South Carolina
Wetland Resources

South Carolina has about 4.6 million acres of wetlands, accounting for about 23.4 percent of the surface area of the State (Dahl, 1990). Only two other States, Florida and Louisiana, have a higher percentage of land area as wetlands. Freshwater forested wetlands (fig. 1) are the most common type of wetland in South Carolina.

The benefits of South Carolina's wetlands include enhanced water quality, fish and wildlife productivity, and socioeconomic values. Wetlands enhance water quality by intercepting upland runoff and filtering out nutrients, wastes, and sediment. Fish and wildlife benefit from the abundance of habitat and food that wetlands provide. For example, South Carolina wetlands serve as wintering areas for migrating waterfowl, supporting greater than 30 percent each of American green-winged teal, northern shovelers, mallards, northern pintails, American wigeon, and gadwall that traverse the Atlantic Flyway (Gordon and others, 1989). Socioeconomic values of wetlands include flood protection, erosion control, and groundwater recharge as well as opportunities for hunting, fishing, tourism, and other recreational activities that are economically important to the State.

TYPES AND DISTRIBUTION

Wetlands are lands transitional between terrestrial and deepwater habitats where the water table usually is at or near the land surface or the land is covered by shallow water (Cowardin and others, 1979). The distribution of wetlands and deepwater habitats in South Carolina is shown in figure 2*A*; only wetlands are discussed herein.

Wetlands can be vegetated or nonvegetated and are classified on the basis of their hydrology, vegetation, and substrate. In this summary, wetlands are classified according to the system proposed by Cowardin and others (1979), which is used by the U.S. Fish and Wildlife Service (FWS) to map and inventory the Nation's wetlands. At the most general level of the classification system, wetlands are grouped into five ecological systems: Palustrine, Lacustrine, Riverine, Estuarine, and Marine. The Palustrine System includes only wetlands, whereas the other systems comprise wetlands and deepwater habitats. Wetlands of the systems that occur in South Carolina are described below.

Figure 1. A freshwater forested wetland at the upper end of Lake Marion in South Carolina.

System	Wetland description
Palustrine	Nontidal and tidal-freshwater wetlands in which vegetation is predominantly trees (forested wetlands); shrubs (scrub-shrub wetlands); persistent or nonpersistent emergent, erect, rooted herbaceous plants (persistent- and nonpersistent-*emergent wetlands); or submersed and (or)* floating plants (aquatic beds). Also, intermittently to permanently flooded open-water bodies of less than 20 acres in which water is less than 6.6 feet deep.
Lacustrine	Nontidal and tidal-freshwater wetlands within an intermittently to permanently flooded lake or reservoir larger than 20 acres and (or) deeper than 6.6 feet. Vegetation, when present, is predominantly nonpersistent emergent plants (nonpersistent-emergent wetlands), or submersed and (or) floating plants (aquatic beds), or both.
Riverine	Nontidal and tidal-freshwater wetlands within a channel. Vegetation, when present, is same as in the Lacustrine System.
Estuarine	Tidal wetlands in low-wave-energy environments where the salinity of the water is greater than 0.5 part per thousand (ppt) and is variable owing to evaporation and the mixing of seawater and freshwater.
Marine	Tidal wetlands that are exposed to waves and currents of the open ocean and to water having a salinity greater than 30 ppt.

Ninety percent of South Carolina's wetlands are freshwater (palustrine, lacustrine, and riverine) wetlands and occur primarily in the Coastal Plain and the flood plains of rivers and streams in the Blue Ridge and Piedmont Provinces (fig. 2*A* and 2*B*). Palustrine forested wetlands encompass 3.7 million acres in South Carolina and constitute 80 percent of the wetlands in the State. Palustrine wetlands include areas commonly referred to as wet pine flatwoods, pocosins, Carolina bays, beaver ponds, bottom-land hardwood forests, swamps, and tidal-freshwater marshes.

Wet pine flatwoods (forested wetlands) are extensive flat areas that have a shallow water table and are dominated by pine (longleaf, loblolly, slash, and pond). These wetlands occur primarily in the Coastal Plain. Although acreage estimates are not available, extensive tracts of wet pine flatwoods occur in the Francis Marion National Forest.

Pocosins (scrub-shrub wetlands) are wetlands vegetated by evergreen shrubs or low-growing trees, such as sweet bay or pond pine. However, vegetation in severely burned pocosins may be dominated by herbaceous plants. The word pocosin is derived from an Indian word meaning low marshy ground or swamp. South Carolina pocosins can be found throughout the Coastal Plain.

Carolina bay wetlands are isolated freshwater wetlands formed in elliptical depressions. Because of their variability in size, depth, and substrate conditions, Carolina bays support plant communities ranging from grass-sedge prairies (emergent wetlands) to cypress-gum swamps (forested wetlands). Carolina bays are scattered throughout the Coastal Plain. The State Heritage Trust Program has identified 2,651 Carolina bays that are 2 acres or larger (Bennett and Nelson, 1991).

Beaver ponds are freshwater forested, scrub-shrub or emergent wetlands typically associated with river flood plains and can be found throughout the State. As beavers impound a stream and flood a bottom-land area, many of the trees are killed, thus opening the

canopy and allowing for growth of herbaceous vegetation. Plant communities associated with South Carolina beaver-pond wetlands include water oak, sweet gum, red maple, buttonbush, and rice cutgrass. The structure of the plant community is influenced by factors such as the age, topography, and substrate soil characteristics of the pond. Arner and Hepp (1989) reported that a 1976 survey revealed that beavers have created an estimated 4,400 acres of wetlands in South Carolina.

Bottom-land hardwood forests and swamps are woody communities that are found primarily on alluvial flood plains. These wetlands, found along the rivers of South Carolina, occur in the Piedmont Province and Coastal Plain. Bottom-land hardwood forests support a variety of tree species including oaks, ashes, maples, hackberries, cypress, and tupelo. The presence of extensive wetlands along a 45-mile segment of the Congaree River has resulted in consideration of the Congaree River for the State Scenic Rivers Program. Within this section of the Congaree River flood plain is the Congaree Swamp National Monument, a 15,000-acre wetland that contains one of the few remaining tracts of old-growth bottom-land hardwoods. The Sumter National Forest in the upper Savannah River Basin contains about 1,500 acres of bottom-land hardwood-forest wetlands, and the U.S. Department of Energy's Savannah River Site contains approximately 34,500 acres of bottom-land hardwood-forest wetlands (Bebber, 1988).

Tidal-freshwater marshes (emergent wetlands) occur along South Carolina's coast, where they are tidally influenced, but freshwater input from precipitation and rivers prevents significant saltwater intrusion from the ocean. Dominant plants in tidal-freshwater marshes include yellow pond lily, arrowheads, and sedges. There are an estimated 46,300 acres of tidal-freshwater marshes in South Carolina (Field and others, 1991), mostly occurring along the Santee River and the rivers that form Winyah Bay (the Sampit, Black, Pee Dee, and Waccamaw), Charleston Harbor (the Cooper and Ashley), and Saint Helena Sound (the Ashepoo, Edisto, and Combahee).

Lacustrine wetlands include the shallows of permanently flooded lakes and reservoirs and intermittent lakes. Common lacustrine wetland plants include American lotus, pickerelweed, duckweed, arrowheads, and sedges. Lacustrine wetlands occur throughout the State, most notably along major reservoirs and in association with ephemeral lakes such as Carolina bays. Along the shores of Lake Marion is the Santee National Wildlife Refuge, a 15,000-acre wetland used by migrating waterfowl.

The Riverine and Marine Systems contain mostly deepwater habitat. Riverine wetlands are limited to shallow freshwater river and stream channels or, in the case of deep rivers, to shallow areas near the bank. South Carolina riverine wetlands can contain floating aquatic plants, such as water lily and nonpersistent emergent plants such as pickerelweed. The Marine System is limited to the

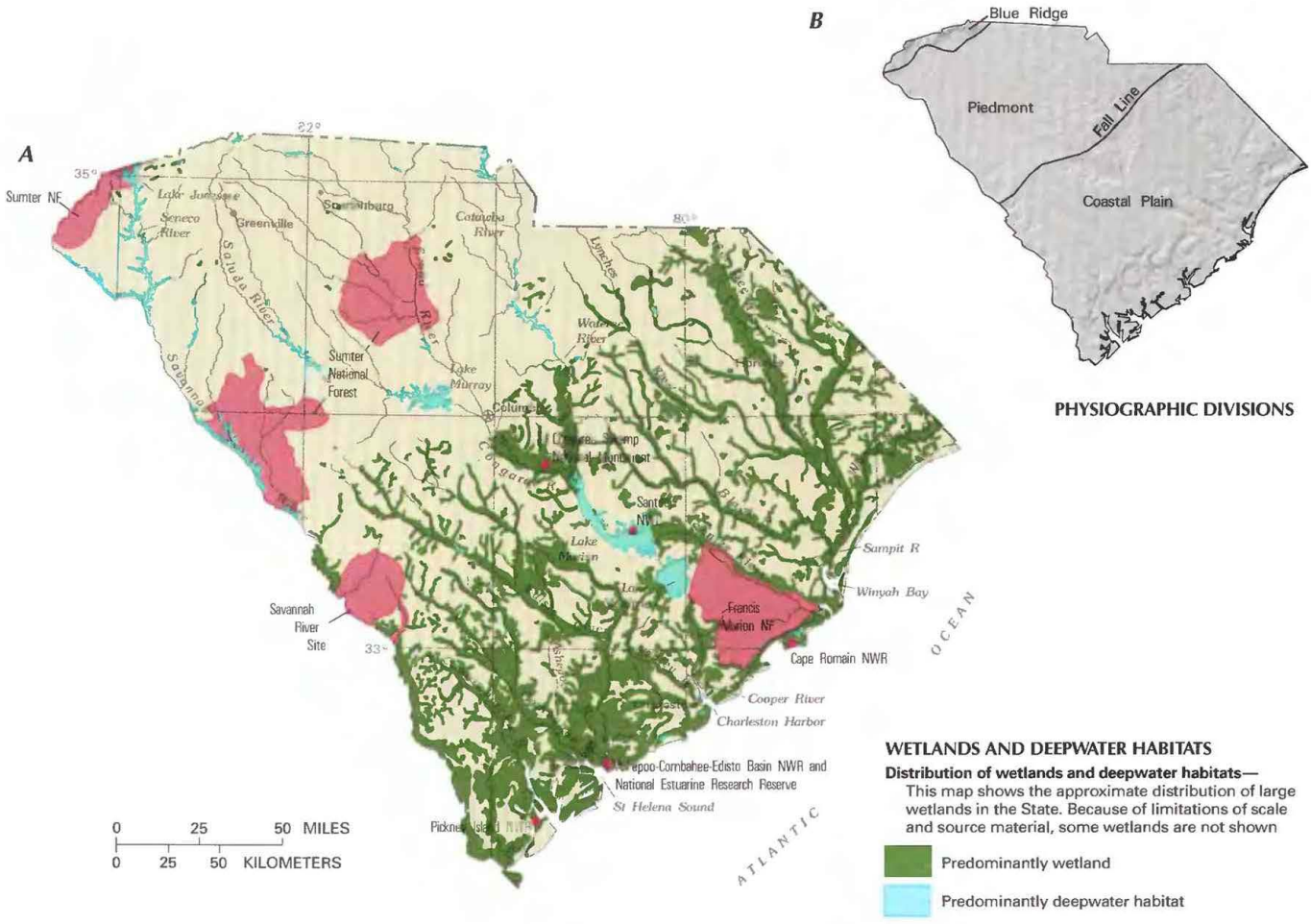

Figure 2. Wetland distribution in South Carolina and physiography of the State. ***A***, Distribution of wetlands and deepwater habitats. ***B***, Physiography. *(Sources: A, T.E. Dahl, U.S. Fish and Wildlife Service, unpub. data, 1991. B, Physiographic divisions from Fenneman, 1946; landforms data from EROS Data Center.)*

open ocean overlying the continental shelf and its associated coastline.

Estuarine wetlands include intertidal flats and irregularly and regularly tidally flooded salt marshes dominated by emergent vegetation such as saltmeadow cordgrass, black needlerush, and smooth cordgrass. Intertidal flats are generally devoid of vegetation as a result of unstable sand or mud sediments that are regularly exposed and flooded by tides. There are about 32,000 acres of intertidal flats and 366,000 acres of salt-marsh wetlands in South Carolina (Field and others, 1991). The Cape Romain National Wildlife Refuge, a 64,000-acre salt-marsh wetland, is located near the mouth of the Santee River. At the mouth of the Coosawhatchie River is Pickney Island National Wildlife Refuge, a 4,053-acre expanse of salt-marsh wetlands. Nearby are the Ashepoo–Combahee–Edisto Basin National Wildlife Refuge (18,000 acres of salt marsh), and the 144,000-acre Ashepoo–Combahee–Edisto National Estuarine Research Reserve.

HYDROLOGIC SETTING

Wetlands generally develop where the land surface is relatively flat and the water table is shallow. Most of South Carolina's wetlands occur in the Coastal Plain where alluvial, marginal-marine, and marine sediments have been deposited and sometimes reworked in lowland flats or upland depressions. Coastal Plain deposits consist of consolidated and unconsolidated sediments of continental and marine origin that range in thickness from a few feet at the Fall Line to more than 4,000 feet at the southern tip of the State. The gently rolling hills of the Piedmont Province and the mountains of the Blue Ridge Province are underlain by metamorphosed sedimentary, volcanic, and igneous rocks. Where hydric soils occur in the Blue Ridge and Piedmont Provinces, they are commonly overlain by 2 to 5 feet of loam and clay as a result of erosion from agricultural areas (Larry Robinson, Natural Resources Conservation Service, oral commun., 1993). Thus, identification of wetlands in the Blue Ridge and Piedmont Provinces based on the presence of hydric soils has been difficult.

The State's moist climate produces ample precipitation, which finds its way to the wetlands by way of overland runoff, periodic flooding by rivers, and ground-water discharge. Average annual precipitation is 80 inches in the Blue Ridge Province, decreasing to approximately 48 inches in the Piedmont Province and most of the Coastal Plain, and then increasing to about 50 inches near the coast (Purvis and others, 1990). Rainfall is greatest during spring and summer and least in fall. Average annual runoff ranges from 10 inches in the Coastal Plain Province to about 50 inches in the Blue Ridge Province. Annual potential evapotranspiration ranges from about 30 inches in the Blue Ridge Province to about 47 inches in the Coastal Plain. Most evaporation occurs during summer (about 3 to 5 inches per month) and the least occurs during winter (about 1 inch per month).

Pocosins and Carolina bays are examples of isolated wetlands that characteristically have no tributary streams, are not spring fed, and rely on direct precipitation and overland runoff to maintain water volume (Sharitz and Gibbons, 1982). Ground-water recharge has been suggested as an additional source in some situations (Schalles and Shure, 1989). Pocosins are typically characterized by poorly drained mineral soils and peats. Carolina bays, generally found in sandy terrain but typically having a clay layer, are aligned in a northwest-southeast direction.

The structure and function of South Carolina's bottom-land hardwood-forest wetlands are determined primarily by the hydrologic regime of the State's large rivers (Patterson and others, 1985). The principal river basins in South Carolina—the Pee Dee, Santee, Edisto, and Savannah—contain rivers that flow eastward through the Coastal Plain to the sea. They have broad flood plains that are flooded for several months during the winter and during storms. Near the coast, daily tides back up freshwater onto these flood plains. Bottom-land hardwood forests dominated by trees that are tolerant of a long dormant season and occasional flooding during the growing season are particularly well developed on these wide flood plains.

As the rivers flow into the sea, freshwater riverine flow mixes with daily tidal influxes from the ocean. The hydrology of the mixing area is poorly understood. However, a combination of factors including freshwater input, tidal influx, and wind direction and velocity create an environment suitable for tidal-freshwater wetlands.

The flood plains near the mouths of these large rivers and the bays behind the barrier island provide protection from destructive waves and storms. These protected areas allow for the accretion of clay and silt sediments and the establishment of vegetation. The extensive estuarine wetlands of South Carolina are formed and maintained by incursions of brackish water over these sediments.

TRENDS

Wetland losses in South Carolina have occurred as a result of both natural and human influences. Natural factors have included sea-level rise, natural succession, erosion and accretion, animal activity, droughts, and major storms. Human factors have included draining and clearing wetlands for agriculture, pond and reservoir construction, urban development, coastal impoundment construction, and pollution. Wetland loss in South Carolina from the 1780's to 1980's has been estimated to be 27 percent (Dahl, 1990). During the period from 1974 through 1983 alone, South Carolina had an estimated wetland loss of about 1.3 percent, approximately 61,000 acres of wetlands (John Hefner, U.S. Fish and Wildlife Service, oral commun., 1993).

Freshwater-wetland losses in South Carolina are not well documented but appear to be less extensive than in some other Southeastern States. However, studies conducted by the South Carolina Heritage Trust Program indicated that Carolina bay wetlands have been extensively disturbed and altered. Of the 2,651 Carolina bays that are 2 acres or larger identified by the State Heritage Trust Program in 1983 (Bennett and Nelson, 1991), more than 80 percent have been significantly altered and degraded. Many of South Carolina's tidal-freshwater marshes were diked, impounded, and converted to rice fields during the 18th and 19th centuries. Estimates of changes in wetland areas as a result of Hurricane Hugo are difficult to determine, but as much as 90 percent of the wet pine flatwoods of the Francis Marion National Forest may have been damaged by the wind.

Loss of freshwater wetlands has also been caused by changes in the hydrologic regime of South Carolina rivers. Alteration of the normal hydrologic regime by construction of dams on the upper Savannah, Santee, and Pee Dee Rivers has changed the natural pattern of annual flooding and has directly affected forested-wetland regeneration in South Carolina wetlands. Conversely, beaver-pond wetlands are thought to be increasing in South Carolina, though information on changes in beaver-pond wetland acreage is limited (Arner and Hepp, 1989).

CONSERVATION

Many government agencies and private organizations participate in wetland conservation in South Carolina. The most active agencies and organizations and some of their activities are listed in table 1.

Federal wetland activities.—Development activities in South Carolina wetlands are regulated by several Federal statutory prohibitions and incentives that are intended to slow wetland losses. Some

of the more important of these are contained in the 1899 Rivers and Harbors Act; the 1972 Clean Water Act and amendments; the 1985 Food Security Act; the 1990 Food, Agriculture, Conservation, and Trade Act; the 1986 Emergency Wetlands Resources Act; and the 1972 Coastal Management Act.

Section 10 of the Rivers and Harbors Act gives the U.S. Army Corps of Engineers (Corps) authority to regulate certain activities in navigable waters. Regulated activities include diking, deepening, filling, excavating, and placing of structures. The related section 404 of the Clean Water Act is the most often-used Federal legislation protecting wetlands. Under section 404 provisions, the Corps issues permits regulating the discharge of dredged or fill material into wetlands. Permits are subject to review and possible veto by the U.S. Environmental Protection Agency, and the FWS has review and advisory roles. Section 401 of the Clean Water Act grants to States and eligible Indian Tribes the authority to approve, apply conditions to, or deny section 404 permit applications on the basis of a proposed activity's probable effects on the water quality of a wetland.

Most farming, ranching, and silviculture activities are not subject to section 404 regulation. However, the "Swampbuster" provision of the 1985 Food Security Act and amendments in the 1990 Food, Agriculture, Conservation, and Trade Act discourage (through financial disincentives) the draining, filling, or other alteration of wetlands for agricultural use. The law allows exemptions from penalties in some cases, especially if the farmer agrees to restore the altered wetland or other wetlands that have been converted to agricultural use. The Wetlands Reserve Program of the 1990 Food, Agriculture, Conservation, and Trade Act authorizes the Federal Government to purchase conservation easements from landowners who agree to protect or restore wetlands. The Consolidated Farm Service Agency (formerly the Agricultural Stabilization and Conservation Service) administers the Swampbuster provisions and Wetlands Reserve Program. The Natural Resources Conservation Service (formerly the Soil Conservation Service) determines compliance with Swampbuster provisions and assists farmers in the identification of wetlands and in the development of wetland protection, restoration, or creation plans.

The 1986 Emergency Wetlands Resources Act and the 1972 Coastal Zone Management Act and amendments encourage wetland protection through funding incentives. The Emergency Wetland Resources Act requires States to address wetland protection in their Statewide Comprehensive Outdoor Recreation Plans to qualify for Federal funding for State recreational land; the National Park Service provides guidance to States in developing the wetland component of their plans. Coastal and Great Lakes States that adopt coastal-zone management programs and plans approved by the National Oceanic and Atmospheric Administration are eligible for Federal funding and technical assistance through the Coastal Zone Management Act.

State wetland activities.—South Carolina regulates coastal wetlands under the South Carolina Coastal Management Act. The act authorizes the South Carolina Coastal Council to regulate any activities that fill, remove, dredge, drain, construct, or in any way alter any critical area within the eight coastal counties that are under its jurisdiction. The State Coastal Management Act provides 10 criteria to guide the Coastal Council in determining whether to issue a permit. Two of the key criteria are (1) a comparison of economic benefits to preservation benefits and (2) the extent to which all feasible safeguards to avoid adverse economic impact are considered. Under the Coastal Council regulations, dredging and filling wetlands is undertaken only if the activity is water dependent and no feasible alternatives exist. Applications are denied for purposes other than access, navigation, mining, or drainage unless an overriding public interest can be demonstrated. The Coastal Council regulates freshwater wetlands indirectly through review of other State or Federal permits required in coastal areas.

Table 1. Selected wetland-related activities of government agencies and private organizations in South Carolina, 1993

[Source: Classification of activities is generalized from information provided by agencies and organizations. •, agency or organization participates in wetland-related activity; ..., agency or organization does not participate in wetland-related activity. MAN, management; REG, regulation; R&C, restoration and creation; LAN, land acquisition; R&D, research and data collection; D&I, delineation and inventory]

Agency or organization						
FEDERAL						
Department of Agriculture						
Consolidated Farm Service Agency	...	•	...	...	...	...
Natural Resources Conservation Service	...	•	•	...	•	•
Department of Commerce						
National Oceanic and Atmospheric Administration	•	•	..	...	•	...
Department of Defense						
Army Corps of Engineers	•	•	•	...	•	•
Department of the Interior						
Fish and Wildlife Service	•	...	•	•	•	•
Geological Survey	...	...	...	...	•	...
National Biological Service	...	...	...	...	•	...
National Park Service	•	...	•	•	•	•
Environmental Protection Agency	...	•	...	...	•	•
STATE						
Belle W. Baruch Institute	...	...	...	...	•	...
Clemson University	...	...	...	...	•	...
Coastal Council	•	•	...	...	...	...
Department of Health and Environmental Control	...	•	...	..	...	...
Department of Highways and Public Transportation	...	...	•	...	...	...
Department of Parks, Recreation, and Tourism	•	..	...	•	...	...
Forestry Commission	•	...	...	...	...	...
Land Resources Commission	•	..	...	...	...	•
Soil and Water Conservation District	•	•	•	...	...	...
University of Georgia						
Savannah River Ecology Lab	..	...	...	...	•	...
University of South Carolina	...	...	...	...	•	...
Water Resources Commission	...	•	...	...	...	•
Department of Natural Resources	...	...	•	...	...	...
Heritage Trust Program	•	...	...	•	•	•
PRIVATE						
Ducks Unlimited	•	...	•	•	...	...
South Carolina Waterfowl Association	•	...	•	•	...	...
The Nature Conservancy	•	...	•	•	...	...

The South Carolina Department of Health and Environmental Control is active in wetland conservation through the section 401 and 402 requirements of the Clean Water Act. Section 401 requires that a permit applicant provide certification from the State that a discharge will comply with water-quality standards. The certification from the Department is necessary before a permit from the Corps can be obtained. Section 402 of the Clean Water Act requires that permits be obtained for discharges of treated wastewater to wetlands and other water bodies under the National Pollutant Discharge Elimination System program. The Department of Health and Environmental Control is the State agency delegated to administer this program.

Another State program that has relevance to wetlands is the South Carolina Navigable Waters Permitting Program administered by the South Carolina Water Resources Commission in association with the State Budget and Control Board. Under this program, a permit is required for any kind of construction or alteration activity in what the State considers navigable waters, similar to the requirements of Section 10 of the Federal Rivers and Harbors Act Program. However, most wetlands in the State are outside the jurisdiction of the Navigable Waters Permitting Program.

The Heritage Trust Program of the South Carolina Department of Natural Resources has been involved in the study and acquisition of Carolina bay wetlands. The Department manages about 42,000 acres of wetlands contained within Wildlife Management Areas. The Department of Parks, Recreation, and Tourism manages approximately 15,000 acres of wetlands included in the South Carolina State Park system. The South Carolina Forestry Commission and South Carolina Land Resources Commission have developed best-management practices for activities in forested wetlands. Under the South Carolina Scenic Rivers Act, the South Carolina Water Resources Commission and the Department of Natural Resources share responsibilities for planning, acquisition, regulation, and enforcement.

Private wetland activities.—The Nature Conservancy has acquired more than 35,000 acres of wetlands in South Carolina and currently manages about 9,000 acres of wetlands. Ducks Unlimited and the South Carolina Waterfowl Association are actively involved in wetland acquisition and management of waterfowl. One focus of the Association is to work with landowners who wish to flood former rice fields to increase tidal freshwater marsh acreage. The South Carolina Wildlife Federation promotes education concerning the importance of wetlands and also reviews permit applications.

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