

Alabama

Wetland Resources

Wetlands cover about 10 percent of Alabama and range in size from small areas of less than an acre scattered throughout the State to a large forested tract of more than 100,000 acres in the Mobile-Tensaw River Delta (fig. 1). Wetlands are a valuable resource because they can reduce flood stages, stabilize banks, and improve water quality. Alabama's wetlands also are important nesting, breeding, nursing, and feeding grounds for many species of fish, birds, and other wildlife and are a vital habitat for rare and endangered plants and animals and for migrating waterfowl (Shaw and Fredine, 1956). Some of the spring-fed wetlands in the State are home to threatened or endangered species such as the watercress darter, coldwater darter, and pygmy sculpin. Commercial and recreational fisheries are sustained in large part by species that spend at least part of their life cycle in wetlands. The State's wetlands and adjacent waters also are used for recreational activities such as hunting, boating, bird watching, and photography and for research and education.

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 Alabama is shown in figure 2A; 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.



Figure 1. Cypress trees and marsh in the Mobile-Tensaw River Delta. A large tract of delta wetlands has been designated a National Natural Landmark by the National Park Service. (Photograph by Benjamin F. McPherson, U.S. Geological Survey.)

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 Alabama are described below.

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.

The FWS estimates that wetlands cover from 2.3 million to 3.1 million acres in Alabama (J.M. Hefner, U.S. Fish and Wildlife Service, written commun., 1992). Palustrine forested wetlands such as cypress and gum swamps, mixed hardwood forests, and wet pine flatwoods account for most of that acreage.

Most of the State's forested wetlands are bottom-land forests in alluvial flood plains. Cypress and tupelo gum commonly predominate in the permanently or seasonally flooded areas (swamps), whereas other trees such as swamp oak, water hickory, red maple, magnolia, sweetgum, and sycamore are more common in less frequently inundated areas. The loss of bottom-land forest has been extensive throughout the Southeastern United States; in some regions, only a small percentage of the original hardwood forests remains (Mitsch and Gosselink, 1986). Alabama has conserved a large tract of its bottom-land forest along approximately 50 miles of the Mobile-Tensaw River Delta.

Other palustrine wetlands, such as shrub swamps (scrub-shrub wetlands) and seepage bogs (emergent wetlands), exist as small, isolated wetlands in the Coastal Plain of Alabama (fig. 2B). These wetlands typically are associated with ground-water seepage in swales or near the bottom of slopes. Seepage bogs support a unique and diverse flora, including at least 20 species of carnivorous plants such as pitcher plants, sundews, butterworts, and bladderworts. The bogs also are home to several species of orchids and a variety of sedges (Mohlenbrock, 1992). Fresh marshes, emergent wetlands

vegetated primarily by sedges, rushes, and grasses, commonly fringe ponds, reservoirs, and fresh tidal reaches of coastal rivers.

Although not as abundant as palustrine wetlands, lacustrine and riverine wetlands constitute a significant proportion of Alabama's freshwater wetlands. There are few natural lakes in the State, but impoundments on most of the larger rivers have created many acres of lacustrine wetlands in the shallows of the reservoirs. These wetlands can be nonvegetated (unconsolidated-bottom wetlands), vegetated by emergent plants such as American lotus and golden club that are not visible above the water surface during part of the year (nonpersistent-emergent wetlands), or vegetated by plants such as water lily or pondweed that grow on or below the water surface (aquatic-bed wetlands).

Like lacustrine wetlands, riverine wetlands are nonvegetated or vegetated by nonpersistent emergent or submersed plants. Vegetated riverine wetlands are most common in slow-flowing reaches

of Coastal Plain rivers. Whereas many riverine wetlands have been converted to deepwater habitat by impoundment, riverine wetlands are still present in the shallows of the remaining streams and rivers that have not been impounded. Rocky shoals are riverine rock-bottom wetlands that were once more common upstream from the Fall Line in most of the State's rivers before they were impounded. These wetlands are now present only in the Cahaba River system (which remains largely unimpounded) and in a few tributaries of other, now-impounded rivers. Rocky shoals, primarily in the Cahaba River and the Little Cahaba River (a tributary), support stands of the Cahaba lily, a spider lily that grows only in the rocky-shoal habitat (Cahaba River Society, 1992).

Estuarine marshes (emergent wetlands) are extensive in Alabama's coastal waters. Salt marshes form along tidally influenced river reaches, on deltas, and on the shores of estuaries and bays. Salt marshes that are greatly influenced by seawater, such as those on

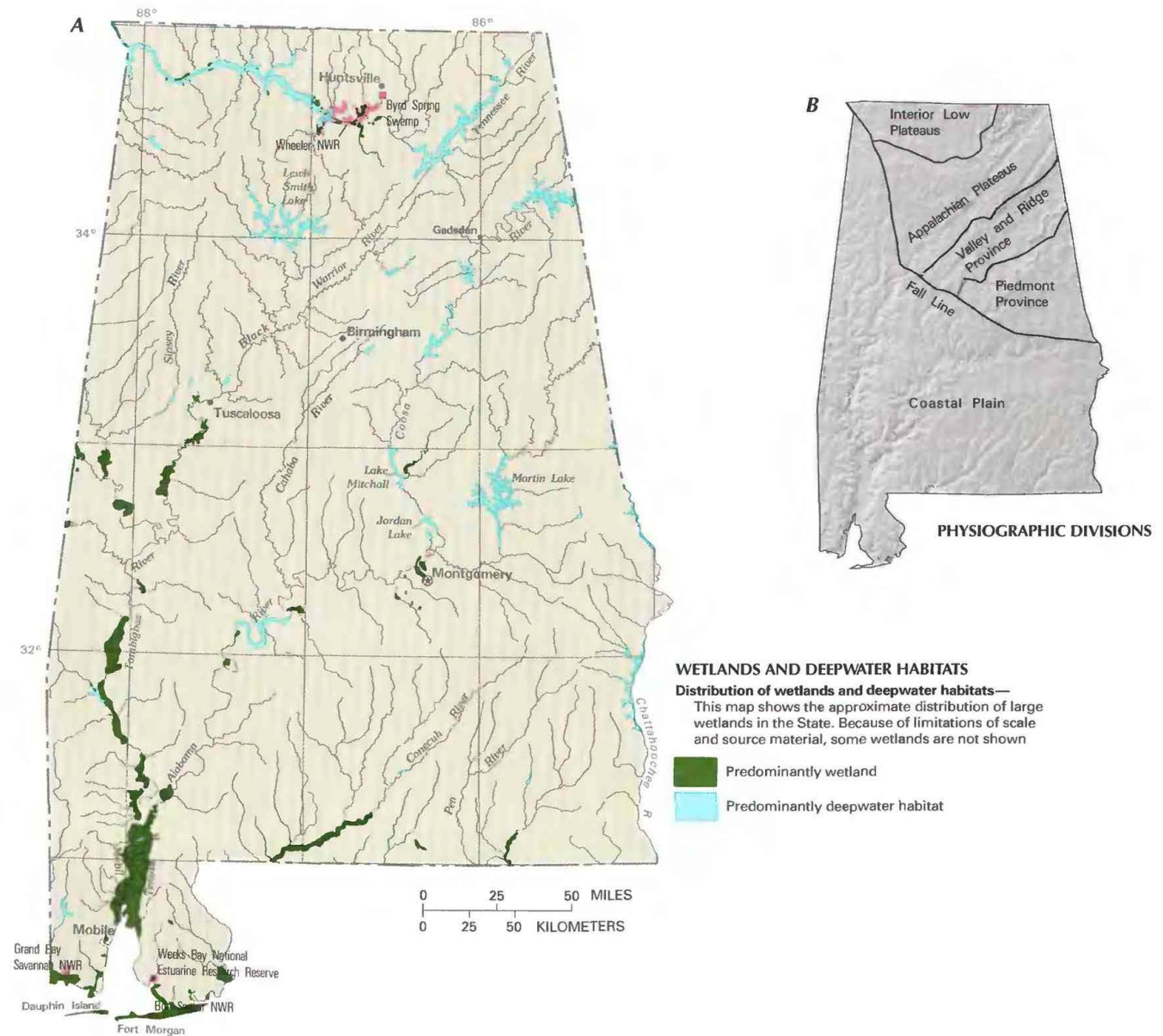
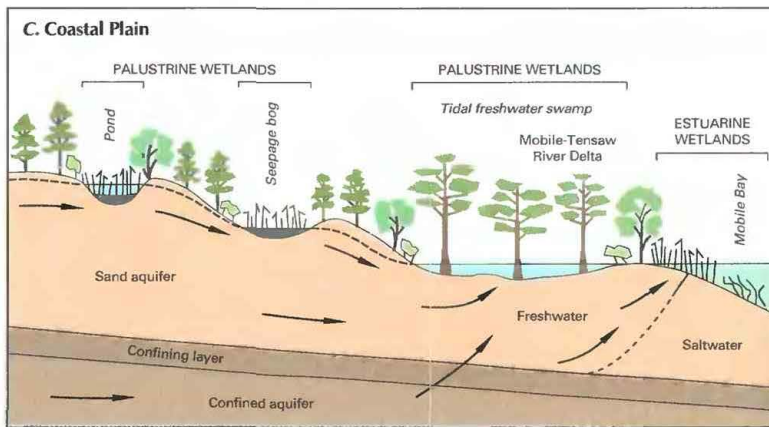
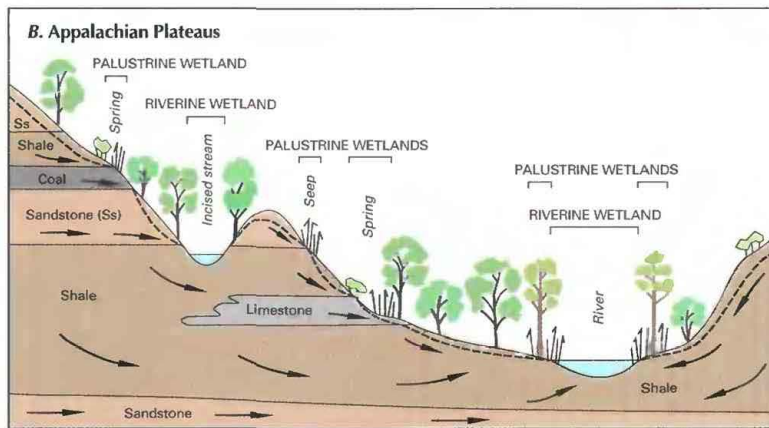
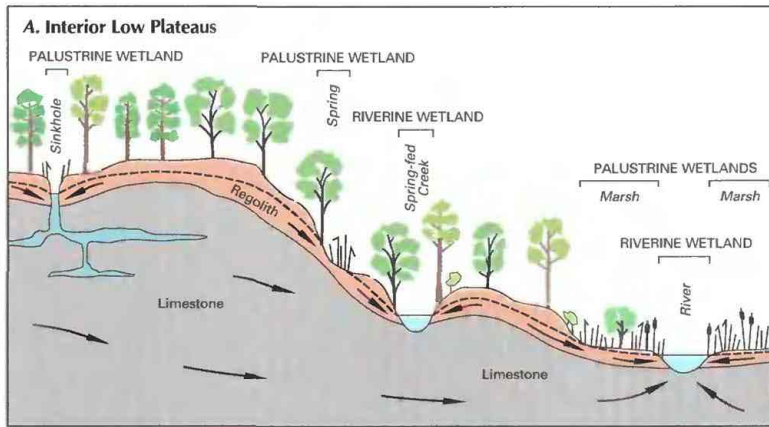


Figure 2. Wetland distribution in Alabama and physiography of the State. **A.** Distribution of wetlands and deepwater habitats. **B.** Physiography. (Sources: A, T.E. Dahl, U.S. Fish and Wildlife Service, unpub. data, 1991. B, Physiographic divisions from Fenneman, 1946; landforms data from EROS Data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



- EXPLANATION**
- Direction of ground-water flow
 - Average water table
 - Forest vegetation
 - Scrub-shrub vegetation
 - Emergent vegetation
 - Submersed aquatic vegetation
 - Sand and organic deposits

Figure 3. Generalized geohydrologic setting of wetlands in three physiographic provinces of Alabama. **A.** Appalachian Plateaus. **B.** Interior Low Plateaus. **C.** Coastal Plain.

Little Dauphin Island and the Fort Morgan peninsula, are vegetated predominantly by dense stands of black needlerush in areas that are flooded during extreme high tides and by smooth cordgrass in areas that are flooded more regularly (Stout, 1979). In contrast, coastal marshes in less saline habitats have a greater diversity of emergent plants (Stout, 1990). Field and others (1991) estimated that coastal salt marshes cover 25,500 acres in southern Alabama.

Beds of submersed aquatic vegetation grow in the shallow waters of Mobile Bay and adjacent estuaries; they are usually inundated except during low tide (Stout, 1990). Only the zone of these aquatic beds exposed during mean low tide is considered to be wetland by the FWS National Wetland Inventory; most estuarine aquatic beds are in deepwater habitats.

HYDROLOGIC SETTING

Wetlands form where there is a persistent water supply at or near the land surface. The location and persistence of the supply is controlled by factors such as precipitation, evapotranspiration, topography, soil type, geology, runoff, and, near the coast, tides. Plentiful rainfall, about 55 inches per year statewide (Jeffcoat and Mooty, 1986), is an important factor contributing to wetland formation and maintenance in Alabama. Wetlands commonly form in topographically low areas, in areas of impeded drainage, and at locations where the water table intersects the land surface. The movement of ground water into wetlands is controlled by hydraulic gradients (which are primarily determined by topography), recharge from precipitation, regional geologic structure, joints and fractures in the bedrock, and aquifer porosity, permeability, and thickness.

For the purpose of discussing wetland hydrology, Alabama can be divided into two geohydrologic regions that are separated by the Fall Line (fig. 2B). The Fall Line is a regional topographic feature that marks the boundary between the ancient, resistant crystalline rocks of the northern part of the State and the younger, softer sediments to the south.

The region north of the Fall Line in Alabama lies in four physiographic provinces—the Interior Low Plateaus, the Appalachian Plateaus, the Valley and Ridge, and the Piedmont (fig. 2B). This region has diverse topography; altitudes range from 200 to 2,400 feet above sea level. Wetlands in this region are commonly associated with rivers, reservoirs, and impoundments (as in Wheeler National Wildlife Refuge) or with springs, seeps, and solution features such as caves and sinkholes (fig. 3A and 3B). Most of the once-common rocky-shoal habitat has been destroyed by channelization and damming of rivers, except in the Cahaba River Basin and a few tributaries of other rivers (Cahaba River Society, 1992). Most of the major springs in the State are in the Interior Low Plateaus and Valley and Ridge Province, where carbonate rocks predominate. These rocks characteristically are fractured and cavernous and readily transmit ground water to the land surface (Chandler and Moore, 1987). Isolated wetlands have formed near springs and seeps and in sinkholes throughout the northern part of the State. Byrd Spring Swamp (also known as Byrd Spring Lake), a 650-acre wetland containing tupelo

gum and other bottom-land hardwoods, is a notable example of a wetland that is spring fed from a karst cave system (U.S. Fish and Wildlife Service, 1992).

The region south of the Fall Line in Alabama—the Coastal Plain—has a gentle slope on which rivers and streams have developed broad flood plains shaped by wide seasonal fluctuations in river levels. Wetlands have formed over extensive areas on these flood plains in response to an abundant supply of water from river flooding and ground-water sources. The hydrology of flood-plain wetlands is typically dominated by river water levels that respond to basinwide climatic conditions (Winter and Woo, 1990). In late winter and early spring, annual flooding by rivers and streams can inundate the entire flood plain to depths of several feet or more. Natural levees along rivers and streams trap water in the flood plain and reduce surface runoff (Hofstetter, 1983). Water trapped in flood-plain wetlands is lost primarily by evapotranspiration and as ground-water recharge (Winter and Woo, 1990). During much of the year, water levels in the flood plains are at or below the land surface, except in ponds, depressions, and sloughs, which can retain surface water year round.

Wetlands on flood plains also are sustained by ground water (fig. 3C). A rise in river stage causes water to go into bank storage, which results in a rise in ground-water levels in the flood plain. Ground-water inflow from adjacent uplands also can be an important source of water to flood-plain wetlands because flood plains are topographically low and are a natural place for discharge from ground-water flow systems (Winter and Woo, 1990).

On flood plains near the coast, river discharge combined with tidal action causes flooding and temporary storage of freshwater in large areas of wetlands, such as those in the Mobile–Tensaw River Delta (fig. 3C). The temporary storage affects the timing and size of freshwater influx into Mobile Bay, which is critical in maintaining optimal salinities in the bay. Temporary storage of freshwater in the delta wetlands also improves the quality of the water that flows into the bay by reducing nutrient and sediment loads and by increasing organic detrital loads that serve as a food source for many estuarine organisms (Dardeau and others, 1990; Stout, 1990).

Estuarine wetlands form where freshwater and saltwater mix and can be subject to widely varying salinity caused by tidal fluctuations and by seasonal and annual differences in freshwater input that result from climate variation. Plants and animals of estuarine wetlands must be adapted to constantly changing hydrologic, salinity, and nutrient-availability regimes. Owing to the differing physiological tolerances of wetland plants and animals, wetland communities develop in identifiable zones in response to those factors.

TRENDS

Alabama has lost as much as 50 percent of its wetlands in the last 200 years (Dahl, 1990). In predevelopment times, wetlands covered about 7.6 million acres of the area that is now Alabama. Recent estimates of the remaining wetland acreage in Alabama range from 2.3 million to 3.1 million acres (J.M. Hefner, U.S. Fish and Wildlife Service, written commun., 1992) to about 3.8 million acres (U.S. Department of Agriculture, 1985). Differences in the estimates possibly reflect differences in inventory terminology or techniques.

Alabama lost about 10 percent of its interior wetlands from 1956 through 1979 (U.S. Fish and Wildlife Service, 1992). Primary causes for the loss of the interior wetlands were agricultural conversion of wetlands to croplands, conversion of bottom-land hardwood forests to pine culture, and inundation caused by reservoir construction.

Alabama lost about 69 percent of its coastal freshwater marsh and 29 percent of its estuarine marsh from 1955 through 1979. Primary reasons for the loss of these coastal wetlands were industrial

and commercial development, residential development, erosion and subsidence, and natural succession from wetlands to uplands (Roach and others, 1987). Much of the loss of coastal wetlands occurred in the Mobile Bay area, where the loss was due to direct and indirect effects of dredging (Duke and Kruczynski, 1992). Stout (1979) estimated that about 6,000 acres of marshland in the bay have been destroyed and about 2,200 acres of marshland created by deposition of dredged material. Cumulative effects of alterations of all kinds on the Mobile Bay ecosystem resulted in a loss of more than 10,000 acres of emergent estuarine marsh and probably more than 50 percent of the submerged aquatic vegetation in the bay between 1955 and 1979 (Watzin and others, in press).

The FWS recently evaluated wetland changes in upper Mobile Bay (Watzin and others, in press). The evaluation revealed no additional loss of estuarine-marsh acreage since 1979 and reported a substantial (75 percent) increase in freshwater marsh from 1979 to 1988. The increase in freshwater marsh was attributed to growth of emergent vegetation in disposal areas and ditches and to mapping errors in earlier inventories. About 1,200 acres (2.7 percent) of forested wetlands in the upper Mobile Bay area were lost or converted to scrub-shrub wetlands between 1979 and 1988. A major cause of the conversions was clearcutting associated with timber harvest. Losses were due largely to creation of impoundments and commercial development.

Wetland regulations currently (1993) in effect generally allow wetland destruction only when mitigated by wetland enhancement or creation. The effectiveness of these measures in slowing wetland loss will depend upon enforcement of and compliance with the mitigation requirements. The effectiveness of wetland mitigation in sustaining the ecological functions of wetlands remains in question (Stout, 1979; Alabama Department of Environmental Management, 1992).

CONSERVATION

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

Federal wetland activities.—Development activities in Alabama 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 Zone 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 (EPA), 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

Table 1. Selected wetland-related activities of government agencies and private organizations in Alabama, 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	MAN	REG	R&C	LAN	R&D	D&I
FEDERAL						
Department of Agriculture						
Consolidated Farm Service Agency		•				
Forest Service	•		•	•	•	•
Natural Resources Conservation Service		•	•		•	•
Department of Commerce						
National Oceanic and Atmospheric Administration	•	•			•	•
Department of Defense						
Army Corps of Engineers	•	•	•	•	•	•
Military reservations	•					
Department of the Interior						
Fish and Wildlife Service	•		•	•	•	•
Geological Survey					•	•
National Biological Service					•	•
National Park Service	•				•	•
Environmental Protection Agency		•			•	•
Tennessee Valley Authority	•				•	
STATE						
Department of Conservation and Natural Resources ..	•	•	•	•	•	•
Department of Economic and Community Affairs					•	•
Department of Environmental Management	•	•			•	•
Geological Survey of Alabama					•	•
Marine Environmental Sciences Consortium					•	•
SOME COUNTY AND LOCAL GOVERNMENTS		•				
PRIVATE ORGANIZATIONS						
The Nature Conservancy	•			•		
Coastal Land Trust	•			•		

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 States that adopt coastal-zone management programs and plans approved by the National Oceanic and Atmospheric Administration (NOAA) are eligible for Federal funding and technical assistance through the Coastal Zone Management Act.

Federal agencies are responsible for the proper management of wetlands on public land under their jurisdiction. In Alabama, the U.S. Forest Service manages wetlands in five National Forests, which contain 636,476 acres of land and more than 400 miles of rivers (Alabama Department of Economic and Community Affairs, 1991). The FWS manages 55,000 acres on five National Wildlife Refuges in the State, of which about 29,000 acres are wetlands

(Frank Dukes, U.S. Fish and Wildlife Service, oral commun., 1992). The Corps manages 14 impoundments in the State and more than 100 public-use areas (U.S. Army Corps of Engineers, 1981). Military bases in Alabama cover an area of about 400,000 acres, some of which contain wetlands. The Sanctuaries and Reserves Division of NOAA, in cooperation with the State of Alabama, manages the Weeks Bay National Estuarine Research Reserve. The Tennessee Valley Authority (TVA) maintains 3,750 acres of managed wetlands in northern Alabama (Wes James, Tennessee Valley Authority, oral commun., 1993). The Wildlife and Natural Heritage Resources Section of TVA develops and implements conservation and management strategies to ensure protection of wildlife and natural heritage resources on TVA lands and promotes protection and enhancement of such resources elsewhere in the region. The Natural Heritage Resources Section, in cooperation with State wildlife-management agencies and the FWS, operates projects that provide critical wetland habitats that support migratory waterfowl and other important wetland species.

Although it does not manage wetlands, EPA's wetland-research programs facilitate wetland management and conservation in Alabama. The EPA, in cooperation with State and other Federal agencies, is assessing coastal wetlands in the State as part of its Gulf of Mexico Program. The EPA and FWS are conducting a demonstration project that will map changes in wetlands in Mobile Bay and the lower Mobile-Tensaw River Delta.

State wetland activities.—Although Alabama currently (1993) has no comprehensive wetland-protection program, the State is assessing the need for a wetlands policy. Several State agencies actively participate in aspects of Federal programs, and some wetlands are protected under State programs.

The Alabama Department of Economic and Community Affairs is responsible for planning policies that protect the State's water resources, including wetlands. The Department's newly formed Office of Water Resources has initiated a 3-year study to be completed in 1995 that will address protection of wetlands and other water resources in the State. The Department also addresses wetland issues in its Statewide Comprehensive Outdoor Recreation Plan in response to section 303 of the Federal Emergency Wetlands Resources Act of 1986.

The Alabama Department of Environmental Management manages wetlands in Alabama's coastal zone through its regulatory authority under the Alabama Coastal Zone Management Act and through its authority to issue section 401 water-quality certification. The Department identifies wetlands and submersed grassbeds as coastal resources for which effects from any regulated uses must be considered. This activity includes review of all State and Federal permitting activities for the coastal zone of the State and primarily, in the case of wetlands, section 404 dredge-and-fill permits and Rivers and Harbors Act navigable-water permits issued by the Corps (Alabama Department of Environmental Management, 1992). Alabama's Coastal Zone Management program defines the coastal zone as that part of the State where the land surface is less than 10 feet above sea level. However, Rathburn and others (1987) reported that approximately 28 percent of Alabama's coastal wetlands are in areas that are higher than 10 feet and, thus, are excluded from protection under the Coastal Zone Management program.

Mitigation for wetland losses caused by approved projects is required in the coastal zone. A review of some of these coastal mitigation projects indicated that, of 14 projects, 6 could not be evaluated, 3 were successful, 2 were partially successful, and 3 were failures (Alabama Department of Environmental Management, 1992).

The Department of Environmental Management regulates dredge-and-fill activities in wetlands that are not in Alabama's coastal zone solely through the State's authority to issue section 401 water-quality certification under the Clean Water Act and through the Nonpoint Source Discharge Management Program. Other ac-

tivities that might affect wetlands, such as draining or logging operations that do not result in significant wetland fill, are not regulated. Wetland waters are considered to be waters of the State in the Alabama Water Pollution Control Act but are not defined or protected by the act for their inherent value (Alabama Department of Environmental Management, 1992).

The Alabama Department of Conservation and Natural Resources comments on section 404 permit applications and on local land-use issues to call attention to potential effects on wildlife. The Department manages, regulates, and acquires land (including wetlands) for wildlife-management areas, State parks, and for other State recreational lands. The Department also will administer a new program, "Forever Wild," that has the objective of acquiring land for protection, recreation, education, and scientific research.

Private wetland activities.—Private organizations in Alabama are important advocates for wetlands. These organizations inform the public on wetland issues, organize citizen networks, and lobby for wetland protection. The Alabama Conservancy, the Coastal Land Trust, the Sierra Club, the National Audubon Society, the Alabama Wildlife Federation, and the Cahaba River Society are involved in State wetland issues.

The Nature Conservancy is active in the acquisition and protection of wetlands in Alabama. The Nature Conservancy, along with the Coastal Land Trust, acquired 18,000 acres of wetlands in the Mobile–Tensaw River Delta. Most of this acreage has been sold to the Corps as part of its Tennessee–Tombigbee Waterway mitigation project and will be managed by the State. The Nature Conservancy has been instrumental in the purchase and preservation of several other wetland areas in the State, including the Bon Secour National Wildlife Refuge, the Weeks Bay National Estuarine Research Reserve, several small (2- to 35-acre) pitcher plant bogs in northern Alabama, and a 156-acre tract in southern Alabama that is primarily pine savannah containing some wetlands. The Nature Conservancy also has been requested by the FWS to assist in the establishment of the Grand Bay Savannah National Wildlife Refuge in southwestern Alabama and southern Mississippi. This proposed 13,000-acre refuge will have substantial wetland acreage (Stratton Bull, The Nature Conservancy of Alabama, written commun., 1993).

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