectural styles, reinforcing the sense of place. Protecting, preserving, and restoring environmental features are also advocated to maintain quality of life standards by providing wildlife habitat, recreational opportunities, flood control, and stormwater abatement and purification. Social equity and economic prospects have been late arrivals to the

process, but they are becoming more prevalent as the arena of sustainable design evolves.

NEW URBANISM

New Urbanism is one trade name for sustainable development endorsing complete and integrated communities that locate the daily needs of residents within easy walking distance. Over the years, many conventional subdivisions have eliminated sidewalks in the name of cost efficiency requiring auto dependence even for the shortest of trips. Wide sidewalks provide mobility options, and most importantly, remove people from their cars. This saves energy, reduces pollution, makes streets safer for children, promotes more social activity, and emphasizes the healthy benefits of walking and biking. Easy access to jobs, schools, churches, stores, and transit stops are also major components of the new urbanism model, while also providing intelligent access for vehicles. A wide range of job opportunities provided by commercial and retail employment centers are advocated. Architecture should follow regional patterns. A broad spectrum of compact, mixed use real estate is also promoted for a diversified population. Civic, cultural, and recreational uses are encouraged in open spaces, while greenbelts provide well-defined pedestrian thoroughfares and edges to communities. Resource conservation, including water, energy, and building materials, is highly supported. New urbanism is also committed to citizen-based participatory planning and design. The “Congress of The New Urbanism” is the central organization for the movement. Their charter specifies

planning recommendations for land, metropolitan, and community levels (Congress for New Urbanism 2006).

Traditional Neighborhood Development

A type of new urbanism called “traditional neighborhood development” (TND) has been espoused by Andres Duany and Elizabeth Plater-Zyberk (Duany et al 2000). Characteristics of this form of sustainable development include grid street patterns, small yards, single-family homes close to narrow streets, porches, alleys, and pedestrian-oriented streetscapes. Small pocket parks interspersed among suburban blocks provide recreational opportunities and create ribbons of greenspace throughout a TND. Proximity to employment, schools, and shopping are also important components. The only drawback is the size of a TND tending to prevent them from being built within existing community frameworks. However, there are many excellent examples of this type of development and their success has encouraged many other developers to follow suit.

Conservation Subdivision

Another type of sustainable development focuses on environmental responsiveness, resource efficiency, and community and cultural sensitivity (Porter 2000). A “conservation subdivision” is a strictly residential form of sustainable development. It focuses largely on resource-conserving techniques by preserving half or more of the buildable land as undivided, public open space (Arendt 1996). Conservation subdivisions have benefits that surpass the typical residential development. They allow homeowners to live in a community with

undeveloped protected landscapes; they support development while responding to a site's ecological features; and they provide financial returns that match or exceed those achieved in conventional developments (Bavinger 2003). Preserved open space is based on a process of delineating land into two groups; "Primary Conservation Areas" and "Secondary Conservation Areas" (Arendt 1996). Unbuildable areas, the primary conservation areas, include steep slopes, wetlands, floodplains, and bodies of water. Secondary conservation areas are critical environments that are buildable, but deserve to be saved such as: mature forests, buffers around wetlands, prime farmland, natural meadows, vital wildlife habitat, and historic or culturally significant sites. Because this form of sustainable development emphasizes community-wide open space networks and the preservation of sensitive ecological diversity, they are typically constructed in more rural settings on the urban fringe. Conservation subdivisions focus on development where water and sewer infrastructure may not be available, but encourage neighborhoods of high density, compact housing that are connected by greenbelts and roads to other neighborhoods and road systems. As land area is quickly being consumed in metropolitan areas, the conservation subdivision model is another successful tool in the fight against sprawl.

LOCALLY APPLIED SUSTAINABLE PRACTICES

As all these types of planning suggest, smart growth is a vision for nurturing sustainable communities that are environmentally, socially, and economically viable. The concepts of smart growth encompass a broad range of sustainable initiatives around the world, but to achieve results they must be

organized and applied locally. The Southface Energy Institute, an Atlanta-based energy efficiency advocacy group, is one organization that has done this. It classifies the broad range of sustainable development solutions into three levels – community, project, and building (Brown 2000).

COMMUNITY

At the community level land must be used wisely when converting it to urban uses. The integrity of natural resources must be maintained through preservation or restoration. When possible existing urban sites should be built upon before green sites. This will help continue the existing urban fabric and will assist in place-making through integration of new architectural features with historic qualities. Improving connectivity among neighborhoods provides alternative transportation routes and stresses community bonding through social interaction and additional access to economic opportunities. Development should be compact with a proper scale of buildings to streetspace and a well-blended mix of uses providing for daily needs of residents.

PROJECT

Practices at the project level should take advantage of the natural amenities of the site by preserving wetlands, forests, and meadows as valuable open space networks. These natural features reduce the impact of pollutants, storm water runoff, and sediments. Infrastructure should be designed for efficiency by connecting to existing systems and minimizing impervious surfaces and site disturbance. All transportation options, walking, biking, auto, and public transit, must be considered and planned for accordingly.

BUILDING

Buildings can reduce site impact by limiting construction activity to the footprint of a structure. Existing trees and other native plant material should be fenced off, providing protection by prohibiting all construction activity inside the drip line. Original land forms should also be saved to maintain the character of the land, and to reduce erosion with unnecessary grading. Impervious paving around buildings should be curtailed and replaced with permeable paving to permit water infiltration. Resourceful, environmentally responsible building materials should always be specified. Materials produced with hazardous chemicals may off-gas in the building after construction is complete, causing hazardous conditions for human and animal residents. Construction debris accounts for a large amount of the waste hauled to landfills each year - on average 3 to 5 tons of waste material is produced for every 2,000 square foot home built (Brown 2000). Creating efficient floor plans that match the dimensions of common materials such as a standard sheet of plywood will reduce a large portion of waste material. When recycled and reused, building waste can be significantly reduced, easily achieving green construction status. In America, cars are frequently blamed for energy usage and pollution problems, but buildings are actually the main culprit consuming over $160 billion in energy costs annually (Barnett and Browning 2004). Adequate insulation, water saving devices, efficient appliances, and orienting buildings for passive solar heating, cooling, and daylighting substantially reduce energy needs, decreasing carbon output and operating costs.

These three levels - community, project, and building - are where the concepts of sustainable development become tangible. Many advocacy groups have written copious publications on the subject of sustainable building and the coverage here barely scratches the surface.

CHAPTER 5

ANALYZING SUSTAINABLE DESIGN IN PLANNED COMMUNITIES

Over the last two decades various forms of progressive community design have gained increasing acceptance in the land development and building industry. This urge to create better communities has been advocated by environmental organizations, innovative town planners, as well as a broad population who have grown weary of congested traffic, pollution, rising energy bills, disenfranchised communities, and degraded natural systems. In response to this dissatisfaction, a handful of new communities introduced in coastal South Carolina over the last fifteen years stray from typical subdivision layouts and exhibit qualities of new urbanism or conservation developments with goals of reestablishing degraded community bonds. Many of these projects are skillfully designed and have significant sustainable attributes yet achieving consistent levels of sustainability remains debatable. To realize a project's level of success, a broad assessment of a community's sustainable features should be conducted. Assessing projects under construction as well as completed projects will further enhance the planning process providing valuable insight for future sustainable communities and improving the lives of coastal residents and surrounding biodiversity.

Led by the three fundamental components of sustainability - economic viability, social equity, and environmental integrity - dynamic designers, leaders,

and environmental organizations have created a variety of assessment methods to evaluate the expansive components of sustainable development. The recently published *Evaluating Sustainable Design in the Built Environment,* listed over 60 assessment methods world-wide, of sustainable design (Brandon and Lombardi 2005). Non-governmental organizations such as Urban Land Institute, Rocky Mountain Institute, Southface Energy Institute, Sierra Club, and Congress for New Urbanism, are just a few of the American-based associations that have crafted theoretical guidelines for sustainable land development. Some of these are broad sweeping objectives while others focus on niche markets, but all provide valid assessments of sustainable design emphasizing the accomplishments and shortcomings of previous projects.

TEN PRINCIPLES OF SUSTAINABLE LAND DEVELOPMENT

Jim Heid, a San Francisco-based leader in sustainable community design and frequent contributor to *Urban Land*, points out, “there are passionate, visionary developers and patient investors who are willing to test, refine, and rework new ideas in a nonformulaic manner” (Heid 2001). To address this demand for improved models of urban design, Heid has crafted a set of principles focused on the scale of planned communities. His guidelines were derived from experts and organizations in sustainable design, and they help create a common vocabulary that planning teams, developers, and policy makers can use to discuss the efficacy of a proposed project and decide how well the design addresses ideals of high quality sustainable land development. The ten principles are: contextually and locationally responsive, systems-based structure,

resource efficiency, streets as public realm, fine-grained mixed use, infrastructure as asset, conscious materials choice, economic viability, connect people and culture, and places not projects.

Contextually and Locationally Responsive

These projects address the geography on a regional scale, beyond the proposed development site and include many complex factors such as local architectural styles, ecological networks, transportation connections, utility infrastructure, and social patterns.

Systems-based Structure

Ecological systems within and adjoining the project area are integrated into the overall plan. This arrangement was made famous by Ian McHarg in the late 60's, involved his innovative system of composite maps considered all the environmental factors contributing to the carrying capacity of the land (McHarg 1992). Today this process is handled with geographic information system (GIS) technology and improved scientific analysis, which provide a higher degree of accuracy when mapping a site's physical features. Accurate geographic maps isolate sensitive natural areas to be preserved and designate more appropriate development alternatives permitting the land to dictate the path of development.

Resource Efficiency

Resource efficiency addresses all the energy related functions of development. In this country, this issue has recently been elevated to the forefront, impacting everything that relies on energy produced from fossil fuels but it also has much to do with efficient land use. Reducing car travel, building

energy efficient structures, enacting water-saving routines, and introducing alternative sources of power generated by solar or wind, balance the patterns of consumption with production. Reducing and disposing of waste are also important components of this element.

STREETS AS PUBLIC REALM

Focuses on multi-faceted possibilities street networks can provide rather than restricting streets to the sole purpose of serving vehicular traffic. Streets in suburban areas and urban retail districts should be safe, vibrant corridors presenting a variety of transportation options as well as pedestrian uses. Street design designates how space will be used. Size, materials, form, light, relationship to buildings, and character of human activity, all play a role in street vitality.

FINE-GRAIN MIXED USE

Mixed use supports the teachings of new urbanism by recommending a well-blended mix of residential options and light commercial businesses to create a public realm with rich vitality. Over zealous zoning has prevented this type of development in the past, but cities and communities are now adopting new progressive zoning codes that encourage more intelligent land use.

INFRASTRUCTURE AS ASSET

Advocates stormwater treatment through natural processes rather than piping it away. Modern suburban development today covers up to 40% of the land area with impervious surfaces (Brown 2000). Impervious roofs and paving prevent natural absorption, storing, and routing of stormwater. The natural

process of infiltration is now being recognized as a significant resource. Actual benefits include: erosion and sediment control, pollutant filtration and absorption, protection of streambed biodiversity, and aquifer recharge. Stormwater retention and detention also provides an opportunity for creative designers to restore or create wildlife habitat. Natural infiltration also saves on high costs associated with drainage pipe and culvert infrastructure.

Conscious Materials Choice

Selecting local and low-hazard building materials in addition to appliances and other products that use energy efficiently is the best decision. Many environmentally friendly products produced from renewable resources are available. Designers and contractors should also investigate the embodied energy of the materials they select. Embodied energy is the energy required to produce, ship, and install the material. Plywood containing potentially toxic adhesive, may off-gas for months after installation contaminating indoor air. Reducing construction waste is also a major concern. This can be achieved through reuse of certain products and by efficient architectural design, based on building material modules.

Economic Viability

Along with social equity and environmental integrity, economic viability is one of the three fundamental building blocks of sustainability. An economically viable development not only provides return for the investor, but also, continues to produce income for stakeholders long after build-out is complete. Employment

opportunities for residents within, or in proximity of the planned community, should always be considered during the planning stages.

CONNECTING PEOPLE AND CULTURE

The introduction of cultural activities is relatively new phenomenon to rise from the sustainable land development movement. A carefully developed understanding of the natural history of both site and region forms the soul of the community, connecting buyers with shared values (Heid 2004). Educational facilities that focus on the site's ecological and historical value are becoming more common in many new planned developments. Other opportunities for cultural experiences may include outdoor amphitheaters, performing art centers, and sports complexes. These venues act as a signature for the development, strengthening the community's identity and reinforcing social bonds among its residents.

PLACES, NOT PROJECTS

Place creation refers to the art of maintaining the character of the region. It can be a nebulous process, but communities that relate to their immediate surroundings retain a sense of regional charm and dignity. Sense of place involves matching architectural styles and street furnishings as well as encouraging genuine programming, such as style of retail opportunities. After all, traveling allows us to experience a new place by gaining pleasure from unfamiliar features that the landscape, vegetation, architecture, or community have to offer.

CHAPTER 6

EVALUATION OF SUSTAINABLE DESIGN IN SIX CASE STUDY SITES

Sustainable features in six case studies sites were evaluated with Jim Heid's ten elements of sustainable land development. This anecdotal evaluation criterion was selected for its fundamental sustainable concepts that promote healthy and socially responsive communities. Visual surveys were conducted during tours of the community case study sites. Some tours were provided by representatives at the case study sites while other tours were conducted without guidance. One survey was conducted by golf cart, another by car, and the final four were conducted by walking and biking through the community. Visual surveys were augmented by on-site interviews with representatives of each case study site and by phone interviews with outside individuals who were not associated with the case study sites, such as environmental officials, landscape architects, and other developers. Questions for the interviews were generated by the ten elements of sustainable design criteria. Literary research also provided supplimental information on the case study sites. The presence of sustainable features of each site were photo-documented and later assessed based on the specified evaluation criteria (Fig. B.4).

The six case study sites are master planned communities located in coastal areas of Beaufort and Charleston counties (Map A.2). This region was selected because of a high concentration of progressively planned communities

and individual case study sites were selected based on recommendations from landscape architects, developers, and environmental leaders familiar with the concept of sustainable development and urbanization patterns in the South Carolina coastal region. Tours of the case study sites were conducted during the middle of the third week in April of 2006. The weather was pleasant, with clear skys during each visit.

CASE STUDY 1: SEA PINES PLANTATION AND RESORT

Hilton Head Island, located in Beaufort County, is 30 miles north of Savannah and 110 miles south of Charleston. The barrier island is 42 square miles with wide, flat, sandy beaches, abundant salt marshes, and marvelous examples of ancient live oak and longleaf pine. Hilton Head has a rich history dating back thousands of years to Native American occupation and European explorers appearing as early as 1521. The Spanish and French took turns at settlement attempts but the English prevailed in 1662. Initially, settlements were frequently harassed by hostile Indians; but once that risk subsided, colonists began to establish lucrative plantation communities growing rice, indigo, and cotton. This plantation economy based on slavery lasted for nearly 150 years. During this time period, wars had a great effect upon the island. Naval blockades, skirmishes, and enemy occupation all impacted island life during the Revolutionary War, War of 1812, and Civil War. Plantation life on the island came to an end in the Civil War, as Union troops seized Hilton Head, for use as a base in their blockade of southern ports. After the war, Hilton Head, became a forgotten barrier island with a dwindling African-American population and few

visitors. However, this sleepy barrier island, with no electricity, plumbing, telephone, or bridge connecting it to the outside world, was about to enter into a dramatic new era.

While exploring the land his father's company owned on the south end of Hilton Head Island in the 1950's, Charles Fraser had a revelation decades before the concept of sustainable development ever emerged. Instilled with an innate appreciation of nature and a new inspiration for land development from his recent Yale education, Fraser saw a grand opportunity in the unspoiled beaches and forests of Hilton Head. He dreamed of people vacationing on this remote barrier island and retiring in a planned seaside community that offered more than the standard coastal resort amenities of golf and tennis. He saw people enjoying casual hikes through the woods and families biking to the village marina for lunch or visiting the beach for an afternoon swim. He envisioned beachfront cottages tucked into the trees, far behind the dunes, and inland townhouses nestled among moss-draped live oaks, towering stands of longleaf pine, and black water lagoons. This vision directly opposed 1950's coastal development styles of adjoining, high-rise hotels and expansive, gridded blocks of beach houses lining the oceanfront. Even though there was no prototype for the kind of community he wanted to build, Fraser was convinced his market would best be served by ecologically sensitive development. Fraser believed that land ownership brought an obligation of stewardship, but he also knew in order to maximize profits he had to create amenities within the properties interior, which meant, conserving wetlands, and forests (Danielson 1995). By adhering to his main goal of carefully

introducing the built environment to the surrounding natural environment, minimal ecological disruption would take place. Fraser's concepts of combining land development with nature set a high standard for coastal resort development. Edward Pinckney, a landscape architect who worked with Fraser from the beginning at Sea Pines, noted "Every man-made addition was blended into its surroundings. Architects worked in a style best described as contemporary camouflage to create a harmonious relationship between the artificial structures and the man-made environment, the "Sea Pines Look," was highly innovative and widely copied," (Danielson 1995). Through this process of promoting and preserving a fabulous natural setting, Fraser created a highly successful, ecologically-driven identity for this island resort community. This novel approach to land development at Sea Pines Plantation became the predecessor of the sustainable design movement in coastal South Carolina.

In 1969, build-out of the Sea Pines community was essentially complete, nearly 20 years before the concept of sustainable design emerged. Many of the pioneering ideas at Sea Pines are now common practices within the current framework of sustainable design theory; however, technological advances may have made former ideas obsolete. Therefore, it is important to conduct a current assessment to interpret the value of these earlier ground-breaking ideas by applying contemporary measures of sustainable design theory.

CONTEXTUALLY AND LOCATIONALLY RESPONSIVE: At the time of construction, Sea Pines was the only project on the island. Linkage to existing road systems, infrastructure, and transportation networks, did not apply. Sea Pines'

environmental ethic regarding local geography and ecological systems appears to be genuine. Community design compliments natural features of the area. Winding roads are positioned to accommodate wetland features and many structures are designed around large trees. Neither architecture nor immediate landscaping appear to relate to regional styles; however, buildings do compliment the immediate environment by receding into the landscape, due to the earth-tone color schemes and vertical accentuating features replicating the verticality of surrounding trees.

SYSTEMS-BASED STRUCTURE*:* The Sea Pines master plan designed by Hideo Sasaki and Associates, considered all natural systems of the site. The firm was quoted as saying, "a master plan concept was created in which the natural environment deliberately dominates the man-made environment" (Danielson 1995). This statement appears accurate. The network of wetlands through the community was altered during construction, now acting more like a system of sculpted lagoons. Yet, many do have undisturbed edges and are connected to original wetland systems, contributing to the natural hydrologic functioning of the site. Abundant wildlife can be seen in and around the ponds. The urban forest system retains a great deal of tree canopy, much of it mature, providing habitat for some wildlife. Over a thousand acres of maritime forest and derelict rice field impoundments were set aside as a nature preserve and for passive recreation.

RESOURCE EFFICIENCY: Initially, the most obvious aspects of resource efficiency are the abundant bike paths throughout the property, limiting some auto trips. These are also very popular with walkers and joggers. The paths not

only connect all points of interest within the community; but also, connect to points beyond the entrance gates into greater Hilton Head. Water is conserved on the golf course by using effluence for irrigation. Most residences use conventional spray head irrigation systems. Little drip irrigation was observed. Some homes use daylighting techniques with large windows and skylights, but the visual survey did not reveal many exterior alternative building resource efficiencies. Interior inspections of structures would be required for an accurate assessment of resource-saving technology.

STREETS AS PUBLIC REALM: Overall layout of the street system follows conventional cul-de-sac styles with only two entry points to the resort. Street design does appear to encourage slower speeds with curves, overhead tree canopy, and vegetated medians, but it is obvious that roads do not accommodate pedestrians. The bike path system adequately handles all pedestrian use and connects to points outside the community. Some short cul-de-sacs with limited vehicular use could double as pedestrian recreation space.

FINE GRAINED MIXED USE: Harbor Town is the community hub which blends architectural styles of an Italian coastal village and Charleston's Rainbow Row. The village includes villas, town homes, and apartments atop stylish shops, boutiques, and cafes. All these amenities face the marina, complete with a 90 foot tall red and white striped signature lighthouse welcoming yachts from Calibogue Sound. Automobiles are relegated to areas behind the buildings, while sidewalks give pedestrians free-reign of shops and pocket parks lining the marina. Density is high with 450 housing units on 120 acres of land (Danielson

1995). Although village shops primarily cater to tourists and do not provide many of the daily necessities for residents, Harbor Town does have the flavor of a dense, mixed use village.

INFRASTRUCTURE AS ASSET: Stormwater management was not an issue during the time of construction. In the 1960's the scientific community had yet to delve into the arena of non-point source pollution and its effects on water quality; therefore, no sophisticated stormwater filtration devices were designed. Stormwater from roads and parking lots is directed to collection points where it is conveyed to lagoons by open swales and ditches, some of which have naturalized plantings. These lagoon systems connect to the overall hydrologic network resulting in natural infiltration, absorption and treatment of stormwater. Some stormwater is directed by open swales into undisturbed natural wetlands where plants provide filtration and absorption services. At the time of development, a high water table and efforts to economize on concrete infrastructure may have serendipitously prevented stormwater from being completely managed with underground pipe.

CONSCIENCE MATERIALS CHOICE: It was difficult to determine by visual survey; but there appeared to be no evidence of local, recycled, or reused building materials. This, however, does not preclude their specified use on site, or their specified use in future building or renovation and remodeling projects. Research did not uncover any regulations for low-impact building materials.

ECONOMIC VIABILITY: Supporting the operation of this community requires a large work force of full and part-time professionals, skilled positions, and

laborers. There are many service oriented employment opportunities provided by numerous on-site amenities such as retail shops, restaurants, golf courses, a tennis center, a spa, the marina, and the nature center. There are also supporting facilities such as the water treatment plant, security force, and grounds maintenance. In addition to the frontline employees, Sea Pines Management Company employs property managers, accountants, administrative personnel, etc. The community does not include any commercial districts (light industry, office complexes, etc).

CONNECT PEOPLE AND CULTURE: Sea Pines provides many opportunities that connect residents and visitors to the surrounding natural environment through recreational programming. Hiking, kayaking, and horseback riding provide residents and visitors an opportunity to explore the bountiful plant and animal life of the island's ecosystems. Historical tours take visitors to ancient Native American shell rings and plantation sites, exposing visitors to the colonial life of former rice and cotton plantations; however, the African-American Gullah-Geechee culture was not noticed in the survey. Frequent outdoor musical performances take place in Harbor Town and the PGA Heritage golf tournament is a popular attraction, drawing thousands of visitors each spring.

PLACES NOT PROJECTS: Sea Pines carries a distinctive visual character through sophisticated design covenants and a fundamental goal of blending human habitation with nature. The community has a vibrant urban forest canopy, which is an indication of the massive forests that once dominated this island. Live oak, longleaf pine, and palmetto are ubiquitous signature plants that add to the

identity of this coastal region; however, many exotic plants are common, diluting the sense of regionality in the landscape. Architectural design standards ensure homes respect their natural setting with proper building placement on the site, and using earth-tone colors to blend home exteriors into the surrounding vegetation. Hardscape features such as; driveways, pools, fences, out buildings, and other property accoutrement are also governed by architectural design review. Older homes have suggestions of modern style with wide overhangs, vertical elements, and large windows. Newer homes reflect a more regional plantation style, with wrap-around porches, pitched roofs, and dormer windows. Community activities and facilities provide abundant opportunities for social interaction.

SYNOPSIS: Sea Pines demonstrates that urbanization does not have to disconnect people and the natural environment, and with proper planning and design, both can occur simultaneously. The remarkable thing about Sea Pines is that, concepts of sustainable communities were nearly 30 years away at its beginning; yet, Sea Pines addresses many of the elements in the sustainable assessment. Had the Bruntland Report been available twenty years earlier, the environmentally sensitive mission behind Sea Pines no doubt would have created an ultimate model for sustainable communities. Fortunately, the ecologically responsive vision introduced by Sea Pines inspired a wave of progressive development along the coastal regions of Charleston and Beaufort counties.

CASE STUDY 2: SPRING ISLAND

Spring Island is located between Hilton Head and Beaufort, about 20 miles from both; Charleston is 90 miles to the north and Savannah is 40 miles to the south. The island encompasses 3,000 acres of mature maritime forests, freshwater wetlands, and a salt marsh estuary fed by the Chechessee and Colleton Rivers. Like most barrier islands of the region, evidence suggests habitation of ancient Native American cultures with colonists occupying the land since the late 1700's. The historic tabby ruins of the original plantation mansion still exist under a magnificent live oak alee, and many of the fields where Sea Island cotton was once grown remain intact.

The island was developed in 1991, by Jim Chaffin and Jim Light. The two developers got their start at Sea Pines, and were heavily influenced by the environmental ethic behind that project. The planning of Spring Island was guided by a vision to preserve the island in its natural state, while introducing a subtle and unassuming human presence. For design purposes, Chaffin and Light selected Robert Marvin; a renowned local landscape architect who they worked with at Sea Pines. Marvin's master plan conceptualized Spring Island as a 'Nature Park', and that theme combined with Chaffin and Light's poetic philosophy, "to appeal to those who come not to be seen, but to behold; not to be heard by others, but to listen – to the special wisdom which only nature and history can impart…" captured the essence behind this ecologically minded, affluent island community (Spring Island Habitat Review Guidelines 2001).

Of the various types of sustainable communities, Spring Island falls into the category of conservation subdivision. In the planning phase, sensitive natural

areas were preserved and suitable low-impact locations were selected for homes and site amenities. The majority of roads follow an original network, in place since the island was initially settled, the majority remaining unpaved. Building density levels are low, averaging one house per seven acres, yet generous setbacks are rigidly enforced, and there are many controls in place to preserve ecological integrity within the building envelope.

CONTEXTUALLY AND LOCATIONALLY RESPONSIVE: The master plan respectfully preserves and highlights natural and man-made features on the island. A well-designed bridge with low visual impact crosses the marsh, connecting the island to the outer world. Upon entering the island, it is difficult to determine if it is developed at all - the only indicator being a narrow paved road. The majority of the island remains in a natural, undisturbed state. Of the 3,000 total acres, only 420 home sites exist, most of them in secluded locations, nestled into the fabric of the maritime forest and few are seen from the road. Architectural standards pay homage to the lowcountry style of pitched roofs, wide overhangs, generous verandas, porches, and raised pier foundations. Historical remnants of the former plantation house are found in the crumbling tabby ruins that now act as a sculptural feature beside the golf course club house. The majestic live oak alee that once welcomed visitors to the plantation house has also been preserved.

SYSTEMS-BASED STRUCTURE: The community strongly emphasizes natural island systems with ecological principles influencing all decisions that impact island life. The island has a wonderful display of preserved mature maritime forests containing magnificent live oaks, pines and other hardwoods. Many unique

natural areas are found throughout the island and are designated as preserves. Many of the site's natural areas are maintained with ecological methods. The community includes a golf course, which is normally viewed as a detriment when regarding sustainability because of associated habitat destruction and chemical requirements. The design of this course, however, took advantage of an existing network of agricultural fields to reduce ecological impact. Rules of Integrated Pest Management are followed to minimize use of fertilizer and pesticides. Jim Chaffin believes the community could now be designed without a golf course because island user interests have become so diversified. (Spring Island is also located in the heart of a golf course saturated region.) But, at the time the island was developed, it was considered risky not to have a golf course with a planned community because of the sport's inherent link with property sales.

RESOURCE EFFICIENCY: The island Habitat Review Board (HRB) is the governing body for all building and land-altering activity. The HRB emphasizes energy and water conservation in all buildings on the island. Suggested housing design characteristics optimize natural energy flow to enhance comfort and reduce energy requirements. HRB assists property owners with selecting home sites that take advantage of energy-saving properties of natural vegetation. Green building materials and recycled materials are endorsed but not required. Conservative irrigation practices are highly preferred, but sprinkler systems are not prohibited. Rainwater storage bins are suggested for irrigation. Recycling of household products is advocated. Walking and biking are easy on the island

roads; however, daily necessities must be attained from sources on the mainland which may require driving 20 or more miles.

STREETS AS PUBLIC REALM: Streets appear safe for pedestrians because of low traffic volume and speed. There are no sidewalks so pedestrians have to use the roads for mobility, but, roads are narrow, winding, frequently unpaved, and are surrounded by dense vegetation, which encourage low traffic speed. However, these same factors, combined with no street lights, may make the roads hazardous for pedestrians during early morning, afternoon, and night use. The layout of the road network does not lend itself to social activities not associated with mobility.

FINE GRAINED MIXED-USE: Spring Island is a private conservation subdivision of single-family homes with no intended commercial application.

INFRASTRUCTURE AS ASSET: Natural infrastructure is the method used to handle all stormwater on the property. Since few roads are paved, and no impervious parking lots exist, stormwater is a minor issue on the island. The sandy soils are very capable of assimilating runoff.

CONSCIENCE MATERIALS CHOICE: Sustainable building materials are emphasized by the Habitat Review Board, but not required. The HRB does have veto power when ruling on design and building material choices; but rulings on building materials appear to be based on aesthetic reasons, not entirely on environmental integrity. Only the main perimeter road is paved, no other impervious paving surfaces are permitted.

ECONOMIC VIABILITY : Jobs, although not designed to employ island residents, are provided through employment that service island amenities including – golf course, tennis, swimming pool, equestrian facilities, health club, hunting club, boat docks, nature center, post office, and River House, the island social hall. An administrative office employs managerial, sales, accounting, design, and support staff.

CONNECT PEOPLE AND CULTURE: The community forms a deep bond with the natural and historical record of the island. Spring Island instills the philosophy of respect and admiration for all things wild among island residents the moment they express interest in owning property. Walker Landing, the nucleus of the community, contains a nature center, post office, business offices, and the River House. The nature center conducts educational programs, teaching residents about island ecology and history. The River House provides meeting space to conduct island business and to host outside speakers who present discussions on a wide range of topics from politics to song bird migration. Instructional classes, such as basketry, painting, cooking, and ceramics are offered. Camps are available for children and a variety of musical events and social gatherings are held throughout the year.

PLACES NOT PROJECTS: The philosophy and master plan of Spring Island has wonderfully maintained the sense of place and lowcountry character of this private barrier island community. Centuries-old forests are preserved, wetlands are protected and provide quality habitat, buildings respect the surrounding vegetation and land forms, architecture accurately depicts the regional flavor,

and natural area management reflects endemic ecological systems. The ecological philosophy of the island is impressed upon the residents, resulting in a cohesive environmental culture.

SYNOPSIS: Spring Island was inspired by the environmental concepts behind Sea Pines but expressed a deeper commitment to ecological sensitivity. Spring Island performs well regarding the environment, good in the social aspects, and low in the economic category. However, these marks do not necessarily downgrade the community's sustainable qualities since the measure of a truly sustainable community becomes challenged when it is located on a fragile barrier island. Obviously, recommendations for high-density, fine-grained mixed use and economic viability would be environmentally disastrous. So, when taking those elements out of the equation, Spring Island scores well in the assessment for sustainable communities. There are two areas the community can improve upon, one fairly simple and the other, although highly improbable, it is very intriguing. The easy change; the design review board can require green building materials in all new homes and remodeling. The difficult idea: manage the golf course in a completely organic manner. Biodynamic managed golf courses do exist although they tend to be in more arid locations where pest problems are limited. But, with proper turf selection and management techniques, it may be possible to accomplish biodynamic golf in the Southeast, which would merge perfectly with Spring Island's high regard for environmental sensitivity.

CASE STUDY 3: DEWEES ISLAND

Dewees Island lies about ten miles north of Charleston and is just north of the Isle of Palms. The island is considerably smaller than its southern neighbor, at only 1,206 acres; but, like all pristine barrier islands, it is rich in ecological diversity. In 1972 a group of investors purchased the island from a hunting club. After a number of failed attempts to create a typical beachfront community, the group decided to hire John Knott, an expert on rehabilitation development. Knott's approach involves an initial inventory of all the assets of the property and then development of a vision from an analysis of the highest priority and best use of those assets (Takesuye 2002). He experienced an amazing variety of natural beauty on Dewees Island, suggesting an environmentally responsible residential development with minimal impact on the unspoiled island.

The vulnerability of the island ecosystems led Knott to craft a set of guidelines that would restrict development within a master plan supported by design covenants. These design covenants would become some of the most restrictive anywhere on the east coast. The entire island was placed in a conservation easement governed by the covenants and enforced by the state. Knott realized in order to protect the fragile systems on this island a progressive set of regulations had to be followed.

The first unique quality of Dewees is the absence of a bridge accessing the island. Visitors arrive by ferry and island transportation is provided by electric golf carts or bikes. A total of 150 lots were designated by the master plan in the most ecologically hardy locations on the island. Regardless of lot size, design

guidelines limit land disruption to no more than 7,500 square feet per lot. This includes the house footprint, driveway, and landscaping. Construction workers are permitted to use equipment to haul and lift building materials, but all of these items must remain within the 7,500 square foot envelope. No impervious surfaces are allowed other than the roof covering the house. Many other design guidelines are in place to maintain regionality of architecture, to encourage 'green' building materials, and low-impact construction methods. Maintaining the environmental integrity of the island ecosystem is the foremost goal of this planned community.

CONTEXTUALLY AND LOCATIONALLY RESPONSIVE: The development on Dewees Island has been skillfully woven into the natural fabric of the island ecosystems. The planning phase determined the maritime forest to be the most ecologically hardy of all the island environments, so that became the receiving area for home sites. Homes nest among wooded lots and are positioned to take advantage of views, sun, and natural vegetation. A design review formula prevents roof lines from exceeding the height of surrounding tree canopies. Trees that impair views are selectively pruned to reveal view sheds, rather than cut down. Landscaping is minimal; lawns are prohibited; and only native vegetation specific to local barrier islands, is permitted. Viewing the island from the beach reveals a natural landscape with few houses peaking through the vegetation. Architecture draws from lowcountry styles, of metal roofs, screened porches, dormer windows, and louvered storm shutters. An active architectural review board upholds the island design standards to ensure local style and sense of place is maintained.

SYSTEMS-BASED STRUCTURE*:* During initial planning, environmental surveys were conducted to analyze island ecosystems. Many areas were deemed too sensitive to tolerate disruption and were protected. Three-hundred fifty acres of prime nesting habitat on the north end of the island were set aside as a wildlife refuge for birds that use the island. Homes are built only in areas with minimal impact to surrounding land form and vegetation. Once build-out is complete, only 5% of Dewees Island will have been disturbed, with building footprints occupying less than 1% of total acreage. Wetlands are never disturbed. Boardwalks and bridges cross even the smallest depressions and dune lowlands. Interpretive signage reminds residents of the roles played by various plants and animals. The entire community evokes a “tread lightly” respect for the natural setting.

RESOURCE EFFICIENCY: Resource efficiency begins on the ferry ride to the island. Cars remain parked on Isle of Palms and people take the fuel efficient ‘Aggie Gray’ to Dewees. The ferry captain says the hull design is modeled after the Chesapeake Bay oyster boat, built to carry heavy loads at slow speeds with minimal fuel consumption. Upon entering the island, electric golf carts carry passengers and baggage to their homes. Houses are positioned to profit from views, seasonal breezes, vegetation and sunlight. To shield buildings from the midday heat, roofs have wide-hanging eaves and shutters accompany windows. Porches are mainly positioned away from hot southern and westerly exposures. Energy-efficient appliances, insulation, and modern double-paned windows are required, while alternative energy sources such as solar are encouraged. The cumulative energy saving practices on Dewees have proven to lower power

consumption by 75% below the regional average (Takesuye 2002). The island's water is supplied by a deep well and is treated by a reverse osmosis system. Water saving plumbing devices are required; rain water is harvested for plants; and only drip irrigation technology is allowed for the landscape. Low-flow water fixtures account for a 70% decrease in household water consumption when compared to average regional rates. Lower volumes of wastewater are easily processed by the island's closed loop sewage system, which eliminates all discharge, protecting shellfish beds surrounding the island. No garbage collection exists on the island so residents must separate refuse from recycling and then ferry it off the island.

STREETS AS PUBLIC REALM: Since cars are not permitted on the island, street traffic consists of slow moving golf carts, bikes, and the occasional family dog. "Street life" does not really exist, because homes are sparsely spaced and do not front roads, streets are merely corridors for travel.

FINE GRAINED MIXED USE: To maintain a low-impact approach and to respect the capacity of the island sewer system, high density housing and mixed-use was not practical.

INFRASTRUCTURE AS ASSET: The natural infrastructure is fully capable of stormwater treatment. Few impervious surfaces combined with existing sandy soil allow rainwater to infiltrate easily.

CONSCIENCE MATERIALS CHOICE: Homes are restricted to 5,000 square feet in size and when possible homeowners are required to use "green" building materials. Only metal roofs are permitted; large timbers are prohibited to avoid

cutting of old-growth forest; and *Trex* or other recycled products are required for decking purposes. Efficient design is also encouraged to reduce building waste.

ECONOMIC VIABILITY: This category does not apply for this community. The, geography, isolation, and low density nature of the community does not support commercial business. Although some employment opportunities are provided through community amenities – pool house, tennis courts, nature center, maintenance shop, land management, administration, and real estate office.

CONNECT PEOPLE AND CULTURE: When people buy a piece of property on Dewees Island, they also buy into the environmental ethic the island community promotes. Karl Ohlandt (MLA UGA 1992) is the Dewees Island land manager. He acts as the island ecologist and wildlife officer and he plays a large role as a design review member and mediator among residents regarding island policies. From his experience, it is usually new island residents who question certain policies because they are not familiar with the ecological implications of their everyday actions; but once people spend enough time on Dewees, they begin to understand the connection of the benefits and values provided by healthy ecosystems. A nature center on the island is the instrument where the ecological message is taught. Funded by a 1.5% tax on property sales, the nature center houses classrooms, a library for residents to use, and supports a full-time naturalist. The naturalist conducts programs, operates summer camps for kids, and gives wildlife tours of the island. Outside speakers conduct lectures on various topics dealing with barrier island life or history. Dewees also hosts many school field trips and university scientific research activities. No golf course

exists on the island; but two tennis courts and a salt water swimming pool are available. Recreational opportunities are mainly provided by the island's own environmental assets – the beach and nature trails provide hiking and bird watching opportunities and docks both in the salt creek and in freshwater ponds provide access to fishing and boating activities.

PLACES NOT PROJECTS: Dewees is a rare example where the majority of the island appears as if no development has taken place, yet a community has been built here without destroying the island's natural systems. Through skilled planning and thoughtful design, Dewees has artfully maintained the sense of place on this small barrier island.

SYNOPSIS: Dewees Island has set the standard for achieving sustainability of a planned community located in an environmentally fragile coastal area. The planning appropriately accounted for all ecological assets and installed protective measures to ensure their permanence. Dewees demonstrates that strict guidelines do not limit the demand for home sales in a beach environment, however, the question of whether this strict style of development can occur in more mainstream communities has yet to be answered.

CASE STUDY 4: DANIEL ISLAND

Located between the Wando and Cooper rivers, Daniel Island sits at the north end of Charleston Harbor. A pastoral island with a heritage of plantation ownership, Daniel Island remained disconnected from the mainland, locked in a time capsule. Completion of the Mark Clarke Expressway in 1992 catapulted Daniel Island to the 21st century. This highway, acting as a perimeter freeway

system around the city of Charleston, bridged the Wando River, connecting Mt. Pleasant to the rural Daniel Island, and then crossed the Cooper River, connecting to the heavily industrialized North Charleston. Commuters and the trucking industry supporting Charleston's global ports were provided an easier route to bypass the historic "Holy City". When the new freeway touched down on Daniel Island, it provided access to one of the last remaining large parcels of land within the Charleston metropolitan area. The city of Charleston, recognizing the enormous tax base potential, quickly annexed the land in anticipation of future development. Local people, familiar with Daniel Island's pastoral qualities, became worried that aggressive developers would take over, turning the island into another sprawling sea of subdivisions and strip malls similar to what exists in neighboring Mt. Pleasant. However, a fortunate set of circumstances controlled patterns of growth and fears of urbanization subsided as initial plans for development were unveiled.

In 1947, the majority of Daniel Island, some 4,500 acres, was purchased by Harry Frank Guggenheim of New York City for use as a cattle ranch, horse farm, and hunting plantation. Mr. Guggenheim, a generous philanthropist, created a foundation which sought to solve problems of violence and aggression in society (Riddle 1992). At his passing in 1971, the assets of Daniel Island were converted over to the foundation with instructions to make the land available for an urban development that embraced the ideals of civic purpose and respected the sensitive island ecosystems. An architecture firm from New

York City was appointed and Andres Duany and Elizabeth Plater-Zyberk were hired as planners for the project.

Concepts for the development differed drastically from standard subdivision mentality of the time. A mission statement for the development was crafted, “to create a richly diverse community that reflects the values and needs of the Trident community (composed of Berkely, Charleston, and Dorchester counties), and takes full advantage of the great natural resources the island has to offer” (Hammatt 2001). The development would be a traditional town on a grid pattern, rather than run-of-the-mill cul-de-sacs. Neighborhoods of single and multi-family housing would be denser than typical subdivisions, located close to parks, and would be within walking distance of most daily necessities. Schools, churches, commercial businesses, and plenty of retail would be easily accessible with or without a car. Light industry would also be invited to locate on Daniel Island. Population projections of 17,000 residents were made for the new town. Of course, all the planning and grand design schemes were contingent upon a bridge connecting the island to the surrounding Charleston area. This finally occurred in June of 1992 with the completion of the Mark Clarke Expressway. Daniel Island quickly made the leap from a sleepy, bucolic setting to a progressively planned urban development.

CONTEXTUALLY AND LOCATIONALLY RESPONSIVE: Daniel Island is a Traditional New Development (TND) that represents the style of many lowcountry towns. The commercial center of the town accurately depicts a southern-style, small town atmosphere with architectural grace, appropriate hardscape details, and a

pleasant selection of shops, cafés, restaurants and other daily necessities – grocery store, pharmacy, etc. The residential areas work well. The grid-patterned neighborhoods are properly scaled; adorned with tree-lined sidewalks, contain small pocket parks, and greenways run between and behind rows of homes. Boardwalks bridge wetland areas connecting neighborhoods. Lots are small, ½ acre or less, and architecture of the houses accurately reflects local regional style.

SYSTEMS-BASED STRUCTURE: Daniel Island was built on a former plantation site that had remained largely in an agricultural state. The southern end of the island had also been used as a spoils site for dredging operations in the Wando and Cooper rivers. Because of these activities, much of the ecological integrity on the island was degraded before the Mark Clark Expressway made landfall. Thousands of acres of wetlands surround the island, and many acres of interior wetlands border tributaries of the rivers. Design elements are woven around these natural features, using them as viewshed amenities. Miles of trails contain boardwalks crossing wetlands, giving residents access to their neighbors and encouraging recreational activities. One disappointing element is the treatment of the edges of marshes adjoining some neighborhoods. Residential properties extend down to the high tide mark with little or no buffer. Tree preservation has been a focus of the development; the Daniel Island Club was identified as one of only ten winners nationally to receive the organization's 2003 Building With Trees Award of Excellence. The community also has a strong commitment to

reforestation and has planted thousands of trees. Many natural areas have been preserved as parks to be enjoyed by residents.

RESOURCE EFFICIENCY: The Daniel Island master plan is an example of efficient land use. Housing density doubles that of comparable developments and 2.5 times the greenspace required by the county has been preserved (Hammett 2001). A grid street pattern provides alternative routes for drivers and deemphasizes car use when possible. Numerous sidewalks encourage pedestrian activity – the town center, schools, and churches can easily be reached by walking or biking. No specific requirements for resource efficiency are present in the design review specifications for structures in Daniel Island.

STREETS AS PUBLIC REALM: Numerous sidewalks, narrow streets, on-street parking, and tree-covered medians create a pleasant, well-connected, and safe pedestrian experience. Neighborhood streets reflect a grid pattern, provide on-street parking, and maintain an atmosphere that deemphasizes car use and supports pedestrian activity. Drivers travel slowly, expecting to see children biking or skateboarding down sidewalks and across streets, which is frequently the case. Medians and islands divide lanes in many residential areas, creating greenspace and shading streets. Utilities are hidden or are buried. The main commercial street, however, is disappointing in that it does not exhibit the pedestrian-friendly qualities of a typical small town. Seven Farms Drive, is a wide street consisting of four lanes of traffic, a paved median, and curb-side parallel parking on both sides of the street. This layout creates a wide corridor of asphalt producing a hostile pedestrian situation that is more hospitable to cars.

FINE GRAINED MIXED USE: The town center is a well-blended mix of retail, office space, and residential apartments located above commercial businesses. Daily necessities are found within walking distance or a short drive from residential areas. A wide range of apartments satisfying a broad mix of income levels are located in areas adjacent to the commercial district. Daniel Island zoning board recently approved the construction of low-income housing in this same location. Single family home neighborhoods of are found a short distance away from downtown.

INFRASTRUCTURE AS ASSET: Natural features are used to assist in collection, retention, and infiltration of stormwater. Micro-wetlands, evident through out the community, act as retention points for storm water. Some of these are in the form of man-made retention ponds in parks and others appear more natural with no manicured look. No constructed infiltration devices, rain gardens, bioswales, etc. were noticed.

CONSCIENCE MATERIALS CHOICE: Daniel Island does not require green building materials in any design review specifications.

ECONOMIC VIABILITY: An abundance of employment opportunities are available throughout the community. A variety of retail, professional offices, service industries, island amenities, and light industrial companies operate within or in proximity to the community. Corporate companies include Blackbaud Inc. a software manufacturer, and Health Source, a large health care provider. Major amenities include facilities for a minor league soccer team, a professional tennis complex hosting the Women's Family Circle Cup, and two golf courses. More

economic opportunities are located a short drive away in the towns of North Charleston and Mt. Pleasant.

CONNECT PEOPLE AND CULTURE: The parks and sports stadiums host a wide spectrum of cultural events – food and wine festivals, sporting events, concerts, theatrical performances, etc. Major annual events include the Komen Charleston Race for the Cure, Park Day, Garden and Art Tour, and the Family Circle Women's Tennis Cup. Blackbaud stadium hosts the *Charleston Battery* professional soccer team. Summer camps for children, adult workshops, and neighborhood festivals create a busy community calendar. One aspect that appeared to be lacking in my investigation was any interpretation of the surrounding natural or historical resources. No nature center or museum exist, no interpretive panels are seen on wetland boardwalks, and no designations of protected, natural, or historic sites were observed, however, this research was limited and may not have been extensive enough in this arena.

PLACES NOT PROJECTS: Steve Dudash of Designworks, a member of the landscape architecture design team, said, "The publicness of the spaces and the connections are the overriding principles of the place." The Daniel Island master plan succeeded with this goal for it seems the overall philosophy of Daniel Island was to create a community identity based on features that unite a healthy society. Houses are positioned to encourage social interaction, parks are available in every neighborhood, children can safely walk or bike to school, sporting events provide family interaction, plentiful waterfront connections exist, and recreational opportunities abound, both on land and water. Daniel Island

has become the successful community representing the high standard for quality of life that Mr. Guggenheim envisioned.

SYNOPSIS: This TND has enjoyed great success recognized by strong home sales and by smart growth awards received from the National Home Builders Association and the American Planning Association. Overall, Daniel Island performs well in the sustainable community analysis; however, there are substantial shortcomings. The expansive Seven Farms Drive was a disappointment. Not only do the multiple lanes of asphalt encourage higher traffic speeds, creating a hazardous pedestrian environment; but it also degrades the vibrancy of downtown street life by creating too much space between opposing rows of storefronts, thus reducing the intimacy and safety enjoyed in a more confined small town atmosphere. A planted median creating a boulevard effect would have greatly enhanced Seven Farms Drive. The lack of adequate buffer zones between private property and high water marks of the salt marsh was also discouraging. With little natural buffer, rainwater can readily wash fertilizers, lawn chemicals, and pet waste into wetlands. Building requirements do not specify any energy or water efficiency devices for homes and no incentives for green building materials are available. The community does do a tremendous job at creating and preserving greenspace and planting trees, however, there is still much opportunity to educate residents on the values and benefits of the natural systems that are in close proximity to their homes. A nature center or special ecology curriculum for schools would be a great start.

CASE STUDY 5: I'ON

I'On is a ten year old, traditional neighborhood development (TND) in Mt. Pleasant, a rapidly growing bedroom community, just three miles from downtown Charleston. The site occupies 243 acres of land adjoining Shellmore and Hobcaw Creeks, two saltwater tributaries of the Wando River. Like most of the territory around Charleston, I'On has roots tying it to the days when plantations dominated the regional landscape. The name comes from Jacob Bond I'On, whose family owned the plantation during the 1800's. Although nearly half the land had converted to mature hardwood forest, the site still supported farming activity a decade before development began. Two man-made lakes totaling 25 acres existed in the heart of the property.

Vince Graham was the mastermind and primary developer behind the project. Graham's guiding principle was to create a traditional walking community, gaining inspiration from regional historic districts in Charleston, Beaufort, and Savannah, and from European cities like Venice, Paris, and London (Freeman 2004). To foster a finer appreciation of these historic spaces, on an earlier project, Graham actually measured the dimensions of an old section of Beaufort noting, street widths, sidewalk widths, depth of porches, and distances between homes and from home to sidewalk. This knowledge was perfected at I'On to create intimate streetscapes, charming parks, and a tight-knit social environment.

I'On broke ground in 1997 and as of May 2006, most of the community construction was nearly complete. The development is divided into six boroughs, each one facing a common space, either a small park or one of the two lakes.

The density is higher than most of the surrounding, older, sprawling subdivisions. There are 759 single-family home sites equating to a density of over three units per acre. Lot sizes range from 3,500 to 10,000 square feet and home prices in 2004 were between $400,000 to $2 million (Freeman 2004). A small commercial center is located in the front of the community filled mostly with retail boutiques, cafés and a pub. I'On has received many awards for its design, environmental ethic, and promotion of community.

CONTEXTUALLY AND LOCATIONALLY RESPONSIVE: I'On draws much of its inspiration from the renowned historic districts of Beaufort, Savannah, and Charleston, but also is influenced by the smaller, fishing villages of Mt. Pleasant and McClellanville. The architecture is lowcountry style, acknowledging a time before air conditioning when people spent their summers on the porch. Homes exhibit the classic Charleston side porch facing the garden; smaller plantation-style cottages have wrap around porches; and larger piazza-styles houses display porches on each level. Classic ornamentation of balustrades, columns, and detailed molding are also accurately portrayed. Homes are positioned close to the street and close to each other, mimicking patterns in Beaufort and Charleston. Palmetto-lined streets are narrow with some following a predictable grid, some jogging irregularly around ancient live oaks, and others curving unexpectedly, creating uniquely shaped lots. In some boroughs, cars park at the curb, while in others, cars access a driveway via narrow alleys behind the home. Paving patterns depict many of those seen in Charleston and Savannah. Brick, cobblestone, gravel and tabby-covered concrete, are common materials in many

of the drives and foot paths. The lots are small, but many home-owners take advantage of intimate garden spaces with lush plantings, fig vine-covered walls, and sounds of trickling water from fountains.

SYSTEMS-BASED STRUCTURE: The land I'On occupies, was once a plantation, therefore, ecological integrity had been somewhat altered. Thirty percent of the land had been reclaimed by hardwood forest when development began (Freeman 2004). None of this forest appears to have been preserved, yet many large specimen live oaks, water oaks, and other trees were retained. Unfortunately, the compact neighborhood design required houses, streets, and driveways to be built very close to the trees, possibly, destroying large sections of root systems in the process. Underground utilities may have also played a role in root damage during development. Currently, many of the trees appear to be in good health, but only time will tell if the trees are able to tolerate the construction, since it may take 3-7 years for larger trees to die after exposure to severe root damage. One side of I'On is bordered by two salt marsh creeks with small tributaries extending into the land. Setbacks from creeks appear to be minimal, since many properties extend close to the edge of the salt marsh. One natural wetland was preserved in the middle of the site and was appropriately named the "Rookery" for the large amount of wading birds seeking refuge there.

RESOURCE EFFICIENCY: The compact design maximizes land use in a very resourceful manner. Average lot sizes are about one-third to a quarter of an acre, yet homes ranging from 2,000 to 5,000 square feet do not feel overly crowded and small yards provide adequate space for many family activities.

Pedestrian-safe streets encourage walking and biking and reaching the small commercial area is an easy task. A full service grocery store and additional restaurants have been constructed across the street from I'On's entrance, although a busy street must be crossed. For most other necessities – school, church, employment, shopping, etc. – driving is required.

STREETS AS PUBLIC REALM: Streets provide a very comfortable atmosphere for pedestrians. Newly planted and older trees create shaded walking zones and many traffic-calming methods are successfully used to manage the speed of cars. The scale of street to sidewalk to home is compact and comfortable. The pattern models that found in Beaufort and the old village of Mt. Pleasant. The commercial area of I'On Square is relatively small, and does not offer many shopping choices, but it does create a pleasant pedestrian experience.

FINE-GRAINED MIXED USE: There is a small amount of mixed-use located at I'On Square, the town center. I'On's design team requested a great deal more mixed-use space, but was met with opposition by city and planning councils (Freeman 2004). Commercial space was limited mainly based on neighboring homeowners' fear of increased traffic. Existing commercial space contains a limited number of specialty shops, offices and eating establishments.

INFRASTRUCTURE AS ASSET: Stormwater appears to be collected and piped into on-site water features (two lakes and rookery), that double as retention areas. Some stormwater is directed to the salt marsh.

CONSCIENCE MATERIALS CHOICE: Some low-impact landscape measures are visible. Footpaths around the edge of the salt marsh and lakes consist of

permeable crushed aggregate, boardwalks with wood decking span sensitive areas, and at the I'On Club permeable gravel is used in the parking bays in place of asphalt. No requirements are in place for green building materials.

ECONOMIC VIABILITY: The original plans for the town square contained additional commercial space; but local opposition forced the design team to reduce the amount. I'On Square offers a few eateries, boutiques, and professional offices; but relatively few job opportunities exist in the community. I'On is located within a short drive to large employment centers of Mt. Pleasant and downtown Charleston.

CONNECT PEOPLE AND CULTURE: Two venues offer guests and residents opportunities for social interaction through; music, movies, and theatrical performances. The Mt. Pleasant Amphitheater on the north end of Westlake hosts large events, while informal gatherings take place at I'On Square.

PLACES NOT PROJECTS: The compact, walkable, friendly neighborhoods create a wonderful environment for social interaction. The trail system attracts frequent users and the streets provide safe access for cars and pedestrians. Numerous pocket parks provide locations for casual meetings or quiet reflection. Recreational opportunities for children and adults are available at the I'On Club and in the small playgrounds scattered throughout the neighborhoods. Access to Hobcaw and Shellmore Creeks provide connections to local waterways, and kayakers also frequent the two lakes. The small shops at I'On Square provide few daily necessities but a grocery store, bank, and pharmacy are located across the street from I'On's main entrance. The design of I'On has skillfully employed

the best attributes of TND, and in the process has captured the essence of a quality lowcountry community.

SYNOPSIS: I'On is an excellent example of new urbanism that offers the same quality standards of living found in more conventional gated communities that require much greater amounts of land. The success of I'On has inspired more developers to explore this efficient style of land development in the region, but one thing it must improve upon is providing adequate sources for daily necessities. I'On originally planned to have twice the amount of retail and office space but was defeated by local opposition who were fearful of increased traffic congestion. In time, people will realize that properly designed communities reduce traffic when all the pieces are in place. Unfortunately, when necessary components such as retail, churches, or schools are eliminated, the level of sustainability is degraded.

CASE STUDY 6: NOISETTE

Take the Mark Clarke Expressway west from Daniel Island, cross the Cooper River, and within a span of five miles you trade a growing, charming, dynamic community for the industrialized, crime-ridden, and downtrodden town of North Charleston. The town, referred to by locals as "North Chuck", is a post WWII working class community characterized by massive fuel storage facilities, welding shops, a paper mill, commercial shipping ports, and the abandoned Charleston Navy Yard. North Charleston, an outward sprawling extension of Charleston, is the state's third largest city with a population of over 80,000 (Krohe 2005). The much smaller core of the town contains 13,000 racially diverse and

economically challenged residents who suffer from all the usual postwar urban ills, in addition to the infirmities unique to military base towns. During the last two decades, much of the town's economy dwindled, crime was out of control, and in 1996 the Department of Defense closed the navy base; continuing a community-wide downward spiral of despair. However, what one person sees as opportunity lost, another sees as opportunity gained.

At the time of the base closing, John Knott was winding down his responsibilities at Dewees Island, and became interested in the roughly 300 acres of riverfront real estate left behind by the vacated Navy base. The entire 1,600 acre military facility had been turned over to the town of North Charleston who had no immediate plans for the site. John Knott saw not only a chance to capitalize on the valuable waterfront property; but also a noble opportunity to revitalize the entire town through a progressive vision guided by the principles of sustainability. Knott formed the Noisette Company, bought 400 acres of the navy site, and struck an agreement with the town of North Charleston, proposing a plan that would redevelop not only; the navy base property; but also; 3,000 acres of the town contiguous to it.

To begin the process of renewal for this oppressed town, the public image of North Charleston must change. Knott's first step was to create a positive identity; therefore, he renamed the town 'Noisette', after Phillip Noisette a 19th century Charleston botanist. In formulating conceptual goals for Noisette, Knott was influenced by two overwhelming theories: the 1994 Sanborn Principles and the concept of Value of Place (Noisette Master Plan 2003). Both are sets of

sustainable attributes similar to Jim Heid's guidelines that have influenced the evolution of sustainable development. Knott's mantra became "to create a balance among people, planet, and prosperity embodying the belief that sustainable cities must be equally responsive to social needs and economic vitality" (Krohe 2005). Plans call for applying sustainable design methods for over a period of twenty years, not only to revamp dilapidated structures and damaged ecosystems, but also to address something that far exceeds most expectations of sustainability. Noisette aims to repair, rehabilitate, and restore, the mind, body, and spirit of the citizens; empowering in them a connection between the health of the environment and their own personnel well-being. Knott senses our society has drifted away from a healthy existence, and he attributes much of this disconnect to poor urban design and irresponsible stewardship of our natural environment. His noble plans for Noisette illustrate a completely restored community; one that not only addresses the built environment, but also cultivates an institution, nurturing its citizens and instilling an awareness of civic pride based on esteemed ecological values.

This grand vision has been translated into a master plan, making Noisette the largest urban reclamation project in the country, requiring a $2 billion investment from private and public sources to be implemented over 20 years (Fahey and Tibbets 2006). Over the last year initial physical improvements have made their mark. The aging downtown area has received a facelift with new sidewalks, street tree plantings, and renovated storefronts. Riverfront Park, a large greenspace displaying sculpture and an industrial styled performance stage

is nearly complete; 7 Storehouse Row, a classic Georgian styled office building, has been restored as the Noisette Company headquarters; and 10 Storehouse Row, a renovated military machine shop, houses office and studio space. Deeply entrenched sustainable goals bolstering the vision behind Noisette will make this an interesting project to monitor as build-out proceeds over the next twenty years.

CONTEXTUALLY AND LOCATIONALLY RESPONSIVE: This forlorn town clings to many treasures of magnificent quality. In 1896 Frederick Law Olmstead, Jr. planned the 600 acre Chicora Park on the east side of town, adjacent to the Cooper River. The park opened the following year but the navy base later took over a majority of the space, however, remnant pieces of the park are still evident. The Olmstead Brothers also designed Park Circle in 1904, a residential area based on Ebenezer Howard's garden city model. The original framework of this plan still exists on the west side of downtown. Noisette Creek runs through the middle of the site feeding into the Cooper River. Wetlands surround the creek, but much of that ecosystem was compromised by military activity. Architectural styles of homes and commercial buildings vary widely including classic styles and more traditional examples of lowcountry, bungalow, and cottage. Former Georgian-styled factory buildings sit next to industrial machine shops. Although neglected and abandoned for years, many of the original downtown storefronts have recently been restored, along with sidewalks, and streets.

SYSTEMS-BASED STRUCTURE: The underlying philosophy of the Noisette Master Plan recognizes healthy societies are based upon vigorous, functioning

ecosystems. Many of the creeks and uplands have been degraded due to industrial activity and apathetic residents. Plans call for all existing natural systems to receive protection and complete restoration. In order for restoration projects to be successful, residents need to be educated about the benefits of healthy ecosystems, and realize basic actions, such as improperly using or disposing of solvents and other home chemicals, can have a severe detrimental impact on surrounding ecology. An education component will accompany ecological restoration plans at the Preserve – an outdoor recreation, eco-tourism, and education center for citizens of the region, located along the banks of Noisette Creek. "We want everyone to recognize that they are stewards of their own environment, that they are linked to their own humanity and health, the health of their neighbors, neighborhoods, community, and the region" (Noisette Master Plan 2003).

RESOURCE EFFICIENCY: Conservation of land, energy and natural resources will be the fundamental goal for the land and every building within the Noisette campus. Much of the urban fabric built in the last 50 years is poorly integrated and sprawling. The Noisette Master Plan seeks to improve efficient use of land by creating denser housing, better connectivity, and preserving or restoring sensitive natural areas. Current land use patterns will be improved, requiring changes in traditional zoning codes to encourage a compact residential scale and provide protection for historic properties. New construction of residential homes will be measured by efficiency performance standards set forth in the Noisette Quality Home Guide. This list of guidelines may be used to evaluate

residential houses based on low-impact site principles, water efficiency, building durability, energy, materials, and indoor environmental quality. All renovation and construction for high-rise residential and commercial buildings will be encouraged to follow LEED (Leadership in Energy and Environmental Design) standards. Last year, the first LEED certified public school in South Carolina was completed in Noisette. The Noisette Master Plan will attempt to reduce vehicular traffic by improving pedestrian connectivity through additional sidewalks, bike paths, greenways, and trail systems. A new public transit network is being designed to move people seamlessly from one mode of transportation to another. Bikeways, taxi stands, bus stops, water taxi, and light rail are all forecast to become part of the intermodal public transit system reducing auto-dependence.

STREETS AS PUBLIC REALM: The Noisette Master Plan regards streets as "the oldest most basic component of the urban fabric, constituting the essential framework for the movement of goods and services, but more importantly, creates a place for social exchange by citizens" (Noisette Master Plan 2003). The master plan emphasizes a street atmosphere that promotes safe, efficient, economically vibrant, and environmentally responsive connections for its citizens. Design principles focus on basic elements that make streets hospitable – tree canopy, adequate lighting, natural stormwater treatment, bike lanes, traffic-calming devices, integration of public art, pocket park plazas, plenty of street furnishings, appropriate signage, and sidewalks that encourage people to leave the car parked.

FINE-GRAINED MIXED USE: Reducing auto trips by preserving and creating more mixed use property is a high priority. Mixed use will be enhanced in the older downtown district and also in more traditional neighborhoods by integrating shops, churches, schools, and other forms of light commercial businesses allowing people to walk or bike to conveniently located daily necessities.

INFRASTRUCTURE AS ASSET: The Noisette Master Plan seeks to eliminate non-point source pollution by treating urban run-off naturally before it enters wetlands or ground water. Plants and natural biota will be relied upon to filter contaminants from stormwater. Bioswales, rain gardens, and green roofs are planned for various locations to slow down, collect, and treat stormwater; and also create micro-habitats for birds, amphibians, insects, aquatic life, etc. Some of these have been constructed in the renovation of the downtown area.

CONSCIENCE MATERIALS CHOICE: Proper choices in construction are one of the main points established in both the Noisette Quality Home Performance Standards and LEED (Leadership in Energy and Environmental Design) manual. The Noisette Master Plan encourages these green building guidelines for private residences and commercial structures. Both sources urge wise use of building materials through efficient design, reusing and recycling materials, reducing waste, and making conscience choices regarding renewable sources.

ECONOMIC VIABILITY: The Noisette Master Plan recognizes that without economic opportunity the community will not be self sustaining and prospects for a variety of income levels should be available in a fully-developed economic revitalization plan. Being the largest sustainable project in the country and its

proximity to local interstates and major ports along the Cooper River; Noisette expects to prompt a wide range of progressive economic growth. Industries that relate to regional and community goals and achievements will be courted. To support economic activity, Noisette desires to create amenities, retail, service industries, a range of housing, effective schools, and public transportation.

CONNECT PEOPLE AND CULTURE: Noisette recognizes two core principles of all successful communities –1) each member of the community must understand the unique history and heritage of their social community and physical place, 2) each member of the community must hold in common a vision for the future to which they help contribute (NMP 2003). Bold plans to support a lasting, harmonious, culture of sustainability that serve the long-term health of the economy, environment, and social fabric are arranged within the Noisette Intuitional Framework, a social program that encompasses three main areas of focus. First, the Sustainability Institute will "build upon the community capacity to become a sustainable culture." It will address the issues of creating a sustainable morale, making people aware of the connection between their choices and how their choices affect the natural world. Second, the Noisette Foundation will "create the life-long learning community" and will house all the initiatives to improve the educational and life skills' component of Noisette's citizens. High performance schools, museum studies, art programs, the Graduate Internship Center, and adult skill training and rehabilitation will all work to empower people to become positive contributors to society. Third, the Michaux Conservancy and Land Trust will "restore the intuitive connection to the natural world." Inspired by Aldo

Leopold's philosophy and writings, all the preserved lands and parks will serve as outdoor learning centers and an environmental curriculum, partnering with the Noisette Foundation, will infuse the school systems to develop an ecological stewardship within students. Efforts to maintain and promote the rich architectural record, local foods, and arts will also be an integral ingredient of community life.

PLACES NOT PROJECTS: Recreating places in new locations is easy compared to what Noisette is up against in this depressing industrial town. Not only must the buildings and infrastructure be restored but the human spirit also needs revitalization and the only way to accomplish that is to provide hope. If this is achieved, then Noisette will become a place many people will be proud to call home.

SYNOPSIS: John Knott's belief that successful places are created by citizens, who exhibit healthy mind, body, and spirit, is evident in his conversation, demeanor, and vision and you can't help feeling empowered by his energy. His dream of a harmonious collaboration between community and natural world may become realized if his aspirations and longevity can be sustained. There are many challenges yet to overcome, but if Knott fulfills his goals, Noisette will be the finest example of a completely restored urban community that this country has ever seen.

CHAPTER 7

CONCLUSIONS OF SUSTAINABLE DESIGN EVALUATIONS

Development that meets the present needs without compromising the ability of future generations to do the same is the solution to accommodate ensuing urban growth in southern coastal regions. South Carolina expects to add another million people by the year 2025, with 30% of those people living near the coast (Farris 2003). A rising population will need new roads, housing, schools, retail shops, and countless other facilities, resulting in great quantities of land, energy, and natural resources being consumed. Land fragmentation, habitat destruction, and pollution may lead to degradation of the very natural systems people have come to enjoy in this region. However, negative urban impacts are preventable with proper growth strategies that involve concepts of sustainable development. Communities that meet the social, economic, and environmental goals of sustainability will create healthier environments and standards of living for people and valuable biodiversity.

As sustainable design concepts – new urbanism, conservation development, and traditional neighborhood design, have become increasingly accepted in broader land development markets, familiar guidelines are helpful in establishing a common vocabulary for governments and the development industry to use to ensure consistent levels of sustainability. Assessments of these six case study sites shed light on sustainable achievements and

deficiencies within these communities. Though the information in this survey is anecdotal, it does provide a valid set of data for developers, planners, and policy makers to use for determining the efficacy of future sustainable land development projects. Assessments also assist in providing information local government officials may include to guide planning procedures for future land use zoning and preservation of sensitive ecosystems.

As in all research projects, analyzing the results reveals information on how the research may have been conducted differently and what areas would be worth focussing on in future research. This thesis was no different. If performed again, the case study sites should be grouped by their types rather than lumping them all into one generic category. For example; the three types of sustainable development, conservation subdivision, new urbanism, and traditional neighborhood development, would be the three categories and case study sites specific to each of these categories would be analyzed with the sustainalbe criteria, providing a more accurate set of results. Comparrisons among case study sites in each category would also provide additional information. Conducting interviews among government officials and a broader base of individuals in the land development industry may also provide valuable information on how sustainable concepts are impacting land development.

One idea that arose in the defense process could be expanded upon in further research is the concept of creating a rating system for planned communities to display their level of sustainability. The rating system would be based upon the quantity and quality of measurable sustainable features derived

from an evaluation process similar to the one conducted in this thesis. A rating system would provide quantifiable information for developers, planners, and future home buyers to use in their decision making processes associated with creating and living in quality sustainable communities. The ratings could be posted on real estate marketing material and a committee of government, environmental, and private sector planning officials could participate in such a system.

Over the last forty years, the evolution of ecologically sensitive design along the coast of South Carolina has produced an array of planned communities displaying many attributes of sustainability. These sustainable trends are continuing in projects currently under construction – “The Ponds” near Summerville, “South Park Village” in Myrtle Beach, and “The Village at Palmetto Bluff” in Bluffton. Each of these support concepts of new urbanism by offering mixed use, human scaled neighborhoods, civic facilities, and high ratios of greenspace. South Park Village is an infill project on a former military base; The Ponds and Palmetto Bluff are rural developments that will celebrate their site’s commanding natural legacy. Recently, The Village at Palmetto Bluff was one of 17 projects around the world to receive The Congress of New Urbanism’s most prestigious honor, “The Charter Award”, recognizing it as a global leader among well-designed cities and towns (CNU 2006). Noisette’s urban renewal plan will continue to promote sustainable design well into the future. John Knott plans to package Noisette’s restorative model for other cities to use for improving their own blighted communities, seeking to initiate a new path of urban recovery for 20

cities by 2025. These highly promoted projects have garnered much praise for their sustainable features; however, if a widely accepted set of sustainable principles were in use, all land development projects could achieve the necessary standards of sustainable communities.

Land development is a dynamic, rapidly paced industry that has lasting effects on people and the environment. To accommodate increasing coastal populations without creating further damage to valued ecosystems, sustainable design must be a part of the strategic growth plans for all municipalities. Although conventional development practices prevail, South Carolina has been a leader in the progressive development industry, providing many examples of how growth can occur that maintain our quality of life without contributing to sprawl. Assessments of past and future planned developments can contribute to this pattern of smart growth, ensuring success for the sustainable land development industry in its quest of creating long-lasting, healthy communities. If the last two decades are any indication, then the outlook for more projects featuring sustainable design along the coast of South Carolina is very encouraging.

EPILOGUE

It doesn't require one to live anywhere for very long to witness urbanization that consumes acres of forests, fields, and other wild areas. Growing up forty-five miles away from Myrtle Beach, I have seen my share of rapid land development consisting mostly of housing tracts surrounding golf courses. These sights were always distressing to me but other than destroying wildlife habitat, I really wasn't aware of all the connections between conventional land development and its impact on the regions ecosystems. Overall most people are unaware of the negative impacts resulting from the loss of natural vegetation, disruption of hydrological cycles, increased use of impervious surfaces, and development that severely alters or destroys natural systems. This thesis allowed me to explore these topics by investigating the connections which improved my understanding of the fact that a healthy environment is required to ensure a vibrant community. The research took me to some of the most progressive communities on the east coast. The tours provided valuable background information and behind the scenes information that even people who live in the communities never see. The thesis process also allowed me to come in contact with some dynamic leaders in the sustainable design industry. I was deeply inspired from my meeting with John Knott. His vision of a healthy society and the means to make it happen at Noisette were truly phenomenal. The land development industry needs more people like him. My conversation with Jim Chaffin was also special. His great respect for the environment and desire to

express that respect through sustainable communities is something I'll always remember. Overall, the thesis provided me with a ticket to explore this subject of sustainable design and I thoroughly enjoyed the ride.

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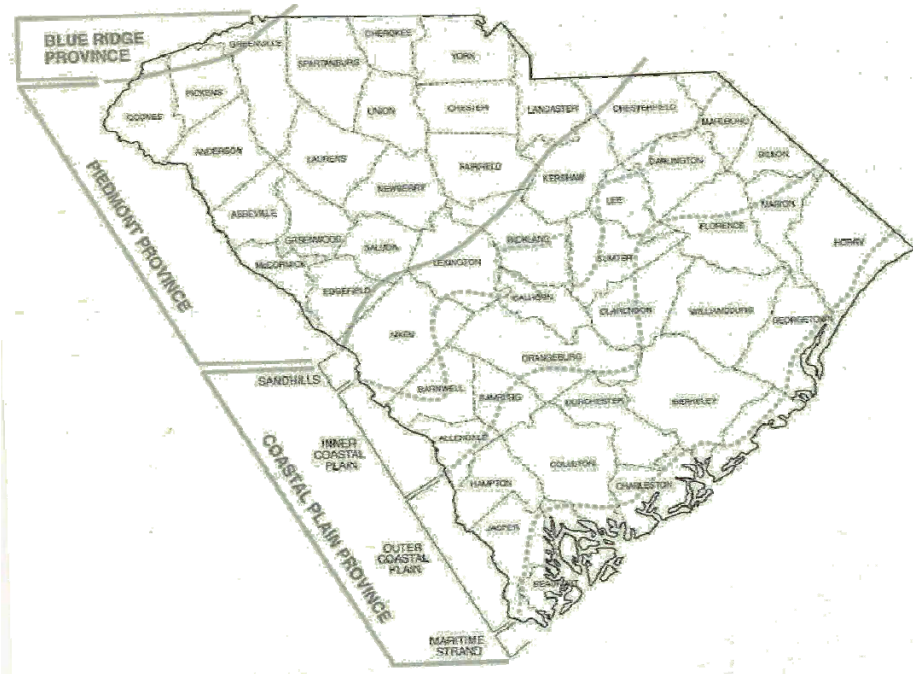
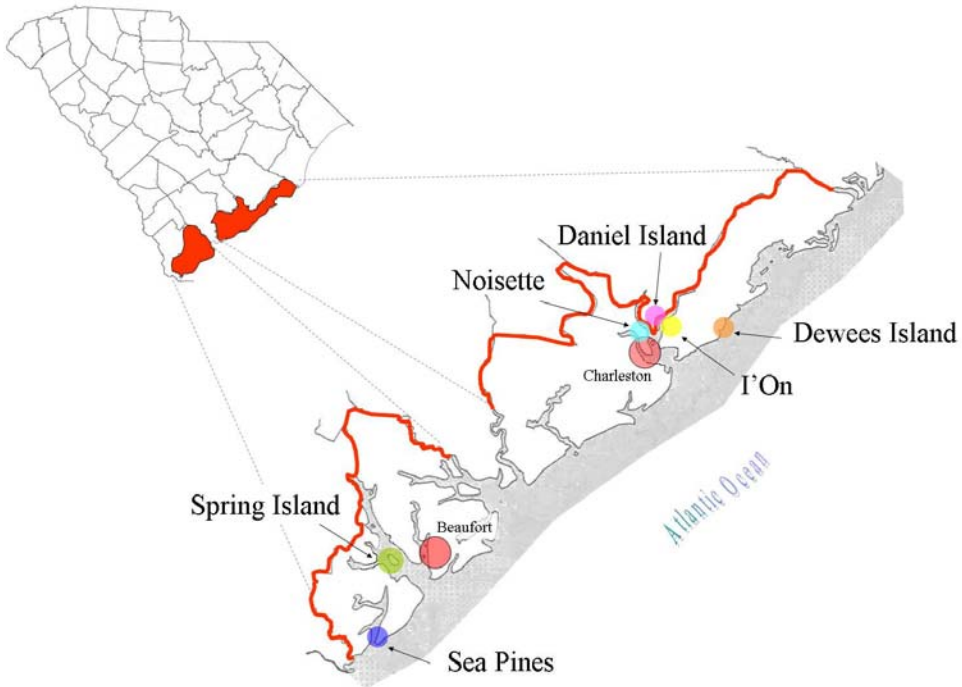
APPENDIX A: MAPS

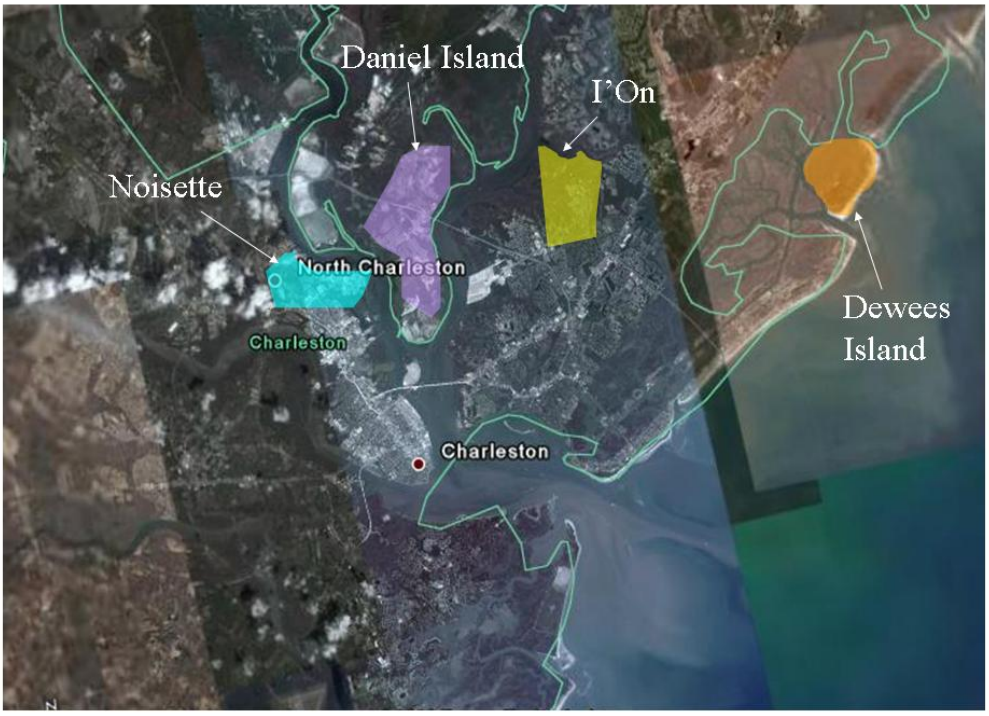
A.1 – South Carolina physiographic regions (Porcher 2001).



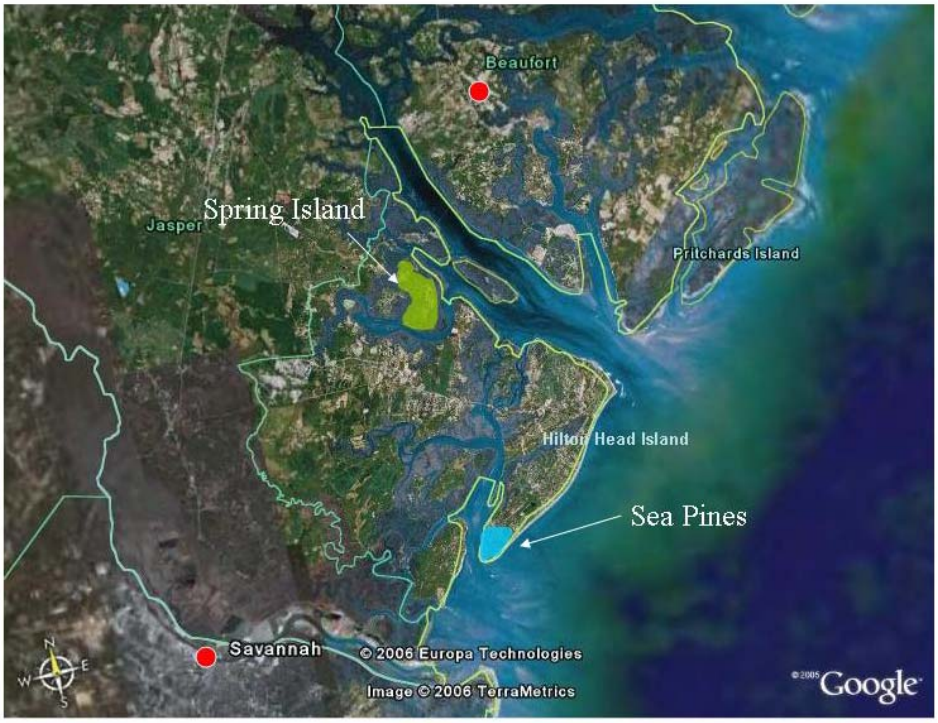
A.2 – Case study site locations in Charleston and Beaufort counties.



A.3 – Aerial view of case study sites in Charleston County (Google Earth 2006).



A.4 – Aerial view of case study sites in Beaufort County (Google Earth 2006).

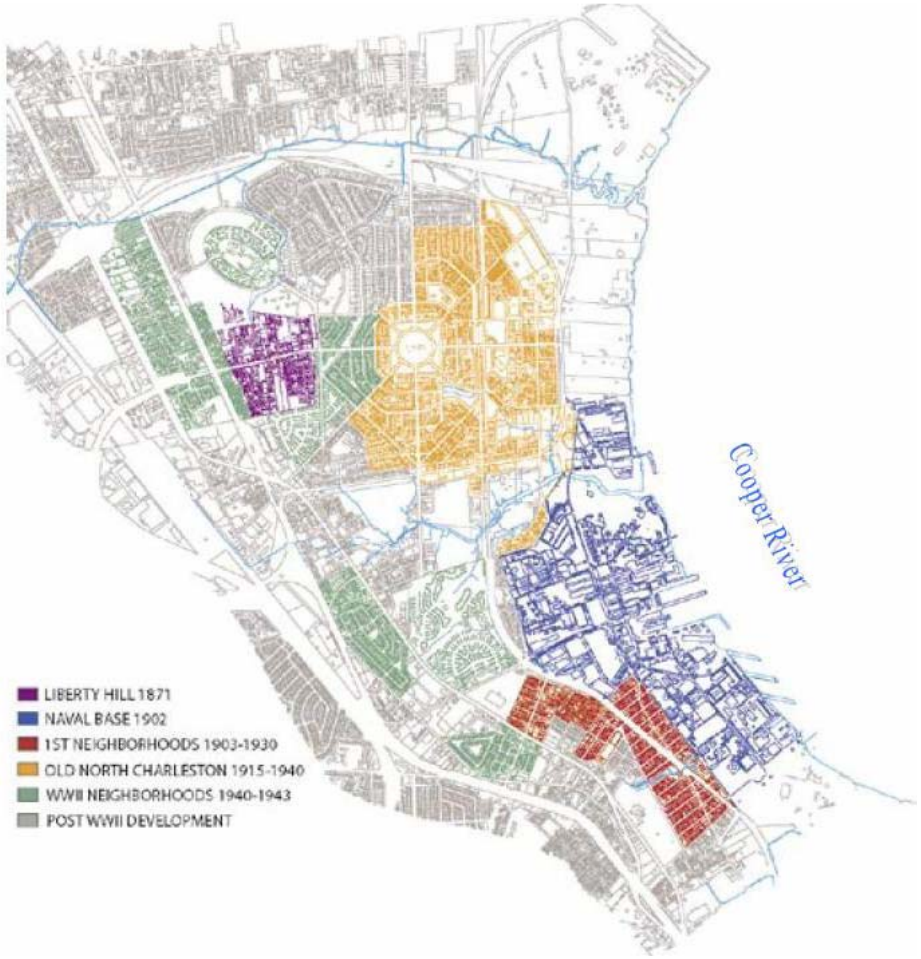


A.5 – Dewees Island site plan (Dewees Island 2006).

A.6 – l'On site plan (l'On 2006).

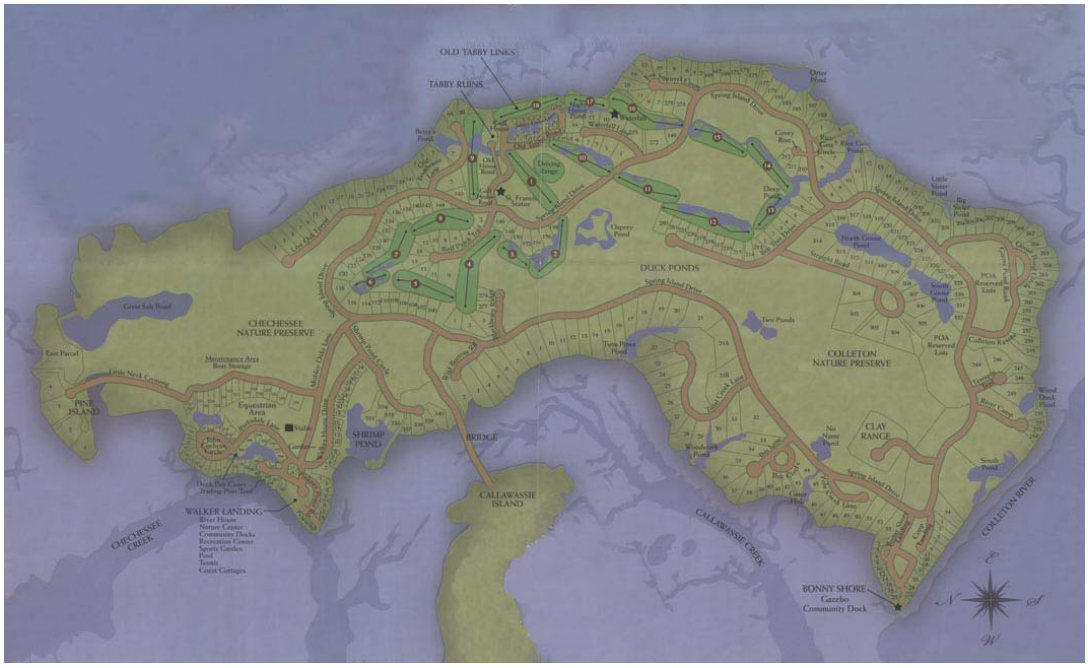
A.7 – Daniel Island site plan (Daniel Island 2006).

A.8 – Noisette site plan (Noisette Company 2006).



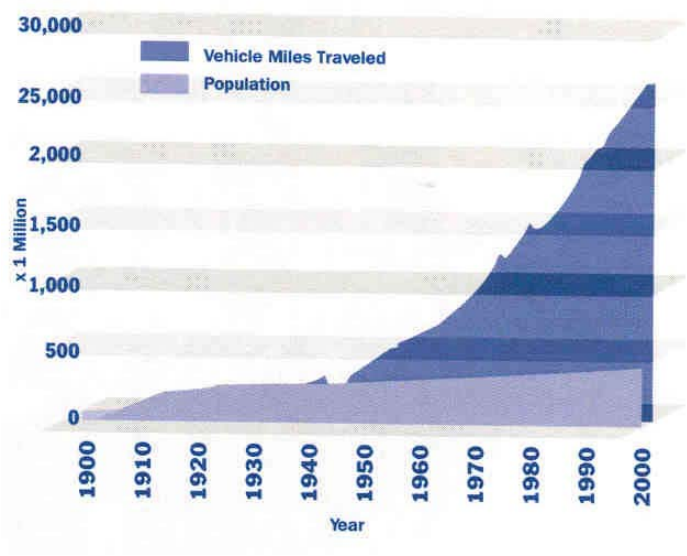
A.9 – Sea Pines site plan.

A.10 – Spring Island site plan (Spring Island 2006).

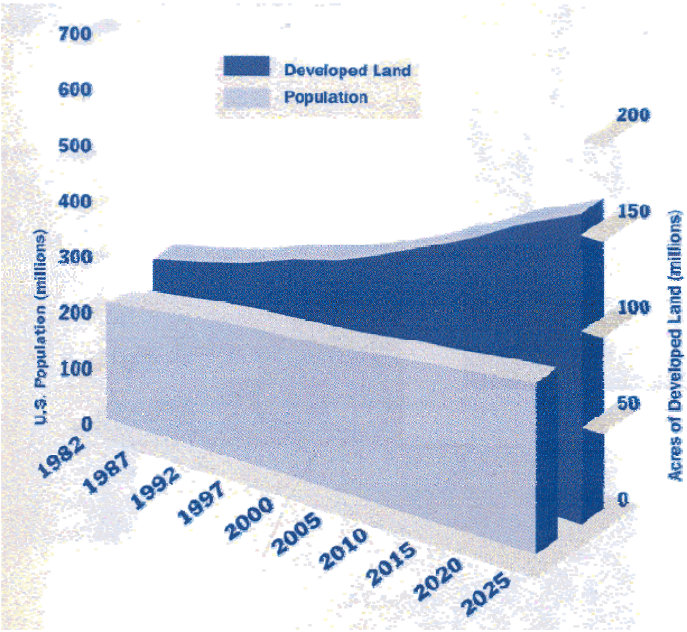


APPENDIX B: FIGURES

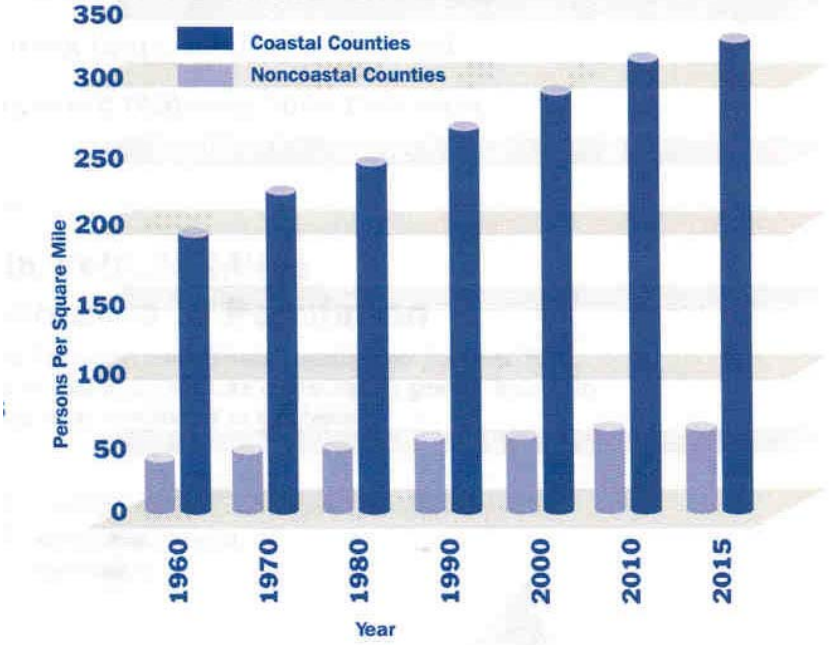
B.1 – Nation wide vehicle miles and population growth (Beach 2002).



B.2 – Nation wide developed land and population growth (Beach 2002).



B.3 – National population density in coastal and noncoastal counties (Beach 2002).



B.4 – Table of assessment data for case study sites.

Assessment Criteria / **Case Study Sites**	Contexually and Locationally Responsive	Systems-based structure	Resource efficiency	Streets as public realm	Fine-grained mixed-use	Infrastructure as asset	Conscious materials choice	Economic viability	Connect people and culture	Places not projects
Sea Pines	○	●	○	○	○	●	–	○	○	●
Spring Island	●	●	●	–	–	●	○	–	●	●
Dewees Island	●	●	●	–	–	●	●	–	●	●
Daniel Island	●	○	○	●	●	○	–	●	○	●
I'On	●	○	○	●	○	○	–	●	●	●
Noisette (future project)	●	●	●	●	●	●	●	●	●	●

● element optimally addressed
○ element partially addressed
– element not addressed or does not apply

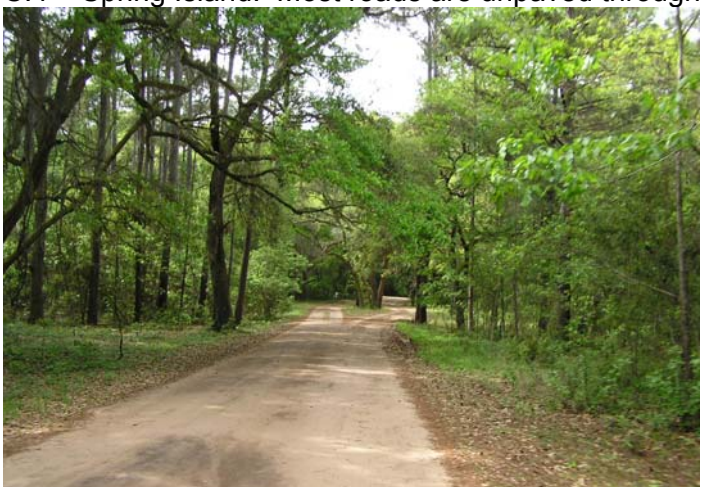
APPENDIX C: FIGURES OF CASE STUDIES

C.1 – Sea Pines. House with trend-setting earth tone color set between live oaks.

C.2 – Sea Pines. Interprative signage along boardwalk in the forest preserve.

C.3 – Sea Pines. Numerous bike paths provide recreation and alternative transportation.

C.4 – Spring Island. Most roads are unpaved throughout the property.



C.5 – Spring Island. Home integrated into existing vegetation with permeable driveway.

C.6 – Spring Island. Historic tabby ruins preserved throughout site.

C.7 – l'On. Safe streets encourage bicycle use.

C.8 – l'On. Pocket park tucked beside homes and lake.

C.9 – l'On. Neighborhood trails give people access around creeks through site.

C.10 – Daniel Island. Seven Farms Drive in downtown commercial district.

C.11 – Daniel Island. Pocket park with stormwater retention pond.

C. 12 – Daniel Island, alley providing access behind homesites.

C.12 – Noisette. Newly renovated downtown (formerly North Charleston).

C.13 – Noisette. Classic style architecture amid industrial buildings at former navy base.

C.14 Noisette. The first L.E.E.D. certified public school in South Carolina.

C.15 – Dewees Island. Home integrated into natural vegetation and boardwalk traversing sensitive areas.

C.16 – Dewees Island. Golf carts parked at ferry dock, which act as only motorized source of transportation.

C.17 – Dewees Island. Home construction nested within island vegetation.