

# U.S. Virgin Islands

## Wetland Resources

The wetlands of the U.S. Virgin Islands, which comprise St. Croix, St. Thomas, St. John, and about 50 smaller islands, are limited in area but are an important natural resource. The U.S. Virgin Islands are located on the northeastern edge of the Caribbean Sea east of Puerto Rico's Vieques and Culebra islands in the arc of the Lesser Antilles, which curves southward toward South America. The wetlands of these islands generally are coastal wetlands such as mangrove forests and saltponds (fig. 1). Many of these valuable wetlands are threatened by development.

Wetlands on the U.S. Virgin Islands are biologically productive. They support food webs intricately linked to seagrasses and coral reefs of the nearshore waters of the Caribbean Sea by providing nursery and feeding habitat for marine fish and shellfish (Lopez and others, 1988). Seagrass beds provide foraging for the threatened green turtle and important nursery grounds for lobster and conch. Ninety percent of the U.S. Virgin Islands' resident and migratory bird species use wetlands (Philibosian and Yntema, 1977). One-hundred twenty-one species of birds have been observed in coastal wetlands (William Knowles, U.S. Virgin Islands Department of Planning and Natural Resources, written commun., 1994). Endangered species, such as the peregrine falcon and brown pelican, and other rare species, such as the white-cheeked pintail and white-crowned pigeon, nest and feed within the wetlands. Sandpipers, plovers, snipe, and other shorebirds depend on these areas during migration. The wetlands also maintain water quality by trapping sediments transported in runoff from the island interior, protect the shoreline from wave erosion, and dampen the effects of storm surges.

### 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 the U.S. Virgin Islands is shown in figure 2; only wetlands are discussed herein.

Wetlands can be vegetated or unvegetated and are classified on the basis of their hydrology, vegetation, and substrate. In this summary, wetlands are classified according to the system proposed



**Figure 1.** Salt Pond near Saltpond Bay in Virgin Islands National Park on St. John, U.S. Virgin Islands. (Photograph by D. Briane Adams, U.S. Geological Survey.)

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 the U.S. Virgin Islands are described below.

#### System

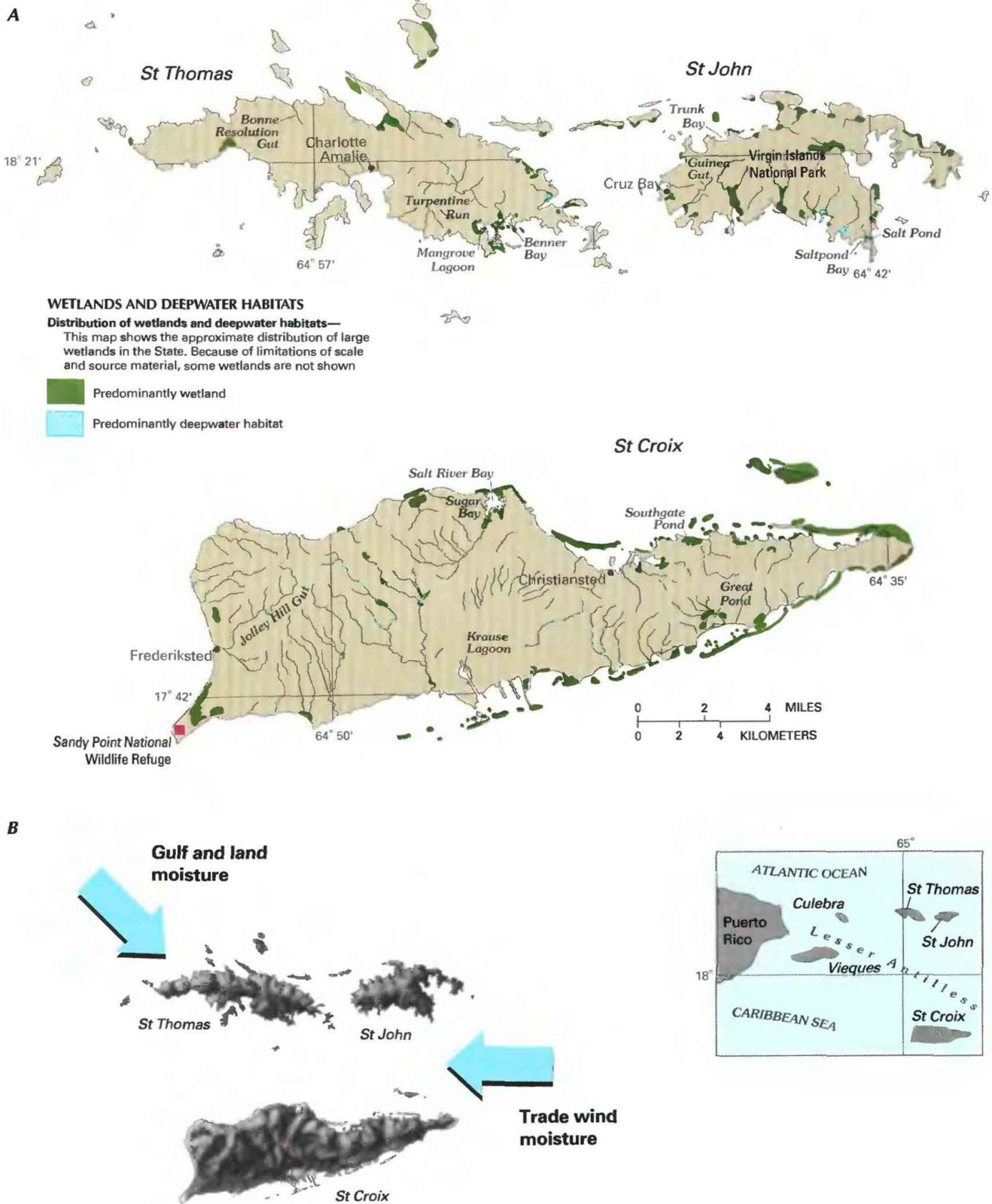
#### Wetland description

Palustrine .....	Nontidal and tidal-freshwater wetlands in which vegetation is predominantly trees (forested wetlands); shrubs (scrub-shrub wetlands); persistent or nonpersistent emergent, erect, rooted herbaceous plants (persistent- and nonpersistent-emergent wetlands); or submersed and (or) floating plants (aquatic beds). Also, intermittently to permanently flooded open-water bodies of less than 20 acres in which water is less than 6.6 feet deep.
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.

As a result of steep terrain, small drainage basins, and limited rainfall, freshwater wetlands and deepwater habitats are scarce on the U.S. Virgin Islands. St. Thomas, about 28 square miles in area, reaches an altitude of 1,556 feet above sea level and is very steep. St. John, about 19 square miles in area, reaches an altitude of 1,297 feet above sea level and is also steep. St. Croix, about 84 square miles in area, reaches an altitude of 1,165 feet above sea level and is less rugged—more than 50 percent of the landscape has a slope of less than 10 percent. No lacustrine habitats (large freshwater bodies) occur in the islands. Because nearly all streams are ephemeral, riverine wetlands are limited to channels of intermittent streams. Palustrine wetlands consist of a few small marshes. Constructed catchment basins fill with water during the wet season and may be vegetated by cattails or other wetland plants, depending on the time of year, age of the impoundment, and degree of maintenance. There are three small, natural freshwater marshes on St. Croix. One is a small emergent area at the interior edge of the Sugar Bay wetland complex. The second is a 7-acre, seasonally flooded marsh about 1 mile north of Frederiksted. The third is a small area owned and managed by the University of the Virgin Islands northeast of Krause Lagoon.

Most wetlands of the U.S. Virgin Islands are located along the coasts and are classified as estuarine or marine wetlands. The largest of the wetlands are on St. Croix, where the terrain is less steep and the drainage basins are larger than on St. Thomas or St. John.

Estuarine intertidal vegetated wetlands in the U.S. Virgin Islands are dominated by red, white, and black mangroves. Buttonwood also is common, particularly in hypersaline (salinity greater than seawater) environments. Mangroves grow in shallow lagoons,



**Figure 2.** , Distribution of wetlands and deepwater habitats in the U.S. Virgin Islands. **B**, Principal sources and patterns of delivery of moisture into the U.S. Virgin Islands. (Sources: A, Digitized from USFWS—NWI, U.S. Fish and Wildlife Service, National Wetland Inventory, unpub. data, 1994. B, Data from Douglas Clark and Andrea Lage, Wisconsin Geological and Natural History Survey.)



such as Mangrove Lagoon on St. Thomas; ring “saltponds,” such as Great Pond on St. Croix; or fringe bays and coves, such as the Salt River Bay–Sugar Bay estuary on St. Croix.

Saltponds are the predominant wetlands in the U.S. Virgin Islands. They are tidal flats or basins that are at least partially separated from direct contact to the sea by a beach berm. Saltponds range in size from less than 1 acre to more than 125 acres. An example of this wetland type is Salt Pond near Saltpond Bay in Virgin Islands National Park on St. John (fig. 1). Saltwater inputs to the ponds result from tidal or storm-surge overwash of the berm, seepage of seawater through the berm, or from subterranean connections to the sea. Ponds that have sporadic input of seawater go through an annual cycle of filling with freshwater runoff and rainfall during the rainy season and drawing down or drying during the remainder of the year. Consequently, saltponds are subject to extreme salinity variations during the annual cycle.

Coral reefs ring many of the U.S. Virgin Islands. Though most of the reefs and seagrass beds are submersed, at least some are exposed at low tide and thus are classified as wetlands. The most extensive of the reefs surround St. Croix. The reef in Trunk Bay in Virgin Islands National Park on St. John is the site of an underwater trail and has corals typical of those in the Caribbean area.

## HYDROLOGIC SETTING

Wetlands form where the local hydrology makes possible a dependable water supply at or near the land surface. In the U.S. Virgin Islands, the type of wetland that exists at a particular location is determined by the local hydrologic setting. The components of that setting include the duration of inundation or saturation, the salinity of the water, and the nature of the substrate, which in turn are the result of climate, geology, and topography.

The climate of the U.S. Virgin Islands is classified as subtropical (Ewell and Whitmore, 1973). Winters are mild and dry, whereas summers are warm and humid. In the winter, precipitation generally comes from frontal systems from the northwest and is greatest during February and March, when the regional climate is influenced by a subtropical high pressure area. During summer, the regional climate is no longer influenced by high atmospheric pressure, and there is a steady westerly flow of moist air from the Atlantic Ocean (the trade winds) that is the primary source of summer and fall precipitation (fig. 2B).

Average annual precipitation ranges from about 30 inches in the lowlands of St. Croix to about 55 inches in the mountain peaks of St. John. Precipitation increases with altitude because moist air in the weather systems is forced up the slopes into the cooler air at the higher altitudes, causing the moisture to condense and fall as rain. However, because of the small size of the islands and brief time for passage of these systems over them, these effects are not

as pronounced as for larger Caribbean islands with higher mountain peaks. Clouds form as they pass over St. Thomas and St. Croix, but most resultant precipitation falls in the Caribbean Sea on the lee side of the islands.

The geology and topography of the U.S. Virgin Islands are major factors influencing the hydrology of the islands, which in turn controls the presence or absence of wetlands. The U.S. Virgin Islands are composed of volcanic rock that was uplifted by tectonic activity. The islands have steep slopes and irregular coastlines. Both St. Thomas and St. John have steep slopes throughout, but on St. Croix the mountains in the northwest give way to rolling hills that broaden to an expanse of relatively low flatland along the southern two-thirds of the island.

Ground water in the U.S. Virgin Islands is scarce. The most extensive ground-water source on the islands is the fractured volcanic rocks of which the islands are generally composed (Gómez-Gómez and others, 1985). Embayment aquifers occur near guts (stream drainages) along the coasts of the islands. These aquifers are composed principally of weathered rocks overlain by shallow alluvium. They are recharged by seepage from the surrounding volcanic rocks and by direct infiltration from ephemeral runoff and precipitation. Discharge from these aquifers to the oceans is a source of freshwater for estuarine wetlands, such as mangrove wetlands, in the coastal embayments. On St. Croix, an aquifer composed of limestone interbedded with sand and gravel and covered by alluvium exists throughout most of the lowlands. This aquifer discharges small amounts of ground water to coastal wetlands.

On an annual basis, surface runoff, which is a major factor in the formation of streamside and coastal wetlands, is low. There are no perennial streams, and most natural surface-water drainages are dry for long periods of time and flow only during periods of intense rainfall. Because of the impermeable underlying volcanic rocks, floodwaters accumulate and recede rapidly, generally in less than 1 day. During a year of average precipitation, annual runoff ranges from about 2 to 8 percent of the rainfall (Santiago-Rivera and Colón-Dieppa, 1986), which is about 0.5 to 2 inches, depending on conditions in a particular basin. Runoff is controlled by topography, soil moisture, local evaporation rates, and vegetation cover. On St. Croix, runoff is stored in ponds for agricultural uses. Commonly, total runoff from individual storms exceeds 10 percent of the rainfall and can be as high as 30 percent when rainfall is intense and soil moisture demands are low. As these floodwaters reach the coastal areas, they overflow saltponds and provide freshwater inflow to embayments that support mangrove stands and coral reefs (fig. 3).

A few streams are intermittent; that is, they flow year-round in some reaches. For Turpentine Run on St. Thomas, base flow is predominantly from sewage effluent, and about one-half to three-

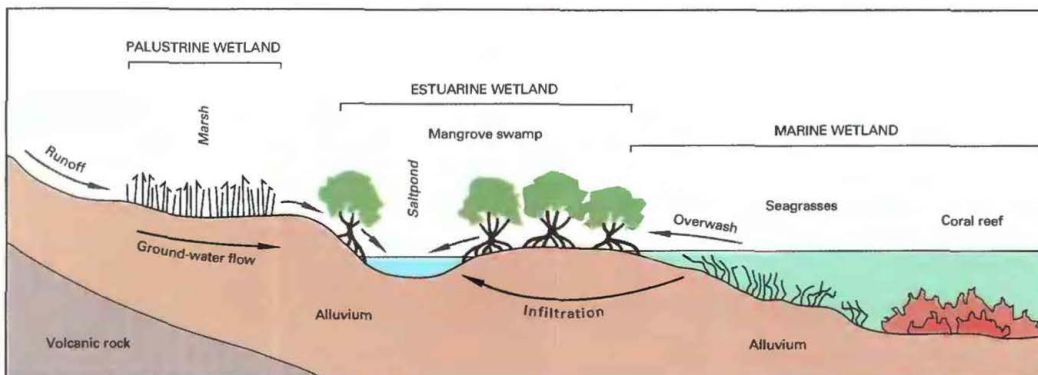


Figure 3. Generalized hydrologic setting of wetlands in the U.S. Virgin Islands. (Source: *Wetland types* from Lugo and Brown, 1988.)



fourths of total flow is from storm runoff (Santiago-Rivera and Colón-Dieppa, 1986). Turpentine Run discharges to Mangrove Lagoon (fig. 4A) on the southeastern side of the island. On St. Thomas, the only other intermittent stream is Bonne Resolution Gut. Guinea Gut on St. John, which has base flow from spring discharge, and Jolley Hill Gut on St. Croix, once reported to be perennial, are the only intermittent streams on those islands.

## TRENDS

Wetlands in the U.S. Virgin Islands occupy less than 3 percent of the land area. On the basis of mapping by the FWS National Wetlands Inventory, there are 960 acres of wetlands on St. Croix, 320 acres of wetlands on St. Thomas, and 425 acres of wetlands on St. John.

The wetlands of the U.S. Virgin Islands have been adversely affected by both natural forces and human activities. Hurricane Hugo, which passed directly over St. Croix in September 1989, was the last major storm to significantly alter the wetlands of the islands. Hurricane winds defoliated mangroves to such an extent that many died. In addition, many black and white mangroves were uprooted (Knowles and Amrani, 1991). Although recovery might be slow, the wetland vegetation probably will become reestablished if it is not disturbed.

Human-caused wetland alterations have been severe and will likely be long lasting. Wetlands in the islands remained virtually untouched until the 1960's. During the economic growth period of the 1960's and 1970's, numerous wetlands were altered on St. Tho-

mas and St. John (J.H. Farrelly, U.S. Virgin Islands Department of Planning and Natural Resources, written commun., 1992). The most extensive wetland alteration took place in St. Croix at Krause Lagoon, the largest of the U.S. Virgin Island wetlands. By the late 1970's, Krause Lagoon was virtually eliminated by dredging and filling for construction of port facilities for a major oil refinery, an aluminum plant, and a container manufacturer. An important large wetland complex, Mangrove Lagoon–Benner Bay (fig. 4A) on St. Thomas, has been similarly affected. Mangrove Lagoon is one of the U.S. Virgin Islands' largest wetland complexes, consisting of saltponds, a barrier reef, and fringe mangroves. Loss of mangroves and associated submersed seagrasses and corals has resulted from construction of marinas, recreation facilities, a wastewater treatment facility, and encroachment by a major landfill. Most of the adverse impacts, except for dredging, are the result of alterations that have disrupted the normal patterns of runoff to the bay.

Wetlands of the U.S. Virgin Islands remain susceptible to development. Their location along the shoreline make them particularly attractive as sites for tourist facilities and water-dependent developments. It is relatively easy to construct marinas from saltponds, as was done in Southgate Pond on the north shore of St. Croix and saltponds on St. Thomas (fig. 4B). The demand for such facilities is great; more than 4,000 vessels are registered in the U.S. Virgin Islands (J.H. Farrelly, U.S. Virgin Islands Department of Planning and Natural Resources, written commun., 1992).

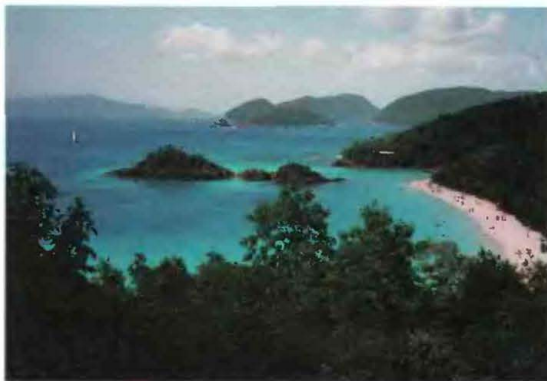
Wetlands also are susceptible to degradation by sedimentation and septic tank leachate from upland areas. The extent to which this type of impact is occurring is unknown.



A



B



C



D

**Figure 4.** Selected U.S. Virgin Islands wetlands. **A**, Mangrove Lagoon–Benner Bay on St. Thomas. **B**, Saltpond on St. Thomas. **C**, Trunk Bay on St. John. **D**, Salt River Bay on St. Croix. (Photographs by D. Briane Adams.)

## CONSERVATION

Many government agencies and private organizations participate in wetland conservation in the U.S. Virgin Islands. The most active agencies and organizations and some of their activities are listed in table 1.

**Table 1.** Selected wetland-related activities of government agencies and private organizations in the U.S. Virgin Islands, 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
<b>FEDERAL</b>						
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 .....	•	•	•	•	•	•
Department of the Interior						
Fish and Wildlife Service .....	•	•	•	•	•	•
Geological Survey .....					•	
National Biological Service .....	•	•	•	•	•	•
National Park Service .....	•	•	•	•	•	•
Environmental Protection Agency .....		•			•	
<b>TERRITORY OF THE U.S. VIRGIN ISLANDS</b>						
Department of Planning and Natural Resources						
Department of Planning and Coastal Zone Management Program .....						
	•	•	•	•	•	•
Division of Fish and Wildlife .....	•	•	•	•	•	•
<b>PRIVATE</b>						
Island Resources Foundation .....	•	•	•	•	•	•

*Federal wetland activities.*—Development within or near wetlands is 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. In the following description of wetland-related Federal legislation, regulations that apply to States also apply to the U.S. Virgin Islands.

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 based on 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, but 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 authorized 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 Wetlands 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 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.

Large tracts of land, many containing wetlands, are managed by the FWS and the NPS. The largest area managed by the FWS is the 326-acre Sandy Point National Wildlife Refuge in southwestern St. Croix. The NPS manages most of the Island of St. John, along with extensive offshore areas, such as the underwater trail at Trunk Bay in Virgin Islands National Park (fig. 4C). The NPS has received authorization to acquire lands around Salt River Bay on St. Croix (fig. 4D). Not only is the area one of the U.S. Virgin Islands' most important wetland complexes, but it is also a valuable historical resource believed to be the landing site of Christopher Columbus on his second voyage to the Americas in 1493.

*Territorial wetland activities.*—The Department of Planning and Natural Resources is the principal agency requiring permit application for construction activities in the coastal zone, where wetlands usually form. This responsibility was granted to the Department by the Coastal Zone Management Act passed in 1978. In addition to evaluating permit requests, the Department comments on Federal permit applications to ensure consistency with the Coastal Zone Management Plan. When wetland losses are unavoidable, the Department requires mitigation actions to ameliorate anticipated losses. The Department also monitors wetlands to ensure that unpermitted activities are not taking place and that authorized activities are in full compliance with permit requirements. The Territorial Legislature adopted the Indigenous and Endangered Species Act of 1990, in which section 104(e) establishes a policy of "no net loss of wetlands" to the maximum extent possible.

*Private wetland activities.*—The Island Resources Foundation is headquartered on St. Thomas. The Foundation is an important advocate for conservation of island wetlands and other natural resources unique to islands of the Caribbean and elsewhere. Through lobbying, organization of citizen networks, and development of educational materials and research, the Foundation promotes sound management of the area's natural resources.

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