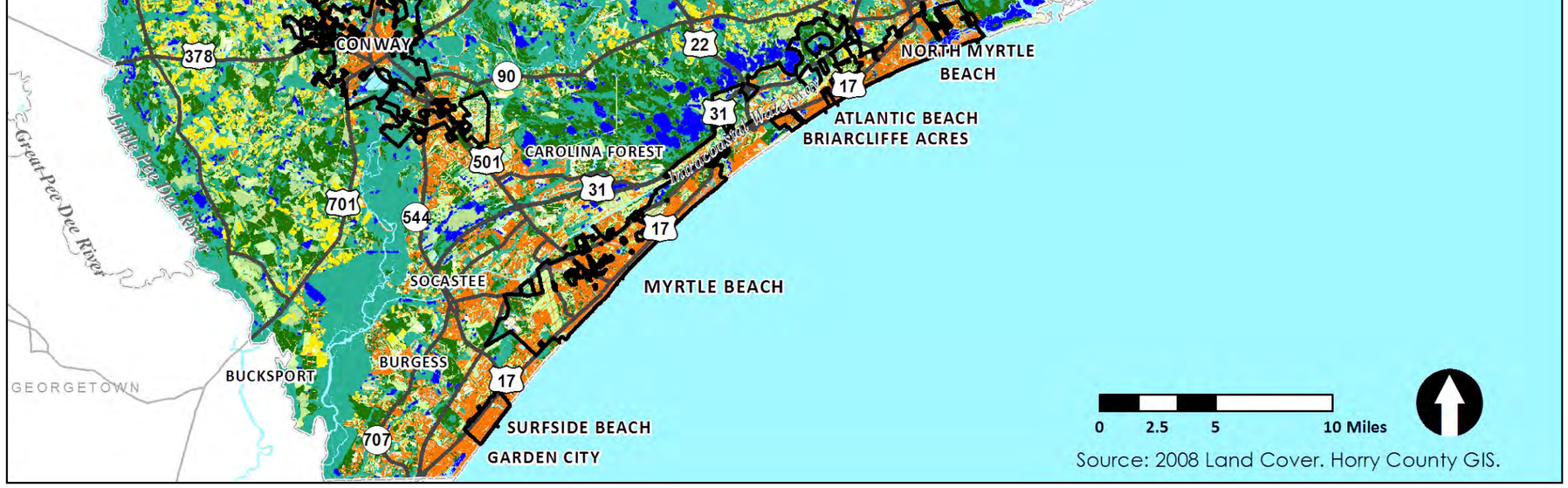
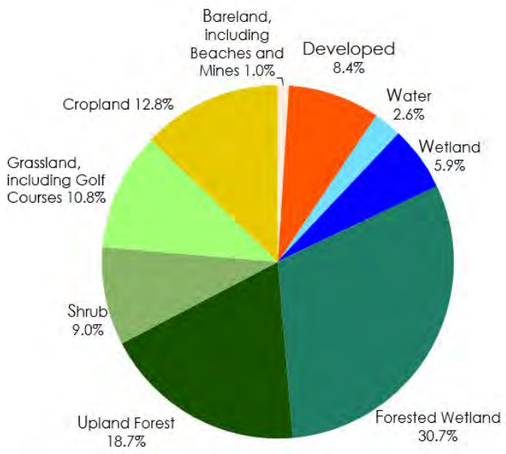
CHAPTER 4: NATURAL RESOURCES

INTRODUCTION

While Horry County is renowned for its beaches and golf resorts, the majority of the County is characterized by its blackwater rivers, wetlands, forestlands, and farmland. As more people continue to locate to and visit the Grand Strand, it will be more important than ever to ensure that development occurs in a manner that promotes a high quality of life while protecting and enhancing the unique resources. This chapter details the existing and changing conditions of the natural resources in the County.



Land Cover Distribution in Horry County



Source: Horry County GIS, LULC 2008

ECOSYSTEM SERVICES

The natural environment provides a variety of benefits for both wildlife and people. Because most of the benefits of a healthy environment carry no price tags and cannot be bought and sold, changes in their supply and capacity may or may not be readily apparent. As development and resource consumption continues to increase, it is essential for local and global ecosystem services to be identified and monitored and that their value be incorporated into decision-making processes.

The inherent benefits of natural resources include, but are not limited to:

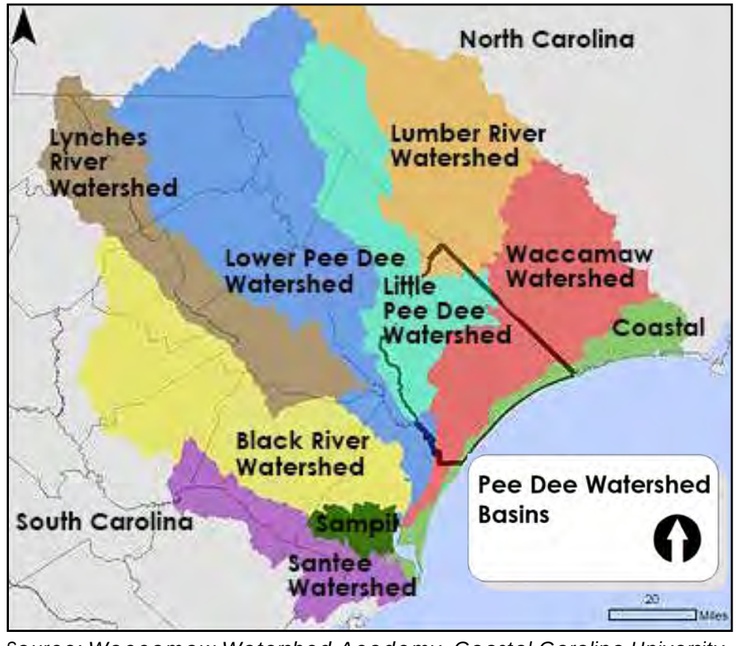
- Water quality protection and enhancement by moderating surface runoff, recharging groundwater supplies, and trapping and removing sediments, nutrients, and chemical pollutants.
- Flood hazard reduction by reducing the velocity of flowing water, absorbing and slowly releasing floodwaters, thereby lowering flood peaks.
- Climate stabilization and moderation of weather extremes, such as floods and drought.
- The regeneration of prime agricultural soils and pollination for the cultivation of crops, grazing of livestock, and harvesting of timber.
- Diverse fauna and landscapes that provide critical breeding, nesting, and feeding habitats for many species of mammals, waterfowl, reptiles, fish and shellfish species.
- Recreational opportunities for bird watchers, hunters, canoeists, anglers, and others.
- Purification of air through forested areas.
- Biological transformation through detoxification and decomposition of waste.

WATER RESOURCES

Horry County has significant water resources including multiple watersheds, freshwater wetlands and Carolina Bays, The natural resources of Horry County are largely defined by its major waterways, their tributary creeks and expansive floodplains.

WATERSHEDS AND WATERWAYS

Horry County lies within the Pee Dee River Basin, which incorporates 45 watersheds and some 5.5 million acres within the state of South Carolina (SCDHEC, Pee Dee, 2013). The watersheds in Horry County are dominated by the black waters of the Lumber, Little Pee Dee, Great Pee Dee and Waccamaw Rivers. These slow moving river systems flow through forested swamps where tannin rich, decaying vegetation stains the water dark brown.



Source: Waccamaw Watershed Academy, Coastal Carolina University

Horry County's rivers serve as scenic resources and are a draw for outdoor recreational enthusiasts. The upper reaches of the Waccamaw, Little Pee Dee, and Lumber Rivers are covered in vegetation and are often impassible by motorized boats. Their sandy banks are enjoyed by boaters and campers alike. Further downstream, the rivers widen and merge into one another, the sandy banks disappear, and the waters begin to fluctuate on a tidal cycle as they near Winyah Bay. Eventually, these dark waters disperse into the Atlantic Ocean and darken the waters along our coast.

Bull Creek, the Great Pee Dee and Little Pee Dee Rivers, and the Intracoastal Waterway are the primary sources of drinking water in Horry County, making water quality and protection of these rivers of utmost importance. Extensive development and often over-pumping of the Black Creek aquifer in the 1980s depressed water levels leading to declines of up to 10ft per year. Most utilities and municipalities in Horry County abandoned their water wells from aquifers in the Black Creek Formation and built surface-water facilities due to these declines. Since then, water suppliers in Horry County have relied more heavily on surface water, leading to a large recovery of aquifer levels. More information on water quality and water suppliers can be found in the Community Facilities Chapter.

Kayakers Enjoying the Waccamaw Blue Trail
Source: https://www.americanrivers.org/rivers/discover-your-river/blue-trails/

State and National River Recognition

In 1989, the South Carolina Rivers Act established the South Carolina Scenic Rivers Program to protect the natural and cultural heritage of South Carolina's rivers. Natural and scenic rivers or river segments with "unique or outstanding scenic, recreational, geologic, botanical, fish, wildlife, historic or cultural values" are selected to join this program. In 1990, fourteen miles of the Little Pee Dee River from Highway 378 to the confluence with the Great Pee Dee River was designated as a State Scenic River. In 2002, the governor signed a bill designating 70 miles of the Great Pee Dee as a Scenic River from the Highway 378 Bridge between Florence and Marion Counties to the Highway 17 Bridge at Winyah Bay. Landowners, community leaders, and South Carolina Department of Natural Resources staff are currently developing the Pee Dee Scenic River Management Plan to address key environmental concerns and management practices to implement on lands bordering these scenic rivers.

The Waccamaw River is another scenic waterway of historic and ecological importance. The Waccamaw extends 100 miles through the protected bottomland hardwood swamps of the Waccamaw Heritage Preserve and the Waccamaw National Wildlife Refuge. It also connects the City of Conway to the City of Georgetown. In 2009, it was designated as a National Water Trail by the National Parks Service because of its local and regional significance. The Waccamaw Blue Trail is drawing paddlers and wildlife enthusiasts to the area.

Intracoastal Waterway

The Intracoastal Waterway (ICW) is a 3,000 mile inland waterway that runs parallel to the Atlantic and Gulf coasts. Some sections of the waterway consist of natural inlets, saltwater rivers, bays and sounds, while others are artificial canals. While the Waccamaw River and Little River are natural portions of the ICW, the majority of the ICW in Horry County was constructed by the Army Corps Of Engineers (ACOE) in 1936. Over time, the waterway has become a part of the natural scenery. While the ICW in Horry County is tidally influenced, salt water only influences its northern reach in Little River. The remaining portion of the ICW in the Grand Strand is freshwater until it reaches Winyah Bay in Georgetown County. The artificial portion of the waterway in Horry County mimics the blackwater rivers in the area.

Originally established to provide a safe transportation route and to protect commerce, the ICW now mainly serves as a route for transient boaters and other recreational users. Because the ICW is no longer primarily used for the transportation of goods, it is no longer regularly dredged to sustain its channel, potentially affecting its future navigability.

Socastee Swing Bridge over the Intracoastal Waterway
Source: Wikipedia

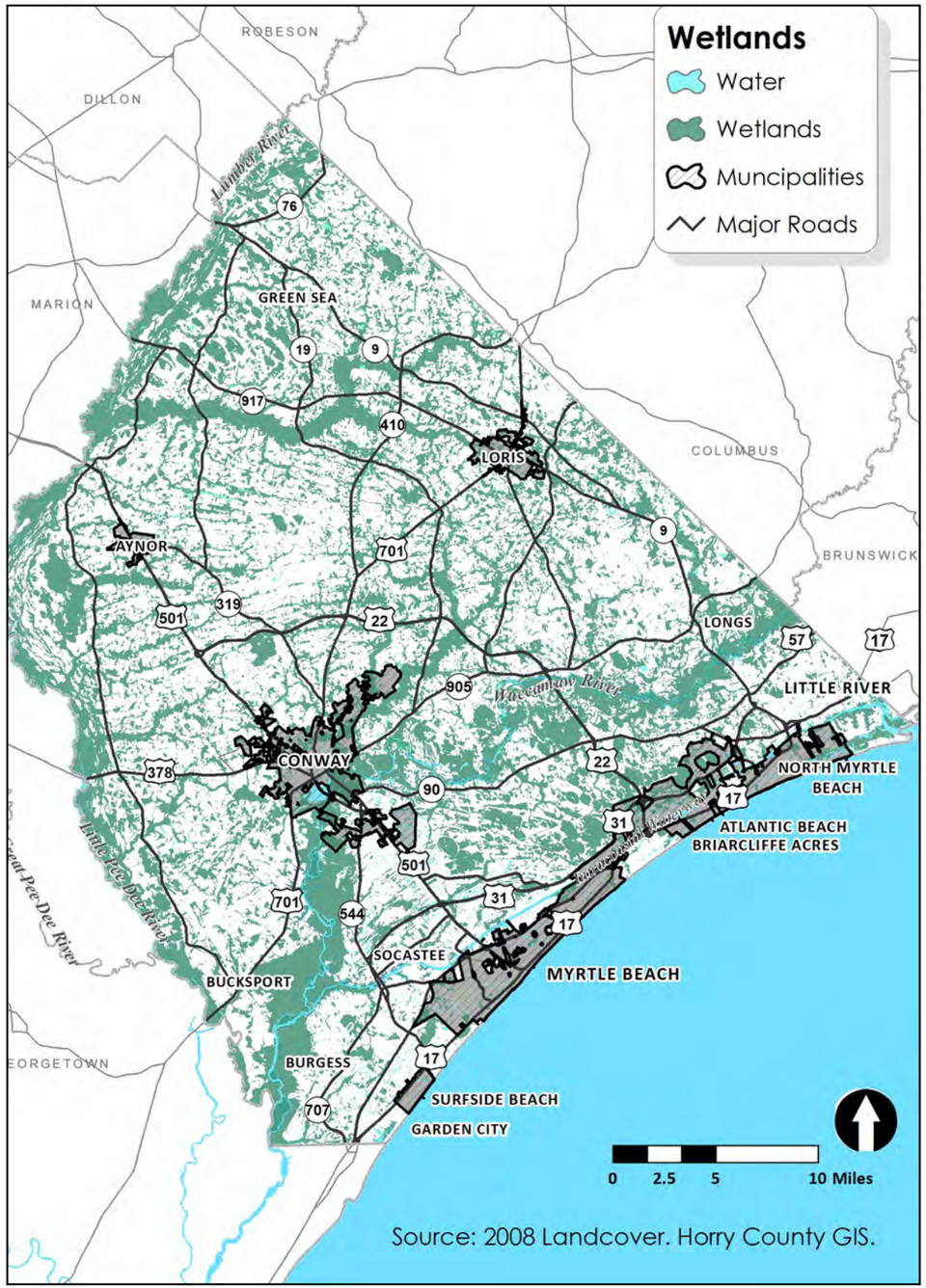
Fish Consumption Advisories

Blackwater rivers are known to have naturally occurring mercury, which can be toxic to people, wildlife and the environment. While naturally found in our air, water and soil, mercury is also released into the environment through numerous human activities from industrial sources that burn coal to improper disposal of mercury-containing products. These toxins build up in the tissue of many types of fish we consume. High levels of mercury can prompt fish consumption advisories. Advisories tell you when you should limit the amount and specific types of fish you eat. Besides mercury, other contaminants, like polychlorinated biphenyls (PCBs) and radioisotopes can also prompt an advisory. Fish Consumption Advisories (https://www.scdhec.gov/library/ML-004042.pdf) are issued by South Carolina Department of Health and Environmental Control (SCDHEC).

WETLANDS

Wetlands make up approximately 38% of Horry County, with the majority being freshwater (NOAA Horry County Snapshots, 2018). This represents a net decrease of roughly 5.3% since 1996. Wetlands are a pivotal part of the natural system, supplying tremendous benefits for coastal communities. Even small acreages provide some level of benefit. Wetlands are defined as areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions (ACOE, 1987). Wetlands include swamps, marshes, bogs, bottomland forests, Carolina Bays, pine savannahs, and even some ditches.

Wetlands are federally protected by Section 404 of the Clean Water Act, which protects wetlands from being ditched, diked, filled, polluted, or altered in any other way without a permit from the US Army Corps of Engineers (ACOE). Silviculture prac-



tices and isolated wetlands are typically exempt from these federal requirements. South Carolina's Pollution Control Act serves as a mechanism to protect isolated wetlands that are not within the Army Corps' jurisdiction. DHEC is the regulatory agency responsible for implementing this act. In addition, they are responsible for regulating wetlands in the coastal zone. Local governments also have the authority to establish regulations that exceed state and federal standards. Horry County requires a wetland delineation letter from the ACOE and protection during construction. Despite growing efforts to preserve wetlands, they continue to be lost at a rapid rate, both from direct conversion and degradation.

Carolina Bays

Carolina Bays are elliptical-shaped, freshwater wetlands that are only found in the coastal plain of the eastern United States. They are oriented in a northwest-southeast direction, and their origin remains unknown. The Carolina Bay is sometimes called 'pocosin' which is the Indian word for "swamp on a hill." Many have raised sand rims and their interiors are rich with peat. The plants and animals that live in or around these wetlands are dependent upon their seasonal fluctuation in water levels. Many are also reliant upon fire for increased productivity.

Bays can range in size from less than one acre to more than 1,000 acres. According to a SCDNR report, Horry County has 410 Carolina Bays over 2 acres, which is more than any other county in the state (Bennett & Nelson, 1991). Unlike bays found in other counties, those in Horry County are typically small and often overlap one another. The Waccamaw River happens to be the only river in the world to originate and be fed by a Carolina Bay.

Carolina Bays have been heavily impacted by ditching, draining, or ponding for agricultural uses. Activities along the perimeter of these Bays, such as development and sand mining, can have an indirect impact on the biodiversity of these wetlands. Many animals, especially reptiles, are dependent upon these adjacent uplands for a portion of their lives, but these outer rims are not protected by federal and state wetland regulations. Because Carolina Bays are considered a threatened ecosystem, South Carolina Department of Natural Resources (SCDNR) has incorporated Lewis Ocean Bay and Cartwheel Bay into their Heritage Preserve Program.

Lewis Ocean Bay Heritage Preserve
Source: Horry County Aerial 2017 Imagery

BEACHES AND MARSHES

The beach and coastal waters are perhaps the most recognizable and popular of all the natural resources in Horry County. There are over 30 miles of sandy beaches and approximately 2,000 acres of salt marsh in Horry County. It is known as the Grand Strand because it makes up the longest continuous beachfront in South Carolina. Unlike other coastal areas in the state, Horry County's beachfront is joined to the mainland and lacks barrier islands. The beachfront is only periodically interrupted by swashes, which are relic tidal inlets that have enclosed over time, both naturally and because of development. Saltwater estuaries are present only along the most northern and southern coast. Sections of the beachfront offer distinctive and varying atmospheres depending on the type and amount of development. Our beaches and marshes not only support wildlife habitat and recreation, they also serve as the primary draw for tourists and the influx of people moving to the area.

The South Carolina Office of Ocean and Coastal Resource Management (OCRM) is responsible for the protection and permitting of activities in the Critical Areas of South Carolina's coast, including tidelands, beaches, and dunes. At the local level, Horry County and the municipalities within it, are responsible for providing public access to these coastal resources and for the development that occurs in these areas. Maintaining these critical resources is part of a cooperative effort between local governments and state and federal agencies.

Singleton Swash from Sand Dune Club
Source: CCU, Center for Marine and Wetland Studies

Beach Management

The beaches in Horry County experience both erosion and accretion, which is often dependent upon seasonal weather patterns and the impacts of coastal storms. OCRM establishes and periodically reviews the regulatory beachfront baseline and setback construction lines. These lines delineate the extent of OCRM's direct permitting authority for activities within the defined beach and dune critical areas. A critical component of these lines is to control future development and redevelopment within erosion prone areas of the beachfront, protect habitat, and maintain a healthy dune system. In many areas of the Grand Strand, there are no dune systems, as many older resorts were built directly within the dune line or the beachfront and dune system has eroded over time. Protecting the beach and properties are of upmost importance to the economic vitality of the Grand Strand.

Renourishment is a soft stabilization measure to minimize the impact of erosion and maintain a healthy, wide beach and restore dune systems. Renourishment dredges sand onto the active beach from offshore sources. It is typically done every 7 to 9 years along the Grand Strand. In 2017, the Army Corps of Engineers' Reach 3 Project placed more than 900,000 cubic yards of sand from Myrtle Beach State Park to Garden City/Georgetown County (7.5 miles). The Reach 1 & 2 Projects renourished areas along North Myrtle Beach and Myrtle Beach. SC renourishment projects from 1954 through 2017 have placed 48,846,625 cubic yards of sand along SC beaches for a total expenditure of $452,946,020. Some borrow pits for sand are no longer viable. As sand harvesting becomes scarcer, the price tag will continue to rise (Paul Gayes 2018). While renourishment maintains the recreational use of the beach, it also sustains the habitat that is necessary for wildlife, such as migratory birds and sea turtles. Preserving habitat, protecting property, and ensuring equitable public access are just a few of the challenges addressed within the Horry County Beachfront Management Plan, which is mandated by OCRM.

The most recent renourishment, with a planned completion in Spring 2019, is along a 1.1 mile section of Arcadian Shores beach just southeast of Shores Drive, starting just west of Singleton Swash and terminating at the Apache Campground Pier. The primary purpose of this project is storm damage reduction.

Beach Access

There are over 350 public beach access sites along the Grand Strand, 22 of which are maintained and located within the 10 miles of beachfront in unincorporated Horry County. These access sites are critical to sustaining the local economy as they provide beach access for millions of beach goers each year. Recent storms heavily damaged public access sites throughout the Grand Strand; however, repairs and improvements have been made to ensure safe passage to the beach. While high visitor use and intense development sustain our economy, constant beach activity and usage can impair the natural processes and accretion of sand along the beach.

Swimming Advisories

Protecting water quality along Horry County's coast is essential to ensure that our waters are safe for recreation and the consumption of fish and shellfish. Since the beginning of the Beach Water Quality monitoring program in 1997, SCDHEC has routinely collected water samples at over 40 locations on Horry County's beaches, many of which are located near swashes. Sampling occurs at least once per week between May 1 and October 1. The samples are tested for enterococci, a fecal indicator bacteria. High enterococcus levels mean there is a greater chance of disease-causing organisms being present in the water, which triggers a swimming advisory for the portion of beach where the sample was taken.

Of the 42 beach monitoring sites in Horry County, 23 have permanent swimming advisory signs posted because of the frequency that the advisories are issued. An advisory means that DHEC advises you NOT to swim within 200 feet of where these signs are posted, especially after a heavy rainfall. Advisories do not mean that the beach is closed. Wading, fishing, and shell collecting do not typically pose a risk except after heavy rainfall events (SCDHEC, 2004). Horry County is the only coastal county in the state with permanent swimming advisories along its beaches. Information on beach swimming advisories can be found at: https://gis.dhec.sc.gov/beachaccess/.

Source: SCDHEC

In addition to DHEC beach monitoring, the County, in cooperation with municipalities and Coastal Carolina University's Environmental Quality Lab (CCU EQL), conduct additional beach monitoring. Monitoring at 2nd Ave, Apache, and Cherry Grove Fishing piers look for a combination of environmental conditions, including those that can contribute to fish kills as the result of low oxygen levels. More information on water quality monitoring can be found in the Community Facilities Chapter.

Salt Marshes

Tidal marshes are highly productive components of the marine food web of coastal waters and estuaries. Many commercially and recreationally important fish and shellfish species depend on these estuaries for all or part of their life cycle for foraging, refuge, and breeding. Marshes also perform a valuable waste treatment function, as dense vegetation filters and traps sediments and pollutants that enter as stormwater run-off from the upland areas. In addition, marsh and dune systems protect adjacent highlands from erosion and storm damage by absorbing and dissipating wave energy.

Little River Marsh View
Source: Horry County Planning and Zoning Staff Picture

Salt marshes can only be found in Murrells Inlet behind Garden City Beach and in the Hog Inlet area on the northern end of the County near Cherry Grove and Little River. Degrading water quality challenges the marshes' ability to sustain consumable oysters, which could impact the local economy and deter the use of these recreational waters. SCDHEC's Shellfish Sanitation Program samples tidal creeks for fecal coliform bacteria to ensure that mollusk and shellfish, and areas from which they are harvested, meet the health and environmental quality standards provided by federal and state regulations for safe consumption. Shellfish harvesting is prohibited in Little River and is restricted near Waties Island, Cherry Grove, Garden City and in the swashes (SCDHEC, Shellfish, 2013). The Murrells Inlet Watershed and Hog Inlet Watershed Plans were recently developed to address water quality challenges in these estuaries.

Beyond water quality, globally increasing levels of carbon dioxide are likely to result in ocean acidification. One impact from acidification is weakened shells of oysters and other shellfish and crustaceans. This could transform entire marine ecosystems and the wildlife as well as people dependent upon shellfish for sustenance. While this is a global phenomenon, it has the potential to have local impacts.

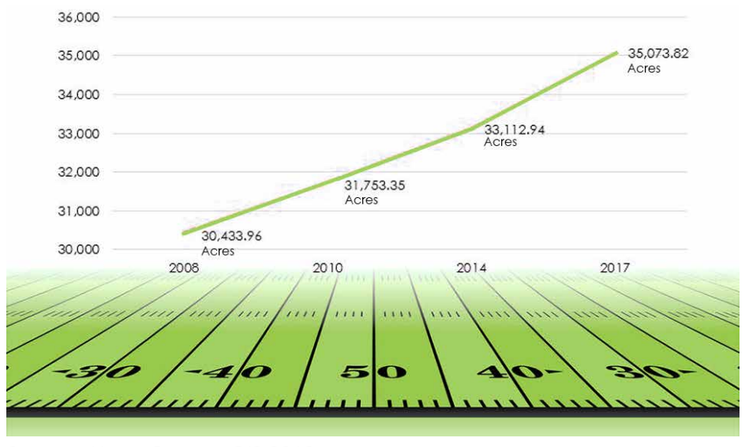
SURFACE WATER QUALITY

Horry County's waterways are impacted by both source and nonpoint source pollution. Source pollution includes pollution from wastewater facilities, which include discharges from industry, municipal storm sewer and waste water systems, and construction sites; however, the majority of the water quality challenges in the County stem from nonpoint sources (NPS). NPS water pollution generally comes from rain runoff that can transport sediments, pesticides and fertilizers from farms and lawns, motor oil and grease deposited on roads and

parking lots, or bacteria containing waste from agricultural animal facilities, wildlife, domestic pet waste, malfunctioning septic systems or sanitary sewer system overflows. The rain moves the pollutants across the land to the nearest water body or storm drain where they may impact the water quality in creeks, rivers, lakes, ponds, estuaries and wetlands. NPS pollution may also impact groundwater when it is allowed to seep into aquifers.

Poor water quality results in fish die-offs, interference with or elimination of recreational uses of a water body, closure of shellfish beds and fish consumption advisories, reduced water supply, or taste and odor problems in drinking water, potential human health problems due to contact with bacteria and chemicals in runoff, and increased potential for flooding from water bodies choked with sediment.

Impervious Surface Analysis



Source: Horry County GIS 2018

Impervious surfaces, such as roads and rooftops, tend to adversely impact water quality, as they reduce the natural infiltration of rainwater runoff. Studies have shown that water quality typically begins to decline as impervious cover reaches 10% of a watershed. Once a watershed is more than 25% impervious cover, it almost assuredly is degraded (Schueler, 1992 and Holland and Sanger, 2008). Horry County's growth is resulting in more impervious surfaces. Between 2014 and 2017 alone, Horry County's impervious surface increased by more than 1,960 acres, which is equivalent to 1,485 football fields. This means that of Horry County's 803,200 total acres, roughly 35,073.82 are impervious, translating to 4.37%. Beyond conversion of forestland into development, drought and heavy rainfall also impact water quality. When water flows have decreased from drought or upstream withdrawals, pollutants may become more concentrated on the landscape. During the next rainfall, this concentrated pollution is quickly transported off the land to the nearest water body.

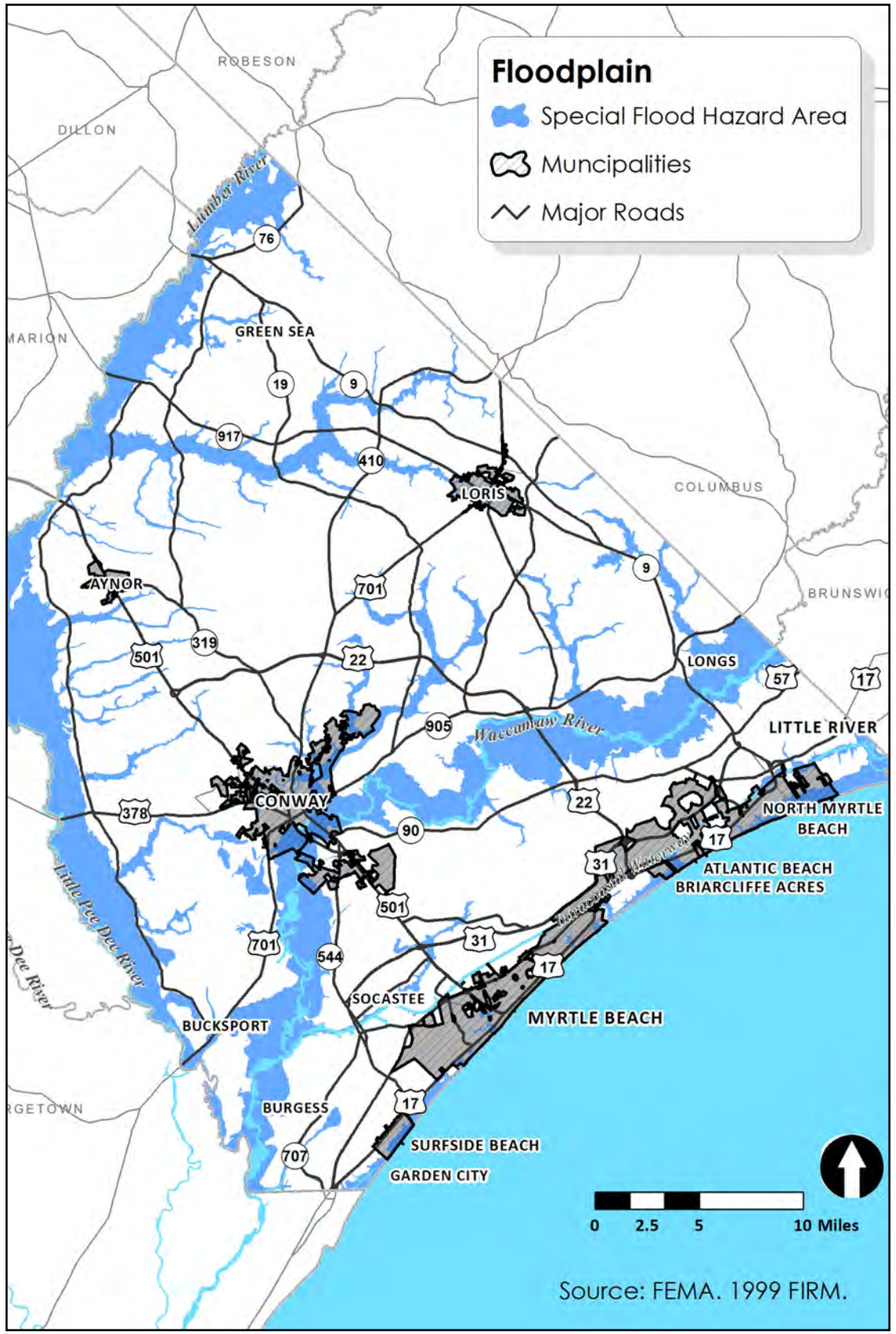
The Clean Water Act establishes the regulatory structure for managing direct point-source discharges and non-point sources of pollutants into the waters of the United States. The Clean Water Act also establishes a framework for several non-regulatory tools to help address water quality concerns at all regulatory levels. The objective of this comprehensive legislation is to restore and maintain the overall quality of the nation's waters to ensure the "protection and propagation of fish, shellfish, and wildlife and recreation in and on the water." At the state level, SCDHEC has established water classifications based upon use and each classification has specific water quality standards that must be met in order to sustain that use. Water quality monitoring is done by SCDHEC on a variable basis depending upon the type of water use and necessary monitoring. High levels of fecal coliform bacteria, enterococcus, mercury, or dissolved oxygen are indicators of poor water quality. If waterbodies experience ongoing water quality problems, then SCDHEC and the local government will develop a Total Maximum Daily Load (TMDL) of pollutants for that water body and identify ways to improve it. An up-to-date list of impaired waterbodies can be found at: http://www.scdhec.gov/HomeAndEnvironment/Water/ImpairedWaters/Overview/. Horry County works in partnership with neighboring jurisdictions, the Waccamaw Regional Council of Governments, SCDHEC, and the Coastal Waccamaw Stormwater Education Consortium to address water quality in our County.

Low Impact Development

The term low impact development (LID) refers to systems and practices that use or mimic natural processes that result in the infiltration, evapotranspiration or use of stormwater in order to protect water quality and associated aquatic habitat. At both the site and regional scale, LID practices aim to preserve, restore and create green space using soils, vegetation, and rainwater harvest techniques. LID employs principles such as preserving and recreating natural landscape features, minimizing effective imperviousness to create functional and appealing site drainage that treat stormwater as a resource rather than a waste product.

There are many practices that have been used to adhere to these principles such as bioretention facilities, rain gardens, vegetated rooftops, rain barrels and permeable pavements.

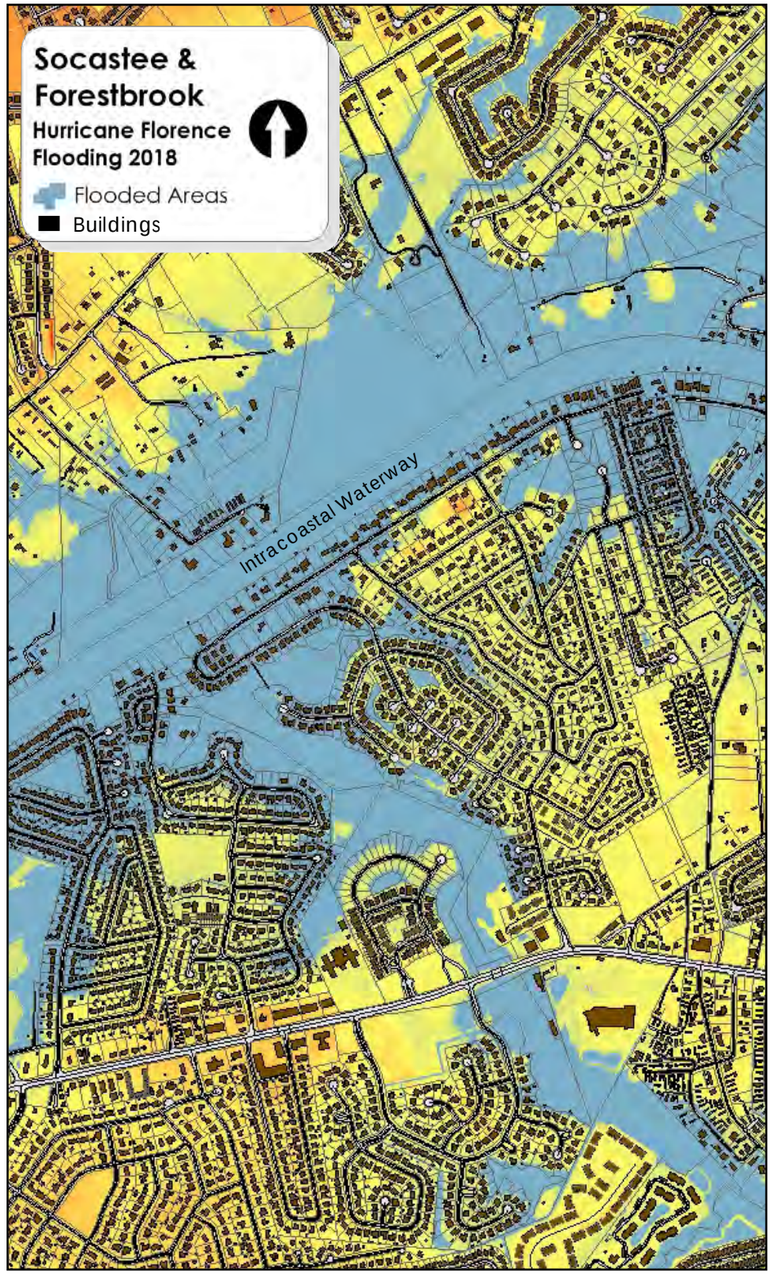
Bioswale, Green Stormwater Infrastructure
Source: The Nature Conservancy (TNC)



By implementing LID principles and practices, water can be managed in a way that reduces the impact of built areas and promotes the natural movement of water within an ecosystem or watershed. Applied on a broad scale, LID can maintain or restore a watershed's hydrologic and ecological functions (Urban Runoff, 2017).

FLOODPLAIN

Approximately 24% of Horry County's total land area lies within the 100-year floodplain and is vulnerable to flooding. The floodzone primarily lies along the Waccamaw, Little Pee Dee and Lumber Rivers, where the water levels fluctuate with seasonal rain patterns. Major rain events have caused the greatest amount of flood damage in Horry County, trumping the impact of most storms that have impacted the beach front. In 2015, Hurricane Joaquin caused extensive inland flood damage, as rainfall persisted for multiple days. A year later Hurricane Matthew also caused major flooding for the County, in many places setting new flood height records. Just two years later, the flooding following Hurricane Florence broke Hurricane Matthew's records by approximately 3-4 feet, depending on location, and flooded many homes and roads along the Little Pee Dee River, Waccamaw River, and along the Intracoastal Waterway. Some homes that experienced reoccurring flooding damage, otherwise known as repetitive losses properties, prior to hurricane Matthew, have been removed from these floodprone areas through funding assistance from the Federal Emergency Management Agency (FEMA) and Horry County.

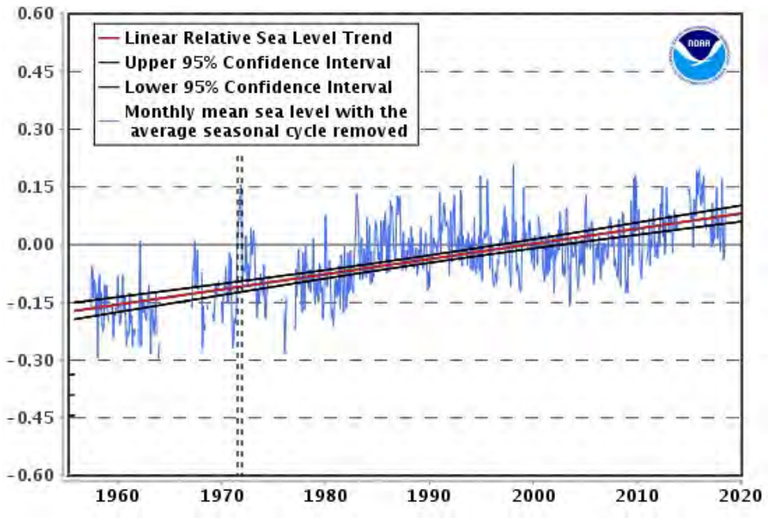


Record Breaking Flooding Levels from Hurricane Florence 2018
Source: Horry County Stormwater

Horry County continues to actively pursue flood mitigation efforts throughout the County. One such way that Horry County is working to address this issue is through improvement of Community Rating System (CRS) scores. The CRS program is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimal National Flood Insurance Program's (NFIP) requirements. This program reduces the insurance premium rates for policy holders, enhances public safety, reduces damages to property and infrastructure, helps to avoid economic disruption and losses, and protects the environment.

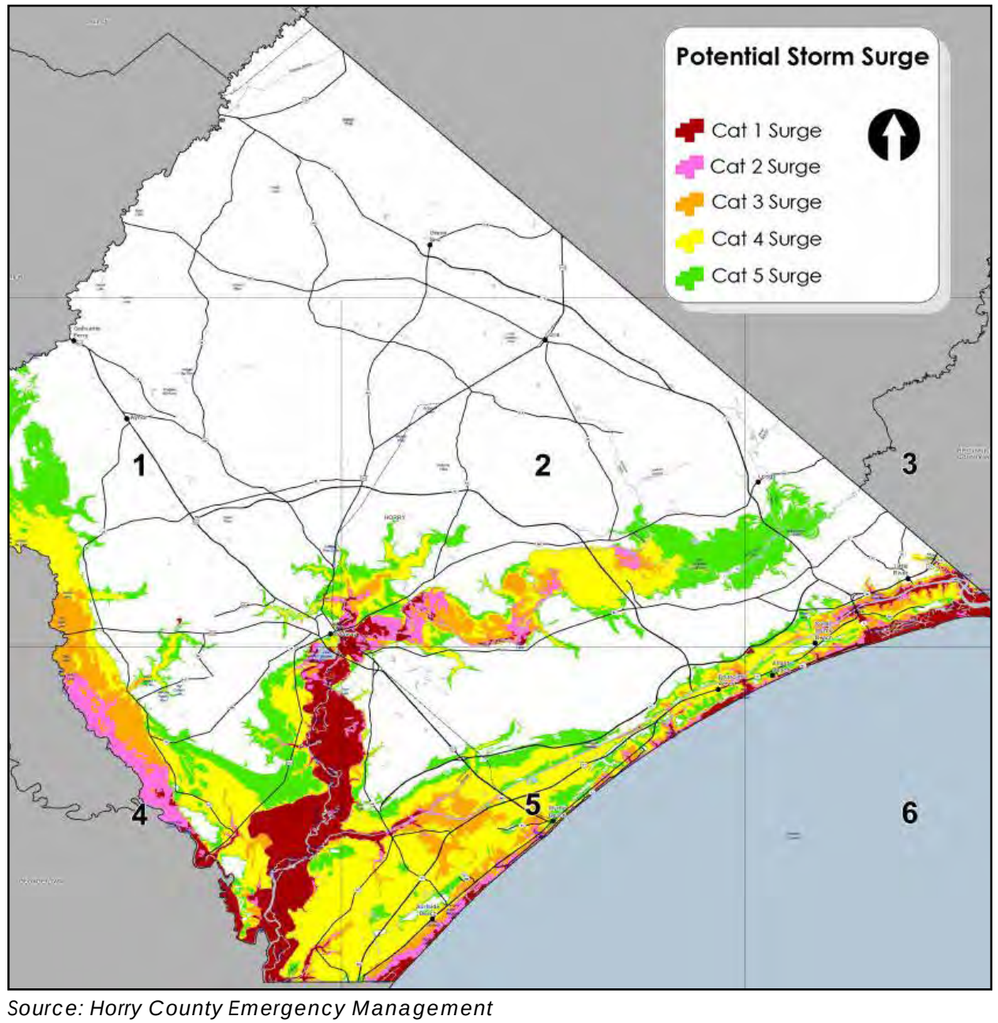
Less than 1% of the County falls within the coastal high hazard area, which includes those areas that could be impacted by wave action in addition to flooding. While the beach front makes up very little of the County's floodplain, it constitutes a majority of the County's land values and tax base. Front row development along the unincorporated Horry County shoreline varies greatly in character and density. Of all the developed portions of the County's coastline, Garden City is most vulnerable to shallow coastal flooding and storm surge inundation. Its low-lying topography, lack of established dune systems, and the fact that it is affected by tidal action on both the beach front and the marsh front make it especially susceptible to flooding. This is particularly true in the one mile reach north of Atlantic Avenue. Structures in this area tend to be large, and many encroach onto the active beach. The Shore Drive area between the City of Myrtle Beach and North Myrtle Beach also has large structures located seaward of the OCRM setback line; however, beach widths are greater there and erosion is not as rapid as it is in Garden City.

Historic Relative Sea Level Rise at Springmaid Pier, 1957-2016



Source: NOAA. Historic Relative Sea Level Trend, Springmaid Pier 1957 to 2016. https://tidesandcurrents.noaa.gov/sltrends/sltrends.html

Other coastal areas of the County that are extremely susceptible to flood damage and are significant habitats have been restricted from the use of federal flood insurance and other federal financial assistance, as they are part of the Coastal Barrier Resource System (CBRS). A total of 2,520 acres of the Horry County coast have been protected by disincentivizing development. While areas within the CBRS can be developed by private developers and property owners, the property owners are responsible for bearing the brunt of the costs in the event of a flood. In Horry County, there are just a few areas included within the CBRS, including the Meher Baba Spiritual Center, the maritime forest and beach front of Briarcliffe Acres, the inlet at White Point Swash, and Waties Island. While Waties Island has been partly set aside as conserved land through Coastal Carolina University, a large portion of the island remains in private ownership and could be developed through private lenders. This island not only serves as an example of a pristine natural area, it also serves as the gateway to the South Carolina portion of the Intracoastal Waterway.



Source: Horry County Emergency Management

Flood Resilience

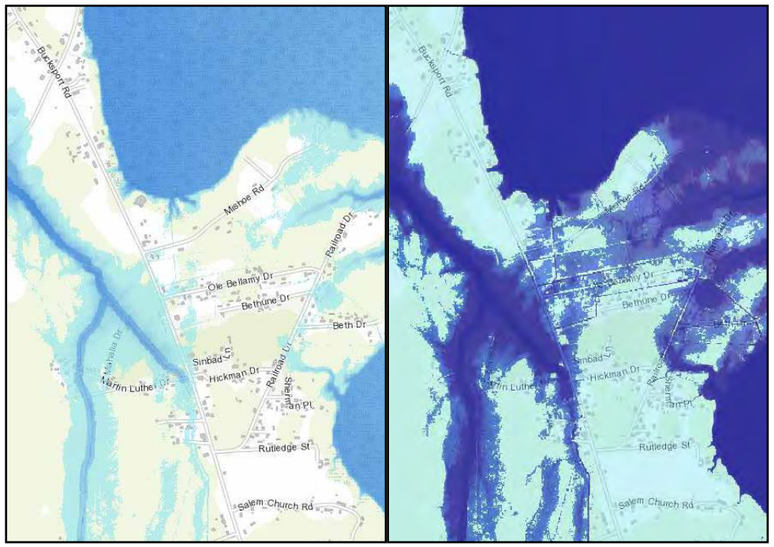
There are many low-lying areas in Horry County that are susceptible to flooding from storms and large rainfall events, but there are also areas that are impacted regularly by extreme high tides. The sea level along Horry County's coast has risen roughly 1.29 feet in the last century. While this equates to approximately 3.94 mm/year, these numbers are anticipated to increase due to global changes.

While there are varying estimates of how much sea levels will rise in the next 100 years, there is no doubt the rising trend will continue. The National Oceanic and Atmospheric Administration (NOAA) estimates a sea level rise of roughly 1 to 6 feet by 2100 for the Grand Strand (http://coast.noaa.gove/slr). A rise of 1 to 2 feet could have major impacts to coastal communities, especially those located along the marsh, like Garden City and Cherry Grove.

Consecutive record breaking flooding in 2015, 2016 and 2018 may illustrate results of climate change. In addition, increases in high tide flood events will become more frequent. Increased flooding and flood frequency from rainfall and tidal events, increased erosion, and the increase of runoff are just a few of the challenges that coastal and riverine communities will need to be prepared for. In light of these trends, measures should be taken to reduce vulnerability to flooding and support long-term recovery after a flood. One of the major components of flood resilience is discouraging development within the floodplain and along river corridors. By avoiding increasing the number of communities at risk, while still meeting housing, services, and facilities needs, the County can improve flooding resilience.

North Coast Resilience Project

Horry County, Georgetown County, and the municipalities within the Waccamaw Council of Governments have come together with The Nature Conservancy and numerous science and conservation partners to research opportunities to improve flood resilience in the region. Collectively referred to as the North Coast, these communities have witnessed flooding impacts of recent storms. Participants in the North Coast Resilience project are working proactively to identify measures to reduce the threats and damages of future flood events and to identify, protect, and restore natural infrastructure in this area.



2017 Hurricane Matthew Flooding and 2060 Predicted Flooding Risk of the Bucksport Community
Source: The Nature Conservancy, Coastal Resilience Project. http://maps.coastalresilience.org/southcarolina/#

Flooding in Socastee following Hurricane Matthew in 2016
Source: WPDE

While Horry County may best be known for the beaches of the Grand Strand, the Waccamaw River has experienced extensive and persistent flooding in recent years. During storm events, local rivers and their tributaries swell over their banks, closing roads and flooding neighborhoods. The Nature Conservancy has modeled and mapped current and future flood risk to determine ideal locations to restore habitat and preserve the natural features of the floodplain to best reduce the County's vulnerability. The mapping incorporated information from local stream and tidal gauges, high water marks, deployed sensors, hindcasted water elevations, and post hurricane satellite imagery. The flood areas from recent storms were mapped, followed by mapping potential flood areas for the year 2035 and 2060. This information will be used by The Nature Conservancy and partners to implement restoration projects that will protect and improve the management of lower order streams connected to the Waccamaw River. It is being used by other conservation partners to prioritize land conservation efforts, especially along the Waccamaw River. Beyond this short-term project, the maps are available for planning and public education purposes.

WATER RESOURCES FINDINGS

Conserving land in the floodplain is important both along the coast and along inland waterways. The protection and conservation of environmental and natural resources becomes increasingly important with growth pressures. Undeveloped, forested land provides an area to slow down and absorb floodwaters. Wetlands act as an essential natural water infil-

tration system. Dune systems and wetlands also serve as protection against floodwaters. By protecting these natural assets, Horry County can simultaneously protect its citizens, properties, and tax base. Without the preservation of such natural features catastrophic flooding could continue to worsen.

In addition to preserving these areas, Horry County Stormwater has updated its Stormwater Management Design Manual to include new technologies (i.e. LID practices), methodologies (i.e. Post-development volume control design) and the requirements of the latest versions of the SCDHEC Municipal Separate Storm Sewer System (MS4) Permit and the Construction General Permit. Continued support of the Crabtree Project, Murrells Inlte and Hog Inlet Projects, and the Stormwater Ocean Outfalls will help address both flooding and water-quality issues.

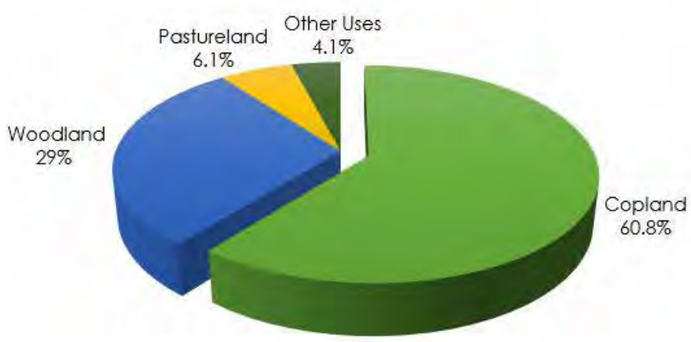
AGRICULTURE

Agricultural lands are a key component of Horry County's landscape, history, and economy. Agricultural lands compromise about 22% of the land in the County.

In 2012, there were 938 farms, including lands for crops, pasture and grazing, and woodlands (USDA, 2012). Between 2002 and 2012, there was a 5% decrease in the number of farms in the County, along with a decrease in farm acreage and average farm size. While these numbers indicate little change in agriculture during the last decade, agricultural lands and the number of farms decreased from 2002-2007. This loss of farmland coincides with development increases in Horry County.

Since 2007, these numbers have nearly recovered and agricultural sales have seen a sharp incline. In 2012 alone, Horry County generated over $101 million crop and livestock sales. Despite the loss of farmland, agriculture continues to have a strong impact on our local economy. More information on the economic impact

Lands in Farms by Type of Land

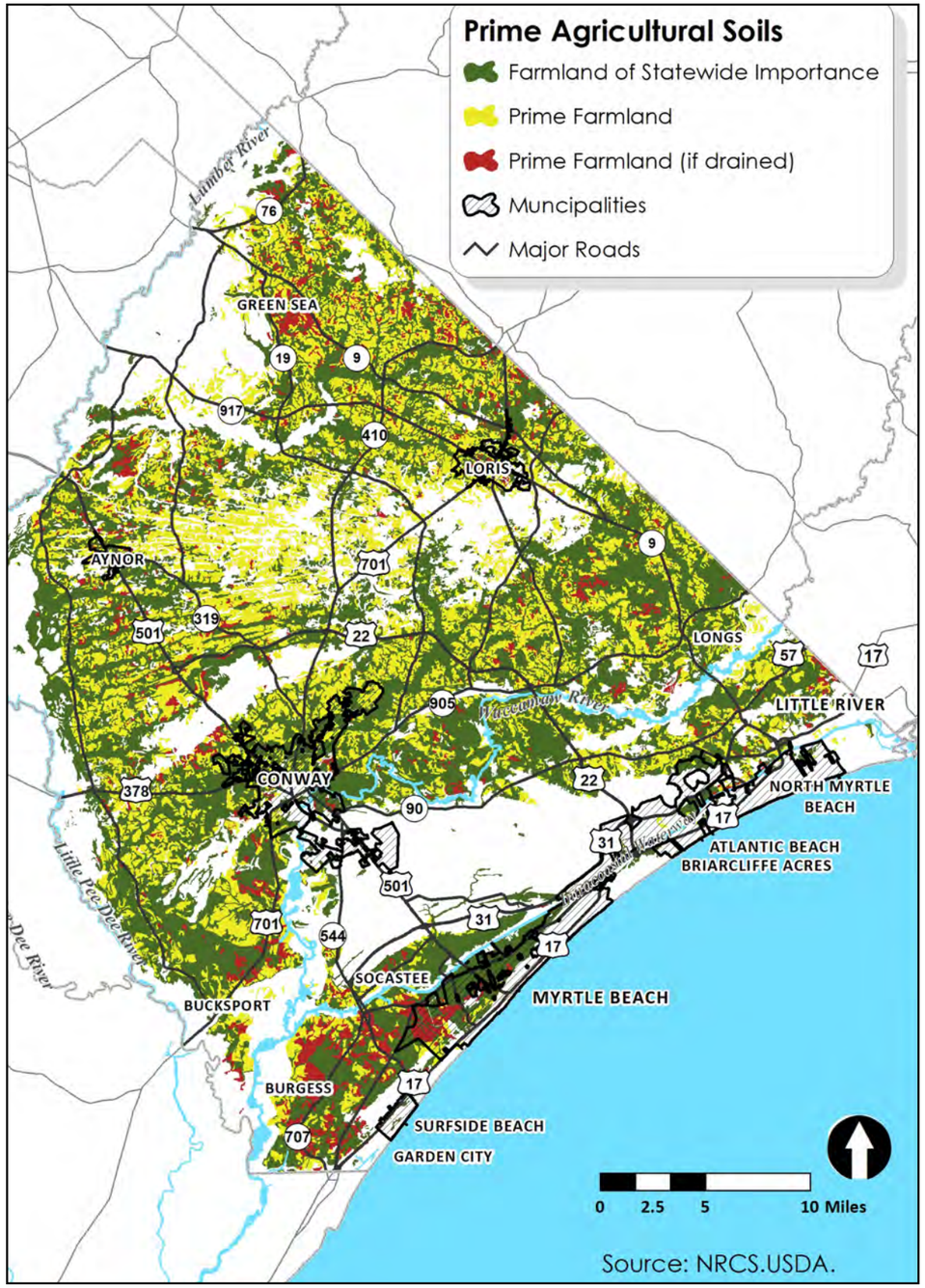


Source:USDA, 2012

Farmland Trends in Horry County

	2002	2007	2012
Number of Farms	988	914	938
Acres in Farms	188,311	163,622	177,569
Average Farm Size	191	179	189

Source: USDA, 2012



of agriculture can be found in the Economic Development Chapter of this plan.

CROPLAND

Prime agricultural soils are abundant throughout Horry County, covering over 60% of the County's total land area. While much of the County is viable for crop production, only 12.8% is currently in use. These croplands account for two-thirds of all agricultural revenue in Horry County. Until recently, tobacco served as the largest revenue generating crop. While Horry County remains the number one producer of tobacco in the state (USDA, 2012), many farmers are diversifying or transitioning into growing other crops, such as peanuts or sweet potatoes (Hughes, 2013). The most abundantly grown crops in Horry County today include soybeans, corn, wheat, and peanuts (USDA, 2012). Cotton production and yield also increased markedly from 2007 to 2012 (USDA, 2012).

Horry County lags behind the state and region in fruit, vegetables, melons, berries, and nuts. However, given the increase in the number of area farmers markets, the local food movement occurring nationwide, and the decrease in farm sizes, fruit and vegetable farming could be an opportunity to expand market share (Hughes, 2013).

Poultry and Livestock

Poultry and livestock generated over $21 million in sales in 2012. Despite the fact that sales revenues have remained relatively the same since 2007, poultry and livestock inventories continue to decrease in Horry County. From 2007 to 2012, the sale of poultry and eggs decreased from nearly $11 million to $5.5 million and the inventory of broilers decreased by more than 360,000. During this same timeframe, the number of hogs decreased from 42,000 to 34,000, but sales increased over $3 million, exceeding $12 million in 2012. Horry County continues to serve as the number two producer of hogs in the state (USDA, 2012). The County likely has a larger concentration of hogs and pigs than other South Carolina counties because of access to swine slaughtering facilities in southeastern North Carolina (Hughes, 2013). Other livestock revenue is derived from the sale of cattle, horses, and goats (USDA, 2012). The number and sale of horses and ponies has slightly increased since 2007. Because Horry County is such a large tourist destination and there is no other type of facility in the region, the County would be a prime location for a livestock and equestrian arena. Such a facility could help foster this agricultural sector.

FARMLAND PRESERVATION

Often, lands that are most at risk for development are farmlands and timberlands. As farmers age and farming becomes less economically viable for them, many are opting to sell their land for development rather than continuing to farm. When this happens, benefits such as flood control, groundwater recharge and wildlife habitat are replaced by the social costs of infrastructure. In 2011, Horry County developed the Highway 319 Area Plan to protect the rural and agricultural heritage of the corridor between Conway and Aynor. Rural communities throughout the County are being encroached upon by new development, potentially threatening the agricultural heritage of the County. Targeted agricultural preservation is one means to minimize the subdivision and sale of farmland for large scale, residential development.

Farmers can participate in several state and federal programs that can help protect the cultural heritage and ecological benefits derived from farming. One such program is the Farm and Ranch Lands Protection Program, which is managed by the USDA. Through this program and upon the request of the property owner, the USDA can purchase conservation easements on productive farm and ranch land. Farmers receive financial assistance in exchange for preserving their farmland and protecting the habitat, wetlands and streams on their property. In exchange for utilizing best management practices, farmers can improve their economic situation and simultaneously protect the environment. In Horry County, the Farm and Ranch Land Protection Program has eight properties enrolled, permanently conserving over 825 acres of land (SC Conservation Bank, 2014). The Pee Dee Land Trust also supports agricultural preservation in the Pee Dee region, and has preserved two tracts in Horry County, totaling 306 acres (PDLT, 2014).

Beyond land conservation, the South Carolina Code of Laws Title 46- Agriculture, Chapter 45, also known as the "Right to Farm Act" issues specific directives to conserve, promote, and encourage the development and improvement of its agricultural operations. The act keeps active farms from being deemed a nuisance and being shut down. It is enacted to reduce the loss to the state of its agricultural resources by limiting the circumstances under which agricultural facilities and operations may be considered a nuisance. It only provides protections for commercial agricultural facilities, not personal use agriculture. Horry County's code relating to chickens, bees and other typically agricultural in nature animals can be found in Chapter 4; Animals and Fowl of the Code of Ordinances of Horry County.

AGRICULTURE FINDINGS

Protecting farmland carries with it the safeguarding of our agriculture heritage, economic resources and numerous ecological benefits. The rural areas of Horry County are particularly vulnerable to development. Farmers need ways in which to be able to keep their farms amid the growing pressures for development. Through concentrating development

in the urban and suburban areas of the County where public facilities and infrastructure exist and encouraging low density development in rural communities, the County can help preserve rural character. Supporting local agricultural and timber operations through tax relief initiatives to owners who keep their property in agricultural or timber production can also help promote rural preservation. Horry County approved an Agritourism permit in 2016 and encourages eligible farmers to become Century Farms. For more information on these projects, see the ***Horry County Historic Preservation Plan***.

Participants in the IMAGINE 2040 Public Input Survey who lived in Aynor, Loris, Longs, and the Green Sea Floyds area indicated a high desire to maintain the agricultural open spaces in their communities. Participants county-wide indicated a high preference for increased farm stand opportunities. Please see the Land Use Chapter for a more detailed analysis of farmland and rural preservation.

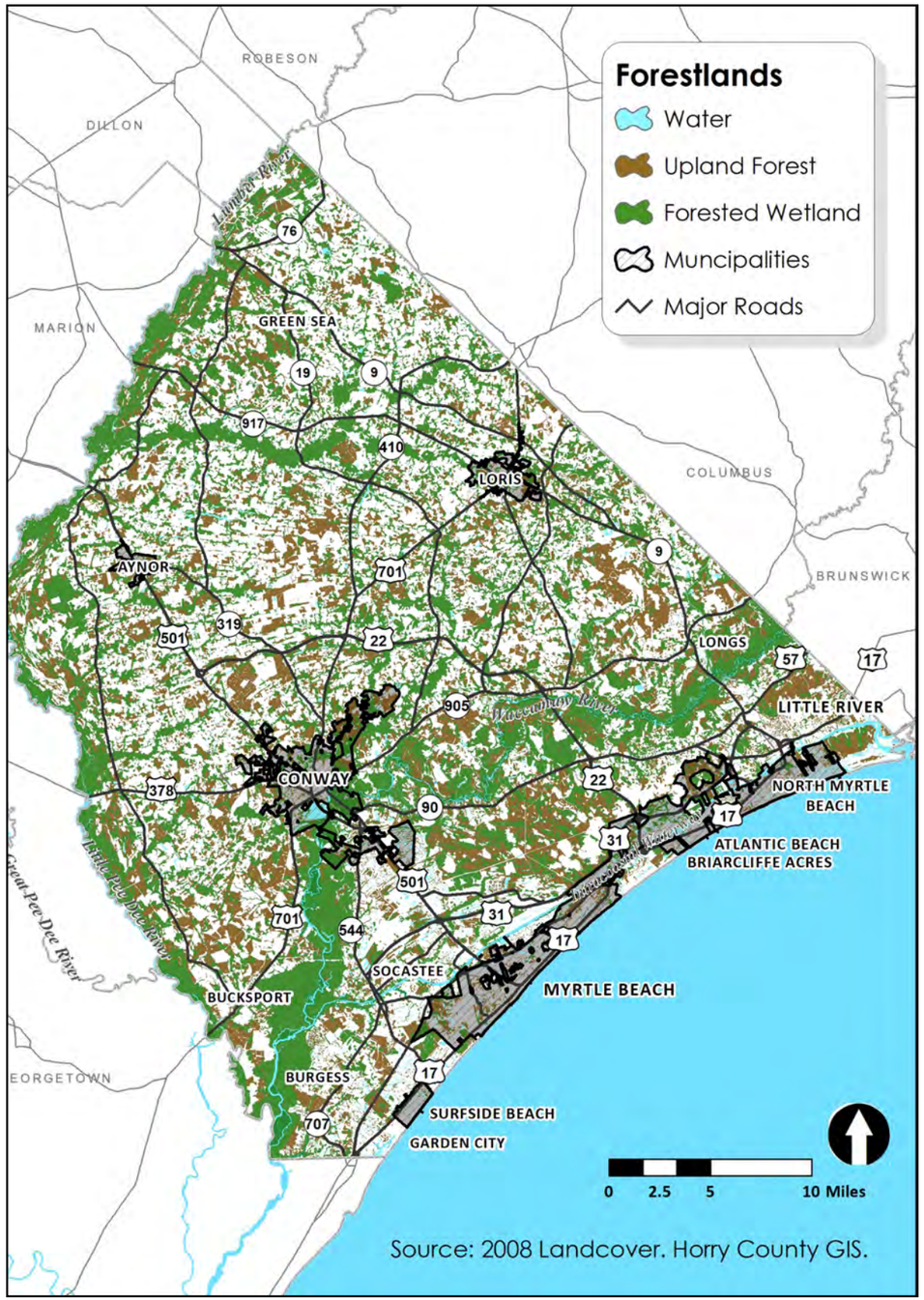
FORESTLAND

Per SC Forestry, Horry County contains 725,574 acres of land of which 460,176 acres is classified as forestland, with 30.7% considered forested wetlands and 18.7% as upland forests. Nearly all of the upland forests are comprised of evergreens, while bald cypress and water tupelo trees are located along the floodplains of our waterways and within Carolina Bays. Forestlands are valuable natural resources and, if properly provide:

- Environmental quality by controlling noise, abating winds, filtering air, preventing soil erosion, and protecting water quality;
- Habitat for a variety of wildlife, including both game and non-game species;
- Outdoor recreational opportunities and enjoyment of scenic beauty through camping, hiking, picnicking, hunting, and bird watching;
- Job creation and the creation of more than 5,000 types of products.

WILDFIRES

The SC Forestry Commission (SCFC) fights more than 2,000 wildfires in the state each year. On average, Horry County has approximately 242 wildfires that damage over 1,700 acres annually. In 2009, the Highway 31 Fire, also known as the Barefoot Fire, burned over 19,000 acres, destroyed 76 homes, and damaged another 97, resulting in over $50 million in damages. The South Carolina Forestry Commission reports that between 35-45% of wildfires are caused by outdoor debris burning. This is by far the largest cause of wildfires in the state. Outdoor burning causes an increased risk in densely developed neighborhoods or those in close proximity to natural areas, such as the Lewis Ocean Bay Heritage Preserve. Horry County has helped address this risk by adopting an ordinance to prohibit open burning in major subdivisions. Wildfires happen most often between January and April, when relative humidity is low, pine debris and grasses are driest, and conditions are worst for fast spreading wildfires.



While wildfires have historically occurred in Horry County, increased development alongside large forested tracts of land hinders the ability for land managers to conduct prescribed or controlled burns to reduce wildfire fuels. Prescribed burning is the planned application of a controlled fire to forest, brush, or grassland vegetative fuels under specified environmental conditions and precautions which causes the fire to be confined to a predetermined area and allow accomplishment of the planned land management objectives. This decreases the likelihood of larger, more intense wildfires and the chance of residents accidentally starting wildfires by using fireworks, burning debris, bonfires, or other activities. Prescribed burning also interrupts the continuity of the fuel layer, not only horizontally on the ground surface, but also vertically. As underbrush grows taller over time, a vertical fuel structure is developed, which can lead to surface wildfires climbing the fuel ladder and becoming disastrous crown fires.

Highway 31 Fire, 2009
Source: SCFC

SCFC employees work with local fire departments to assess the potential for wildfire damage to communities and individual homes. As part of the National Fire Plan effort, SCFC personnel also have been conducting workshops to educate community leaders and homeowners in high fire risk communities throughout the state (SC Forestry Commission, Wildland-Urban Interface Fire Prevention). The threat of wildfires will continue to increase as we develop closer to these wildfire dependent habitats. It also reduces the ability of DNR and SC Forestry to conduct controlled burns; therefore, making the threat worse. In addition, global climate change is resulting in having more extended time periods of droughts, which makes these areas even more fire prone.

FIREWISE

So far, sixteen communities in Horry County have achieved a Firewise designation through the assistance of SCFC and the Horry County Wildfire Team. Many more communities are seeking this designation to voluntarily reduce their vulnerability to wildfires. Such measures include reduction of wildfire fuels within neighborhood open space and in individual yards. The County continues to work with neighborhoods seeking this designation, in addition to taking efforts to ensure that communities are developed safer from the start.

Example of Defensible Space
Source: NFPA

There are steps that the County can take to reduce wildfire risks within major subdivisions, such as requiring developers to include defensible space into developments bordering a dense forested tract. Defensible space is an area around a structure where fuels and vegetation are treated, cleared or reduced to slow the spread of wildfire towards the structure. It also reduces the chance of a structure fire moving from a building to the surrounding forest (Dennis, 2003). Additionally, the County can protect property and lives by amending the Land Development Regulations to reduce block lengths or ensuring that future Planned Developments and Multi-Residential Developments have shorter block lengths, especially for those areas in close proximity to Carolina Bays and other wildfire prone forestlands. In addition, the County can discourage the approval of design modifications that reduce the required number of improved points of ingress and egress for new development. A floating overlay zone for high wildfire risk areas, detailing construction and design standards is also a mechanism the County could use to ensure development is safer from the start. It can also coordinate with SC Forestry Commission to conduct mitigation projects, ranging from emergency access upgrades to wildfire reduction measures. Through voluntary and regulatory efforts, combined with community education, Horry County can significantly reduce the threat of wildfire to life and property.

URBAN FORESTRY

A majority of properties are being clear cut to meet stormwater grading needs to prevent flood damage, in exchange, there is a decrease in tree canopy to absorb flood waters. Participants in the IMAGINE 2040 Land Use Mapping Workshop indicated a number of areas where tree and forestland preservation are desired. While some of these areas were in rural areas, many were in the urban and suburban communities of Carolina Forest, Burgess, Forestbrook, Socast-

ee, and Little River. There are numerous benefits to providing urban and suburban green spaces, community forests, and streetscapes within neighborhoods and commercial areas, including:

- Habitat for urban wildlife
- Reduced heating and cooling costs
- Interception and storage of rainwater/reduced flooding
- Improved air quality
- Sound buffer, and
- Increased property values.
- Increased sense of place and community identity

As development increases in Horry County, natural tree coverage and vegetation will inevitably be lost. Because of the many benefits that trees provide, Horry County has measures in place to protect mature trees, including a Tree Preservation and Landscape Buffer Ordinance. This ordinance has mitigation requirements when large trees are cut down for commercial development. In addition every commercial project is also required to put trees back into the landscape on their parcel. In recent years, there have also been overlays added to the zoning ordinance which require additional trees greater than the requirements of the Landscape Ordinance to be added to commercial designs.

FORESTLAND FINDINGS

As urban and suburban development encroaches on natural areas it will become increasingly important to recognize and plan for fire safety. Discouraging development adjacent to or impeding into natural areas, such as the Lewis Ocean Bay Heritage Preserve, will allow DNR to continue prescribed burning which helps preserve the much needed natural lands and ecological systems that protect the County from dangerous and costly flooding, provide residents and visitors alike with recreational opportunities, and help maintain clean air and water. Public education about controlled burns is beneficial and should be promoted. In addition, addressing outdoor burning and wildfire risks through voluntary efforts, burning regulations, and design standards will also help to protect Horry County residents, businesses, and visitors from the potential for wildfires.

SOILS

Horry's coastal character can be seen throughout the County, as sandy soils and relic sand dunes can even be found inland and along the Lumber, Little Pee Dee and Waccamaw Rivers. Coquina and limestone resources can also be found throughout the entire Pee Dee Region. While relatively flat, Horry County's highest elevations reach over 110 feet above sea level along the sand ridges of Carolina Bays (HC GIS, 2008). While Horry County's flat topography presents few development constraints, poor soil drainage can serve as a challenge for developers and property owners due to the possibility of flooding and poor septic percolation.

DRAINAGE

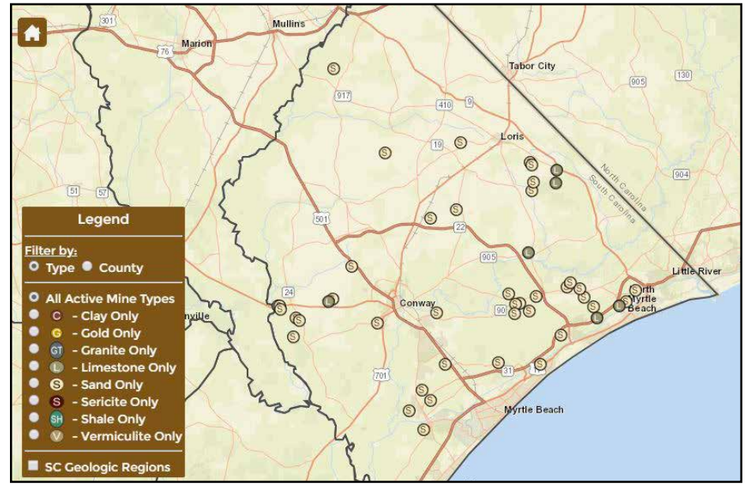
According to the USDA Natural Resource Conservation Service's Soil Survey, the majority of soils in Horry County are loamy sand and sandy loam with generally poor drainage characteristics. Approximately 43% of the soils in Horry County have high to medium run-off potential with poor drainage capacity and a slow infiltration rate. These areas are found throughout the County but are concentrated near major rivers and streams. Poor drainage areas often coincide with wetland and floodplain areas and are typically classified as hydric soils. Areas with the best infiltration occur near the beach because the sandy soils have a higher infiltration rate and better drainage capacity.

Highly Drained to Poorly Drained, Hydric Soils
Source: USACE

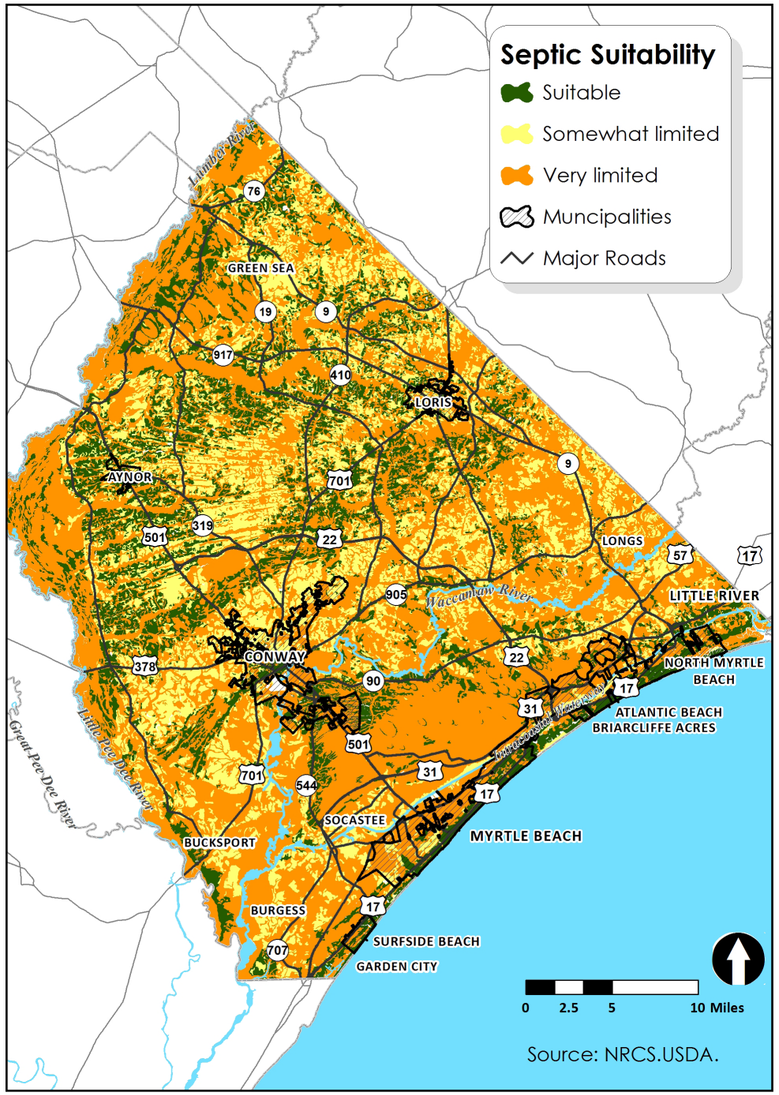
MINING

There are several types of surface mining done in South Carolina, including open pit, strip mines, and dredging. The SC Mining Act of 1974 defines mining as the removal of ores from the ground for sale or for use in a business. The Act and regulations outline the application process, how to conduct mine operations, and minimum reclamation standards. Mine permits and certificates are issued through DHEC's Division of Mining and Solid Waste Management.

There are 45 SCDHEC permitted mines in the County (SCDHEC, 2018). The material coming out of these mines is primar-



SCDHEC Permitted Mining Operations
Source: SCDHEC



ily used for road construction and development projects. SC Department of Transportation (SCDOT), SC State Ports Authority, SC Department of Commerce - Division of Public Railways borrow pits operated by or for are exempt from mining permits if the material is used soley for the building or repair of South Carolina Public Roads, SC State Port Authority's shipping container terminals, or public rail infrastructure of the State. Practices such as farming and on-site construction may be exempt from mining permits from SCDHEC.

Horry County specifically recognizes that mining operation and activities are controlled by: (i) South Carolina Minin2 Act, S.C. Code Ann. §§ 48-20-10 el seq.; (ii) South Carolina Mining Compact, S.C. Code Ann.§§ 48-21-10 et seq.; (iii) Stormwater Man-agement and Sediment Reduction Act §§48-14-10, et al., (iv) the Clean Water Act, 33 U.S.C. §§ 1251, et seq.; (v) South Caro-lina Pollution Control Act, S.C. Code Ann.§§ 48-1-10, et seq.; (vi) Clean Air Act, 42, U.S.C. 7401 et seq. and (vii) regulations pro-mulgated thereto. Horry County recognizes that the South Carolina Department of Health and Environmental is the agency responsible for administering the South Carolina Mining Act, South Carolina Pollution Control Act, Clean Water Act, Clean Air Act and Stormwater Management and Sediment Reduction Act and regulations promulgated thereunder. The listing of these specific statutes is not intended to be exhaustive but is intended to be illustrative of the scheme governing mining activities in Horry County and these statutes, inter alia, are the controllin2 authority for mining in Horry County. Horry County's intent is that no Horry County ordinance conflict with these authorities and that Horry County removes itself from regulation of mining, which is best left to federal and state authorities.

SEPTIC SUITABILITY

Approximately 88% of Horry County has severe limitations for septic tank absorption fields. The soil absorption field provides the final treatment and distribution of the wastewater of a septic system. To treat wastewater, a septic system relies heavily on the microorganisms in the soil to help remove the organic matter, solids and nutrients left in the water (Lesikar, B., 2008). It is also dependent upon soil drainage. Areas less suitable for septic tanks usually require special design, significant increases in construction costs, and increased maintenance. In many cases, installing or connecting to a sewer line is a more viable and environmentally conscious choice. On the other hand, expanding sewer lines into rural areas can encourage development in areas of the County that are more suitable for agriculture, forest land, conservation or outdoor recreation.

Septic maintenance is also a problem countywide. Many utilizing septic fields need to tie into GSWSA for water quality rea-sons. This is especially a concern for those relying on well water for drinking. Due to changes in SCDHEC regulations in May 2016, many previously permitted septic fields no longer meet state standards. These fields will be required by SCDHEC to con-nect to public sewage treatment in the occurrence of issues or repairs.

SOIL FINDINGS

One of the biggest inhibitors of development in the County is water issues. This can be from constraints upon the land due to wetlands, floodplain or due to the inability of the soil to perk for septic systems. In addition to this, the flatness of the land can

also make it harder to move water away from structures placing another restriction on development. And the more development takes place, the less pervious area there is to absorb the excess water.

SPECIES HABITAT

Horry County's diverse landscape supports a variety of plant and animal species. In many cases, the rich biodiversity found throughout the County can be directly associated with the abundance of water resources. Biodiversity is a sign of a healthy ecosystem, as it supports ecosystem productivity and ensures the greater capability to withstand and recover from disasters. Plant life is some of the most beneficial for ecosystem stability when it comes to absorbing flood waters. Plant life is somewhat sessile and unable to relocate making it very vulnerable to development pressures. A changing climate alone could have very heavy negative implications for such sessile life forms. According to South Carolina Department of Natural Resources, the land along the Lumber, Little Pee Dee, and Waccamaw Rivers have the potential to support the greatest variety of species in the County, as seen in the Species Richness Map (SCDNR, 2001). While this map does not reflect the actual numbers of animals or their abundance in a given area, it does indicate where the greatest biodiversity of plant and animal species is likely to be found; therefore, indicating the areas with the greatest need for land and habitat protection. For a more complete map please see SCDNR's SC State Wildlife Action Plan (SWAP) maps.

THREATENED AND ENDANGERED SPECIES

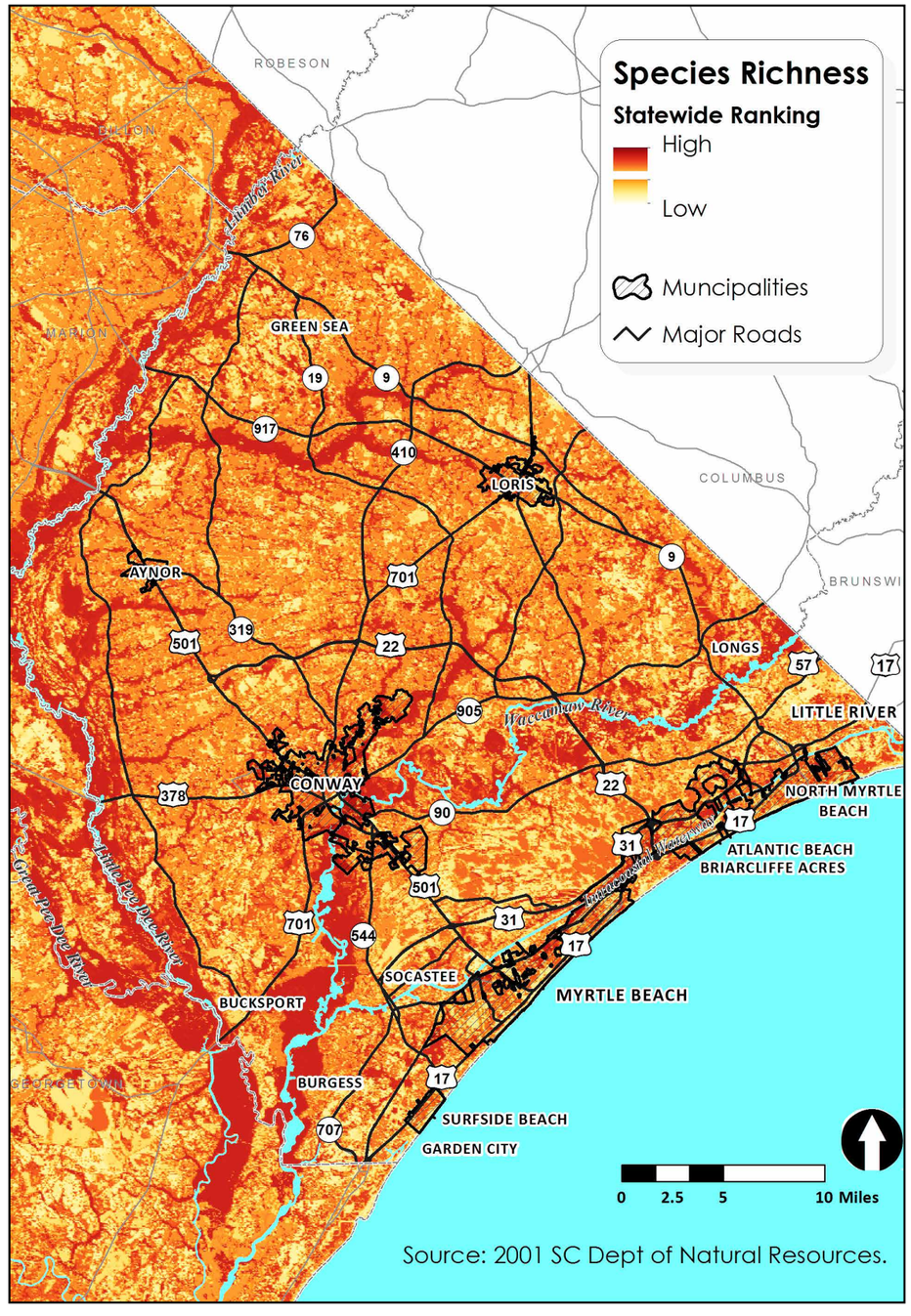
Horry County has a variety of rare, threatened and endangered plant and animal species. Development, logging, the use of pesticides, fishing and hunting are just a handful of reasons why some animal populations have declined throughout the Country. Invasive plants and animals that out compete and consume similar resources are another reason for the decline in certain plant and animal species.

The loggerhead sea turtle is a well-known endangered species. Their populations began to rebound with the use of Turtle Excluder Devices in commercial fishing nets and through volunteer efforts to protect and monitor nests along the beach. There are a number of threatened and endangered birds that reside or migrate through Horry County. The red-cockaded woodpecker is a well-known endangered species in this region, as they rely upon old growth long leaf pines, which nearly disappeared from Horry County in the late 1800s. Similarly, the bald eagle remains threatened in South Carolina, although it has been taken off the en-

Threatened and Endangered Species in Horry County

Vertebrate Animals		
Caretta caretta	Loggerhead	Threatened
Clemmys guttata	Spotted Turtle	Threatened
Corynorhinus rafinesquii	Rafinesque's Big-eared Bat	Endangered
Haliaeetus leucocephalus	Bald Eagle	Threatened
Mycteria americana	Wood Stork	Endangered
Picoides borealis	Red-cockaded Woodpecker	Endangered
Sterna antillarum	Least Tern	Threatened
Vascular Plants		
Amaranthus pumilus	Seabeach Amaranth	Threatened
Schwalbea americana	Chaffseed	Endangered

Source: Updated from SCDNR, 2018



Source: 2001 SC Dept of Natural Resources.

dangered list at the federal level. Bald eagle populations declined drastically from the 1940s through the 1970s due to the loss of habitat, shooting, and pollutants like DDT. Through conservation and habitat restoration efforts, many plant and animal species are on the road to recovery. Despite these efforts, additional rare, threatened, and endangered species continue to be added to state and federal listings. For a more complete list please see SCDNR's species lists.

INVASIVE SPECIES

Invasive species are non-native plant, insect or animal species that have been introduced into an area outside of their original range and compete with native species for resources. Invasive species are recognized as one of the leading threats to biodiversity and impose enormous costs to human enterprises, as well as to human health. Most recent estimates indicate that 42% of the nation's endangered and threatened species have declined as a result of encroaching exotic invasive species (SCDNR, 2008).

Not all non-native species are invasive, as many have become naturalized over time. Exotic plants are only a problem when they escape cultivation, spread rapidly and aggressively compete with native species. One example is bamboo. Unfortunately, many of these plants continue to be sold in nurseries.

Asian Longhorned Beetle, Emerald Ash Borer, Brown Marmorated Stink Bug, and the Fire Ant are just a few of the commonly found invasive insects in South Carolina. In 2011, the Kudzu Bug arrived in South Carolina and quickly spread to every county in the state within the year, damaging soybean crops. Untreated soybeans were estimated to have a 20% loss in South Carolina (Clemson, 2014). Invasive animals can also be found in Horry County, including, but not limited to feral hogs, coyotes, and the apple snail. Problems stemming from invasive animals include competing with native wildlife for food, damaging upland and wetland habitats, preying on small game, outdoor pets and deer, and altering the natural balance of the ecosystem.

New invasive species will likely be introduced into our County. Preventing further spread of invasive species and restoring impacted sites is a monumental task that depends on public awareness, eradication measures, and ongoing monitoring.

CONSERVATION LAND

There are numerous federal, state, and non-profit organizations involved in conserving the unique habitats and wildlife corridors in Horry County, including, but not limited to, the US Fish and Wildlife Service, USDA Natural Resources Conservation Service, the SC Department of Natural Resources, The Nature Conservancy, Ducks Unlimited, and the Pee Dee Land Trust. Additional entities, such as the Waccamaw Riverkeeper, American Rivers, and the Coastal Conservation League are also partners involved in identifying local conservation priorities.

The Horry County Parks and Open Space Board developed the ***Horry County Parks and Open Space Plan*** to identify priority conservation areas based upon the location of existing conservation lands, wetlands, floodplains, and critical habitat corridors. The Priority Conservation Areas Map, see following page, not only identifies sites to expand existing conservation corridors, it also identifies opportunities to connect existing recreational amenities to these natural amenities. The following details some of the existing conservation lands in Horry County.

Waccamaw National Wildlife Refuge

The U.S. Fish and Wildlife Service (USFWS) established the ***Waccamaw National Wildlife Refuge*** (NWR) in December 1997. The refuge was established to protect and manage diverse habitat components within an important coastal river ecosystem for the benefit of endangered and threatened species, freshwater and anadromous fish, migratory birds, and forest wildlife. The Refuge includes a wide array of plants and animals associated with bottomland hardwood habitats and provides compatible wildlife-dependent recreational activities, including hunting, fishing, wildlife observation, photography, and environmental education.

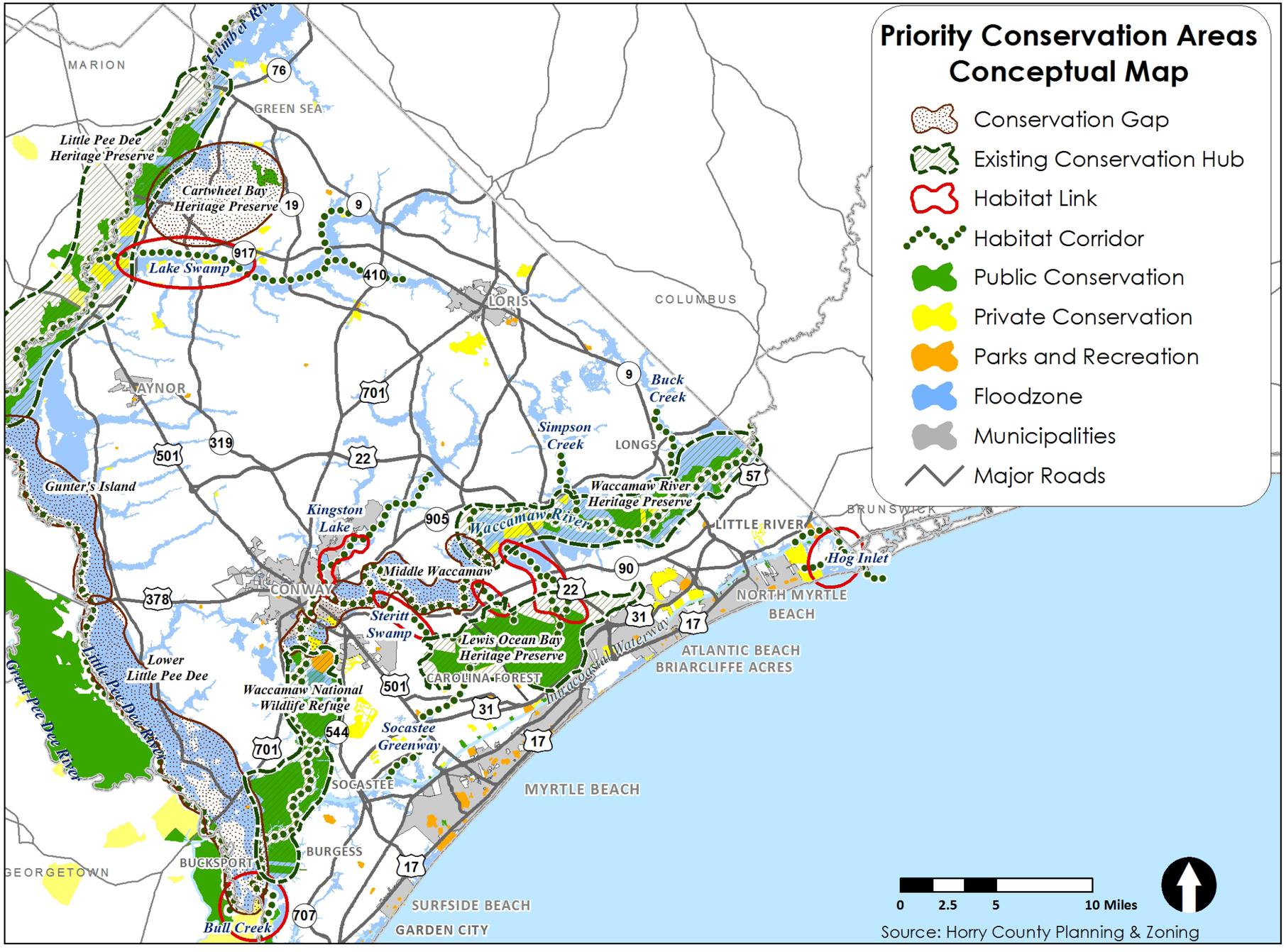
Located in portions of Horry, Georgetown, and Marion County, the Waccamaw NWR acquisition boundary spans over 55,000 acres and includes large sections of the Waccamaw and Great Pee Dee Rivers and a small section of the Little Pee Dee River. The USFWS is actively acquiring lands within this acquisition boundary from willing sellers and has acquired 27,000 acres thus far (USFW, 2013).

SC DNR Heritage Trust Preserves

The South Carolina Department of Natural Resources' Heritage Trust Program was created in 1976 to preserve natural features and cultural remains, which are quickly disappearing as the state's population increases. The program's purpose is to identify, evaluate, and protect the elements considered the most outstanding representatives of the state's heritage. There are currently four heritage preserves in Horry County (SCDNR, 2014).

Waccamaw River Heritage Preserve – This preserve is 5,347 acres, which includes 30 miles of protected river wetlands and bottomland hardwood forests. The property contains examples of rare and threatened plant species, including the dwarf fimbry. It also contains mature hardwood forest.

Cartwheel Bay Heritage Preserve – This 568 acre preserve protects one of the few known Carolina bay-longleaf pine



savannah complexes in South Carolina. The longleaf pine savannahs contain white fringed, yellow fringed and rosebud orchids, Venus' flytraps, pitcher plants and a diverse array of wildflowers.

Lewis Ocean Bay Heritage Preserve – This 10,444 acre preserve contains a group of 23 Carolina Bays. This preserve includes habitats for black bears, red-cockaded woodpeckers, Venus flytraps and a pond pine pocosin plant community.

Little Pee Dee Heritage Preserve – This 9,000 acre tract is in both Marion and Horry Counties. This property protects the rare sarvis holly, a mature floodplain forest, and scenic frontage along the Little Pee Dee River. The preserve includes Knife Island and four scenic oxbow lakes (SCDNR, Heritage Preserves).

NATURE-BASED SOLUTIONS

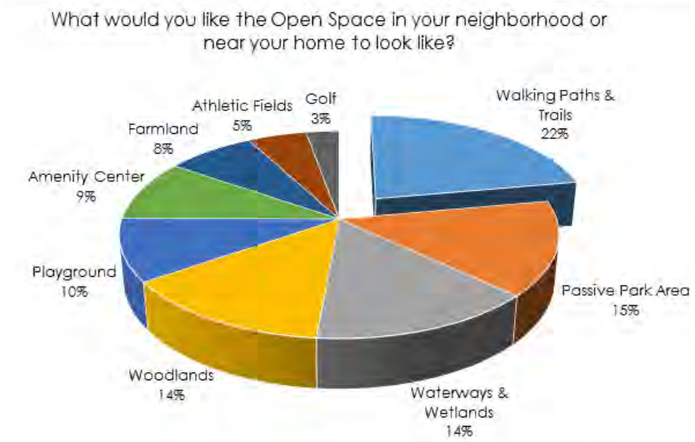
The International Union for Conservation of Nature (IUCN) defines nature-based solutions as including "actions to protect, sustainability manage, and restore natural or modified eco-systems, that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits." Nature-based solutions support and safeguard human well-being in ways that enhance resilience of ecosystems and their capacity. They are designed to address food security, climate change, water security, human health, disaster risk, social and economic development. The following sections outline recommended nature-based solutions in Horry County.

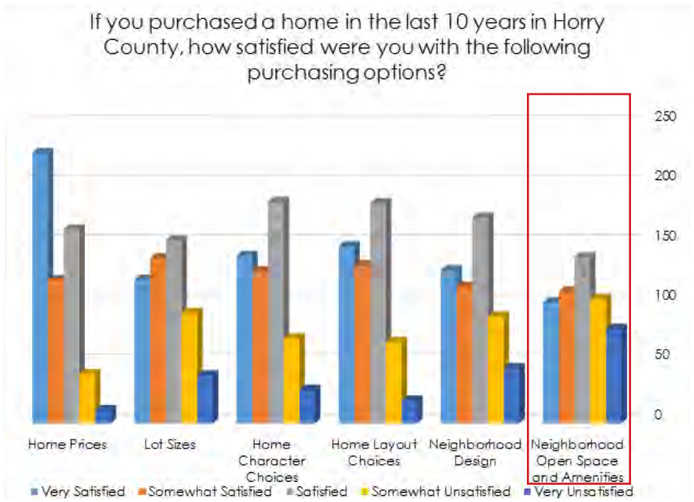
Conservation Subdivision

Conservation subdivisions are a design strategy that attempts to preserve undivided, buildable tracts of land as communal open space for residents. Ideally, in a conservation subdivision, 50-70% of the buildable land is set aside as open space by grouping homes on the developed portions of the land. These types of subdivisions offer additional economic and environmental benefits when compared to conventional subdivisions. Not only do homes in such subdivisions typically have higher home values, but reducing the developed land area can also decrease the infrastructure and engineering costs, benefit wildlife corridors, result in decreased impervious surface (thereby decreasing stormwater management needs), and increased access to open space.

Interconnected Open Space

Linking parks, greenways, river corridors, and other natural or restored lands together to create an interconnected green space system provides far greater benefits for people, wildlife, and the economy. It helps connect people and neighborhoods, provides opportunities for exercise that can counter today's trends in obesity and adult onset diabetes, and enhances emotional well-being by bringing nature closer to homes. According to results from the IMAGINE 2040 community survey, residents of Horry County preferred to see additional walking trails, passive park areas, waterways and wetlands, and woodlands closer to their homes. In addition, respondents showed a lesser level of satisfaction with neighborhood open space compared to other home purchasing option categories.





HABITAT FINDINGS

The rise of suburban sprawl as the prevalent development pattern in America has resulted in extensive fragmentation of the landscape. Fragmentation reduces the diversity of wildlife, contributes to the degradation of water resources, and impacts community character. As development occurs, elements like roads, houses, railways, parking lots and utility lines divide the natural landscape into ever-smaller pieces. Natural habitat areas are reduced in size and quality, and native plant and animal populations decline. Some of the more sensitive species disappear. Compared to the obvious damage of a filled wetland or a clear-cut forest, the effects of fragmentation are subtle.

Every type of animal or plant has certain requirements for survival. The minimum area required to provide these needs and the amount of human disturbance that can be tolerated varies widely by species. For example, a single black bear needs anywhere from 6 to 160 sq. miles for roaming and foraging, depending upon the availability of food, water, and shelter (SCDNR, 2013).

As research continues, it is becoming clear that for many types of wildlife, it's not the total acreage of habitat that counts, but how much of that habitat exists in large, undisturbed tracts. According to ecologists, large areas of continuous, unfragmented natural lands with a diversity of habitat types are needed. Experts also suggest that scattering moderate sized, 125 – 500 acre natural areas is also necessary. These smaller preserves can support species that do not require large forests in which to breed, and may even support small populations of the more sensitive species. Ideally, these smaller tracts should be as close as possible to larger tracts, contain a diversity of habitat/landscape types, and be connected to other natural areas. Isolated pockets

of natural lands are of value to the community, but to maximize ecological value it is important to connect open space wherever possible. Parcels contiguous to existing large and medium-sized tracts should be given high priority for conservation. Riverine floodplains should be targeted as these areas serve as both critical habitat and wildlife corridors for almost 70% of all vertebrate species.

While state and federal agencies, in addition to many private land holders, have protected their lands from development, many native species remain threatened by habitat fragmentation, which is the largest threat to wildlife in Horry County. Retaining the environmental, social and economic benefits of unfragmented open land requires a strategy that combines natural resource-based community planning and design, land conservation, with wise management of both developed and natural areas.

ENERGY

AIR QUALITY

Historically, air quality has not been a concern in Horry County, as there are few point sources emitting chemicals into the air. In addition, the prevailing winds coming off of the ocean disperse most point and non-point sources of air pollution. While air quality is not a major concern in Horry County, the pollution generated here only exacerbates pollution problems elsewhere. Air pollution is becoming a more significant issue in South Carolina and throughout the World. The Waccamaw Air Quality Coalition was formed to serve as a forum to discuss air quality concerns and share ideas to reduce air pollution in the tri-county region (Georgetown, Horry, Williamsburg Counties).

SCDHEC is responsible for air quality monitoring. Air monitors are operated throughout the state to measure the concentrations of pollutants in the air. Through the Clean Air Act, the USEPA set National Ambient Air Quality Standards (NAAQS) for pollutants considered harmful to public health and the environment.

The air pollution in Horry County can be divided into several types of sources. Point sources are large, fixed sources, such as industrial sites that emit pollutants from activities on the site. Area sources are also fixed sources, but they are generally small and widespread; examples are dry cleaners and gasoline refueling stations. The mobile source category of air pollution is broken into on-road and non-road sources. On-road sources refer to highway vehicles, and non-road sources refer to vehicles or equipment, such as construction equipment and recreational boats. The EPA monitors emissions in several different ways from monitoring point sources, like smoke stacks of power plants, to measuring particulate matter and ozone at selected locations to capture the overall conditions of an airshed. As of 2012, there were only two active point source emitters in the County, far fewer than 12 just a decade ago. Inevitably, the emissions from point sources have reduced over time. SCDHEC no longer operates a particulate matter monitoring station in Horry County, although one was active in Myrtle Beach from 1990-2008. During that time, area sources served as the largest source of air pollution. This trend has likely changed, as vehicular traffic has increased and point sources have decreased.

SCDHEC has also not consistently operated an ozone monitoring site in Horry County because past studies and monitoring have indicated good air quality. SCDHEC is now exploring a potential ozone monitoring site in either Horry or Brunswick County because the EPA monitoring standards have evolved and Horry County and Brunswick counties are now part of a Metropolitan Statistical Area. On-road vehicles are likely the largest contributor to ozone emissions in Horry County and other pollutants, like nitrogen dioxide, sulfur dioxide, carbon monoxide, and lead. On-road pollution can be reduced by improving the flow of traffic, reducing idling times, and reducing the total number of on-road vehicles by providing alternative transportation options.

WIND ENERGY

In order to protect air quality and reduce fossil fuel emissions, the EPA is calling for states to diversify their energy sources. Horry County has two potential renewable energy sources available to supply the state's power grid, including wind and solar energy. The South Atlantic Bight, including the Grand Strand, has been identified as a suitable location to establish off-shore wind turbines because of the available wind resource and the shallow water depths (Musial and Bam, 2010). The slope is much more gradual in waters off the Carolinas than in other areas off the Eastern Seaboard, meaning the towers can be positioned ten or more miles from beach-

Onshore Wind Testing Turbine, North Myrtle Beach Oceanfront park
Source: Aisha Khan, SCNow

es without impairing scenic views. In 2016, Bureau of Ocean Energy Management (BOEM) saw 13 environmental studies completed in support of the Renewable Energy Program along the Atlantic coast. These studies include regional surveys, modeling ocean circulation and identifying shipwrecks (Renewable Energy, 2016).

South Carolina is well situated to become an economic hub for offshore wind development. In addition, Clemson Energy Innovation Center in Charleston operates the largest wind turbine testing facility in the world (Colbert-Busch, 2012). All of these factors make Horry County a prime location to incorporate offshore wind resources into the power grid.

The North Strand Wind Coalition Wind Team was established to support the development of wind energy in the Grand Strand and within the state. Since its inception, the City of North Myrtle Beach passed a resolution in support of the development of offshore wind resources and to accommodate electric cables from offshore sites through its deepwater stormwater outfalls. Additionally, the City of North Myrtle Beach has adopted a Small Wind Energy Systems Ordinance to promote the use of small onshore wind turbines, but in a manner that does not have adverse effects on neighboring properties (Ord. No. 10-03, § 1, 4-5-10). Onshore wind turbines can already be seen among beach resort high rises in North Myrtle Beach.

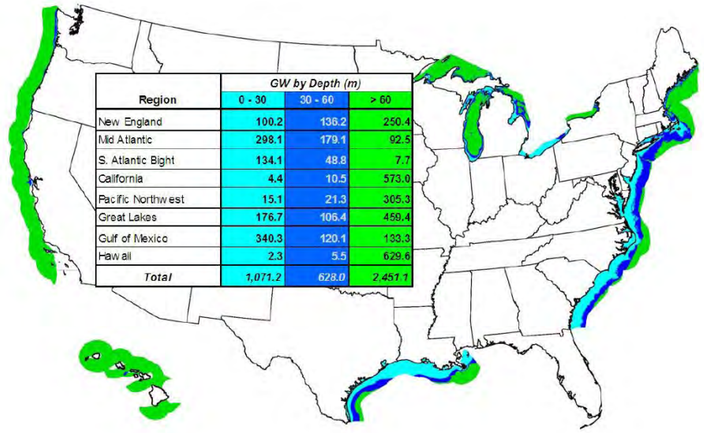
SOLAR POWER

Solar energy is also an opportunity in Horry County, whether at the single homeowner level or large scale operations. South Carolina residents can receive a 25% tax credit for the installation of solar panels. Similar credits are also available for businesses. While the use of solar power is not prevalent in Horry County, Santee Cooper is working to expand its presence through demonstration projects and has added a new incentive program for customers who install solar energy. Santee Cooper installed a grid-tied solar array, consisting of 1,350 solar panels, on its maintenance facility on 10th Avenue in Myrtle Beach (see the Community Facilities Chapter).

Many of Horry County's new schools have also been equipped with a solar array on their rooftops. Santee Cooper and the state's electric cooperatives partnered to install solar in twenty schools throughout South Carolina, calling them Green Power Solar Schools. The initiative was designed to encourage interest in the environment and demonstrate the feasibility and limitations of renewable power generation.

Solar Array on Santee Cooper Facility
Source: Santee Cooper

In 2018, Santee Cooper opened the Bell Bay Solar Farm on Highway 701. It has nearly 6,000 solar panels on 10 acres producing 2,800 megawatt hours (MWh) annually, which is enough power to run 205 households. Santee Cooper is also currently developing a solar project on a landfill wite within Myrtle Beach International Airport. The site will have over 6,00 panels on 14 acres. While large solar installations are not common in Horry County, there are many rooftops that could be equipped to provide power to the grid. Additionally, solar farms may prove to be a viable alternative for underutilized farmland in Horry County.



U.S. Offshore Wind Resources by Region and Water Depth for Annual Wind Speed Sites over 7.0 m/s
Source: Musial and Bam, 2010

OFFSHORE DRILLING

BOEM has recently opened 98% of the oil and gas resources in federal offshore areas to be considered for exploration and development. Three lease sales are in the Draft Proposal Program for the area that includes South Carolina. However, coastal communities are against this. (Groups, 2018) Even Governor Henry McMaster is advocating for an offshore 'no drill' oil exemption. (South Carolina Government, 2018) This is a battle that will continue to take place in the future.

ENERGY FINDINGS

While air quality issues resulting from coal burning power plants has not been a problem for the Grand Strand historically, growing trends in more ecologically friendly "green"

energy solutions have placed Horry County in the forefront for potential sustainable energy solutions. New innovations and continued expansions in solar and wind power are critical for Horry County, both economically and ecologically.

CONCLUSIONS

Conservation, preservation, and restoration of our natural resources is important for Horry County's future. People locate to Horry County in part due to access to the beach and natural areas. As population continues to rise, water quality, impacts of development on waterways, habitat fragmentation, natural resilience to flooding and fires, and the preservation of forestland are key issues that the County will need to address.

Containing residential development in the already suburban and urbanized areas can mitigate impact on our natural resources. In addition, encouraging permeability, Low impact development, better site design, and conservation of natural lands will allow for the protection of existing open space, water quality protection, habitat, agricultural, and culturally significant landscapes. It will also help to preserve rural character and encourage enhancements in existing public facilities and infrastructure in already densely populated areas.

By discouraging destruction of wetlands, restraining development in the floodplain, incorporating innovative flood resilient designs, and through encouraging sustainable energy solutions, Horry County can become more resilient to damages from a changing climate and rising sea level. Protection and restoration of damaged forestland, wetlands, and dune systems are critical to this resilience. Utilizing natural stormwater control is also vital in support of protection, conservation, restoration. Further enhancing the Stormwater regulations and best management practices can increase Horry County's resilience from future flooding events and the effects of sea level rise. Through innovative, thoughtful design and planning Horry County can mitigate the disturbance of our natural resources and harness these assets for their ability to enhance our economic, social, and ecological resilience.