

Maine

Wetland Resources

Maine is rich in wetland resources. About 5 million acres, or one-fourth of the State, is wetland. Maine has a wide variety of wetlands, ranging from immense inland peatlands to salt marshes and mud flats along the coast.

Wetlands are an integral part of Maine's natural resources. Wetlands provide essential habitat for certain types of wildlife and vegetation, including rare and endangered species. They are used for timber and peat; hunting, fishing, and shellfishing; education and research; and bird, wildlife and plant observation, all of which boost tourism and the general economy. Wetlands also provide flood control, bank and shoreline-erosion control, sediment retention, water filtration, and nutrient uptake. In recognition of the importance of wetlands, many government and private organizations have worked to preserve wetlands and educate the public about wetland values. For example, the Maine Department of Conservation owns most of Maine's largest bog—the Great Heath (fig. 1), and wetlands in Acadia National Park and Rachel Carson National Wildlife Refuge are visited by thousands of people each year.



Figure 1. Fall foliage in an extensive dwarf-shrub community in Maine's Great Heath. A raised bog that has a coalesced dome, the Great Heath is Maine's largest continuous open bog. (Photograph by Bob Johnston, Maine Geological Survey.)

TYPES AND DISTRIBUTION

Wetlands are lands transitional between terrestrial and deep-water 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 Maine 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. 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 Maine are described below.

System

Wetland description

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|------------------|---|
| 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. |

Widoff (1988) estimated Maine's wetland area to be about 5,199,200 acres, whereas Tiner and Veneman (1989) classified 6,460,000 acres as wetland. The estimate by Tiner and Veneman (1989) was calculated from Natural Resources Conservation Service (NRCS, formerly the Soil Conservation Service) estimates of the distribution of hydric (wet) soils, and is considered high because it includes drained soils and hydric soils that occur in somewhat poorly drained areas that are not wetland. The estimate by Widoff (1988) is a compilation of earlier inventories. It estimates that wetlands in Maine comprise about 5,041,700 acres of palustrine, 87,500 acres of marine, and 70,000 acres of estuarine wetlands. Acreage for riverine and lacustrine wetlands is unknown.

The distribution of wetlands in Maine is influenced by physiography (fig. 2B). Many large wetlands occur in the Seaboard Lowland of eastern Maine. In the White Mountain Section of western Maine, wetlands occur primarily in narrow valleys separating mountains and foothills. Wetlands are distributed throughout the New England Upland of central and northern Maine but occur mainly in broad valleys between uplands of moderate relief. In many areas of the State, small wetlands are interrelated and form large wetland complexes.

Palustrine forested wetlands that have organic-rich mineral soils are commonly referred to as swamps, whereas wetlands that have organic soils over mineral soils are called peatlands. Widoff (1988) estimated that Maine contains at least 3,000,000 acres of wooded swamp. Swamps in southern Maine are dominated by hardwood communities similar to those in southern New England wetlands. Silver maple and black ash are characteristic in flood plains of major rivers, red maple swamps typically occur in poorly drained basins and along small streams, and black willow-alder swamps tend

to dominate small watercourses and swales (Maine Natural Heritage Program, 1991). A few wetlands in southern Maine contain species at the northern extent of their range, such as Atlantic white cedar and black gum. Forested wetlands in northern Maine are dominated by communities similar to those in Canadian wetlands. For example, red spruce-balsam fir swamps typically occur in poorly drained basins and borders of streams; northern white cedar swamps occur in similar settings that have higher alkalinity; and black spruce, larch, and northern white cedar predominate in forested peatlands.

Palustrine scrub-shrub vegetation grows in most wetlands, generally as a transitional community to open water or upland, or between emergent wetlands and forested wetlands. Alder, willow, and sweet gale are characteristic of shrub swamps. Scrub-shrub vegetation in peatlands comprises predominantly broad-leaved evergreen shrubs such as leatherleaf, bog laurel, and labrador tea as well as stunted black spruce and larch. Peatlands that have large expanses of dwarf shrubs are referred to locally as heaths (Worley, 1981).

Peatlands (palustrine forested, scrub-shrub, emergent, and moss-lichen wetlands) occur throughout Maine and have been estimated to comprise about 700,000 acres (Widoff, 1988). The terms bog and fen are used to define peatland types in some classification systems (Davis and Anderson, 1991). Bogs are acidic, nutrient poor, and have a low species diversity, whereas fens are less acidic and have higher nutrient levels and species diversity. Typically, the herbaceous layer in bogs is dominated by sphagnum moss, whereas in fens it is dominated by sedges and mosses. Maine has numerous peatland types, including some that have a restricted distribution in the State (fig. 2C). For example, ribbed fens (fens that have lin-

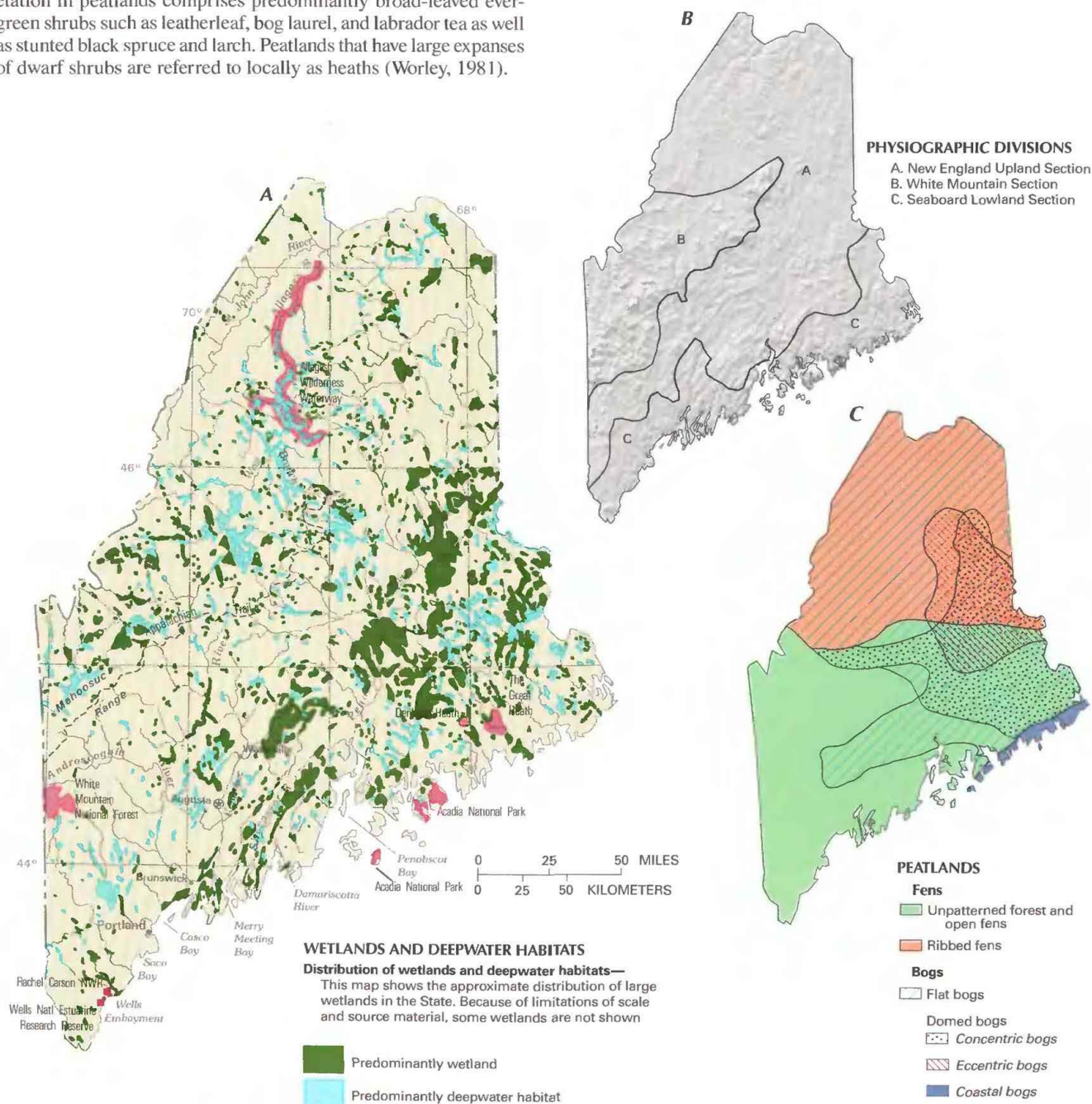


Figure 2. Wetland distribution, physiography, and distribution of peatland types in Maine. **A.** Distribution of wetlands and deepwater habitats. **B.** Physiography. **C.** Distribution of peatland types. (Sources: A, T.E. Dahl, U.S. Fish and Wildlife Service, unpub. data, 1991. B, Physiographic divisions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

ear patterns created by ridges of peat and vegetation separated by elongate hollows or shallow pools) occur in northern and northwestern Maine (Sorenson, 1986); flat bogs occur in all but southwestern and southeastern Maine; and domed bogs (bogs that have raised surface profiles) occur in eastern Maine (Worley, 1981). Domed bogs exhibit different landforms, including concentric bogs (domed bogs that have ringing crescent-shaped pools), eccentric bogs (domed bogs on valley slopes), and coastal-plateau bogs (domed bogs that have flattened raised surfaces and steep margins). Coastal-plateau bogs and eccentric bogs are rare in the United States and reach their southern limit for the Northeastern United States in Maine (Davis and Anderson, 1991).

Palustrine emergent wetlands, commonly referred to as freshwater marshes, cover a small area in Maine relative to forested and scrub-shrub wetlands. In southern and central Maine, marshes are typically associated with lakes or slow streams. In general, cattails are characteristic of deeper water or permanently flooded marshes; grasses predominate in areas that have permanently saturated mineral soils, such as swales; and sedges typically occur in permanently saturated or seasonally flooded peatlands or areas that have muck soils.

Most of Maine's rivers and lakes have some areas that have slow reaches or shallow water where submersed, floating, or emergent aquatic vegetation is established. These wetlands are very important to the biological productivity of rivers and lakes. As a result of recent increases in beaver populations, many riverine and riparian palustrine wetlands have been flooded behind beaver dams. This flooding can be detrimental to existing wetlands but also can create wetlands that have high value to some wildlife, such as waterfowl.

Along Maine's coast the predominant wetlands are mud flats, rocky shores, beaches and bars, reefs, and aquatic beds (marine and estuarine wetlands). These habitats total about 125,500 acres (Widoff, 1988). Maine also has about 34,000 acres of salt and brackish marshes (estuarine emergent wetlands) (Widoff, 1988). Many salt and brackish marshes are small, and fringe creeks and indentations in the rocky coast. Jacobson and others (1987) divided Maine's coast into four physiographic subsections in which salt marshes differ in character and distribution. The southwestern coast is characterized by bays having sandy beaches behind which large salt marshes have developed, such as those of the Wells Embayment and Saco Bay. These are generally irregularly flooded marsh communities dominated by saltmeadow cordgrass and black grass. The south-central coast is characterized by fluvial marshes in the upper parts of narrow embayments, such as those of the Damariscotta and Sheepscot Rivers. This area of the coast also contains some tidally influenced freshwater wetlands (palustrine and riverine wetlands), such as those in Merry Meeting Bay at the confluence of the Kennebec and Androscoggin Rivers. The north-central coast, including Penobscot Bay, is a high-energy environment where marshes exist only as fringes bordering a few protected coves. The northeastern coast is characterized by narrow marshes that form along the base of coastal bluffs. These are generally regularly flooded marsh communities dominated by saltmarsh cordgrass.

HYDROLOGIC SETTING

Wetlands are hydrologic features that occur wherever climate and physiography favor the retention of water (Winter, 1992). Wetlands are found along rivers, lakes, and estuaries where flooding is likely to occur; in isolated depressions surrounded by upland where surface water collects; and on slopes and surface drainageways or where ground water discharges to the land surface in spring or seepage areas. Soil saturation favors the growth of wetland plants and the development of wetland soils. Water can be either present on the surface of wetlands, or it can keep underlying soils saturated near the surface with no surface water present (Tiner, 1991). The

timing and duration of the presence of water affects water chemistry, soil development, and plant communities in wetlands. Although wetness plays a large role in the determination of wetland type, many ecologic functions of wetlands depend upon other characteristics such as size, position of the wetland in a drainage network, or sources of water (Brinson, 1993). The type of wetland that develops in any particular setting is determined by complex interactions between hydrology and other factors such as climate, physiography, geology, biology, and site history.

Maine's climate provides moisture necessary for wetland formation and cool temperatures that allow peat to accumulate. Precipitation and fog are frequent. Most climatic variables that affect vegetation differ greatly across Maine, largely owing to the southwest-northeast orientation of mountains and coastline. For example, mean annual precipitation, potential evapotranspiration, mean annual temperature, and the frost-free period decrease from the coast to northwestern Maine (McMahon, 1990). Climatic conditions play a role in the unusual diversity of peatland types in Maine. For example, coastal-plateau bogs exist only in areas along Maine's northern coast where precipitation is high, fog is frequent, and temperature is moderate.

The distribution of wetlands in Maine is partly determined by physiography, glacial deposits, and the underlying bedrock. Areas of steep topography do not retain water long enough for wetlands to develop. Given favorable hydrologic conditions, wetlands form on drainage divides and near mountain tops. For example, several ridge-top subalpine bogs occur in the Mahoosuc Range (Johnson, 1985). Most of Maine's wetlands, however, are in lowlands, valleys, and depressions that have more favorable hydrologic conditions for wetlands.

Much of the low-lying area of Maine is covered by stratified clay, silt, sand, and gravel deposited during periods of glaciation by glacial meltwater in streams and lakes (Cameron, 1989). Most uplands are composed of bedrock mantled by glacial till, an unstratified mixture of clay, silt, sand, gravel, and boulders. Both till and fine-grained sediments (clay and silt) can restrict drainage and retain surface water. Thus, wetlands occur over till in central and northern Maine and at higher altitudes; over fine-grained glacial lake deposits in portions of some valleys of central Maine, such as the West Branch of the Penobscot; and over fine-grained marine deposits in the lowlands of coastal Maine and areas reaching inland along major river valleys.

Some Maine valleys contain deposits of coarse-grained stratified drift (sand and gravel). These coarse-grained deposits can transmit ground water to overlying wetlands. Some glacial landforms, such as ridges (eskers), hills (drumlins, kames, and moraines), depressions (kettles), and terraces and plains (outwash) can create conditions favorable for wetlands by disrupting drainage patterns, attenuating runoff, or retaining water. For example, in east-central Maine, numerous wetlands are found in kettles that formed when ice blocks buried by glacial outwash melted (Timson and Pickart, 1992). These kettles either filled with water to form kettle ponds or passed through several successional stages of infilling to become kettle-hole bogs. In other areas, eskers may block drainage and create areas of swampy terrain. On occasion, roads without adequate culverts can have similar effects.

Interactions between hydrology and vegetation can be illustrated by peatlands and coastal wetlands. In peatlands, vegetation patterns are determined largely by water chemistry and movement (Damman and French, 1987). For instance, bogs receive little input from runoff or ground water and rely on precipitation (including fog) and windblown dust as sources for water, nutrients, and minerals. Vegetation in bogs commonly occurs in concentric zones caused by the scarcity of nutrients and minerals available in the center of the bog and the increased availability of nutrients and minerals along bog margins. Fens also receive water from precipitation but rely on ground water and runoff for input of minerals and

nutrients. Vegetation patterns in coastal wetlands respond to a wide range of physiographic, chemical, and biological processes that are influenced by tidal energy (Mitsch and Gosselink, 1986). For instance, the tidal range in Maine doubles from south to north, where it has a range of about 20 feet. In northeastern Maine, tidal flooding creates a sharp contrast between subtidal and terrestrial habitats and tends to compact and enhance the zonation of vegetation in Maine's salt marshes (Fefer and Shettig, 1980). As a result of high tidal energy, a shortage of sediment, and a steep, rocky coast, many coastal environments that are colonized by vegetation in other States occur as rocky shores and extensive mud flats in Maine.

TRENDS

Dahl (1990) estimated that Maine has lost about 20 percent of its wetlands since about the 1780's. However, this may be an overestimate because it was based on hydric soil mapping units (R. W. Tiner, Fish and Wildlife Service, written commun., 1993). Changes in land use have led to losses of both wetlands and contiguous upland fringes. The history of wetland loss in Maine is largely a history of the State's urban and agricultural development. Early in Maine's history, expansion of fishing and farming communities along the coast resulted in the filling of many coastal wetlands. Later, many flood-plain wetlands were filled or converted to agricultural use as development spread upstate along inland waterways. In the past few decades, most losses have been a consequence of development and urbanization (Widoff, 1988). Other factors that can destroy wetlands or affect wetland functions include road building, creation of reservoirs, agricultural activities, peat harvesting, timber harvesting, hydropower releases, inadequate bridge and culvert sizing, navigation improvements, and air or water pollution. Most Federal and State regulations focus on minimizing wetland losses from these and other sources. The cumulative effect of loss or alteration of wetlands in Maine is likely to be an important issue in the future.

CONSERVATION

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

Federal wetland activities.—Development activities in Maine 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; and the 1986 Emergency Wetlands Resources 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

Table 1. Selected wetland-related activities of government agencies and private organizations in Maine, 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	●	●	●
STATE						
Department of Agriculture	●	..	●
Department of Conservation						
Bureau of Parks and Recreation	●
Bureau of Public Lands	●
Forest Bureau	●
Land Use Regulation Commission	●	●	●
Maine Geological Survey	●	●
Department of Economics and Community Development						
Natural Areas Program	●
Department of Environmental Protection	●	●	●	●	●	●
Department of Inland Fisheries and Wildlife	●	●	●	●	●	●
State Planning Office	●
State university programs	●	●
LOCAL						
Soil and Water Conservation Districts	●	●
Some county, town, and city governments	●	●	●	●	●	●
PRIVATE ORGANIZATIONS						
Maine Coast Heritage Trust	●
The Nature Conservancy	●	●
Private colleges and universities	●	...

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 NRCS 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 (NPS) 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 manage many wetlands in Maine. The FWS manages wetlands in Waterfowl-Protection Areas, National Fish Hatcheries, and National Wildlife Refuges. Also, the FWS administers wetland-acquisition programs such as the Partners for Wildlife Program, which helps restore wetlands on private lands, and the North American Waterfowl Management Plan, a cooperative program that provides funding for purchasing wetlands and contiguous uplands. The NPS manages wetlands in Acadia National Park and along the Appalachian Trail and the Allagash River. The NPS has designated 15 sites as National Natural Landmarks in Maine, several of which are entirely wetland. Some of these are protected by the State, and others are protected voluntarily by individual landowners. Wetlands also are managed by the U.S. Forest Service in the White Mountain National Forest, and by NOAA at the Wells National Estuarine Research Reserve.

Federal agencies provide funding for research and inventory of Maine wetlands. The FWS has funded research on peatland ecology (Damman and French, 1987) and is funding a study of wetland trends in selected coastal areas in cooperation with the Gulf of Maine Council. The NPS is inventorying wetlands in Acadia National Park. The EPA funds the Casco Bay Estuary Project with the goal of minimizing adverse environmental impacts from the use and development of land and marine resources. The Wells National Estuarine Research Reserve is available for Federal, State, public, and private research projects. The U.S. Geological Survey (USGS), with cooperative funding from State agencies, has inventoried peatlands in Maine (Cameron, 1989) and studied the hydrology of Denbow Heath and the Great Heath (Nichols, 1983).

State wetland activities.—Maine protects wetlands primarily through administration of the Natural Resources Protection Act and the Mandatory Shoreland Zoning Act by the Maine Department of Environmental Protection and through activities of the Department of Conservation, Land Use Regulation Commission. The Natural Resources Protection Act protects freshwater and coastal wetlands, great ponds, rivers and streams, and other significant wildlife habitats. Any proposed alteration in or within 100 feet of protected areas requires a permit from the Department of Environmental Protection. Regulated wetlands include freshwater wetlands of 10 or more acres and coastal and flood-plain wetlands regardless of size. For regulatory purposes, the act establishes three classes of wetlands (Maine Department of Environmental Protection, 1990). Each class is assigned a value based on the wetland's functions. Class I wetlands receive the greatest protection owing to their biological functions. These are wetlands such as coastal wetlands; great ponds; and wetlands that provide habitat for endangered or threatened plants and animals, unique natural communities, or significant wildlife habitat as defined by the Maine Department of Inland Fisheries and Wildlife and the Atlantic Sea Run Salmon Commission. Class II wetlands are rated largely by hydrologic functions. These are wetlands such as large emergent marshes, (nonforested) peatlands, flood-plain wetlands, and wetlands within 250 feet of rivers, streams, lakes, or coastal wetlands. Class III wetlands include forested wetlands and wet meadows not located near open water. The act does not regulate the cutting of most forested wetlands.

The Mandatory Shoreline Zoning Act, administered by the Department of Environmental Protection, requires municipalities in coastal areas to establish land-use controls for all land areas within set distances of rivers, ponds, and wetlands. Land-use controls in the unorganized territories of northern Maine are established by the Land Use Regulation Commission. Zoning maps produced by the commission set buffers around scrub-shrub and emergent wetlands and also around streams and lakes. The Maine Department of Ag-

riculture, Bureau of Production and Marketing, assists by setting up best-management practices and reviewing permits for farming activities near great ponds and wetlands.

The Department of Environmental Protection also administers sections 305(b) and 401 of the Clean Water Act. Section 305(b) requires States to submit biennial water-quality-assessment reports to Congress and the EPA, a part of which specifically addresses water quality in wetlands. Section 401 requires State water-quality certification before a section 404 permit may be issued. Other laws administered by the Department that protect wetlands include the Dam Registration, Abandonment and Water Level Act and the Site Location of Development Law. The Department also works closely with other State and Federal agencies. For example, wetland losses due to road building are minimized through cooperation between the Maine Department of Transportation and the Department of Environmental Protection. The Corps has issued a Maine State Programmatic General Permit which allows permit work that would have otherwise required a Corps permit to be approved through the Department of Environmental Protection's permitting process.

Other State agencies manage, research, and inventory wetlands. The Department of Inland Fisheries and Wildlife may designate buffers around wetlands of high value, such as emergent wetlands, and around features such as deer yards or eagle nests, many of which are in or contiguous to wetland areas. The Department of Environmental Conservation, Maine Geological Survey, has inventoried Maine's peatland resources (Cameron and others, 1984) and coastal wetlands, has served as the lead agency for cooperative projects with the USGS, investigates surficial geology and coastal processes in wetland areas, and furnishes information such as FWS National Wetland Inventory maps to the public. The Maine Department of Economic and Community Development, Natural Areas Program, conducts an inventory and information-management program focused on endangered and rare plants and exemplary natural communities and has an official register of Maine Critical Areas and a mandate to effect voluntary conservation of these areas, more than 100 of which are wetlands. The program has published reports describing many of these critical areas.

State land acquisition is coordinated for all agencies by the Maine State Planning Office. In the last 5 years, the State Planning Office has purchased about 48,000 acres of land with a \$35 million bond from the Land for Maine's Future Program funded by Maine voters in 1987. Several purchases were entirely wetland. Ownership of State lands is divided among three agencies—the Bureau of Parks and Recreation, the Bureau of Public Lands, and the Department of Inland Fisheries and Wildlife. The Bureau of Public Lands administers 450,000 acres of Public Reserved Lands, an estimated 5 percent of which are wetlands (Widoff, 1988). The Bureau of Parks and Recreation owns a few thousand acres of wetland within State parks and the Allagash Wilderness Waterway. Inland Fisheries and Wildlife manages about 32 major Wildlife Management Areas, many of which contain wetlands as their primary feature.

County and local wetland activities.—Municipalities are active in wetland protection in Maine. Under the Mandatory Shoreline Zoning Act, every municipality is empowered to adopt, administer, and enforce its own shoreland zoning ordinance and map. Some towns have imposed stricter regulations than the act requires. On the local level, town code enforcement officers often have first contact with individuals and developers whose activities in wetlands areas are regulated under the Natural Resources Protection Act and Mandatory Shoreline Zoning Act. The Department of Economics and Community Development, Office of Community Development, runs a Code Enforcement, Training, and Certification Program to train local code enforcement officers on State wetland rules and regulations.

Private wetland activities.—Private organizations perform complementary functions that cannot readily be accomplished by

governmental agencies. For example, wetlands research is conducted in several academic departments at the University of Maine and at other colleges and universities in the State. Private organizations such as The Nature Conservancy can provide rapid action in purchase of property. The Maine Chapter of The Nature Conservancy owns 83 preserves, many which are entirely wetlands. The Maine Coast Heritage Trust is a land-conservation organization that facilitates donation of easements and land transactions for conservation purposes. Through their activities, some important natural areas that include wetlands have been designated as "forever wild." Other organizations involved with protection of Maine's wetlands or with some wetland holdings include 73 local land trusts, the Maine Audubon Society, the National Audubon Society, the Society for the Protection of New Hampshire Forests, the New England Wildflower Society, Ducks Unlimited, the Izaak Walton League, and many others. Individuals, timber companies, and other private landowners own most of Maine's wetlands, and many actively pursue wetland conservation.

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