Maryland and the District of Columbia
Wetland Resources

Wetlands cover about 9.3 percent of Maryland and the District of Columbia. Many of these wetlands harbor unique and endangered species of plants and animals, and life is abundant in all of them. Some the most familiar wetlands in the region are the tidal marshes of the Chesapeake Bay (fig. 1).

Wetlands have many physical, chemical, and biological functions. For example, wetlands trap waterborne sediments, nutrients, and toxic chemicals by filtering them out of inflowing water and either storing or transforming them. Coastal-zone and flood-plain wetlands mitigate the effects of flooding from runoff and tides by reducing flow velocity, storing water temporarily, and releasing it gradually. Vegetation in riparian wetlands maintains stream channels by stabilizing the banks, and tidal wetlands impede erosion by storm surges and waves. One of the most important functions of wetlands is as habitat for waterfowl, wildlife, and a wide variety of plant life. Wetlands provide food, shelter, resting places on migration routes, breeding areas, and nurseries for many animals including species of economic importance in Maryland such as ducks, geese, oysters, blue crabs, and several kinds of finfish. Many rare and endangered plant species are adapted to conditions present only in wetlands.

Maryland's wetlands have considerable historic and economic value. Humans have inhabited Maryland's coastal wetlands for thousands of years, and unique cultures have developed there. Wetlands provide outdoor educational, recreational, and financial opportunities—hunting, commercial and sport fishing, bird watching, and tourism—all benefit Maryland's economy.

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 Maryland and the District of Columbia is shown in figure 2*A*; only wetlands are discussed herein.

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

Figure 1. Wetlands on the Eastern Shore of the Chesapeake Bay. Local variation in topography, soil characteristics, and hydrology are reflected in the vegetation patterns. *(Photograph by David F. Usher, U.S. Geological Survey.)*

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.

Palustrine wetlands comprise most (57 percent) of the wetlands in Maryland and the District of Columbia, followed by estuarine wetlands (42 percent). Ninety percent of wetlands in Maryland and the District of Columbia are vegetated. The predominant vegetation or specific location of a wetland frequently determines its common name. Dune slacks are topographic depressions among sand dunes on the Eastern Shore (the part of Maryland on the Delmarva Peninsula) that contain palustrine emergent or scrub-shrub wetlands. Delmarva bays are topographic depressions on the Delmarva Peninsula that often contain seasonally flooded palustrine emergent, scrub-shrub, or forested wetlands. Swamps or swamp forests are palustrine tidal or nontidal forested wetlands. Seeps are small palustrine wetlands formed around springs; the pH of the water can be neutral, acidic (in sandstone), or alkaline (in carbonate rocks). Peatlands are palustrine emergent, scrub-shrub, or forested wetlands that have organic soils. A type of peatland called a bog in Maryland is permanently saturated by ground water and is, therefore, actually a fen. Seasonal sinkhole wetlands are seasonally wet palustrine emergent wetlands that form in sinkholes in areas underlain by limestone. Wet meadows are spring-fed palustrine emergent wetlands. Seagrass beds are estuarine aquatic-bed wetlands in which eelgrass commonly is the predominant vegetation. Riverine and lacustrine aquatic-bed wetlands, in which submersed aquatic vegetation such

as wild celery and hydrilla predominate, are known locally as SAV wetlands (for "submersed aquatic vegetation"). Salt and brackish marshes are estuarine emergent wetlands in which the predominant vegetation is tolerant of water that ranges from brackish to salty. Small scrub-shrub wetlands commonly are associated with salt marshes.

Maryland covers an area that extends from the Atlantic Ocean into the Appalachian Mountains. About 590,800 acres (9.3 percent) of Maryland's land area is wetland (R.W. Tiner, U.S. Fish and Wildlife Service, oral commun., 1992). Tidal and nontidal wetlands each comprise about one-half of the wetland acreage. The size and distribution of tidal wetlands are determined primarily by local topography and tidal range. The distribution of nontidal wetlands is determined by local topography, soil characteristics, and geohydrologic conditions. Tidal wetlands occur in or near the Chesapeake Bay and its tributaries or behind barrier islands on the Atlantic coast, whereas nontidal wetlands occur throughout the State. The most abundant wetland type in Maryland is palustrine forested wetland, which covers about 286,300 acres, nearly one-half the total wetland area in the State. Next most abundant is estuarine emergent wetland, covering about 203,400 acres. Maryland also has about 2,000 acres of riverine, 1,400 acres of lacustrine, and 700 acres of marine wetlands (mostly beaches and sand bars).

The District of Columbia has about 840 acres of wetlands (Guerrero, 1993); most are in the Coastal Plain along the Chesapeake and Ohio (C&O) Canal and the tidal reaches of the Potomac and Anacostia Rivers. Only a few acres of the District's wetlands are in the Piedmont Province. About 62 percent of the District's wetlands are riverine aquatic beds. Most of those are in the Anacostia River and the C&O Canal. About 34 percent of the District's wetlands are palustrine and are located along the Potomac and Anacostia Rivers and Rock Creek and on Theodore Roosevelt Island. Sixty percent of these palustrine wetlands are emergent, 16 percent are scrub-shrub, and 24 percent are forested. About 4 percent of the District's wetlands are lucustrine.

HYDROLOGIC SETTING

Maryland and the District of Columbia can be divided into three geohydrologic regions for purposes of discussing wetland hydrology: the Coastal Plain; a central region consisting of the Piedmont, Blue Ridge, and Valley and Ridge physiographic provinces; and the Appalachian Plateaus (fig. 2*B*).

Coastal Plain.—The relatively flat Coastal Plain physiographic province rises from below sea level to about 100 feet above sea level on the Delmarva Peninsula east of the Chesapeake Bay and to about 200 feet above sea level in southern Maryland west of the Chesapeake Bay (James, 1986). The Coastal Plain is underlain by unconsolidated sediments. More than 90 percent of Maryland's total wetland area, including all of its estuarine wetlands, is in this province (Tiner, 1987).

Recharge of the ground-water system in this region is mainly by infiltration of precipitation and occurs in interstream areas. Discharge occurs by seepage to streams, estuaries, and the ocean. Many Coastal Plain wetlands are in discharge areas of coastal and riparian zones. The low-lying areas of the Coastal Plain contain extensive wetlands in the form of seagrass beds, salt marshes, and tidal and nontidal freshwater marshes and swamps. These wetlands have complex hydrology; streamflow, ground-water flow, and tidal flow all are components. The many rivers and streams of the Coastal Plain have forested wetlands in the bottom lands along the channels. These wetlands are sustained by local and regional ground-water flow systems and overbank flooding during storms. The width of forested wetlands in streamside areas often is reduced by artificial draining and conversion of the land for agricultural use.

The Coastal Plain can be divided into two subregions of differing hydrology: the Eastern Shore and the area of the Coastal Plain west of the Chesapeake Bay. Inland, the Eastern Shore is poorly drained and has small depressional palustrine wetlands (Delmarva bays) and narrow bands of palustrine wetlands along ditches, streams, and rivers that drain areas from inland to the coasts (fig.

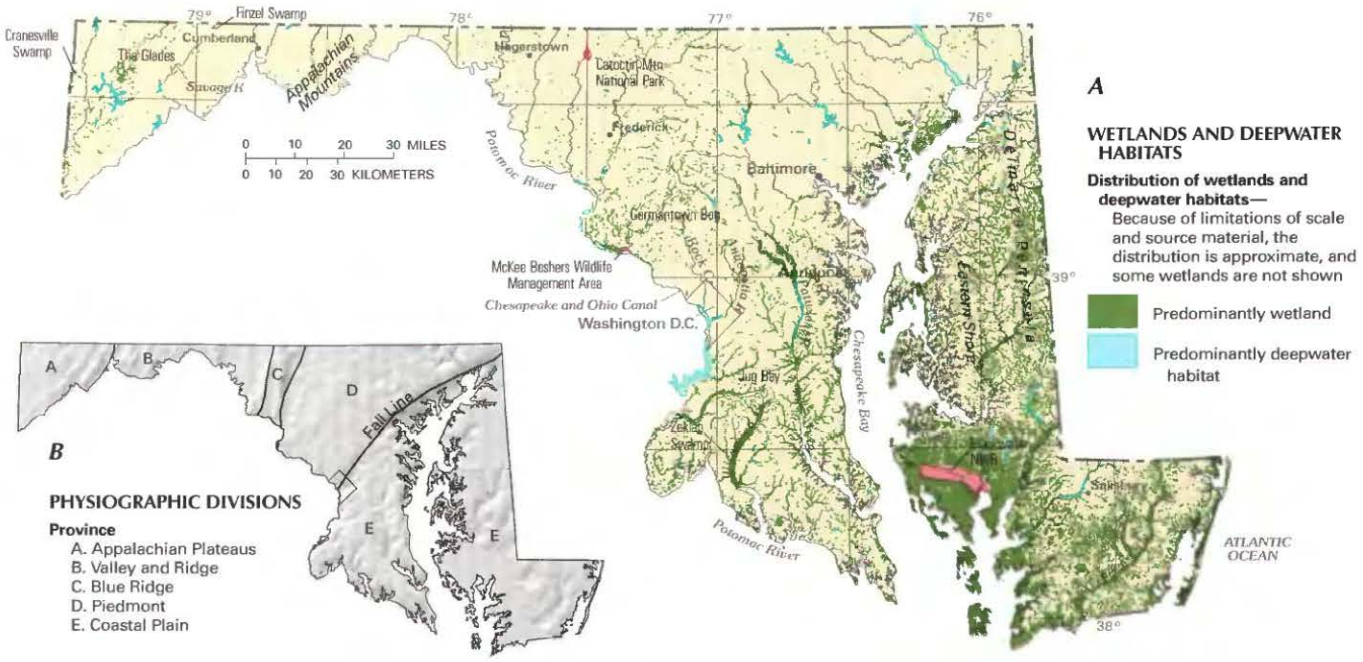

Figure 2. Wetland distribution in Maryland and the District of Columbia and physiography of the State and District. ***A***, Distribution of wetlands and deepwater habitats. ***B***, Physiography. *(Sources: A, T.E. Dahl, U.S. Fish and Wildlife Service, unpub. data, 1991. B, Physiographic divisions from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

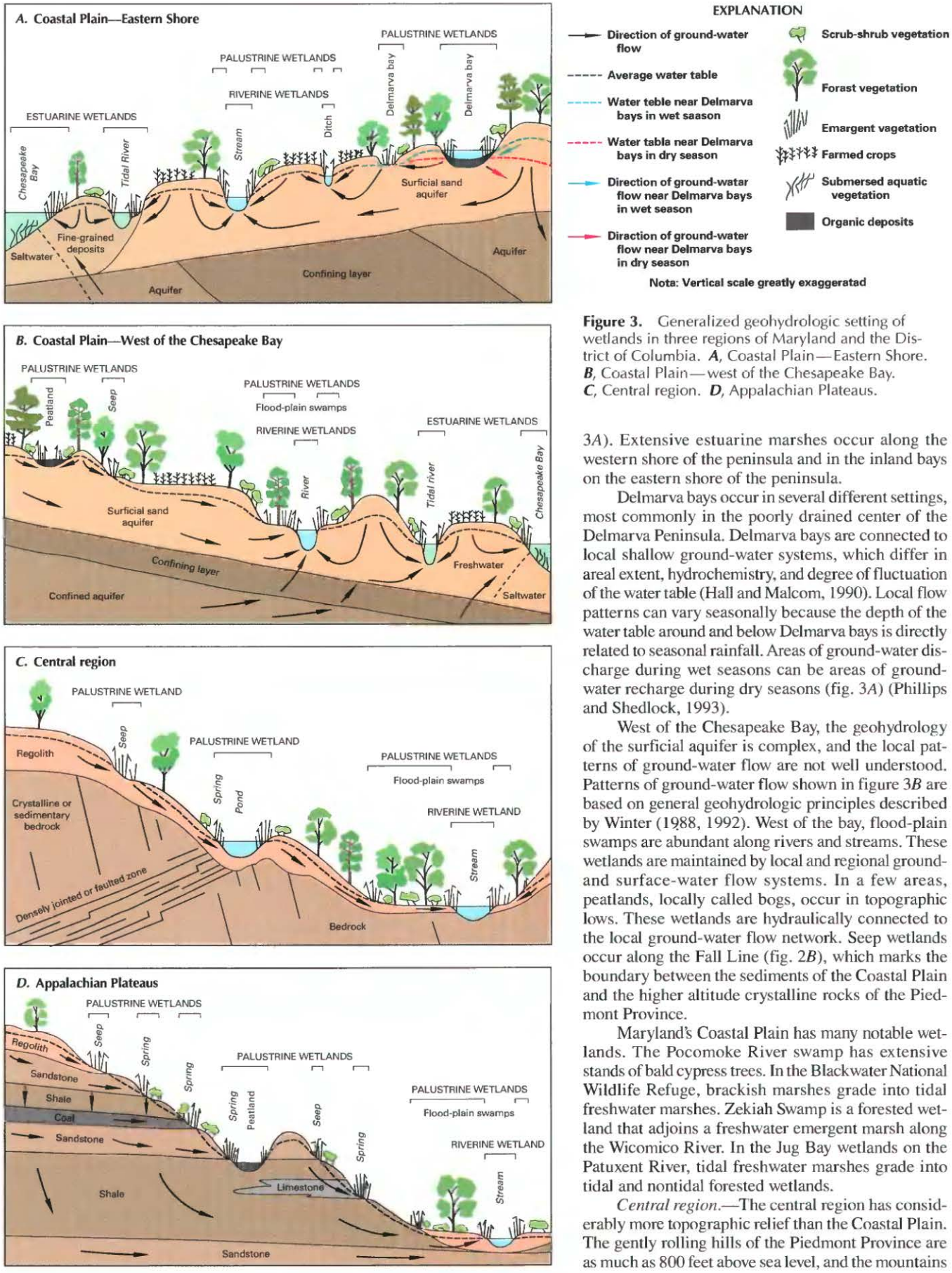

Figure 3. Generalized geohydrologic setting of wetlands in three regions of Maryland and the District of Columbia. ***A***, Coastal Plain—Eastern Shore. ***B***, Coastal Plain—west of the Chesapeake Bay. ***C***, Central region. ***D***, Appalachian Plateaus.

3*A*). Extensive estuarine marshes occur along the western shore of the peninsula and in the inland bays on the eastern shore of the peninsula.

Delmarva bays occur in several different settings, most commonly in the poorly drained center of the Delmarva Peninsula. Delmarva bays are connected to local shallow ground-water systems, which differ in areal extent, hydrochemistry, and degree of fluctuation of the water table (Hall and Malcom, 1990). Local flow patterns can vary seasonally because the depth of the water table around and below Delmarva bays is directly related to seasonal rainfall. Areas of ground-water discharge during wet seasons can be areas of ground-water recharge during dry seasons (fig. 3*A*) (Phillips and Shedlock, 1993).

West of the Chesapeake Bay, the geohydrology of the surficial aquifer is complex, and the local patterns of ground-water flow are not well understood. Patterns of ground-water flow shown in figure 3*B* are based on general geohydrologic principles described by Winter (1988, 1992). West of the bay, flood-plain swamps are abundant along rivers and streams. These wetlands are maintained by local and regional ground- and surface-water flow systems. In a few areas, peatlands, locally called bogs, occur in topographic lows. These wetlands are hydraulically connected to the local ground-water flow network. Seep wetlands occur along the Fall Line (fig. 2*B*), which marks the boundary between the sediments of the Coastal Plain and the higher altitude crystalline rocks of the Piedmont Province.

Maryland's Coastal Plain has many notable wetlands. The Pocomoke River swamp has extensive stands of bald cypress trees. In the Blackwater National Wildlife Refuge, brackish marshes grade into tidal freshwater marshes. Zekiah Swamp is a forested wetland that adjoins a freshwater emergent marsh along the Wicomico River. In the Jug Bay wetlands on the Patuxent River, tidal freshwater marshes grade into tidal and nontidal forested wetlands.

Central region.—The central region has considerably more topographic relief than the Coastal Plain. The gently rolling hills of the Piedmont Province are as much as 800 feet above sea level, and the mountains

of the Blue Ridge Province rise to more than 1,600 feet. Altitudes in the Valley and Ridge Province range from about 400 feet in the valleys to about 1,500 feet on ridges (James, 1986). The central region is underlain by crystalline and consolidated sedimentary bedrock that has been subjected to considerable folding and faulting and that is overlain by a regolith of variable thickness. Regolith, which forms the land surface nearly everywhere, is a layer of unconsolidated, mostly fine-grained material composed of fragmental, weathered bedrock and alluvium overlying unweathered bedrock.

Recharge of the ground-water system in the central region is by infiltration of precipitation, mostly in the forested uplands. Most of the precipitation seeps into a thick, permeable soil layer, and most of that water moves laterally through the soil to surface depressions or streams. Water that moves below the soil zone enters the regolith, and much of that water seeps into the underlying bedrock. Ground water discharges from the regolith or bedrock by evapotranspiration, as seeps or springs, or directly into streams (fig. 3*C*). Much of the ground water available to wetlands in the region is held in the regolith (Metzgar, 1973).

Most of the wetlands in the central region are in valleys or other surface depressions. These topographic lows often indicate the presence of fracture zones in the bedrock. Fracture zones are more susceptible than unfractured zones to weathering and erosion, which allows the evolution of topographic depressions, and they are the major pathways of ground-water movement through bedrock (Heath, 1984). Water is more likely to be discharged into depressions than into other areas. For example, the source of water in the Germantown Bog is primarily ground water and, although no streams flow into this peatland, a stream flows out of it. Wetlands in the Piedmont Province include peatlands; flood-plain emergent marshes; chemically neutral, acidic, and alkaline seeps; seasonal sinkholes; and farm ponds. Wetlands in the Blue Ridge Province include isolated peatlands and forested wetlands in seepage areas smaller than 1 acre and surrounded by forest. Wetlands are rare in the Valley and Ridge Province, but those that are there include seeps, forested flood-plain wetlands, and wet meadows.

Notable wetlands in the Piedmont Province include the Germantown Bog (a fen rather than a true bog) and flood-plain marshes such as those in the McKee Beshers Wildlife Management Area. The isolated wetlands in the Blue Ridge Province, such as the acidic seeps in Catoctin Mountain National Park, are essential habitats for rare and endangered plants. Wetlands also provide important habitat in the Valley and Ridge Province, where the major wetlands are flood-plain swamps of the Potomac River and its tributaries and wet meadows in the area around Hagerstown.

Appalachian Plateaus.—The valleys and mountains of the Appalachian Plateaus range from 1,500 to 3,000 feet above sea level (James, 1986). The Appalachian Plateaus are characterized by severely eroded, flat-lying to gently folded shale, sandstone, coal, and limestone. The landscape consists of mountain crests, ridges, and hilltops that are formed of or capped by sandstone; wide, elongated valleys of intermediate altitude; and narrow, steep-sided valleys (Abbe, 1902).

Recharge of the ground-water system in this region is by infiltration of precipitation. Recharge primarily occurs in outcrop areas of sandstone formations in the uplands between streams (Heath, 1984). Discharge from the ground-water system is through seeps, springs, and streams (fig. 3*D*).

Most of the wetlands in this region are in wide valleys and topographic lows in shale beds and along contacts and bedding planes in the bedrock. Small wetlands are isolated from the surface-water system, but large wetlands drain into streams. For example, streams draining from Finzel Swamp (also known as Cranberry Swamp), a large peatland, are the headwaters for the Savage River. Peatlands are the largest wetland complexes in the Appalachian Plateaus; other wetland types in the region include seeps and flood-plain swamps. The peatlands generally are spring fed and have acidic water, although some are buffered by limestone. The predominant vegetation in many peatlands is shrubs and grasses, but some have open sphagnum mats. Notable wetlands in the Appalachian Plateaus are large peatlands such as Finzel Swamp, The Glades, and Cranesville Swamp, which is a classic northern peatland.

TRENDS

In the 1780's, about 1,650,000 acres, or 24 percent, of Maryland (Dahl, 1990) and about 8,700 acres, or 20 percent, of the District of Columbia (Department of Consumer and Regulatory Affairs, 1990) were wetland. At that time, and for 2 centuries thereafter, wetlands were regarded as a public nuisance—a source of disease and useful only if they could be turned into dry land (Maryland Conservation Commission, 1909). The influence of agricultural, tourism, recreational, and industrial interests led to the draining, dredging, filling, diking, and damming of wetland areas and to extensive stream channelization. These practices—in combination with other human activities such as forestry; mining; crop tillage; increased pesticide, herbicide, nutrient, and sediment loading from upland activities; urban development and pollution; natural impacts such as saltwater intrusion caused by sea-level rise and ground subsidence; wave-generated erosion; and hurricanes—have contributed to widespread wetland loss or degradation. About 590,800 wetland acres, or about 9.3 percent of the land surface, remain in Maryland (R.W. Tiner, U.S. Fish and Wildlife Service, oral commun., 1992)—a loss of about 64 percent since the 1780's.

When the District of Columbia was established in the 1790's, dredging and filling of wetlands to control disease and flooding began immediately. By the 1920's, most of the streams and springs that once drained into the Potomac and Anacostia Rivers were dry or enclosed in pipes (Williams, 1989). Most of the palustrine wetlands that those springs and streams supported have been covered by monuments, buildings, and parks. By 1992, only about 840 acres of wetlands, or about 10 percent of the wetland area in the 1780's, remained. The Department of Public Works and the U.S. Army Corps of Engineers (Corps) are directing wetland-restoration projects in the Anacostia River basin, where most of the District's remaining tidal wetlands are located.

CONSERVATION

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

Federal wetland activities.—Development activities in Maryland and the District of Columbia 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 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

Table 1. Selected wetland-related activities of government agencies and private organizations in Maryland, 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	...	•	...	...	...	...
Natural Resources Conservation Service	...	•	•	...	•	•
Department of Commerce						
National Oceanic and						
Atmospheric Administration	•	•	...	...	•	•
Department of Defense						
Army Corps of Engineers	•	•	•	•	•	•
Department of the Interior						
Fish and Wildlife Service	•	...	•	•	•	•
Geological Survey	...	...	...	...	...	...
National Biological Survey	...	...	...	...	•	...
National Park Service	•	...	•	•	•	•
Environmental Protection Agency	...	•	...	...	•	•
STATE						
Department of the Environment						
Water Management Administration	•	•	•	•	•	•
Department of Natural Resources						
Chesapeake Bay and Watershed Programs	•	...	•	...	•	•
Natural Heritage Program	•	...	...	...	•	•
Program Open Space	...	...	...	•	...	...
Office of State Planning	...	...	...	...	...	•
State Highway Administration	...	...	•	...	...	...
University of Maryland	...	...	...	...	•	...
DISTRICT OF COLUMBIA						
Department of Consumer and						
Regulatory Affairs	...	•	...	...	...	...
Department of Public Works	•	...	•	...	...	...
Metropolitan Council of Governments	...	•	...	...	...	...
Soil and Water Conservation District	•	•	•	...	...	...
SOME COUNTY AND LOCAL GOVERNMENTS	•	•	•	...	...	...
PRIVATE ORGANIZATIONS						
Chesapeake Bay Foundation	...	•	...	...	...	...
Environmental Concern, Inc.	...	...	•	...	•	...
Maryland Land Trust Alliance	•	...	...	•	...	...
The Nature Conservancy	•	...	...	•	...	...

401 of the Clean Water Act grants to States and eligible Indian Tribes the authority to approve, apply conditions to, or deny section 404 permit applications on the basis of a proposed activity's probable effects on the water quality of a wetland.

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

The 1986 Emergency Wetlands Resources Act and the 1972 Coastal Zone Management Act and amendments encourage wetland protection through funding incentives. The Emergency Wetland Resources Act requires States to address wetland protection in their Statewide Comprehensive Outdoor Recreation Plans to qualify for Federal funding for State recreational land; the National Park Service (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 are eligible for Federal funding and technical assistance through the Coastal Zone Management Act.

State wetland activities.—Maryland's Wetlands and Riparian Rights Act and Non-Tidal Wetlands Protection Act and Chapters 20 and 21 of the District of Columbia Code contain State-level requirements for construction activities in wetlands. To obtain permits for altering wetlands in Maryland, a joint State-Federal application must be submitted to the Maryland Department of the Environment's Water Resources Administration, which will route it to the appropriate regulatory agencies. The Department of the Environment administers the Maryland wetland-protection acts and is responsible for State compliance with section 305(b) of the Clean Water Act, which requires States to submit water-quality-assessment reports to Congress and the EPA biennially. These reports must specifically address water quality in wetlands. The Department of the Environment also administers section 401 of the Clean Water Act, which requires State water-quality certification before a section 404 permit may be issued.

Other regulatory activities are conducted by the Department of Natural Resources, the Office of State Planning, and the State Highway Administration. All activities in tidal wetlands are conducted under the Department of Chesapeake Bay and Watershed Programs; other activities are conducted by the Department's Natural Heritage and Greenways and Resource Planning Programs, by the Greenways Commission, by the Department of the Environment's Mining Program, and by the University of Maryland. The Maryland Natural Heritage Program supervises wetland management on State-owned lands and administers land-acquisition programs. The Department of Natural Resources' Greenways Program and the Greenways Commission work to maintain the integrity of natural areas and to integrate them with recreational use. The Mining Program has a small wetlands mitigation and restoration program in the Appalachian Plateaus region. Several academic departments and the Center for Environmental and Estuarine Studies at the University of Maryland conduct wetlands research.

Most wetlands in the District of Columbia are owned by the NPS, which maintains them and monitors wetland restoration and creation efforts along the Anacostia River. Permits for wetland alteration in the District of Columbia must be obtained from the Corps and the Department of Consumer and Regulatory Affairs.

County and local wetland activities.—County and local governments have enacted zoning restrictions on development in wetlands and created many conservation programs. Some counties (Baltimore, Harford, and Anne Arundel) have wetland programs. Prince Georges County has received partial authority from the State to implement the State Nontidal Wetland program. Other cooperative programs among State and local government agencies and private organizations coordinate regional programs and management and protection efforts, particularly around the District of Columbia and the Chesapeake Bay.

Private wetland activities.—Private organizations with interests in wetlands in Maryland and the District of Columbia are active primarily in regulation and policy planning, land acquisition and management, research, and adult and professional education.

A few of the many organizations in the region are the Chesapeake Bay Foundation (regulation and policy planning), the Maryland Land Trust Alliance and The Nature Conservancy (land acquisition and management), Environmental Concern, Inc. (research and adult and professional education), and Alliance for the Chesapeake Bay (adult and professional education).

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