Statewide Summary for Alabama

By Larry Handley[1], Kathryn Spear[1], Stephen Jones[2], and Cindy Thatcher[1]

Background

Alabama is over 132,000 km^2 (51,000 miles^2) in area, 483 km (300 miles) long, and 322 km (200 miles) wide (Copeland, 1968). Coastal Alabama comprises Mobile and Baldwin Counties and the surrounding State waters in the Gulf of Mexico (Figure 1; O'Neil and Mettee, 1982). It is part of both the East Gulf Coastal Plain section of the Coastal Plain province and the Mississippi-Alabama shelf section of the Continental Shelf province. Within the East Gulf Coastal Plain section, Alabama's coastal land falls within the Southern Pine Hills and Coastal Lowlands subdivisions. The Southern Pine Hills subdivision is a sloping landscape composed of sand and clay. Its elevation varies from approximately 30 m (98 ft) near the coast to over 90 m (295 ft) in the northern areas of the two coastal counties. The Coastal Lowlands subdivision is a flat to slightly undulating plain with creeks, rivers, estuaries, and marshes leading to the surrounding bays and the Gulf of Mexico. Offshore Alabama is part of the Mississippi-Alabama section of the Continental Shelf. Barrier islands and spits in coastal Alabama include Dauphin Island, Fort Morgan Peninsula, and Perdido Key. Dauphin Island consists of a beach with dunes on the Gulf side and beaches and marshes on the north side. It was once over 24 km long, but after Hurricane Katrina it has been broken into two distinct islands. Fort Morgan Peninsula is attached to the eastern mainland and extends westward between Mobile Bay and the Gulf of Mexico. A large beach exists on the gulf side, with numerous

[1] U.S. Geological Survey National Wetlands Research Center, 700 Cajundome Blvd., Lafayette, LA 70506

[2] Geological Survey of Alabama, Geological Investigations Division, 420 Hackberry Lane, Tuscaloosa, AL 35486

lagoons and marshes on the bayside. Perdido Key is a narrow peninsula on the easternmost Alabama coast near the Alabama-Florida border, south of Perdido Bay. It consists of beaches and high dunes, with some marshes on the lagoon side of the peninsula.

Mobile Bay, parts of Mississippi Sound, Perdido Bay, and many smaller rivers and streams are the main bodies of water in coastal Alabama. Mobile Bay, a submerged river valley, is the largest at 1,070 km^2 (413 $miles^2$) in area and 51.5 km (32 miles) in length (Mobile Bay NEP, 2008). Mobile Bay is 37 km (23 miles) wide at its maximum width near the opening to the Gulf of Mexico at the south end of the bay, and 16.1 km (10 miles) wide at the city of Mobile (Mobile Bay NEP, 2003; Mobile Bay NEP, 2008). It is remarkably shallow with an average depth of 3 m (10 ft), yet it discharges approximately 1,755.6 m^3 (62,000 ft^3) of water every second on average (Mobile Bay NEP, 2008). Mississippi Sound runs parallel to the coasts of Mississippi and part of Alabama. The length of the Alabama portion of Mississippi Sound is approximately 26 km (16.2 miles) from the Dauphin Island bridge to the Mississippi-Alabama State line (O'Neil and Mettee, 1982). Dauphin Island separates the sound from the Gulf of Mexico. The sound drains into the Gulf of Mexico west of Dauphin Island at Petit Bois Pass, which is approximately 8 km (5 miles) wide. Mississippi Sound averages approximately 3.5 m (11.5 ft) in depth. Salt marshes, large areas of wetland scrub-shrub, and tidal creeks characterize the northern shore of Mississippi Sound, and the southern shore is composed of sandy barrier islands. Perdido Bay is located at the boundary of Baldwin County and Florida's Escambia County. It is approximately 27 km (16.8 miles) long, 5 km (3 miles) at its widest point, and, on average, 2.4 m (7.9 ft) deep. The major fresh-water resource in

coastal Alabama is the Mobile River, formed by the confluence of the Alabama and Tombigbee Rivers. The watershed for the Mobile River is approximately 111,369 km^2 (43,000 $miles^2$) large and includes parts of Alabama, Georgia, Mississippi, and Tennessee (Handley et al., 2007). Parts of Alabama and the Florida Panhandle drain into the Perdido River basin and western coastal Alabama drains into the Escatawpa River.

Emergent wetlands offer valuable ecological services in coastal Alabama. Marshes provide extensive plant material, which provides energy to the detritus-based estuarine ecological system (O'Neil et al., 1983). They provide habitat for many organisms, including shrimp and crabs, whose harvest is a major industry in coastal Alabama. Marshes provide habitat for refuge, feeding, breeding, and spawning. They also remove excess nutrients from water and contribute to erosion control. Degradation of marshes by pollutants, sediments, and other impacts decreases productivity of the entire estuarine ecosystem. Among the nation's states, Alabama ranks fifth in number of different species (144 endemic species), second in number of extinctions that have already occurred (90 extinct species) and fourth in number of species at risk for extinction (14.8% at risk out of 4,533 total species; Stein, 2002). Many species of wildlife benefit from the wetland habitats in coastal Alabama. Numerous bird species can be found in coastal Alabama emergent marshes, which provide habitat for shore- and wading-birds that inhabit salt or brackish water coastal environments (Anderson et al., 1981). Colonial seabirds nest on coastal Alabama's islands, the mainland, and dredge disposal sites (Cooley, 1987). The Mobile-Tensaw Delta and Mobile Bay are the state's primary migratory waterfowl coastal wintering areas (U.S. Fish and Wildlife Service, 1982). The shallow waters, abundance of fish, and vegetative cover in emergent marsh

contribute to excellent waterfowl habitat. Emergent wetlands in Alabama also provide habitat for a multitude of endangered species, including various species of raptors and wading- and shorebirds (O'Neil et al., 1983).

Statewide Status and Trends

Monitoring during 1955, 1979, 1988, and 2001/2002 confirms the loss and decline of emergent wetland habitat in coastal Alabama (Table 1, Figures 2-5). Alabama lost 3,822 hectares (9,444 acres), or 14.1 percent, of its emergent wetlands between 1955 and 1979; 7,023 hectares (17,354 acres), or 25.9 percent, between 1979 and 1988; and an additional 3,913 hectares (9,670 acres), or 14.4 percent, between 1988 and 2001/2002. During the complete 47-yr time period this study encompasses, coastal Alabama lost 14,758 hectares (36,468 acres), or 54.4 percent, of the emergent wetlands present in the mid-1950's.

Table 1. Emergent wetland coverage in Alabama for 1955, 1979, 1988, and 2001/2002.

Emergent Wetland Type	**1955**		**1979**		**1988**		**2001/2002**		**Total Change 1955-2001/2002**	
	Hectares	Acres	Hectares	Acres	Hectares	Acres	Hectares	Acres	Hectares	Acres
Estuarine	15,803	39,049	12,912	31,906	11,873	29,338	10,614	26,229	-5,188	-12,820
Palustrine	11,326	27,986	10,394	25,685	4,411	10,899	1,756	4,339	-9,570	-23,647
Total	27,128	67,035	23,306	57,591	16,283	40,237	12,370	30,567	-14,758	-36,468

Between 1955 and 1979, Alabama lost 2,891 hectares (7,143 acres), or 18.3 percent, of its salt marshes. A loss of 1,039 hectares (2,568 acres), or 6.6 percent, of salt marsh occurred between 1979 and 1988, and another 1,258 hectares (3,110 acres), or 8.0

percent, were lost between 1988 and 2001/2002. A total of 5,188 hectares (12,820 acres), or 32.8 percent, of salt marsh was lost during the entire 47-yr study period.

Alabama lost 931 hectares (2,301 acres), or 8.2 percent, of coastal fresh marsh between 1955 and 1979. A loss of 5,984 hectares (14,786 acres), or 52.8 percent, of fresh marsh occurred between 1979 and 1988. Alabama lost 2,655 hectares (6,560 acres), or 23.4 percent, between 1988 and 2001/2002. A total of 9,570 hectares (23,647 acres), or 84.5 percent, of fresh marsh was lost in coastal Alabama throughout the entire 47-yr study period.

Causes of Change

Emergent wetland ecosystems are sensitive and highly susceptible to ecological damage. Significant threats facing coastal Alabama's emergent wetlands include development and growth—industrial, suburban, urban, port, commercial, residential, and recreational—as well as oil exploration (Friend et al., 1981). Tourism; ecotourism; recreational and commercial fishing; recreational boating; shipping; and chemical, pulp, and paper production are significant industries in Mobile Bay and coastal Alabama (Mobile Bay NEP, 1997). Despite the approximately $5 billion total investment and 15,000 jobs these industries bring into the community, the growth, development, and environmental stress they create threaten the ecosystem. The Port of Mobile was ranked 8th in the U.S. in total exports in 1997 and 13th in foreign waterborne tonnage and is Alabama's only ocean-ship port (Mobile Bay NEP, 2008). Baldwin County, located on the east side of the Bay, experienced a population increase of 75% from 1990 to 2007, with an 89% increase in housing units (Mobile Bay NEP, 2008). The State of Alabama has lost a great deal of its wetlands as a result of increasing population growth and urban

development (Mobile Bay NEP, 2008). Wetland loss in northern Mobile Bay was more than four times greater than the national and southeastern average of wetland loss between the mid-1950s and the late 1970s (Burgan and Engle, 2006). Mobile Bay lost over 4,049 ha (10,000 acres) of emergent wetlands between the 1940's and 1979 (Duke and Kruczynski, 1992). The majority of this loss most likely occurred after WWII with wetland loss relatively stable prior to that. Urban and silvicultural developments were the primary cause of palustrine wetland loss between 1955 and 1979 (Roach et al., 1987). Natural succession; industrial, navigational, and urban development; and erosion were the primary causes of estuarine wetland loss. Erosion was caused and/or exacerbated by reduced upstream sediment input, sea level rise in more recent years, hurricane and storm damage, nutria and muskrat damage, oil and gas exploration, and marsh fires. Dredge and fill projects in coastal Alabama destroy wetlands, and the subsequent pollution and dredge material disposal from development decreases wetland productivity and water quality. Oil spills are a constant threat to the health of coastal Alabama, since exploration began in the 1900s (Friend et al., 1981; U.S. Fish and Wildlife Service, 1982). Oil, gas, and hydrocarbon product extraction are now major industries in coastal Alabama (O'Neil et al., 1983). Large volumes of daily waste (although routinely treated, subject to occasional sanitary sewer overflows) can cause bacterial pollution, oxygen depletion, and toxic compound buildup in Alabama's coastal waters (O'Neil and Mettee, 1982). Heavy rain in coastal Alabama creates large amounts of runoff carrying nonpoint source pollution, contaminating waters with fertilizers, chemicals, sediment, oil, trash, and sewage (Mobile Bay NEP, 1997). Sea-level rise, along with erosion and shoreline

recession caused by waves, tides, and currents, is expected to continue to contribute to more wetland habitat loss (Mobile Bay NEP, 2008).

Coastal Alabama lies between the migratory bird Mississippi and Atlantic Flyways and provides critical habitat and renourishment for migratory birds (Mobile Bay NEP, 2003). Many barrier island bird colonies have disappeared because of human disturbance and loss of habitat to development. Draining wetlands has destroyed important habitat for species such as snowy egret, least bittern, and blue-winged teal (Anderson et al., 1981). The presence of wading birds is an indicator of wetland habitat quality; their decline in coastal Alabama suggests the ecosystem is impaired (Mobile Bay NEP, 2003). Ten to twenty percent of Alabama's plant and animal species are threatened by exotic species. More than 80 of these exotic, invasive species are found in waterways and on the coast of Alabama (Mobile Bay NEP, 2008). In addition to the socioeconomic effects that the decline of wildlife species has on local industries such as shellfish harvesting, these declines further degrade the emergent wetland ecosystems in coastal Alabama. Development and industry support the coastal Alabama economy, but they are also dependent on the continued health, sustainability, and production of the water and living resources of the Mobile Bay ecosystem. The loss of Alabama's coastal wetlands remains a threat to the State's ecological and socioeconomic prosperity.

Overview of Emergent Wetland Restoration Efforts

A review of the Mobile Bay National Estuary Program's Mississippi-Alabama Habitats Tool (http://habitats.disl.org/), National Estuaries Restoration Inventory (https://neri.noaa.gov/neri/), and Gulf of Mexico Foundation (http://www.gulfmex.org/conservation-restoration/gulf-conservation-restoration-and-

preservation/) databases with respect to previous emergent vegetation restoration or conservation has mainly been a function of land acquisitions to conservation and protection from the effects of hard shoreline armoring and the removal of invasive species. A very limited amount of emergent vegetation restoration projects has been identified and likely planned to date.

The Mobile Bay National Estuary Program's Mississippi-Alabama Habitats Tool contains the most comprehensive list of emergent marsh restoration efforts. The Alonzo Landing Salt Marsh project and the Mon Luis Island Marsh Restoration – Phase I are noted in the database as 2004 efforts. Each describes where to protect, enhance, or reestablish marsh habitat lost by erosion. In 2006, the Little Bay Emergency Disaster Relief Program Finfish and Shellfish Habitat Restoration project, located in Mississippi Sound and adjacent to the Bayou la Batre channel to the west, created about 12 hectares (30 acres) of breakwater-protected marsh. Each of the habitat records reviewed in this database indicates a monitoring plan is in place. By 2008, the Mobile County Wildlife and Conservation Association had completed the conversion of a mud flat near Battleship Park into marsh habitat by planting bull tongue, giant bulrush, and black needlerush. Approximately 1.4 hectares (3.5 acres) of Helen Wood Park, Mobile County, was improved between 2007 and 2009 by removal of invasive phragmites and Chinese Tallow, excavation to enhance tidal flooding, and estuarine vegetation plantings.

The Nature Conservancy is working on the project "100-1000: Restore Coastal Alabama Partnership" to protect and promote the growth of approximately 405 hectares (1,000 acres) of marsh. This project utilizes breakwaters and includes the installation of approximately 161 km (100 miles) of oyster shell breakwaters.

During the development of the Choctaw Point Terminals in north Mobile Bay, the Alabama State Port Authority completed a mitigation project that converted approximately 23 hectares (56 acres) of uplands into tidal fringe marsh at Arlington Cove, North Garrows Bend, and South McDuffie Island (Harris, 2009).

Overview of Monitoring, Restoration, and Enhancement Opportunities

In 2009, in support of Section 309 of the Coastal Zone Management Act of 1972, the Geological Survey of Alabama began an in-depth investigation to map detailed shoreline protection, generalized shoreline type, and boat ramps, and further, to quantify short-term erosion within Mobile Bay. Currently, no inventory of geographic information system (GIS) thematic layers representing shoreline protection, shoreline type, and comprehensive compilation of public and private boat ramps for coastal Alabama exists. This project was warranted, in part, due to the inherent relationship between the type and geospatial position of shoreline protection and the proximity of shoreline and marsh habitat loss in relation to the protection. This work was finalized in 2012 (Jones et al, 2009; Jones and Tidwell, 2011 and 2012) and is summarized in the following three paragraphs.

An estimated 1,323 km (822 miles) of shore protection was mapped for coastal Baldwin and Mobile Counties. The dominant shore protection mapped was natural unretained, determined to be 894 km (555.6 miles) or 67.6 percent of the total. An estimated 32.4 percent of the shoreline mapped is protected by hard armoring type. Bulkheads make up 268 km (166.3 miles) or 20.2 percent of the total and the largest type of hard shore protection mapped. Rubble/riprap makes up 75 km (46.8 miles) or 5.7 percent of the total shore protection in Baldwin and Mobile counties.

An estimated 1,326 km (823.5 miles) of shoreline type was mapped for Baldwin and Mobile Counties. The dominant shoreline type was organic, having 594 km (368.9 miles) or 44.8 percent of the total shoreline type mapped. This includes organic marsh, fringe, and forested wetland. Vegetated and sediment types make up 37.1 percent and 12.6 percent of the total shoreline type mapped, respectively.

A total of 7,601 selected transects was generated by DSAS and represents shorelines within Mobile Bay, Wolf Bay, Little Lagoon, Cotton Bayou, Terry's Cove, Heron Bay, Fowl River Bay, Portersville Bay, Grand Bay, Isle aux Herbes, and Little Dauphin Island. Areas of greatest erosion were found in Mississippi Sound, specifically the marsh habitat at Isle aux Herbes with a maximum erosion rate of -5.54 ± 0.66 m/year (-18.18 ± 2.17 ft/year) and a mean erosion rate of -2.11 ± 0.81m/year (-6.92 ± 2.66 ft/year).

Although others exist, opportunities tend to be associated with funding sources such as the Coastal Impact Assistance Program, the Forever Wild Program, and Emergency Disaster Relief Programs. Possibly the greatest emergent wetland restoration areas of opportunity exist within Mississippi Sound, where much marsh habitat has been lost to erosion, as well as north Mobile Bay.

Established monitoring programs for emergent wetlands in coastal Alabama include the Alabama Department of Conservation and Natural Resources – Dauphin Island Sea Lab Emergency Disaster Relief Program Partnership and the Weeks Bay National Estuarine Research Reserve.

References Cited

Anderson, S.H., Robbins, C.S., and Partelow, J.R., 1981, Habitat Management for Birds

of Alabama, Eastern Energy and Land Use Team, U.S. Fish and Wildlife Service, FWS/OBS-81/39.3, 51 p.

Burgan, B., and Engle, V., 2006, National Estuary Program Coastal Condition Report: U.S. Environmental Protection Agency 842/B-06/001, 445 p.

Cooley, C.D., 1987, Status of Colonial Seabird Resources in Coastal Alabama, In: Symposium on the Natural Resources of the Mobile Bay Estuary, Lowery, T.A., ed., Alabama Sea Grant Extension Service, Mobile, AL, pp. 56-66.

Copeland, C.W., ed., 1968, Geology of the Alabama Coastal Plain: A Guidebook, Geological Survey of Alabama, Circular 47, 97 p.

Duke, T., and Kruczynski, W.L., 1992, Status and Trends of Emergent and Submerged Vegetated Habitats of Gulf of Mexico Coastal Waters, U.S.A.: U.S. Environmental Protection Agency 800-R-92-003, 161 p.

Friend, J.H., Lyon, M., Garrett, N., Borom, J.L., Ferguson, J., and Lloyd, G.C., 1981, Alabama coastal region ecological characterization: Volume 3: a socioeconomic study, U.S. Fish and Wildlife Service, Office of Biological Services, Washington, D.C., FWS/OBS-81/41, 367 p.

Handley, L., Altsman, D., and DeMay, R., eds., 2007, Seagrass Status and Trends in the Northern Gulf of Mexico: 1940-2002: U.S. Geological Survey Scientific Investigations Report 2006-5287 and U.S. Environmental Protection Agency 855-R-04-003, 267 p.

Harris, Robert C., 2009, Choctaw Point Terminals Mitigation Project, 2009 AAPA

Environmental Awards Competion, Mitigation Category; Alabama State Port Authority http://aapa.files.cms-plus.com/PDFs/EnvironmentalAwards/2009/Alabama_ENV_Award_09.pdf

Jones, S. C., Tidwell, D. K., and Darby, S. B., 2009, Comprehensive shoreline mapping, Baldwin and Mobile Counties, Alabama: Phase I: Alabama Geological Survey, Open-File Report 0921, 80 p. + appendix 22 p.

Jones, Stephen C. and Tidwell, David K., 2011, Comprehensive shoreline mapping, Baldwin and Mobile Counties, Alabama: Phase II: Alabama Geological Survey, Open-File Report 1106, 50 p.

Jones, Stephen C. and Tidwell, David K., 2012, Comprehensive shoreline mapping, Baldwin and Mobile Counties, Alabama: Phase III: Alabama Geological Survey, Open-File Report 1204, 112 p.

Mobile Bay National Estuary Program, 1997, Hard Rain: A Report from the Mobile Bay National Estuary Program. <http://www.mobilebaynep.com/site/news_pubs/Publications/Hard%20Rain.pdf>

Mobile Bay National Estuary Program, 2003, Where Rivers Meet the Sea: A Report from the Mobile Bay National Estuary Program. http://www.mobilebaynep.com/newspaper%20insert.htm

Mobile Bay National Estuary Program, 2008, State of Mobile Bay: A Status Report on Alabama's Coastline from the Delta to Our Coastal Waters, Mobile Bay National Estuary Program. <http://www.mobilebaynep.com/site/news_pubs/Publications/Indicator_Report-Final.pdf>

National Wetlands Research Center, U.S. Geological Survey, U.S. Department of the Interior, 2007, Mobile Bay, Alabama: Fifty Years of Habitat Change (color poster with maps and text): Lafayette, LA, Scale 1:150,000, USGS-NWRC 2007-01-0012.

O'Neil, P.E. and Mettee, M.F., 1982, Alabama coastal region ecological characterization, Volume 2: A synthesis of environmental data, U.S. Fish and Wildlife Service, Office of Biological Services, Washington, D.C., FWS/OBS-82/42, 346 p.

O'Neil, P.E., Mettee, M.F., McCullough, E.J., and Smith, E., 1983, Sensitivity of Alabama Coastal Shoreline Habitats to Spilled Hydrocarbons, Geological Survey of Alabama, Information Series 63, 76 p.

Roach, E.R., Watzin, M.C., Scurry, J.D., and Johnson, J.B., 1987, Wetland Changes in Coastal Alabama, In: Symposium on the Natural Resources of the Mobile Bay Estuary, Lowery, T.A., ed., Alabama Sea Grant Extension Service, Mobile, AL, pp. 92-101.

Stein, B.A., 2002, *States of the Union: Ranking America's Biodiversity*. Arlington, Virginia: NatureServe.

U.S. Fish and Wildlife Service, Region IV, 1982, Central Gulf Coast Wetlands Migratory Bird Habitat Preservation Program, Category 9, 103 p.

Figure 1. Scope of area for the Alabama summary.

Figure 2. Distribution of emergent wetlands in Alabama, 1956.

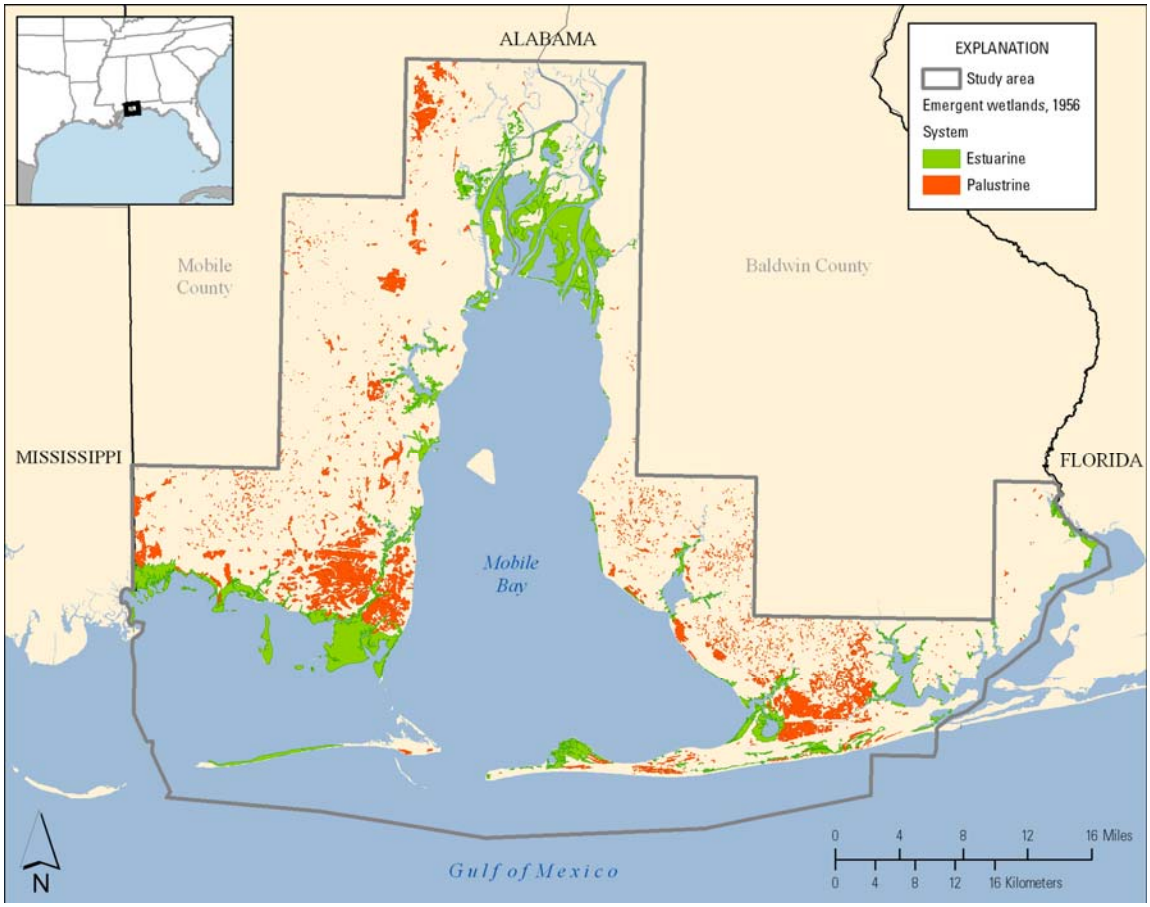

Figure 3. Distribution of emergent wetlands in Alabama, 1979.

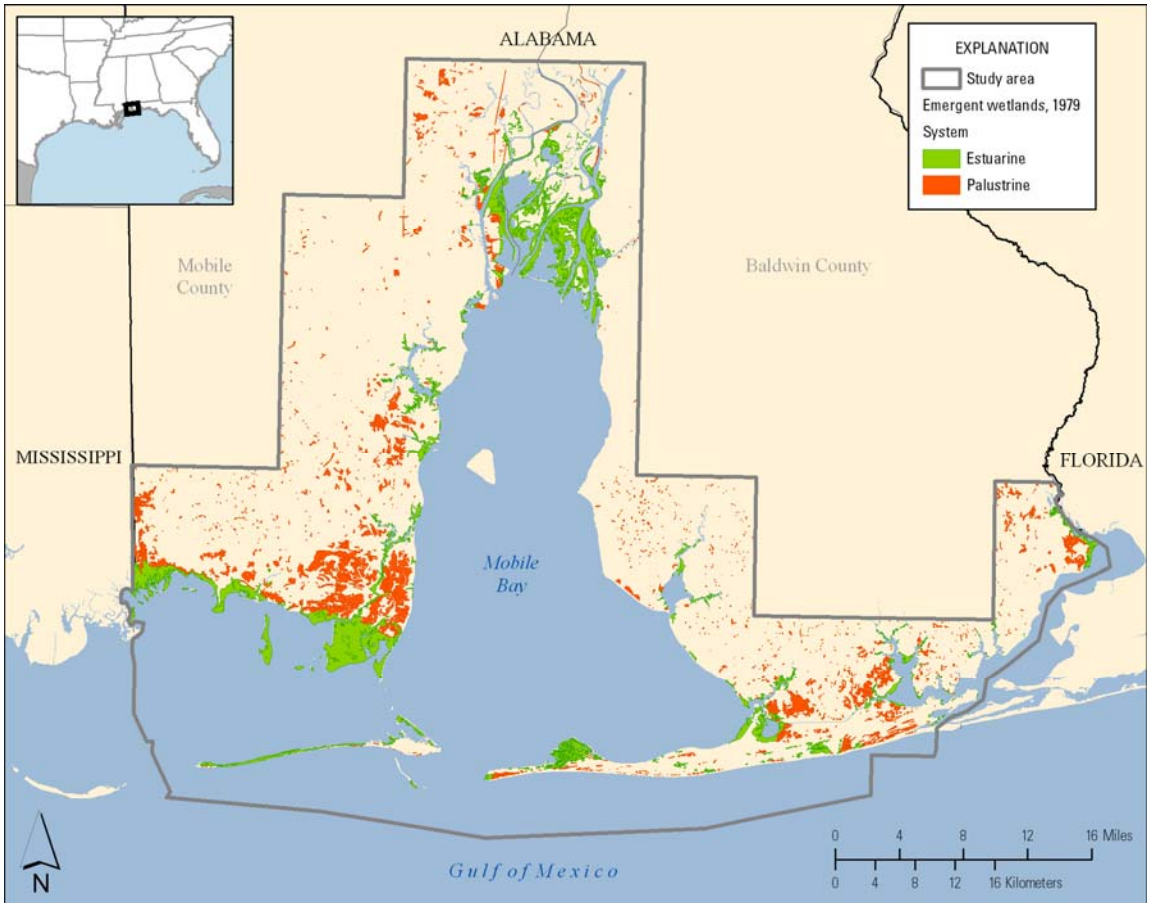

Figure 4. Distribution of emergent wetlands in Alabama, 1988.

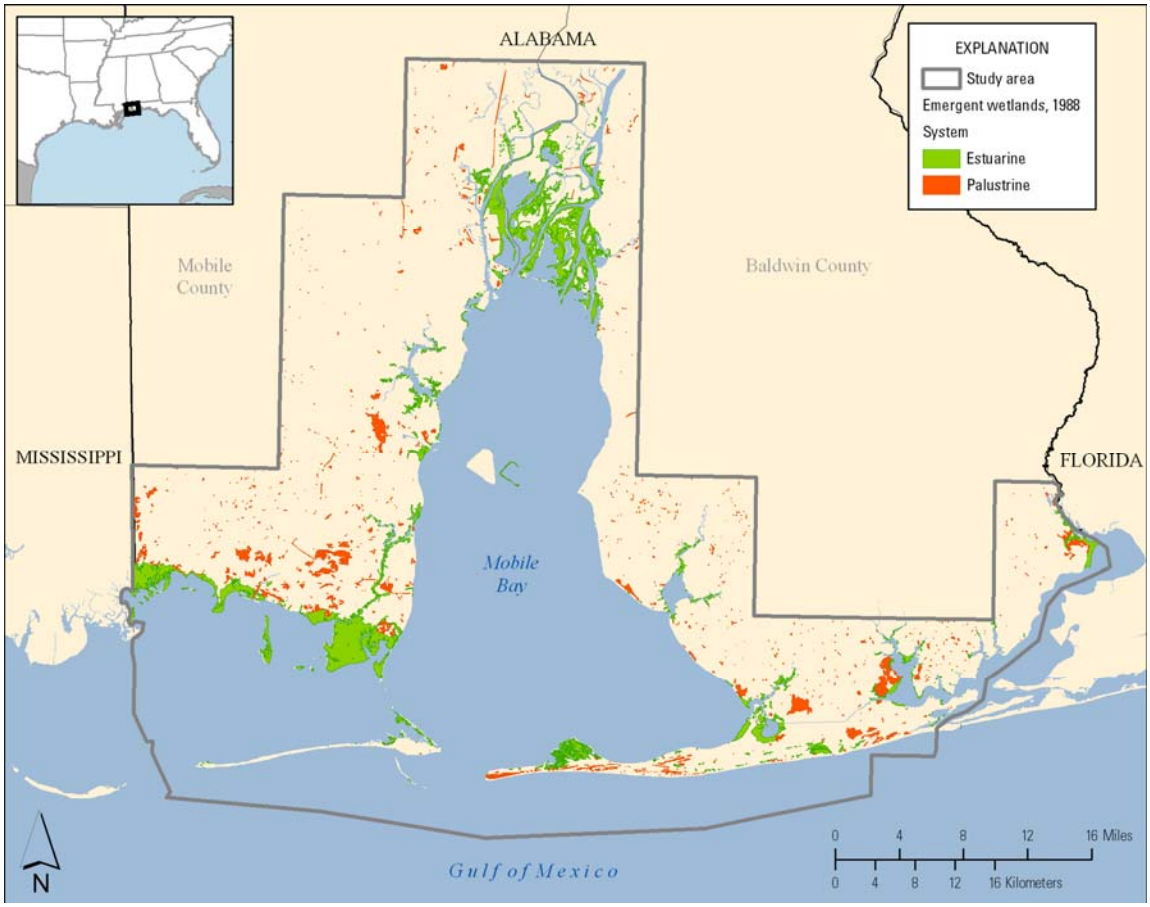

Figure 5. Distribution of emergent wetlands in Alabama, 2001/2002.