

2.0 Coastal Natural Resources

2.1 Overview

This Section of the Coastal Stormwater Supplement (CSS) provides an introduction to some of the most valuable natural resources found in coastal Georgia (Figure 2.1) and describes the numerous ecological functions and values that they provide. These natural resources, which include both aquatic and terrestrial resources, provide habitat, food and shelter for many important resident and migratory organisms and contribute greatly to the region's natural beauty, economic well-being and quality of life.

2.2 Aquatic Resources

An introduction to some of coastal Georgia's most valuable aquatic resources, which include freshwater, estuarine, marine and groundwater resources, is provided below.

2.2.1 Freshwater Resources

Freshwater aquatic resources can be found throughout Georgia's 24-county coastal region. An introduction to these aquatic resources, which include rivers and streams and freshwater wetlands, is provided below. Each of these resources provides habitat for high priority plant and animal species (Appendix A) and are considered to be high priority habitat areas (WRD, 2005).

2.2.1.1 Rivers and Streams



Figure 2.2: Altamaha River
(Source: Georgia Department of Economic Development)

Freshwater rivers and streams drain water from the landscape as they meander from areas of higher elevation to the Atlantic Ocean. These rivers and streams, which include the Altamaha River (Figure 2.2), Ogeechee River, Satilla River, Savannah River and St. Mary's River, as well as many other smaller rivers, streams and creeks, known as tributaries, provide habitat for a diverse group of aquatic and terrestrial organisms. While fish, insects and other aquatic organisms can be found living within the rivers and streams themselves, birds, mammals and other terrestrial organisms find food and shelter in the vegetation that grows in the floodplain swamps (Section 2.2.1.2) and bottomland hardwood forests

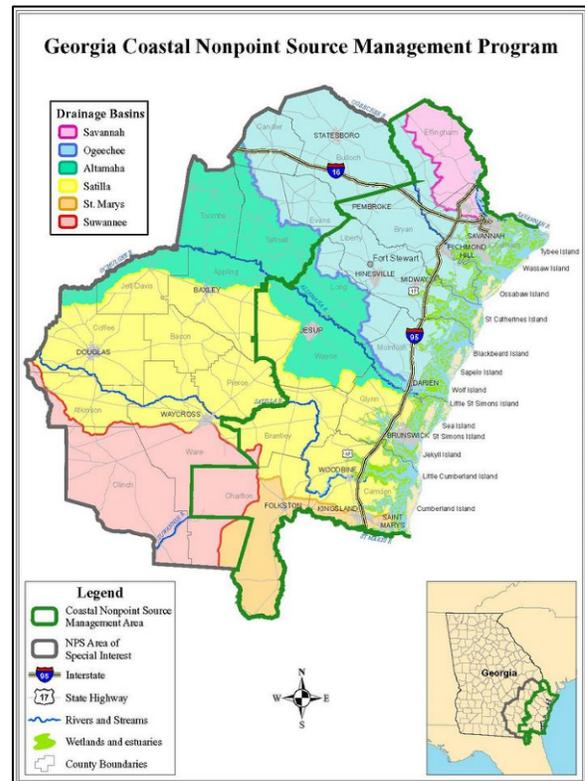


Figure 2.1: Georgia's Coastal Nonpoint Source Management Area and Area of Special Interest

(Source: Georgia Department of Natural Resources)

(Section 2.3.5) that can be found adjacent to these valuable aquatic resources. Freshwater rivers and streams also provide numerous recreational opportunities, such as boating, fishing and bird watching, and, in some situations, can be used as a water supply.

2.2.1.2 Freshwater Wetlands

Georgia's 24-county coastal region is rich in freshwater wetlands, which are areas that have hydric soils, support the growth of wetland vegetation and are either temporarily or permanently inundated or saturated by surface or groundwater (US ACOE, 1987). Freshwater wetlands, which include marshes, swamps and bogs, and are described in more detail below, provide many important ecological services and functions, including pollutant removal, flood attenuation, erosion control, groundwater recharge and wildlife habitat (Wright et al., 2006). While it is difficult to put a monetary value on these otherwise "free" ecological services, recent wetland valuation studies have estimated that freshwater wetlands and the services they provide may be worth as much as \$370,000 per acre (Heimlich et al., 1998).

Although coastal Georgia is best known for its coastal marshlands (Section 2.2.2.4), its freshwater wetlands are an extremely important natural resource. Freshwater wetlands provide a number of recreational opportunities, including hunting, fishing, canoeing and bird watching, which can generate income for communities located near or adjacent to these important aquatic resources. In fact, in 2006, Americans spent more than \$122 billion on the outdoor activities, such as hunting, fishing and bird watching, that typically occur in and around freshwater wetlands (USFWS and USCB, 2008). In Georgia alone, residents and tourists spent more than \$3.5 billion on these activities (USFWS and USCB, 2008). Freshwater wetlands also support a wide range of threatened and endangered species, and even the smallest of freshwater wetlands can support fragile amphibian populations, which are threatened globally (Houlahan et al., 2000). Because of their value and particular sensitivity to the direct impacts of the land development process (Section 3.2), high priority should be given to protecting coastal Georgia's freshwater wetlands.

Marshes

Freshwater marshes (Figure 2.3) can be found throughout coastal Georgia, particularly along freshwater rivers and streams, in poorly drained depressions, in the shallow waters located around the edges of lakes, ponds and coastal marshlands and interspersed with sand dunes on the barrier islands. They are typically dominated by emergent wetland vegetation, including cutgrass, sawgrass, pickerel weed, wild rice and other grasses, sedges, rushes and reeds. They provide habitat for a wide variety of animals, including fish, mink, otter and alligator, and are a popular roosting and nesting place for many birds. In addition to their considerable habitat value, freshwater marshes serve many important ecological functions, including pollutant removal, flood attenuation, erosion control and groundwater recharge (Wright et al., 2006).



Figure 2.3: Freshwater Marsh
(Source: Center for Watershed Protection)

Swamps

Swamps (Figure 2.4) are freshwater wetlands that are dominated by trees and other woody vegetation. They can be found throughout Georgia's 24-county coastal region, especially along the freshwater rivers, streams and creeks that meander through the landscape. They have saturated, highly organic soils, which support the growth of water tolerant trees, such as bald cypress, tupelo gum, swamp privet, water elm and swamp dogwood. While non-alluvial (i.e., blackwater) swamps are typically nutrient-poor, alluvial (i.e., brownwater) swamps are subject to overbank sediment deposition, which typically makes them more productive. Both alluvial and non-alluvial swamps provide downstream flood protection, help improve water quality by removing excess nutrients from stormwater runoff and provide food and shelter to a wide variety of aquatic and terrestrial organisms (Wright et al., 2006).



Figure 2.4: Swamp
(Source: Center for Watershed Protection)

Coastal Georgia also happens to be home to one of the largest swamps in North America, the Okefenokee Swamp (Figure 2.5). A wide variety of wildlife can be found within the swamp, including more than 200 varieties of birds, more than 60 kinds of reptiles and a number of different mammals, amphibians and fish (GHC and UGP, 2008a).



Figure 2.5: Okefenokee Swamp
(Source: Georgia Department of Economic Development)

Bogs

Bogs, also known as forested depressional wetlands, bayheads or shrub bogs, are forested wetlands that can be found scattered throughout coastal Georgia. They are typically found in poorly-drained areas and have saturated, nutrient poor soils that are comprised of a mixture of organic peat and sand. Forested depressional wetlands (Figure 2.6) are typically dominated by broad-leaved evergreen trees and shrubs, including sweetbay (magnolia), loblolly bay, white cedar, pond pine, slash pine and swamp titi, and receive all or most of their water from precipitation, rather than from stormwater runoff, groundwater or streamflow. They provide valuable habitat for a variety of plants and animals, including a number of threatened and endangered species, such as the flatwoods salamander, and help reduce flooding by retaining precipitation that would otherwise be converted to stormwater runoff.



Figure 2.6: Forested Depressional Wetland
(Source: Duke University Wetland Center)

2.2.2 Estuarine Resources

Estuaries are large, semi-enclosed bodies of water where water from freshwater rivers and streams meets and mixes with saltwater from the ocean. Estuaries are transitional areas between land and sea and are among the most productive ecosystems on earth. They provide critical habitat and nursery areas for a diverse community of aquatic organisms including sea and shore birds, fish, crabs, marine mammals, clams, mussels, marine worms and reptiles. In addition to having significant ecological value, estuaries are inexorably linked to the economic well-being of coastal Georgia and the rest of the state. Approximately 75 percent of the commercial fish species caught in the United States use the estuarine environment as habitat during at least one stage of their life (Morton, 1997). These commercial fish species, together with their recreational counterparts, support a national fishing industry that is worth an estimated \$12 billion (US EPA, 1993).

An introduction to Georgia's estuarine resources, which include tidal rivers, sounds, tidal creeks, coastal marshlands and tidal flats, is provided below. Each of these resources provides habitat for high priority plant and animal species (Appendix A) and are considered to be high priority habitat areas (WRD, 2005).

2.2.2.1 Tidal Rivers

A tidal river is a river or stream or, more commonly, a segment of a river or stream, that is influenced by the Atlantic Ocean. In coastal Georgia, the influence of the Atlantic Ocean extends nearly 60 miles inland and creates a tidal range of between 6 and 9 feet (CRD, 2007). This unusually large tidal range, and the associated tidal water volumes, velocities and turbidities, prevents submerged aquatic vegetation from growing in coastal Georgia's tidal rivers and streams. It is worth noting that submerged aquatic vegetation can be found growing in the tidal rivers of most of the other Eastern, Southeastern and Gulf states.



Figure 2.7: Shipping on the Savannah River
(Source: Georgia Department of Economic Development)

Georgia's major tidal rivers, which include the lower reaches of the Altamaha, Ogeechee, Satilla, Savannah and St. Mary's Rivers, as well as other smaller tidal rivers and streams, provide the freshwater that meets and mixes with saltwater from the Atlantic Ocean to create the estuarine environment. Although not all of Georgia's tidal rivers and streams are estuarine, those that are provide habitat for a variety of aquatic organisms, including fish, dolphins, manatees, whales, alligators, turtles, plankton, nematodes and marine worms. They also provide a number of recreational opportunities, including fishing and boating, and, in some situations, are used as commercial shipping routes (Figure 2.7).

2.2.2.2 Sounds

The tidal rivers of coastal Georgia connect with the Atlantic Ocean in large, open bodies of water known as sounds. The sounds of coastal Georgia, which include, from north to south, Wassaw Sound, Ossabaw Sound, St. Catherine's Sound, Sapelo Sound, Doboy Sound (Figure 2.8), Altamaha Sound, Buttermilk Sound, St. Simon's Sound, Jekyll Sound, St. Andrew Sound and Cumberland Sound, are found in between the coastal barrier islands and the coastal mainland.

Although the sounds are greatly influenced by the tides, many of them are protected from the full force of ocean waves, winds and storms by the barrier islands. These sheltered waters provide habitat for a diverse group of aquatic organisms including fish, turtles, dolphins, manatees, whales, shrimp and blue crabs. They also provide a number of recreational opportunities for tourists as well as residents of Georgia's 24-county coastal area.

2.2.2.3 Tidal Creeks

Tidal creeks are the small, tidally-influenced waterways that can be found meandering through the marshlands and barrier islands of coastal Georgia. These tidal creeks, which can be found along the entire length of the Georgia coast, typically begin in upland areas and work their way through the landscape (Figure 2.9) until they join another tidal creek, larger tidal river or sound. As an estuarine resource, they provide critical habitat and food for many aquatic organisms, acting as primary nursery areas for fish, shrimp, crabs and sea and shore birds. Red drum, spotted sea trout, spot, croaker, white and brown shrimp and blue crabs are just some of the economically important fish and shellfish species that spend at least some of their time in tidal creeks (Holland and Sanger, 2008). The productivity and accessibility of these tidal creeks makes them a very popular place for both commercial and recreational fishing and shellfishing.



Figure 2.8: Doboy Sound

(Source: National Oceanic and Atmospheric Administration)



Figure 2.9: Tidal Creek

(Source: Georgia Department of Natural Resources)

2.2.2.4 Coastal Marshlands



Figure 2.10: Coastal Marshlands

(Source: Center for Watershed Protection)

Almost a third of the remaining vegetated coastal marshlands found along our nation's Atlantic coastline can be found in coastal Georgia (GHC and UGP, 2008b). These expansive, low-lying, tidally influenced wetlands (Figure 2.10) can be found along the entire length of the Georgia coast, in a four to six mile wide band between the coastal barrier islands and the coastal mainland. Dominated by vast expanses of emergent salt marsh vegetation, particularly smooth cordgrass (*Spartina alterniflora*), saltmeadow cordgrass (*Spartina patens*) and black needlerush (*Juncus roemerianus*), the coastal marshlands are perhaps coastal Georgia's most visible and

valuable natural resource. They provide vital food and habitat for many terrestrial and aquatic organisms, acting as nesting sites for several species of sea and shore birds, and as nursery areas

for many important species of fish and shellfish, including red drum, spotted sea trout, spot, croaker, white and brown shrimp and blue crabs (Holland and Sanger, 2008). These and other economically important fish and shellfish species that can be found in the coastal marshlands contribute an estimated \$5 billion to the value of the national fishing and shellfishing industries (US EPA, 1993). Coastal marshlands also provide a buffer against flooding and erosion, help control and reduce pollution and provide a natural beauty that enhances property values and the quality of life in Georgia's 24-county coastal region.



Figure 2.11: Georgia's Coastal Marshlands

(Source: Sapelo Island National Estuarine Research Reserve)

Georgia's coastal marshlands, as legally defined, include all of the salt marshes, intertidal areas, tidal flats and tidal water bottoms that are found within the state's legally defined estuarine area. The coastal marshlands are considered a public resource and, in all but a few cases, are owned and managed by the state, in trust, for both current and future generations. Portions of the coastal marshlands that are not owned by the state include areas that have been granted, through unbroken chain of title, to private land owners by the King of England or the State of Georgia. Even when the public does not own them, the function and value of all of Georgia's coastal marshlands (Figure 2.11) are protected by the state's *Coastal Marshlands Protection Act*

(O.C.G.A. §12-5-280 through §12-5-297). According to the *Act*, activities within the coastal marshlands that are typically considered contrary to the public interest include the placement of fill for residential or commercial purposes, the placement of dredge spoils and the construction of private roadways.

2.2.2.5 Tidal Flats

Tidal flats (Figure 2.12), including both mud and sand flats, can be found within the coastal marshlands in areas where emergent salt marsh vegetation cannot grow. They are often formed in areas where fine sediments or sands have been deposited by tidal rivers, tidal creeks or the tides themselves, and prevent the growth of emergent salt marsh vegetation. Despite the absence of vegetation, tidal flats are often recognized for their high productivity and abundant wildlife populations. Large populations of plankton, snails, oysters, clams and worms are often found within tidal flats and many species of fish and sea and shore birds, including plovers, sandpipers and dowitchers, migrate into them with the tides to feed. Since they provide habitat for many species of shellfish, they are also popular place for both commercial and recreational shellfishing.



Figure 2.12: Tidal Flat

(Source: Hugh and Carol Nourse)

2.2.2.6 Scrub-Shrub Wetlands

Scrub-shrub wetlands (Figure 2.13) can be found along the Georgia coast, near the shoreward reaches of the coastal marshlands. Although they are typically dominated by groundsel tree, marsh elder, yaupon holly, wax myrtle, Florida privet and false willow, they may also contain wind-pruned red cedar. These unique estuarine wetlands, which are infrequently flooded by tidal action, provide habitat for a variety of aquatic and terrestrial organisms and often form an ecotone between the estuarine and terrestrial environments.



Figure 2.13: Scrub-Shrub Wetland
(Source: National Oceanic and Atmospheric Administration)

2.2.3 Marine Resources

The marine environment extends from the seaward edge of the estuarine environment to the outer edge of the continental shelf. Unlike the estuarine environment, it is completely exposed to the full force of ocean waves, winds and storms and, except in areas immediately adjacent to the mouths of large rivers and streams, is not influenced by freshwater to any great extent. Although not as biologically productive as the estuarine environment, the marine environment does have a level of productivity that is higher than that of the open ocean and provides habitat for a number of aquatic and terrestrial organisms. An introduction to the marine resources of coastal Georgia, which include near coastal waters and beaches, is provided below.



Figure 2.14: Sapelo Island and the Near Coastal Waters of the Atlantic Ocean
(Source: Georgia Department of Economic Development)

2.2.3.1 Near Coastal Waters

The near coastal waters of the Atlantic Ocean (Figure 2.14) provide habitat for a number of fish, turtles and marine mammals, including bottlenose dolphins, manatees, North Atlantic right whales and loggerhead, green and leatherback turtles. They also provide habitat for many commercially important species of fish and shellfish, including penaid shrimp, blue crab, star drum, spot and croaker. As a result, they are a popular place for both commercial and recreational fishing.



Figure 2.15: Beach on Jekyll Island
(Source: Georgia Department of Economic Development)

2.2.3.2 Beaches

The estuarine environment meets the marine environment along the sandy beaches of the coastal barrier islands, which can be found along the entire length of the Georgia coast between the open ocean and the coastal mainland.

Georgia's barrier islands include, from north to south, Tybee Island, Little Tybee Island, Wassaw Island, Ossabaw Island, St. Catherine's Island, Blackbeard Island, Sapelo Island, Wolf Island, Little St. Simon's Island, St. Simon's Island, Sea Island, Jekyll Island, which is a State Park, and Cumberland Island, which is the largest barrier island in the United States. Stretches of sandy beach (Figure 2.15) along these barrier islands provide numerous recreational opportunities, such as boating, fishing, swimming, walking, beachcombing, bird-watching and sunbathing. Due to the recreational opportunities they provide, a number of them have become popular tourist destinations and, as a result, valuable economic resources (e.g., Tybee Island, Jekyll Island). Beaches also provide habitat for a variety of plants and animals, including turtles, soft-shelled clams, crabs and worms. Sea and shore birds feed extensively on beaches and over 75 percent of migratory waterfowl live on or depend on beaches for food or shelter during at least one stage of their lives (US EPA, 1998).

2.2.4 Groundwater Resources

Groundwater resources can be found throughout Georgia's 24-county coastal region. An introduction to these aquatic resources, which include groundwater aquifers, is provided below.

2.2.4.1 Groundwater Aquifers

Since the 1880s, groundwater aquifers have served as the principal source of water for coastal Georgia. Much of this water comes from the Upper Floridan aquifer, which is an extremely permeable and high-yielding confined aquifer system that underlies an area of about 100,000 square miles beneath southeast Georgia, southwest South Carolina, southeast Alabama and Florida (Figure 2.16) (Priest, 2004). Because of the amount of groundwater that it yields, the Floridan aquifer system is often recognized as one of the most productive aquifers in the world.

The distance between the surface and the top of the Floridan aquifer ranges from less than 150 feet in coastal South Carolina to more than 1,400 feet in southeastern Georgia (i.e., Glynn and Camden Counties). Between the surface and the top of the Floridan aquifer system lies the confined Brunswick aquifer system and the unconfined shallow surficial aquifer system. Although the shallow surficial aquifer system does not supply much potable water in coastal Georgia, it does help maintain valuable baseflow within the region's rivers, streams and other aquatic resources.



Figure 2.16: Floridan Aquifer System
(Source: U.S. Geological Survey)

2.3 Terrestrial Resources

An introduction to some of coastal Georgia's most valuable terrestrial resources, which include dunes, maritime forests, marsh hammocks, evergreen hammocks, canebrakes, bottomland hardwood forests, beech-magnolia forests, pine flatwoods, longleaf pine-wiregrass savannas and longleaf pine-scrub oak woodlands, is provided below. While some of these resources are transitional areas between water and land (e.g., canebrakes, bottomland hardwood forests),

each provides habitat for high priority plant and animal species (Appendix A) and are all considered to be high priority habitat areas (WRD, 2005).

2.3.1 Dunes

Dunes are found just inland of the beaches on the coastal barrier islands. They form ridgelines on the ocean side of the barrier islands, which provide effective protection to the estuarine environment and coastal mainland against the damaging effects of floods, winds, tides and erosion. Along with beaches, sand bars and shoals, they are part of Georgia's sand sharing system and are protected by the state's *Shore Protection Act* (O.C.G.A. §12-5-230 through §12-5-248).



Figure 2.17: Dunes on Cumberland Island
(Source: Georgia Department of Economic Development)

Dunes (Figure 2.17), and their associated ridges, flats and swales, also provide habitat for a number of important plants and animals, including several rare and endangered species. For example, high densities of eastern diamondback rattlesnakes can be found in inter-dune flats and swales that are densely vegetated with bunch grasses and other herbaceous vegetation. These areas provide ideal habitat for this important species, and are abundant on a number of the state's barrier islands, including Little St. Simon's Island and Blackbeard Island (Means, Personal Communication). On Cumberland Island, nearly 10,000 acres of land, which provides valuable habitat not only for the eastern diamondback rattlesnake but also for other important aquatic and terrestrial organisms, are protected as part of the National Wilderness Preservation System (Wilderness Institute, 2008).

2.3.2 Maritime Forests



Figure 2.18: Maritime Forest
(Source: Smithsonian Marine Station)

The largest remaining stands of maritime forest that are found along our nation's Atlantic coastline can be found in coastal Georgia (Ambrose, Personal Communication). These maritime forests can be found covering the more stable portions of the sandy ridges, flats and swales of the coastal barrier islands. They are typically dominated by live oak, palmetto and other broad-leaved evergreen trees and shrubs (Figure 2.18). The organisms that live within a maritime forest are particularly well adapted to the unique characteristics (e.g., limited freshwater availability, periodic seawater inundation, wind damage, dune migration) of these valuable, but endangered terrestrial resources. Maritime forests

help maintain valuable groundwater recharge, help stabilize soils and provide important habitat for wading birds, including the federally endangered wood stork, neotropical migratory birds, diamondback terrapins and other wildlife.

2.3.3 Marsh Hammocks

Marsh hammocks (Figure 2.19), also known as back barrier islands, are small islands of upland habitat located within the coastal marshlands. Ranging from less than an acre to more than 1,000 acres in size, they are the only dry land that can be found within the coastal marshlands. Over the years, the state's Coastal Marshlands Protection Committee, which was created by the *Coastal Marshlands Protection Act* (O.C.G.A. §12-5-280 through §12-5-297), has received numerous applications from land owners and developers who would like to build bridges to these back barrier islands in order to develop them. Historically, the Committee has granted many of these permit applications. Recently, however, the number of permit applications has increased. As a result, many coastal Georgians have become concerned that the continued development of these hammocks, which support the growth of maritime forests (Section 2.3.2) and provide habitat for migrant neotropical birds and a variety of other plants and animals, including a number of important rare, threatened and endangered species, such as the wood stork, painted bunting, silver buckthorn and Florida privet, will have a negative impact on the ecology and overall environmental health of the region.



Figure 2.19: Marsh Hammock
(Source: Coastal Georgia Research Council)

2.3.4 Evergreen Hammocks

Evergreen hammocks are small, isolated areas of upland habitat typically found within alluvial (i.e., brownwater) floodplains and freshwater depressional wetlands (Section 2.2.1.2). Evergreen hammocks provide habitat for a variety of trees and other woody vegetation, including sub-mesic oak and hickory species, as well as southern magnolia, American holly, ironwood, flowering dogwood and spruce pine. Because of their topographic setting and tendency to retain moisture, they provide relatively fire-resistant habitat for a variety of terrestrial organisms.

2.3.5 Canebrakes

Canebrakes (Figure 2.20) can be found throughout coastal Georgia, particularly along the freshwater rivers, streams and creeks that can be found meandering through the landscape. These dense thickets of native river cane (*Arundinaria gigantea*) provide important habitat for a variety insects and migratory neotropical birds, including the Swainson's Warbler. Canebrakes are fire-dependent, meaning that they require periodic burning or other forms of disturbance to prevent them from becoming overgrown by larger, woody shrubs and hardwood tree species.



Figure 2.20: Canebrake
(Source: J. Michael Myers, U.S. Geological Survey)

2.3.6 Bottomland Hardwood Forests

Bottomland hardwood forests (Figure 2.21) can be found on the natural levees and floodplains surrounding coastal Georgia's freshwater rivers and streams. Bottomland hardwood forests that are found on the lower levels of these floodplains are frequently flooded, and are typically classified as swamps or freshwater wetlands (Section 2.2.1.2), while bottomland hardwood forests that are found on the upper levels of these floodplains are typically dry and are rarely inundated. Consequently, bottomland hardwood forests are transitional areas between water and land, and include areas that are considered to be jurisdictional wetlands, as well as those that are not.



Figure 2.21: Bottomland Hardwood Forest
(Source: S.J. Baskauf)

Bottomland hardwood forests contain a wide variety of species but are typically dominated by mesic (i.e., moist) and hydric (i.e., wet) species such as oak, green ash, sweetgum, red maple and water hickory. These diverse and expansive forest communities provide valuable habitat for a wide variety of organisms, and are especially important to those species adapted to life within the dark interior of these and other hardwood forest communities.

2.3.7 Beech-Magnolia Forests

Beech-magnolia forests are relatively rare hardwood forest communities that are often found near hillside seeps, which provide groundwater input for freshwater wetlands, on the bluffs and gentle slopes surrounding coastal Georgia's freshwater rivers and streams. Due to their unique topographic setting and ability to retain moisture, beech-magnolia forests tend to have a unique ability to resist fire. This is perhaps the biggest difference between beech-magnolia forests and their adjacent upland counterparts. In addition to American beech and southern magnolia, beech-magnolia forests may contain water oak, water hickory, American holly and other fire-tolerant hardwood species. Threatened and endangered species, such as the green-fly orchid (Figure 2.22), may also be found in these unique hardwood forests.



Figure 2.22: Green-Fly Orchid
(Source: David R. McAdoo)

2.3.8 Pine Flatwoods

Pine flatwoods are mesic (i.e., moist) or hydric (i.e., wet) forests that can be found covering the flat, poorly-drained areas of the 24-county coastal region. While most of the "wetter" pine flatwoods are considered to be jurisdictional wetlands, some of the better-drained pine flatwoods are not. While the "wetness" of a pine flatwood varies according to local topography and seasonal rainfall, the soils found within these forest communities typically stay saturated for much of the year. In particularly low-lying areas, water may be visible on the surface of a pine

flatwood year round; at higher elevations, little or no surface water may be visible throughout the year.

Historically, pine flatwoods were dominated by longleaf pine; now they are typically dominated by slash pine, loblolly pine or pond pine. Although they are dominated by these pine species, pine flatwoods also contain palmetto, wax myrtle, gallberry, lowbush blueberry and other woody shrub species. These expansive and diverse forest communities provide valuable habitat for a wide variety of terrestrial organisms, including a number of threatened and endangered species, such as the flatwoods salamander (Figure 2.23), which appears on both the state and federal protected species lists.

2.3.9 Longleaf Pine-Wiregrass Savannas

Longleaf pine-wiregrass savannas (Figure 2.24) are characterized by their sparse canopy, which consists primarily of longleaf (Figure 2.25) or slash pine, and well-developed understory, which is typically dominated by wiregrass and other grasses and herbs. Longleaf pine-wiregrass savannas can be either mesic (i.e., moist) or xeric (i.e., dry), or somewhere in between, depending on local topography and soil types. Pine flatwoods (Section 2.3.8) and freshwater depressional wetlands (Section 2.2.1.2), are often



Figure 2.25: Longleaf Pine
(Source: W. Cook)

found within the low-lying areas located in and adjacent to these unique forest communities.

Longleaf pine-wiregrass savannas are fire-dependent, meaning that they require regular burning to prevent them from becoming overgrown by larger, woody shrubs and hardwood tree species. If fire is suppressed within a longleaf pine-wiregrass savanna for a long period of time, less fire-tolerant woody tree and shrub species will begin to move in, which dramatically reduces overall biological diversity.

Today, more than 30 threatened and endangered plant and animal species, including the Eastern Indigo snake, red-cockaded woodpecker, flatwoods salamander, hairy rattleweed and gopher tortoise, can be found living within these longleaf pine-wiregrass savannas. In addition to these threatened and endangered species, a number of other important organisms are known to inhabit these valuable terrestrial resources, including more than 1,200 species of vascular plants and 225 species of birds, mammals, reptiles and amphibians.



Figure 2.23: Flatwoods Salamander
(Source: Fort Stewart)



Figure 2.24: Longleaf Pine-Wiregrass Savanna
(Source: M. Aresco)

2.3.10 Longleaf Pine-Scrub Oak Woodlands

Longleaf pine-scrub oak woodlands are characterized by their sparse canopy, which consists primarily of longleaf pine (Figure 2.25), and patchy oak understory, which is comprised primarily of turkey oak, sand post oak, bluejack oak, blackjack oak and other scrub oak species. These unique forest communities are typically found on ridges and bluffs with deep, sandy soils and on the upper reaches of the gentle slopes surrounding coastal Georgia's freshwater rivers and streams. Longleaf pine-scrub oak woodlands typically have a fairly diverse groundcover layer consisting of grasses, forbs and scrubs that are able to survive on a very limited water supply.

2.4 Other Resources

An introduction to some of coastal Georgia's other important natural resources, which include shellfish harvesting areas, aquatic buffers and floodplains, is provided below. It is important to note that, unlike the aquatic and terrestrial resources described earlier in this Section, the natural resources described below do not represent discrete habitat areas or geographical units. Instead, they represent areas where one or more aquatic and/or terrestrial resources combine to provide special ecosystem services that contribute greatly to coastal Georgia's natural beauty, economic well-being and quality of life.

2.4.1 Shellfish Harvesting Areas

Coastal Georgia's sounds, coastal marshlands, tidal flats and other estuarine resources provide food and habitat for many important species of shellfish, including oysters and clams. Although the productivity and accessibility of these estuarine resources makes them a popular place for both commercial and recreational shellfishing, state law (O.C.G.A. §27-4-190 through §27-4-201) prohibits shellfish from being taken anywhere outside of "open" shellfish harvesting areas (Figure 2.26). All other areas are considered to be "closed" to shellfish harvesting, which makes the shellfish harvesting areas that are open to commercial and recreational shellfishing even more important to the economy of the 24-county coastal region and that of the entire state.

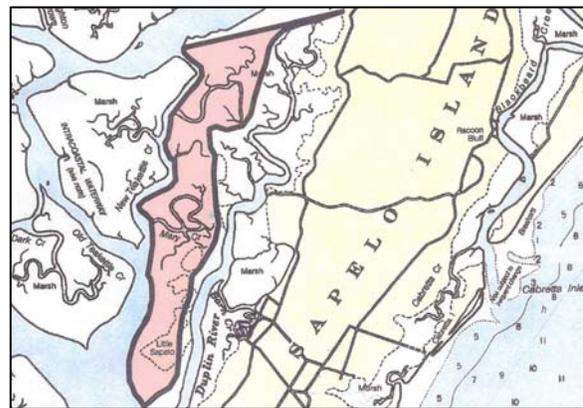


Figure 2.26: "Open" Shellfish Harvesting Area
(Source: Georgia Department of Natural Resources)



Figure 2.27: Freshwater Stream and Adjacent Aquatic Buffer
(Source: Merrill et al., 2006)

2.4.2 Aquatic Buffers

Aquatic buffers (Figure 2.27) are undisturbed natural areas that can be found immediately adjacent to coastal Georgia's rivers and streams, tidal creeks, coastal marshlands and other aquatic resources. Although aquatic buffers function primarily to preserve the integrity of streams, wetlands and other aquatic resources and protect them from the direct impacts of the land development process, they also provide a number of other important ecological services and functions, including pollutant removal, erosion control and conveyance and temporary

storage of flood flows. In an undisturbed state, aquatic buffers create an ecotone between the aquatic and terrestrial environments, and provide important habitat for both aquatic and terrestrial organisms.

2.4.3 Floodplains

Floodplains (Figure 2.28) are flat or relatively flat areas that can be found adjacent to coastal Georgia's rivers and streams, tidal creeks, coastal marshlands and other aquatic resources. They are defined by topography, hydrology and stream geomorphology. When a river, stream or other aquatic resource overtops its banks, its floodplain provides conveyance and temporary storage of the resulting flood flows. In an undisturbed state, floodplains help attenuate these damaging flood flows by conveying them through the dense vegetation that can be found growing within the freshwater wetlands (Section 2.2.1.2), scrub-shrub wetlands (Section 2.2.2.6), bottomland hardwood forests (Section 2.3.6) and other vegetative communities that are associated with them. Although floodplains function primarily to provide flood control, they also provide a number of other important ecological services and functions, including pollutant removal, erosion control, groundwater recharge and wildlife habitat.



Figure 2.28: Tidal Creek and Adjacent Floodplain

(Source: Center for Watershed Protection)

2.5 Summary

As documented above, a variety of valuable aquatic and terrestrial resources can be found within Georgia's 24-county coastal region. These natural resources provide habitat, food and shelter for many important aquatic and terrestrial organisms and contribute greatly to the region's natural beauty, economic well-being and quality of life. The next section of the CSS describes the direct and indirect impacts that the land development process can have on these natural resources and why an integrated approach to natural resource protection, stormwater management and site design is needed to help control and minimize these impacts.

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