Chapter 2
Wetland Types

Photo credit: U.S. Fish and Wildlife Service, Urban C Nelson

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Chapter 2
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CHAPTER SUMMARY

Wetlands, including marshes, swamps, bogs, bottom lands, and tundra, occur along sloping areas between upland and deepwater environments, such as rivers, or form in basins that are isolated from larger water bodies. Wetlands are either periodically or continually inundated by water and generally covered by vegetation adapted to saturated soil conditions that emerges through any standing water. Most wetlands have formed as a result of past glaciation, erosion and sedimentation, beaver activity, freezing and thawing in arctic areas, activities of man, and other processes.

ORIGINS OF WETLANDS

The U.S. Fish and Wildlife Service (FWS) used the term ' 'wetland' in 1952 to describe a number of diverse environments, typically of high productivity, that share characteristics of both aquatic and terrestrial habitats—i. e., they are atleast temporarily inundated and have "emergent" vegetation adapted to saturated soil conditions. While a wide range of environmental conditions exist within this categorization —from salt marshes flooded and exposed daily to bottom land forests inundated only during spring flooding—wetlands also share similar hydrologic and habitat characteristics. These characteristics primarily stem from three interrelated factors: the wetland's origin, hydrology, and vegetation.

Six basic processes are responsible for wetland formation: glaciation, erosion and sedimentation, beaver dams, freezing and thawing, activities of man, and miscellaneous processes (6).

Glaciation

A principal band of wetlands (fig. I) —lying along the northern tier of the United States, including Alaska, Maine, New York, Michigan, Wisconsin, Minnesota, North Dakota, and Washington-was formed in three ways as glaciers melted 9,000 to 12,000 years ago. First, the melting of large blocks of ice left by receding glaciers created pits and depressions in glacial moraines, till, and outwash. Lakes and wetlands formed where the depressions intersected the ground water table or where fine clay and organics sealed their bottoms and permitted the collection of runoff waters. The majority of wetlands in the Northern United States were formed in this manner. Second, glaciers dammed rivers, often creating glacial lakes, sometimes thousands of square miles in area. Once the ice retreated, the lakes were drained partially, resulting in extensive low-lying areas with peat deposits. These areas form some of the large wetlands in the once glaciated Northern States. Third, glaciers scooped out and scoured river valleys and soft bedrock deposits, creating large and deep lakes such as the Great Lakes, and shallow depressions and wetland areas, such as the prairie potholes.

Erosion and Sedimentation

Another principal band of wetlands is found (fig. 1) along the gulf and Atlantic coasts, where sediment has been deposited in the still waters behind barrier islands or reefs and in bays and estuaries. Wetland formation is favored by low-elevation topography along the Atlantic and gulf coasts. The sediment deposited behind Georgia coastal marshes, for instance, may be up to 10 meters in thickness and has formed extensive flat or gently sloping topography conducive to growth of wetland plants.

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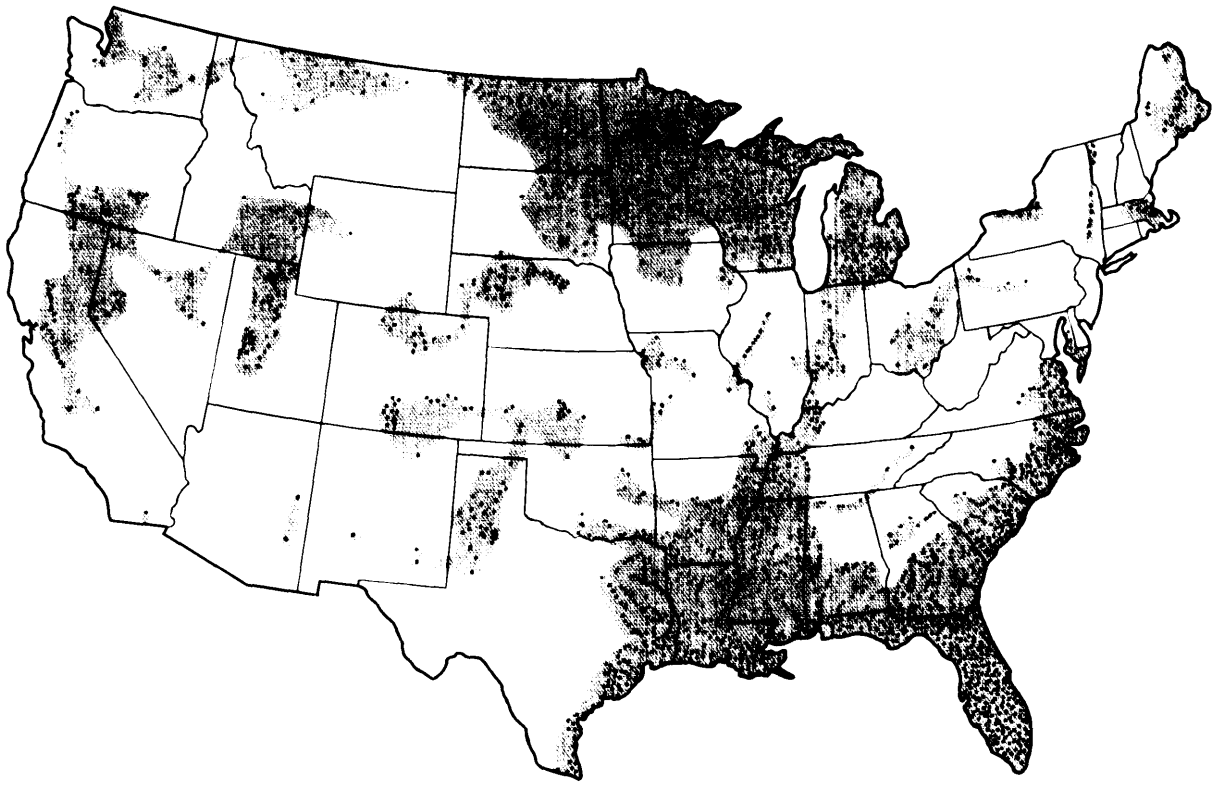
Figure 1.—General Distribution of Wetlands of the United States



Note: Shaded portions incorporate general wetland areas. Each dot represents about 10,000 acres.

SOURCE: Adapted from Samuel P. Shaw and C. Gordon Fredine, "Wetlands of the United States: Their Extent and Their Value to Waterfowl and Other Wildlife," Fish and Wildlife Service, U.S. Department of the Interior, Circular 39, 1956.

Major wetlands also are located along the flood plains of low-gradient rivers such as the Mississippi. River flood plains are created by the deposition of river alluvium on adjacent lands during floods. Rivers may cut new channels, abandoning old water courses, which may then become lakes or wetlands. Extensive wetland areas, such as the Mississippi Delta, are found where sediment is deposited at the mouths of rivers and streams. The deposition of sand, gravel, or silt also can create wetlands along the shores of, or adjacent to, lakes. Vast marshes of this type form along the Great Lakes.

Beaver Dams

At one time, beaver dams played a major role in forming smaller inland wetlands in the forested areas of the Nation. While beaver populations fluctuate due to variability in trapping pressure, their presence can be a major factor in increasing wetland acreage in some regions of the country. For example, in an analysis of wetland trends in 15 Massachusetts towns between 1951 and the 1970's, beaver activity was the third most important cause of increases in wetland acreage out of 11 identified factors (9).

Freezing and Thawing

In the Arctic, wetlands are created when the Sun melts the surface of frozen organic soils while the underlying soil remains permanently frozen. In addition, frost action segregates rock and soil particles of various sizes and shifts them in such a way that shallow, water-filled basins are formed.

Photo credit: Bob Friedman, OTA staff

Waubesa marsh near Madison, Wis., began its development approximately 6,000 years ago with the filling in of a shallow lake created by a retreating glacier. The majority of wetlands in the Northern United States were created by similar processes

Activities of Man

Wetlands may develop naturally adjacent to reservoirs, farm ponds, irrigation canals, and in pits and depressions created by mining. Poor drainage due to construction of highways, levees, and buildings also can lead to the development of wetlands. Finally, manmade wetlands can be created intentionally by Federal, State, and local resource agencies and by conservation groups in shallow, protected waters.

Miscellaneous Processes

Wetlands may be formed by other special processes. In the Sandhills of Nebraska and in other areas of the arid West, depressions have been formed by wind action. The Everglades exist because of a flow of ground water and surface water over bedrock at and directly below the surface. In Kentucky, Indiana, and several other States, wetlands are also found in sink holes and other areas where bedrock has been dissolved by percolating

water. Geologic movements have shaped still other wetlands. Reelfoot Lake in Tennessee, for exampie, was formed by the sudden sinking of the earth from earthquakes. Similarly, San Francisco Bay was formed by movement along the San Andreas Fault.

HYDROLOGIC CHARACTERISTICS OF WETLANDS

Wetlands may be located on the transitional sloping areas between upland and deepwater environments where the water is shallow and calm enough for emergent vegetation to grow. Wetlands also may form in basins that generally are isolated from larger water bodies. These basins: 1) are either at or below the ground water table, or 2) because of poor drainage, retain much of the water that flows into them. The interaction among the hydrologic regime, the wetland topography, and its underlying substrata (e. g., soil) largely controls the general characteristics of a wetland and most, if not all, of the ecological services that it performs.

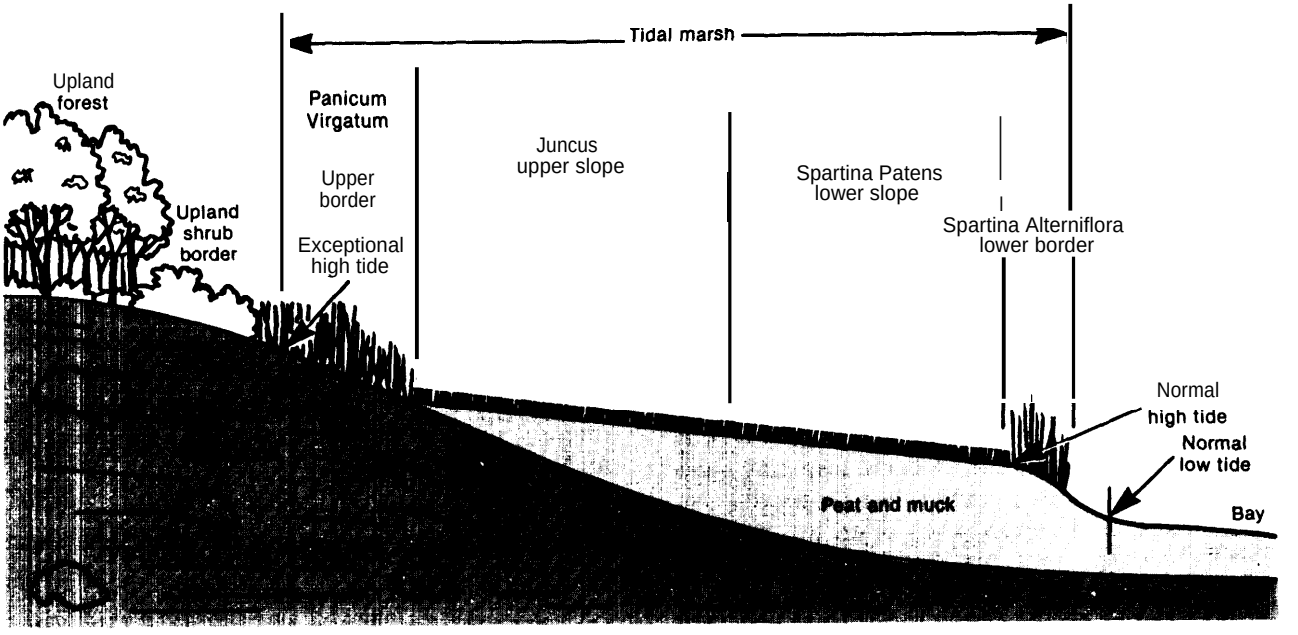
The two hydrologic characteristics that have the greatest influence in ultimately determining the habitat values of a wetland are the depth of the ***water*** and the ***pattern of fluctuation of water depth (8).*** The average depth of water varies greatly among wetlands. Bogs, for instance, typically are saturated to their surfaces, but rarely have standing water. In contrast, a wooded swamp or deep marsh may have standing water several feet deep. Annual fluctuations in water level also vary widely, ranging from those that are wet year-round, to those inundated irregularly for only a fraction of the year, to those flooded and exposed daily by tidal action. One of the most important factors influencing average water depth and patterns of fluctuation is the source of water, whether from direct surface runoff of snowmelt, from a river during spring flooding, or from tidal action in coastal areas. Climate, in addition to influencing the source of water—precipitation, snowmelt, and flooding—also determines seasonal patterns of drying. In the prairie-pothole region of the United States, for instance, shallow wetlands may dry out completely in some years.

WETLAND VEGETATION

A diversity of plant forms is found in wetlands, ranging from deciduous trees to rooted floating plants, such as water lilies. Depending on the soil type, water availability, water quality, and temperature patterns, the dominant plants in wetland areas may be mosses, grasses, sedges, bulrushes, cattails, shrubs, trees, or any combination of these. A common distinction among wetland types is the vegetation type: trees or shrubs dominate swamps; grasses, sedges, cattails, and bulrushes dominate marshes; and mosses and lichens dominate bogs.

With the exception of the severe, limiting effect of high salinity on plant type, water depth and fluctuation are perhaps the dominant physical factors influencing the type and distribution of plants. Plants often have a narrowly defined tolerance for hydrologic conditions. In a typical New England salt marsh, for instance, Spartina alterniflora (salt marsh cordgrass) dominates the water's edge; as the marsh gains elevation, Spartina patens (salt-meadow cordgrass), and then Juncus (rushes) dominate the marsh (see fig. 2). In a freshwater marsh, a typical progression from deep to shallow water would include hard-stemmed bulrush, narrowleaf cattail, and broadleaf cattail. Bald cypress, black willow, willow oak, and swamp chestnut oak are representative species found in a bottom land hardwood forest, from the areas most regularly flooded to those irregularly inundated.

Figure 2.—Cross-Sectional Diagram of New England-Type Salt Marsh
(from Miller and Egler, 1950)



Diagrammatic cross-section of the upland-to-bay sequence, showing the characteristics of the major vegetational units. Vertical Scale much exaggerated.

SOURCE: H. T. Odum, B. J. Copeland, and E. A. McMahan, *Coastal* Ecological Systems *of the United* States, vol. 2 (Washington, D. C.: Tha Conservation Foundation, 1974).

MAJOR TYPES OF WETLANDS AND CLOSELY RELATED HABITATS

Although FWS has developed a comprehensive system for classifying wetlands, for the purposes of this general discussion, OTA has distinguished between very broad types of wetlands using more vernacular terms. The primary factors distinguishing these types of wetlands are:

1. vocation (coastal or inland),
2. salinity (freshwater or saltwater), and
3. dominant vegetation (marsh, swamp, or bog).

Inland Freshwater Marshes

Inland freshwater marshes may occur at any latitude but are not common at very high altitudes. Their water depths generally range from 6 inches to 3 feet. Marsh vegetation is characterized by soft-stemmed plants, grasses, sedges, and rushes that emerge above the surface of the marsh. They include such common plants as water lilies, cattails, reeds, arrowheads, pickerel weed, smartweed, and wild rice (3).

Inland Saline Marshes

Inland saline wetlands occur primarily in shallow lake basins in the Western United States. They are usually saturated during the growing season and often covered with as much as 2 or 3 feet of water. Vegetation is mainly alkali or hard-stemmed bulrushes, often with widgeon grass or sago pondweed in more open areas (13).

Bogs

Bogs occur mostly in shallow lake basins, on flat uplands, and along sluggish streams. The soil, often consisting of thick peat deposits, usually is saturated and supports a spongy covering of mosses. Woody or herbaceous vegetation, or both, also may grow in bogs. In the North, leather-leaf, Labrador tea, cranberries, and cotton grass often are present. Cyrilla, persea, gordonia, sweetbay, pond pine, Virginia chain fern, and pitcher plants grow in southern bogs, which are found on the Southeastern Coatal Plain. These bogs are more commonly known as "pocosins" (13).

Tundra

Tundra is essentially a wet arctic grassland dominated by lichens (reindeer moss), sphagnum mosses, grasses, sedges, and dwarf woody plants. It is characterized by a thick, spongy mat of living and undecayed vegetation that often is saturated with water. Its deeper soil layer or permafrost remains frozen throughout the year; the surface of the tundra is dotted with ponds when not completely frozen. In Alaska, wet tundra occurs at lower elevation, often in conjunction with standing water; moist tundra occurs on slightly higher ground, An alpine tundra or meadow, similar to the arctic tundra, occurs in high mountains of the temperate zone (10).

Shrub Swamp

Shrub swamps occur mostly along sluggish streams and occasionally on flood plains (13). The soil usually is saturated during the growing season and often is covered with as much as 6 inches of water. Vegetation includes alder, willows, button bush, dogwoods, and swamp privet.

Wooded Swamps

Wooded swamps occur mostly along sluggish streams, on flood plains, on flat uplands, and in very shallow lake basins. The soil is saturated at least to within a few inches of its surface during the growing season and often is covered with as much as 1 or 2 feet of water. In the North, trees include tamarack, white cedar, black spruce, balsam, red maple, and black ash. In the South, water oak, overcup oak, tupelo gum, swamp black gum, and cypress are dominant. In the Northwest, western hemlock, red alder, and willows are common. Northern evergreen swamps usually have a thick ground covering of mosses. Deciduous swamps frequently support beds of duckweeds, smartweeds, and other herbs (13).

Bottom Lands and Other Riparian Habitats

Riparian habitats, those areas adjacent to rivers and streams, are most commonly recognized as bottom land hardwood and flood plain forests in the Eastern and Central United States and as streambank vegetation in the arid West. Riparian ecosystems are unique, owing to their high species diversity, high species densities, and high productivity relative to adjacent areas (l).

Bottom lands occur throughout the riverine flood plains of the Southeastern United States, where over 100 woody species occur. Bottom lands vary from being permanently saturated or inundated throughout the growing season at the river's edge to being inundated for short periods at a frequency of only 1 to 10 years per 100 years at the uplands edge (7). On the lowest sites that are flooded the longest, most frequently, and to the greatest depths, bald cypress, tupelo gum, button bush, water elm, and swamp privet are most abundant, As elevation increases (and flooding frequency and depth decrease), overcup oak, red maple, water locust, and bitter pecan occur. Nuttall oak, pin oak, sweet gum, and willow oak appear where flooding occurs regularly during the dormant season but where water rarely is present at midsummer. Sites nearest the high-water mark, which are flooded only occasionally, have shagbark hickory, swamp chestnut oak, and post oak (4).

Photo credit: US. Fish and Wildlife Service

Bottom lands occur throughout the riverine flood plains of the Southeastern United States. They vary from being permanently inundated at the river's edge to being inundated for only short periods at a frequency of 1 to 10 years per 100 years at higher elevations

Riparian habitats in the arid West are scattered widely along ephemeral, intermittent, and permanent streams that commonly flow through arid or semiarid terrain. Woody vegetation associated with these wetlands includes willows and alders at higher elevations; cottonwoods, willows, and salt cedar at intermediate vegetations; and salt cedar, mesquite, cottonwoods, and willows at lower elevations (5).

Coastal Salt Marshes

Salt marshes alternately are inundated and drained by the rise and fall of the tide, Because the plants and animals of the marsh must be able to adjust to the rapid changes in water level, salinity, and temperature caused by tides, only a relatively small number of plants and animals are able to tolerate these conditions. Thus, there is a high degree of similarity in the kinds of species present. Plants of the genus Spartina and the species Jun-***cus*** and ***Salicornia*** are almost universal in their occurrence in U.S. salt marshes (1 2).

Mangrove Swamps

Mangrove is a term denoting any salt-tolerant, intertidal tree species. In the United States, mangroves are limited primarily to Florida coastal areas. Large mangrove-swamp forests are found only in south Florida and are especially extensive along the protected southwestern coast (2). On the northwest Florida coast, black mangrove occurs mostly as scat-

tered scrublands. On the eastern shore of Florida and along the Louisiana coast, mangroves are found behind barrier islands and on the shores of protected coastlines.

Tidal Freshwater Marshes

Tidal freshwater marshes occur in virtually every coastal State but are most abundant in the estuaries of the mid-Atlantic coast and along the coasts of Louisiana and Texas. Dominant intertidal plants include a mixture of grasses and broadleaf species, such as arrow arum, spatterdock, pickerel weed, and arrowhead, which form rather complex multi-layered plant zones. The upper marsh may have from 20 to 50 species of grasses, shrubs, ferns, and herbaceous plants (11).

GEOGRAPHIC DISTRIBUTION OF WETLAND TYPES

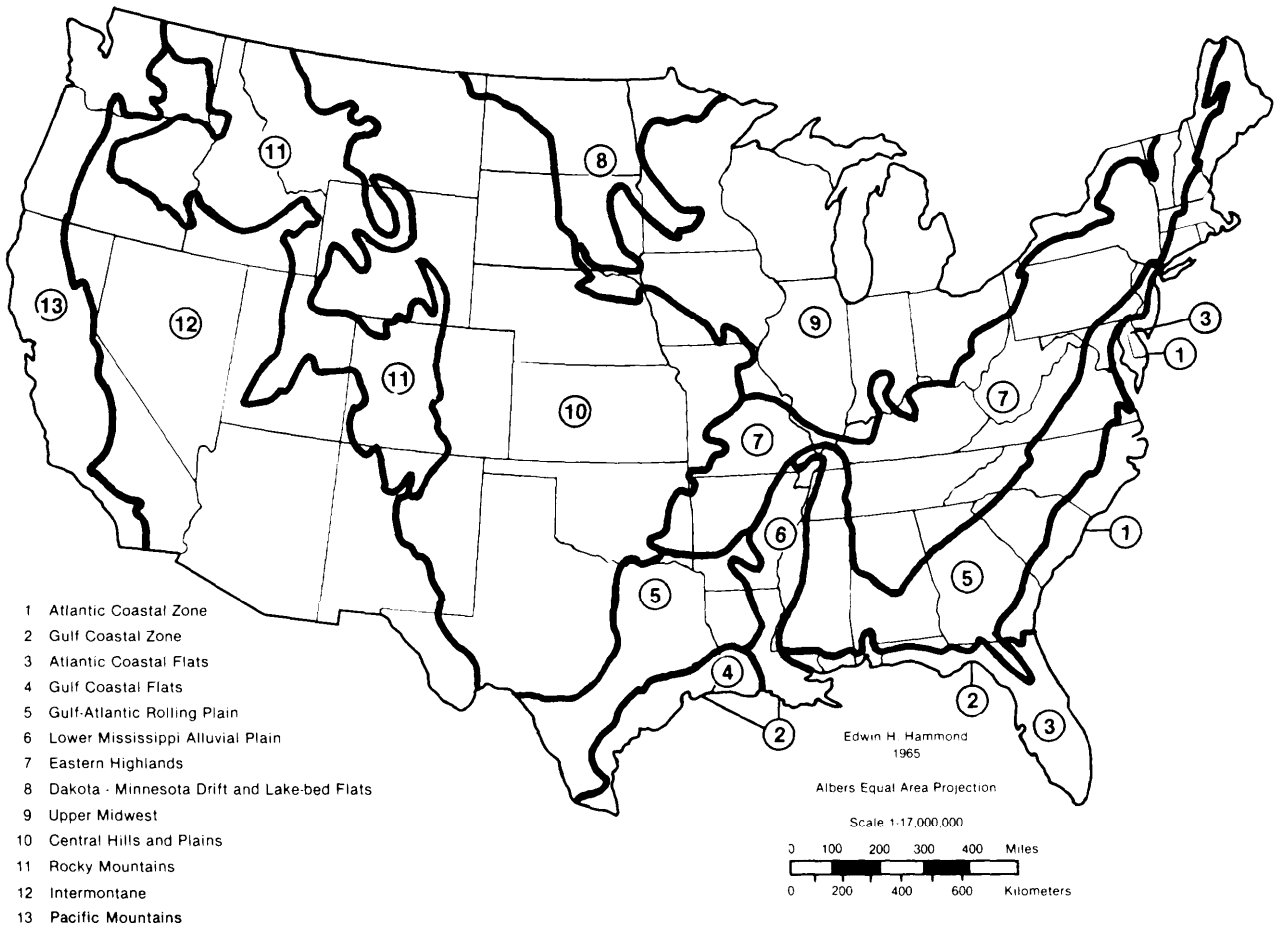
The various wetland types described in the previous section are distributed unevenly across the United States. The regions of the United States with high concentrations of the various types are identified in table 3. The regions described are based on Hammond's Physical Subdivisions (fig. 3), which are the same as those used in ***Chapter 5: Wetland Trends.***

Table 3.—Locations of Various Wetland Types in the United States

Wetland type	Primary regions	States
Inland freshwater marsh	Dakota-Minnesota drift and lake bed (8) Upper Midwest (9); and Gulf Coastal Flats (4)	North Dakota, South Dakota, Nebraska, Minnesota, Florida
Inland saline marshes	Intermontane (12); Pacific Mountains (13)	Oregon, Nevada, Utah, California
Bogs	Upper Midwest (9); Gulf-Atlantic Rolling Plain (5); Gulf Coastal Flat (4); and Atlantic Coastal Flats (3)	Wisconsin, Minnesota, Michigan, Maine, Florida, North Carolina
Tundra	Central Highland and Basin; Arctic Lowland; and Pacific Mountains	Alaska
Shrub swamps	Upper Midwest (9); Gulf Coastal Flats (4)	Minnesota, Wisconsin, Michigan, Florida, Georgia, South Carolina, North Carolina, Louisiana
Wooded swamps	Upper Midwest (9); Gulf Coastal Flats (4); Atlantic Coastal Flats (3); and Lower Mississippi Alluvial Plain (6)	Minnesota, Wisconsin, Michigan, Florida, Georgia, South Carolina, North Carolina, Louisiana
Bottom land hardwood	Lower Mississippi Alluvial Plain (6); Atlantic Coastal Flats (3); Gulf-Atlantic Rolling Plain (5); and Gulf Coastal Flats (4)	Louisiana, Mississippi, Arkansas, Missouri, Tennessee, Alabama, Florida, Georgia, South Carolina, North Carolina, Texas
Coastal salt marshes	Atlantic Coastal Zone (l); Gulf Coastal Zone (2); Eastern Highlands (7); Pacific Moutains (13)	All Coastal States, but particularly the Mid- and South Atlantic and Gulf Coast States
Mangrove swamps	Gulf Coastal Zone (2)	Florida and Louisiana
Tidal freshwater wetlands	Atlantic Coastal Zone (1) and Flats (3); Gulf Coastal Zone (2) and Flats (4)	Louisiana, Texas, North Carolina, Virginia, Maryland, Delaware, New Jersey, Georgia, South Carolina

SOURCE: This table is based on maps from Samuel P. Shaw and C. Gordon Fredine, "Wetlands of the United States: Their Extent and Their Value to Waterfowl and Other Wildlife," Fish and Wildlife Service, U.S. Department of the Interior, Circular 39, 1956.

Figure 3.— Physical Subdivisions



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