Wetlands of Staten Island New York

Valuable Vanishing Urban Wildlands

A Cooperative National Wetlands Inventory Publication

Acknowledgments

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MICHAEL FELLER

Old Place Creek brackish marsh, with rose mallow (foreground) and salt marsh fleabane in bloom.

Wetlands of Staten Island, New York

Valuable Vanishing Urban Wetlands

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Contents

Copies of this booklet may be obtained from the U.S. Environmental Protection Agency, Wetland Protection Section, Region II, 290 Broadway, New York, NY 10007-1866

COVER: *Main Creek at low tide*
BACK COVER: *Sunset over Saw Mill Creek at high tide*

1 Although the information in this document has been funded wholly or in part by the U.S. Environmental Protection Agency under assistance agreement DW14941821-01-0 to the U.S. Fish and Wildlife Service, it may not necessarily reflect the views of the Agency and no official endorsement should be inferred.

Preface

THIS REPORT IS BASED LARGELY ON A wetlands inventory of Staten Island (Richmond County), New York conducted by the U.S. Fish and Wildlife Service's National Wetlands Inventory (NWI) Program. The NWI is producing wetland maps and statistical information on the status and trends of the Nation's wetlands. To date, wetland maps have been produced for approximately 90 percent of the coterminous United States (lower 48 states). The earliest NWI maps are based on 1970s aerial photography and need updating, while the newest maps are compiled from 1990s photography. The NWI was initiated to provide government agencies and the American public with information on the current status of wetlands to aid in resource decision-making. Wetlands provide many important functions (e.g., flood storage, water quality protection, shoreline stabilization, and habitat for many fish and wildlife) and are among the nation's most valuable natural resources. Since European colonization, the coterminous U.S. has lost more than half of its original wetlands. Further loss or degradation of remaining wetlands will jeopardize wetland functions and the values they provide society. The wetlands survey for Staten Island was completed by the NWI with support from EPA Region II. It is an update of earlier NWI mapping based on 1970s 1:80,000 black and white photography. This earlier survey was very conservative in mapping wetlands due to the quality and scale of the aerial photos.

The inventory was designed to determine the status of wetlands and deepwater habitats on Staten Island (Richmond County). The inventory answers a few questions, including: (1) how much wetland acreage exists on the Island?, (2) where are wetlands most abundant?, and (3) what types are most common? The inventory results are presented in a series of large-scale (1:24,000) maps (identifying the location, type, and shape of most wetlands larger than 1 acre in size), a digital map database, and this booklet. The updated inventory utilized 1994/95 aerial photography to map wetlands. Wetlands were classified to various types, including emergent, scrub-shrub, and forested wetlands. Copies of individual maps may be ordered from: Cornell Institute for Resource Information Systems (IRIS), Resource Information Laboratory, 302 Rice Hall, Cornell University, Ithaca, New York 14853, (607) 255-4864 or 255-6520.

This booklet summarizes the results of the wetlands inventory for Staten Island. It provides brief descriptions of the area's wetlands, their distribution, and their values. In addition, the booklet presents information on wetland changes, protection and restoration, plus recommendations to improve management and conservation of wetlands and lists of resource agencies and additional readings.

MICHAEL FELLER

Spring Pond, with white water lily and soft rush (right foreground) in bloom.

What Are Wetlands?

WETLANDS ARE LANDS THAT ARE flooded or saturated at or near the ground surface for varying periods during the year. The term "wetland" is derived from two words, "wet" and "land." This implies that wetlands are lands that are at least periodically wet enough to limit uses of the land (e.g., usually can't farm without draining and can't build without filling). Wetlands are the collection of wet environments that occur on the landscape. They include salt marshes, inland freshwater marshes, wet meadows, swamps, bogs, vernal pools, and seasonally inundated floodplains. Ponds and the shallow water zones of lakes are also considered wetlands, while the deeper zones (more than 6.6 feet) are classified as deepwater habitats.

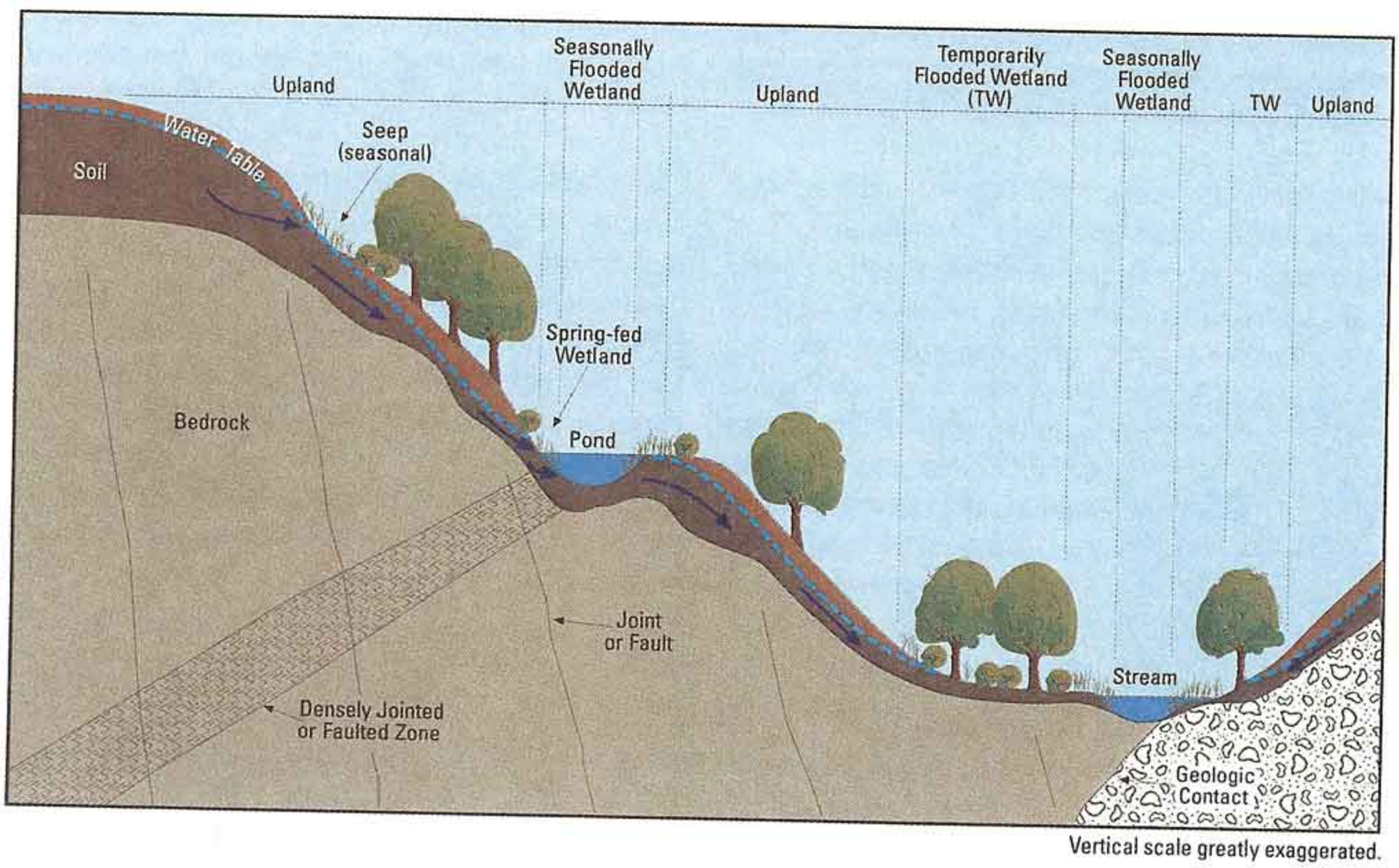
The U.S. Fish and Wildlife Service, with wide scientific peer review, developed a technical definition of wetland for the purpose of conducting a nationwide inventory of wetlands—the National Wetlands Inventory (NWI). This definition forms the foundation for the Service's official wetland classification system which has been adopted as the federal standard for reporting on the status and trends of America's wetlands:

> Wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. For purposes of this classification wetlands must have one or more of the following three attributes: (1) at least periodically, the land supports predominantly hydrophytes; (2) the substrate is predominantly undrained hydric soil; and (3) the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season of each year.[2]

This definition focuses on three attributes: (1) the degree of flooding or soil saturation (wetland hydrology); (2) wetland vegetation (hydrophytes); and (3) wet soils (hydric soils). All areas considered wetlands must frequently have an excess of water for sufficient duration to stress plants and animals not adapted for life in water or periodically saturated soils. Note that wetland laws and regulations have somewhat different definitions to identify wetlands for jurisdictional purposes (e.g., both the federal regulatory wetland definition and the New York State freshwater wetland definition emphasize vegetated wetlands over nonvegetated types).[3]

2 Source: *Classification of Wetlands and Deepwater Habitats of the United States* (1979) published by the U.S. Fish and Wildlife Service, Washington, DC 20240.

3 For an analysis of wetland definitions, consult *Wetland Indicators: A Guide to Wetland Identification, Delineation, Classification, and Mapping* (see *Additional Readings*).



Wetlands develop in places where ground water discharges and/or surface water accumulates. This cross-sectional diagram shows groundwater flow paths that create wetlands at different locations on the landscape. (Adapted from figure by Martha Hayes)

Where Do Wetlands Form?

TOP TO BOTTOM

*Common reed (*Phragmites*) occurs mostly in wetlands, but it also colonizes disturbed sites such as landfills.*

Hydric mineral soil exhibiting typical gray subsoil.

Adventitious water-roots of black willow.

PETER VENEMAN

Wetlands form in areas subject to frequent flooding or prolonged soil saturation. These areas may be covered by surface water from ocean-driven tides, river overflow, or runoff from adjacent uplands. In other areas, high groundwater tables create waterlogged soils. For these wet conditions to have a significant impact on plants, animals, and soil properties, water must be present for an extended period on a recurring basis. Scientists have determined that the minimum wetness for a wetland is saturation within 1 foot of the ground surface for 2 weeks or more during the growing season in most years (every other year, on average).[4] These areas are also wet for extended periods during the "non-growing season" (late fall to early spring). Water entering wetlands comes from several sources including rainfall, snowmelt, tides, river overflow, surface water runoff, lateral subsurface flow, springs, and other groundwater discharge. Besides flooding low-lying relatively flat areas (e.g., floodplains) along waterbodies, water collects in depressions, at the toes of slopes, and even on slopes in association with drainageways, seeps, and springs.

When soils are flooded and/or saturated for a few days or longer, most soils become oxygen-deficient (anaerobic). This has a great impact on plants. Since all plants require oxygen for survival and growth, only plants with special adaptations can live in these periodically anaerobic soils. These plants are called "hydrophytes." These water-tolerant plants have developed special adaptations, like shallow root systems, air-filled organs (aerenchyma tissue), and physiological mechanisms (internal body processes), to cope with these oxygen-deficient conditions.[5] Out of all the vascular plants that grow in the United States, only a third can tolerate the prolonged and recurrent wetness imposed by wetlands. Surprisingly, most of these plants can also grow in uplands to varying degrees. Many are quite common in both wet and dry habitats and some are even cultivated for landscaping around houses (e.g., red maple, silver maple, and pin oak).

Roughly one-quarter of the plants identified as potential hydrophytes grow exclusively in wetlands. These "obligate wetland" species include plants such as water lilies, cattails (frequent in roadside ditches), buttonbush (a shrub typical of shallow inland waters), leatherleaf (a low-growing evergreen shrub of northern bogs), and Atlantic white cedar (an evergreen tree). In areas inundated by saltwater tides, plants must also be adapted to salt stress. Salt-tolerant plants are called "halophytes" and examples include smooth cordgrass (occurring along tidal creekbanks) and common glasswort (a succulent herb found in saline depressions and turning red in the fall).

Soil development is also affected by prolonged wetness. In areas frequently flooded for very long periods, peat or muck accumulate at the soil surface because leaves and other organic matter do not readily decompose under these conditions. Where the organic layer is thicker than 16 inches, the soils are called "organic soils". Soils with a thinner organic layer or lacking such layer are typically "mineral soils." Hydric mineral soils usually possess a thick grayish layer below the topsoil due to anaerobic conditions (lack of oxygen) which cause the soil environment to become chemically reduced.[6] Such soils lose all or most of the red, yellow, or orange color of iron oxides ("rust" color) characteristic of many well-drained (oxygen-rich) soils. Many "hydric soils" are predominantly gray, mottled with orange or yellow spots as iron is leached out of the soil or because iron occurs in a reduced state (ferrous iron). The more the water table fluctuates, the more orange to yellow colors occur in the gray soil. Staten Island possesses many soils derived from red till which do not form typical hydric soil properties. Their red color predominates even when subjected to wetland hydrology, so gray colors are often lacking. Consequently, these soils complicate hydric soil identification on Staten Island. Areas possessing such soils that are wetlands can usually be recognized by considering landscape position, signs of wetland hydrology, hydrophytic vegetation, and special soil characteristics (contact the U.S.D.A. Natural Resources Conservation Service for specifics). In addition, manmade hydric soils created from dredged material deposition are common in certain areas of Staten Island.

4 Source: *Wetlands Characteristics and Boundaries* (1995) published by National Academy Press, Washington, DC 20418.

5 For an indepth analysis of hydrophytes and their adaptations, consult *Wetland Indicators: A Guide to Wetland Identification, Delineation, Classification, and Mapping* (see *Additional Readings).*

6 Consult *In Search of Swampland* and *Wetland Indicators* for details (see *Additional Readings*).

How Are Wetlands Identified?

Given that water collects in certain places on the terrain, the landscape position (e.g., along estuaries, rivers, and lakes) and landform (e.g., depressions, broad flats, floodplains, drainageways, or seepage slopes) often provide the first clues of the likely presence of wetland. There are also apparent signs of wetness, such as an area flooded for extended periods during the growing season or an area with saturated soils in the driest part of summer. Since many wetlands are dry for a significant portion of the year, they are mostly characterized by the presence of hydrophytes and hydric soils or substrates. The federal government has published lists of these plants and soils and developed scientific techniques for identifying wetlands.[7] New York State also has developed somewhat similar procedures for delineating state-regulated wetlands. Field guides to wetland plants, hydric soils, or wetland identification have also been published to aid in recognizing wetlands (see *Additional Readings*). Wetland maps are available to help locate wetlands through the U.S. Fish and Wildlife Service's NWI Program and the New York State Department of Environmental Conservation. These maps are derived by interpreting aerial photographs and, therefore, tend to show the larger wetlands, with many small or narrow wetlands not designated. In addition, locating hydric soil map units on U.S.D.A. Natural Resources Conservation Service's county soil survey reports is another way to detect possible wetland areas.

On-the-ground evaluation must be performed to accurately identify wetlands and their boundaries, especially if the question concerns defining the limits of wetlands regulated by federal, state, or local authorities. Hydrophytic vegetation and hydric soils plus other signs of prolonged saturation are used to identify "regulated wetlands" subject to the federal Clean Water Act regulations.[8] Signs of wetland hydrology include observed water or soil saturation during the growing season, water marks, silt deposits, water-deposited debris (drift lines), water-stained leaves (blackened leaves in depressions), and orange-stained soil around living roots (oxidized rhizospheres). In contrast, the State of New York first emphasizes hydrophytic vegetation for identifying state-regulated wetlands, but also uses other features (hydric soil properties and signs of wetland hydrology) to recognize less obvious wetlands.[9] Remember, however, that not all wetlands are vegetated—mud flats, sand bars, and beaches along exposed tidal shores and shallow bottoms of rivers, lakes, and ponds may not be colonized by plants, but are still considered wetlands by scientists.

MICHAEL FELLER

TOP TO BOTTOM

Seasonally flooded forested wetland in Bloomingdale Woods.

Estuarine intertidal beach along Raritan Bay in Tottenville.

7 For information on these lists and techniques, contact the U.S Army Corps of Engineers, U.S. Environmental Protection Agency, or other federal agencies listed at the end of this booklet.

8 Source: *Corps of Engineers Wetlands Delineation Manual* (1987) published by U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

9 Source: *Freshwater Wetlands Delineation Manual* (1996) published by New York State Department of Environmental Conservation, Division of Fish and Wildlife, Albany, NY.

Richmond Creek salt marsh. Note exposed creekbed at low tide and landfill mound (background).

How Do Wetlands Differ?

A variety of wetland types exist due to differences in soils, hydrology, water chemistry, vegetation, and other factors. Staten Island contains both tidal and nontidal wetlands. Tidal wetlands (e.g., salt marshes and tidal mudflats) are lowlands along coastal embayments and tidal rivers. Most are flooded with brackish water by high tides, but a few are strictly freshwater wetlands whose water levels rise and fall with the tides. Staten Island's nontidal wetlands (e.g., freshwater marshes, swamps, and vernal pools) occur beyond the reach of ocean-driven tides. They are found on floodplains along streams (i.e., lotic wetlands), in the shallow water zone and along the margins of lakes (i.e., lentic wetlands), in ponds and along their shores, and in isolated depressions surrounded by upland (i.e., terrene wetlands). Some wetlands are formed on slopes where groundwater seeps out from below ground (i.e., terrene slope wetlands).[10]

Most wetlands are colonized by plants and are commonly called "marshes", "wet meadows", "swamps", and "bogs".[11] Their periodic wetness or shallow water habitat distinguishes them from "deepwater habitats" of lakes, rivers, and reservoirs. Often, wetland types are named after their dominant plant species, such as common reed marsh, cattail marsh, red maple-sweet gum swamp, and alder swamp. Other wetlands are nonvegetated, periodically exposed flats or shallow water areas along the shores of rivers, streams, ponds, and lakes.

According to the U.S. Fish and Wildlife Service's classification system, wetlands are divided into five ecological systems: marine, estuarine, palustrine, lacustrine, and riverine. The majority of Staten Island's wetlands are *estuarine wetlands* and *palustrine wetlands.* Estuarine wetlands are tidal marshes, mudflats, and sandy beaches associated with coastal embayments (e.g., Raritan Bay) and brackish rivers and streams. *Marine wetlands* are essentially limited to the exposed shoreline along the Atlantic Ocean (e.g., Long Island's South Shore beaches). Palustrine wetlands are mostly inland vegetated wet areas (marshes and swamps), but also include small,

Old Place Creek salt marsh (high marsh), with an abundance of high-tide bush (background).

10 Terms such as lotic, lentic, and terrene are furthered defined in *Keys to Landscape Position and Landform Descriptors for U.S. Wetlands (Operational Draft)* available from U.S. Fish and Wildlife Service (ES-NWI), 300 Westgate Center Drive, Hadley, MA 01035.

11 Consult *In Search of Swampland* for descriptions and illustrations of common wetland species (*Additional Readings*).

shallow ponds. *Lacustrine wetlands* are generally limited to aquatic beds, nonpersistent marshes (characterized by nonwoody vegetation that dies back to the ground every year), and the shallow water zone (less than 6.6 feet deep) of lakes and reservoirs. *Riverine wetlands* may be similarly vegetated, but are contained within a river or stream channel. Most of the riverine wetlands are nonvegetated periodically exposed shores and shallow stream bottoms.

Estuarine Wetlands

Estuarine wetlands are tidal wetlands subjected to either daily inundation or less frequent flooding by salt water. Most of these wetlands are vegetated, but some are nonvegetated. The vegetated ones are commonly called "salt marshes" (estuarine emergent wetlands). They are dominated by halophytes (salt-loving) plants. The nonvegetated estuarine wetlands include beaches, intertidal flats, and rocky shores along tidal rivers and coastal embayments.

Estuarine wetlands may be divided into two zones based on the frequency and duration of flooding: (1) low marsh or regularly flooded zone (inundated daily by tides), and (2) high marsh or irregularly flooded zone (inundated less often than daily). The low marsh is characterized by the tall form of smooth cordgrass which grows to about 6 feet in these places. Vegetation of the high marsh is more varied with several dominant species including smooth cordgrass (short form less than 3 feet tall), salt grass, salt hay grass, and black grass (actually a rush), plus high-tide bush (especially in ditched marshes). Salt marsh fleabane is common in some marshes. In depressions within the high marsh, either pools or pannes (shallow flats) may be found. The former may be colonized by widgeon-grass or other submerged plants, while the latter may be occupied by glassworts and stunted forms of other high marsh plants. Common reed (also known by its scientific name—*Phragmites*) occurs along the upper edges of many tidal wetlands. It also forms virtual monocultures in former salt marshes whose tidal flow is restricted by tide gates or is otherwise cut off. Plant diversity in estuarine marshes typically increases along the upland border. Here plants like American germander, seaside goldenrod, salt marsh fleabane, high-tide bush, groundsel-bush, and rose mallow may be found with some freshwater wetland plants such as poison ivy, swamp rose, and marsh fern.

Good examples of salt marshes can be observed along Richmond Creek, Main Creek, Lemon Creek, Saw Mill Creek, Neck Creek, and Old Place Creek. The William T. Davis Refuge in New Springville is an excellent salt marsh to visit, while the smaller Arlington Marsh (north of Mariners Marsh) is also accessible to the public.

Palustrine Wetlands

Palustrine wetlands are predominantly vegetated marshes and swamps, but also include freshwater ponds with or without macroscopic plant life. Palustrine vegetated wetlands may be separated into four major types based on their dominant vegetation: (1) aquatic beds, (2) emergent wetlands characterized by grasses, sedges, and other nonwoody plants, (3) scrub-shrub wetlands represented by low- to medium-height (less than 20 feet tall) woody plants, and (4) forested wetlands dominated by trees (woody plants 20 feet or taller).

Floating-leaved plants, free-floating plants, and submergent (underwater) plants form **aquatic beds** in waterbodies ranging from ponds to rivers and streams. Among the typical species are white water lily, spatterdock (yellow pond lily), water milfoil, and duckweeds. Sharrots Pond (Clay Pit Ponds State Park Preserve) and Spring Pond (Blue Heron Park) are excellent examples of this wetland type.

On Staten Island, palustrine **emergent wetlands** are mostly represented by marshes and to a lesser extent by wet meadows. Marshes are flooded for much of the year. Organic soils (mucks) or mineral soils with high amounts of organic matter commonly develop in these wetlands. Dominant marsh species include common reed, cattails (both broad-leaved and narrow-leaved types), purple loosestrife, rose mallow, water-willow (swamp loosestrife), bur-reed, and rice cutgrass. Woolgrass and smartweeds are other common species. Former estuarine marshes now restricted from

PROTECTORS OF PINE OAK WOODS

MICHAEL FELLER

TOP TO BOTTOM

Former salt marsh at Midland Beach now dominated by common reed.

Freshwater marsh in Long Pond Park.

Freshwater emergent wetland in New Springville dominated by smartweeds.

MARGARET GARGIULLO

TOP TO BOTTOM

Sweet gum-red maple swamp at Wolfe's Pond Park.

Vernal pool forested wetland in Long Pond Park.

Red maple swamp in Tottenville.

tidal flow are dominated by common reed. Remnant vegetation from pre-existing estuarine marshes may be found, including salt marsh fleabane, marsh orach, and creeping bentgrass. Examples of these wetlands are found in the South Beach and Midland Beach neighborhoods.

Plantlife along the shores of ponds is diverse. Flowering herbs like ditch stonecrop, water purslane, water plantain, rose mallow, water-willow, rose mallow, smartweeds, swamp milkweed, water horehound (bugleweed), false pimpernel, marsh St. John's-wort, and beggar-ticks may occur with various grasses (e.g., switchgrass and millet), sedges (e.g., wool-grass, umbrella sedges, and spikerushes), and woody species especially buttonbush. Typical wetland shrubs and trees may form the upper edge of the pond shore.

Wet meadows are seasonally wet fields. They usually have gray-colored hydric mineral soils reflecting prolonged saturation by high groundwater tables. Some meadows are inundated for brief periods. They typically have high water tables in winter and spring, often with pockets of standing water. In summer, the water tables are quite low and many times, no water can be found. A variety of plants grow in these meadows including flowering herbs such as purple loosestrife (an invasive species with conspicuous purplish blooms in late summer), blue vervain, jewelweed, goldenrods, Joe-Pye-weeds, boneset, smartweeds, and asters, plus grasses or grasslike plants including the ubiquitous common reed, reed canary grass, sedges, bulrushes, soft rush, and other rushes. Shrubs and saplings of trees typical of woody wetlands are often interspersed in wet meadows.

Low woody growth (less than 20 feet tall) typifies **scrub-shrub wetlands**. Southern arrowwood, smooth alder, common elderberry, silky dogwood, willows, sweet pepperbush, and broad-leaved meadowsweet are typical species. Buttonbush and rose mallow colonize shallow ponds or water-filled depressions within forested wetlands. Arrow-leaved tearthumbs, Joe-Pye-weeds, and goldenrods may occur in some of the more open wet thickets.

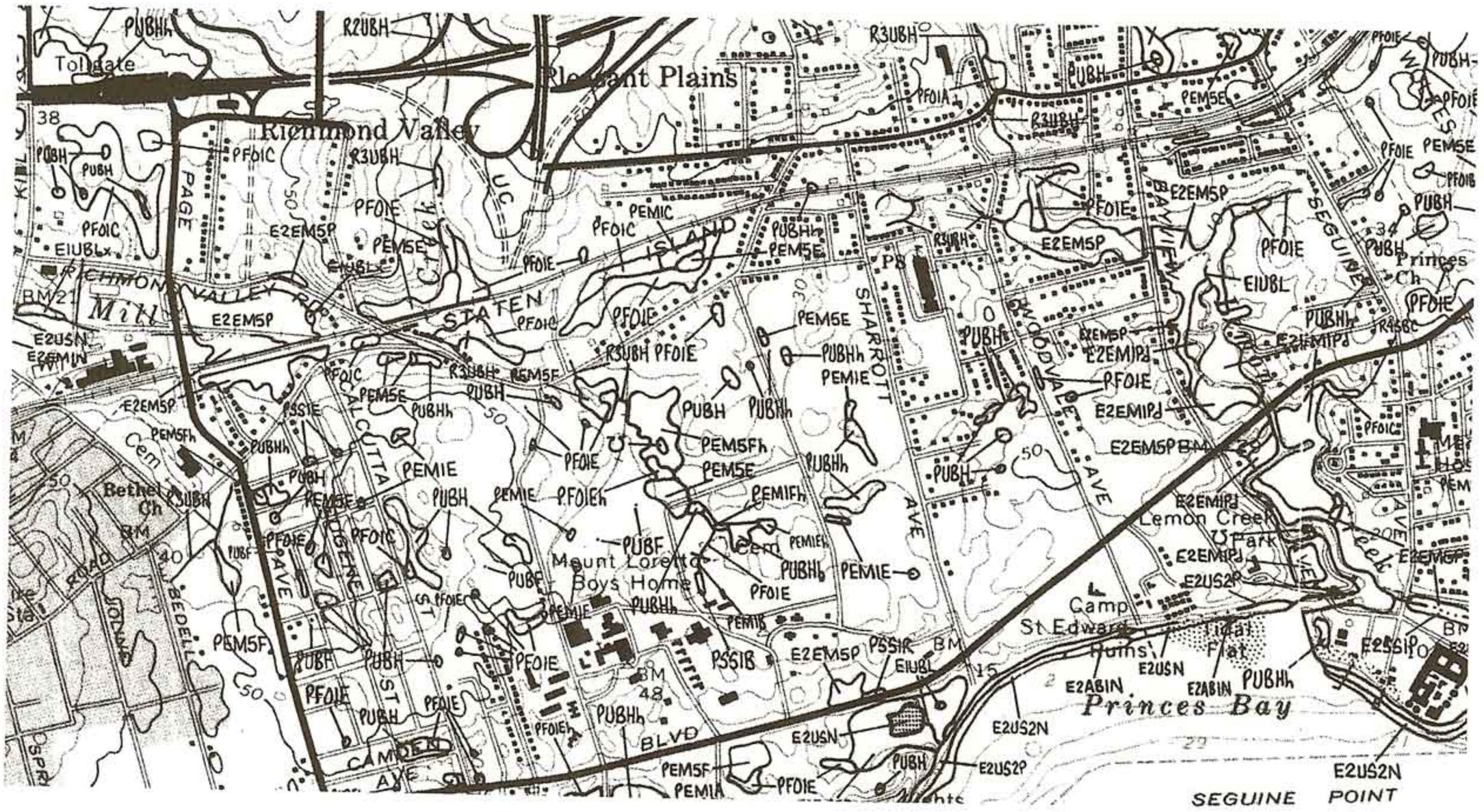
Most of Staten Island's inland wetlands are deciduous **forested wetlands** whose trees lose their leaves each fall. Common trees include red maple, black gum, sweet gum, black willow, pin oak, and swamp white oak. Red maple and sweet gum appear to be the most frequent species. Trees in lesser numbers are American elm, cottonwood, black cherry, ironwood, sycamore, green ash, white ash, silver maple, white oak, river birch, and sassafras. Some state-rare and -endangered trees occur in wetlands in Staten Island forested wetlands, including sweet bay, swamp cottonwood, and possibly willow oak (and hybrids), persimmon, and pawpaw. These plants are southern species near the northern limit of their ranges. Introduced (non-native) trees such as tree-of-heaven occur in some wetlands.

Many forested wetlands have an abundance of shrubs typical of scrub-shrub swamps (listed above) plus others like spicebush, highbush blueberry, swamp azalea, winterberry, serviceberry (shadbush), and chokeberry. Southern wild raisin (or possum haw) is a rare shrub occurring in Staten Island wetlands (near its northern limit). Poison ivy grows vigorously in many forested wetlands. Ferns, like cinnamon fern and sensitive fern, are common in many swamps. Other swamp forest herbs (nonwoody plants) include skunk cabbage, jewelweed, jack-in-the-pulpit, Canada mayflower, clearweed, false nettle, enchanter's nightshade, turk's-cap lily, asters, manna-grasses, white grass, wood reed, and sedges (e.g., tussock sedge and fringed sedge). Lizard's tail may occur in wetter depressions, while Joe-Pye-weed, New York ironweed, and jewelweed may occur in open areas within the forests. Vines such as Virginia creeper and common greenbrier are typical vines of Staten Island's forested wetlands. Invasive plants such as multiflora rose, Japanese honeysuckle, and Japanese knotweed occur in abundance in places.

Small vernal pools may exist within and near forested wetlands. These shallow ponds hold water from late fall through mid-summer and serve as vital breeding grounds for many woodland amphibians (e.g., spotted salamanders and spring peepers). Mariners Marsh in northwestern Staten Island (Arlington) contains vernal pools, sweet gum swamps, pin oak swamps, and several freshwater ponds.

Wetland Maps

A TOTAL OF 4 LARGE-SCALE (1:24,000) National Wetlands Inventory (NWI) maps were prepared for Staten Island: Arthur Kill, Elizabeth, Jersey City, and the Narrows. These maps show the general location of wetlands and deepwater habitats throughout the Island. These habitats were identified through photointerpretation of spring 1994/95, 1:40,000 color infrared aerial photography. With this scale imagery, most wetlands larger than 1 acre in size are likely to be mapped, along with smaller conspicuous depressional wetlands (such as ponds). Wetlands are classified by their vegetation type or substrate (for nonvegetated areas), predicted water regime (hydrology), and other features. The maps use an alpha-numeric code (a series of letters and numbers) to designate different types. For example, estuarine wetlands are designated by the letter "E" such as E2EM1N (regularly flooded emergent wetland), E2EM1P (irregularly flooded emergent wetland; E2EM5P = *Phragmites*-dominated), and E2USN (regularly flooded unconsolidated shore = tidal mudflat). Estuarine and marine deepwater habitats have the following codes, for example, E1UBL (estuarine subtidal unconsolidated bottom) or M1UBL (marine). Palustrine wetlands begin with the letter "P". Palustrine emergent wetlands are classified in categories of increasing wetness as PEM1A (temporarily flooded type), PEM1C (seasonally flooded), PEM1E (seasonally flooded/saturated), and PEM1F (semipermanently flooded). Palustrine scrub-shrub wetlands are designated as PSS-types (e.g., PSS1E for shrub swamps like alder swamps), whereas forested wetlands are shown as PFO-types (e.g., PFO1E for broad-leaved deciduous swamps like red maple-sweet gum swamps). For more information on the codes, see *NWI Maps Made Easy: A User's Guide to National Wetlands Inventory Maps of the Northeast Region* (available from the U.S. Fish and Wildlife Service, ES-NWI, 300 Westgate Center Drive, Hadley, MA 01035). An example of a portion of an NWI map for the Arthur Kill quadrangle in Staten Island is shown below. Copies of the NWI maps are available for purchase from the Cornell Institute for Resource Information Systems (IRIS), 302 Rice Hall, Ithaca, NY 14853. In addition, for use in geographic information systems, NWI maps are available in digital form and may be downloaded from the Internet (*http://wetlands.fws.gov*). Try out the Wetlands Interactive Mapper at this site to obtain information on the location of wetlands in your neighborhood. You may also be able to view an aerial photo of your neighborhood through the Terraserver View at this site.



Wetlands Inventory Acreage Summaries

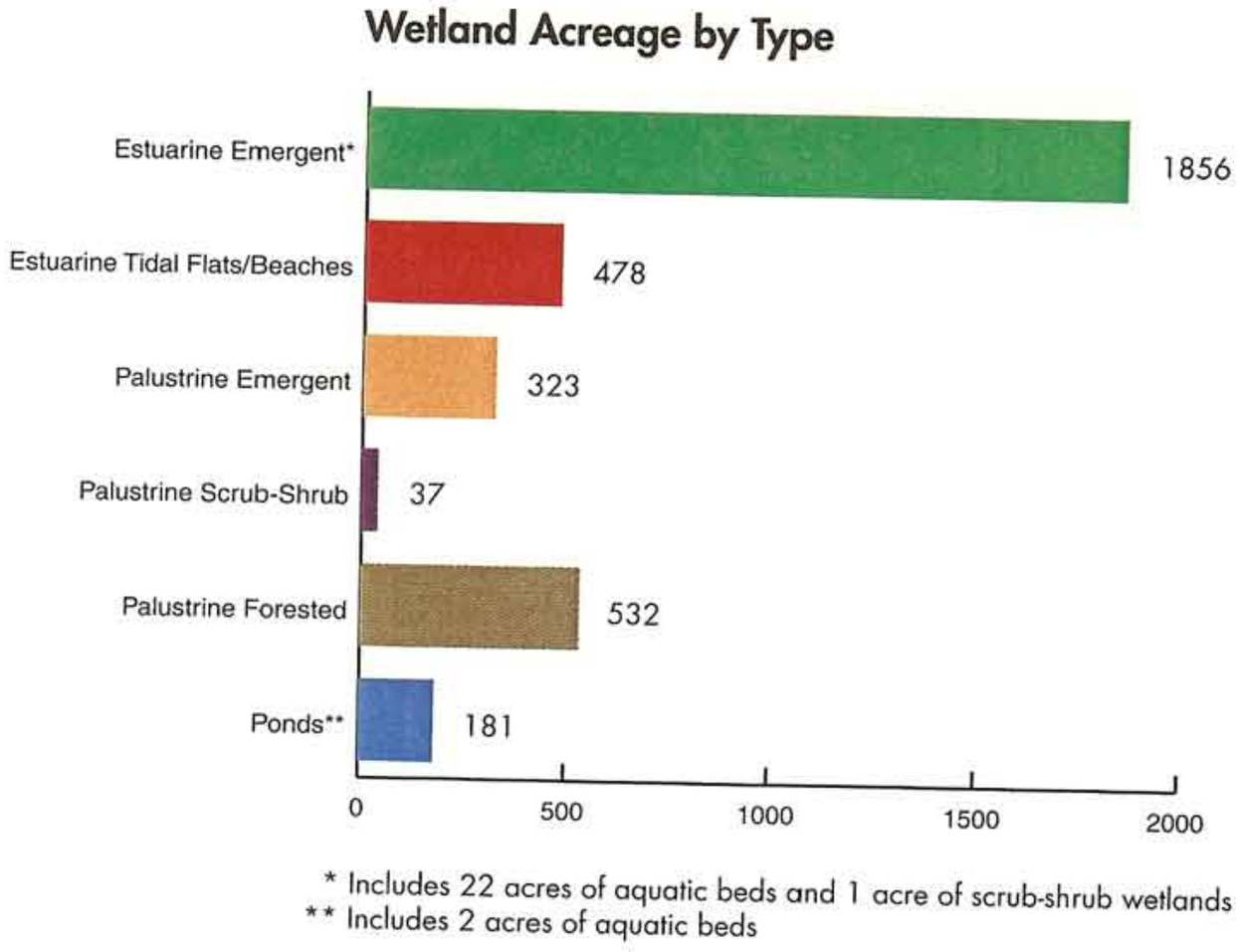
ACREAGES OF WETLANDS AND DEEPWATER habitats for Staten Island were compiled from digital NWI map data using a geographic information system. The data include wetlands and deepwater habitats generally 1 acre in size and larger—the target mapping unit of the NWI maps prepared for this area. Wetlands that escaped detection because they were too small, too narrow, or too difficult to identify through conventional aerial photointerpretation techniques are not included. Miles of small streams and narrow (linear) wetlands mapped during the survey are also reported for the Island. These numbers should not, however, be considered the total stream miles, since many intermittent and smaller streams were not inventoried.

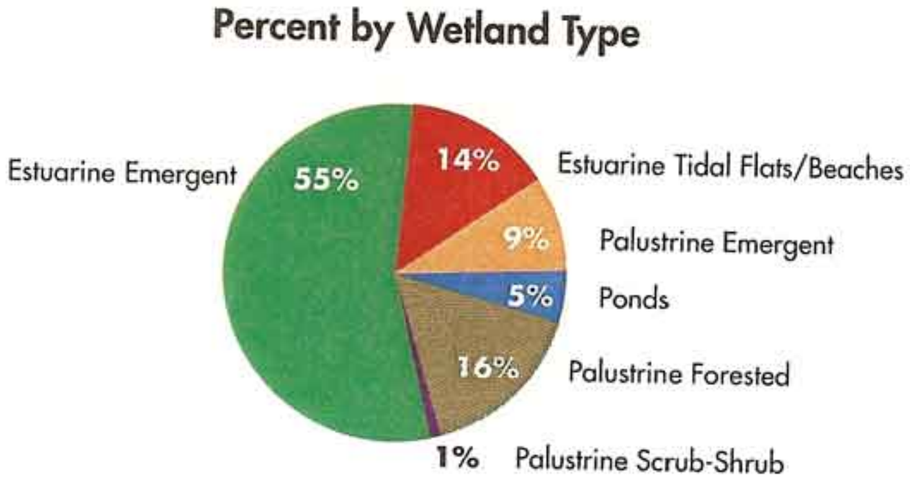
Staten Island is surrounded by estuarine waters: Raritan Bay to the east and south, Arthur Kill to the west, Kill Van Kull to the north, and the Narrows (Hudson River) to the northeast. Estuarine waters ascribed to Staten Island (Richmond County) totaled 28,374 acres, with the bulk of this acreage associated with Raritan Bay. Eighteen miles of linear estuarine waters were inventoried.

The Island itself contains about 59 square-miles of land mass. About 90 percent of Staten Island is now upland: mainly residential development (low and high intensity = 28% and 26%, respectively), upland forests (22%), and commercial/ industrial/transportation development (10%).[12] The rest is wetland or deepwater habitat.

Wetlands occupy about 3407 acres of Staten Island, amounting to 9 percent of Richmond County. Vegetated wetlands predominate with almost 2750 acres inventoried (81% percent of the wetlands). Estuarine emergent wetlands are the most abundant type (1856 acres), representing 54 percent of all wetlands. Nearly six miles of linear estuarine wetlands were mapped (mostly narrow tidal flats). Palustrine forested wetlands were next ranked in abundance, accounting for 532 acres or 16 percent of Staten Island's wetlands. Emergent wetlands followed with 323 acres (10% of all wetlands). Almost 7 miles of linear palustrine wetlands were inventoried, with palustrine forested wetlands predominating (5.2 miles).

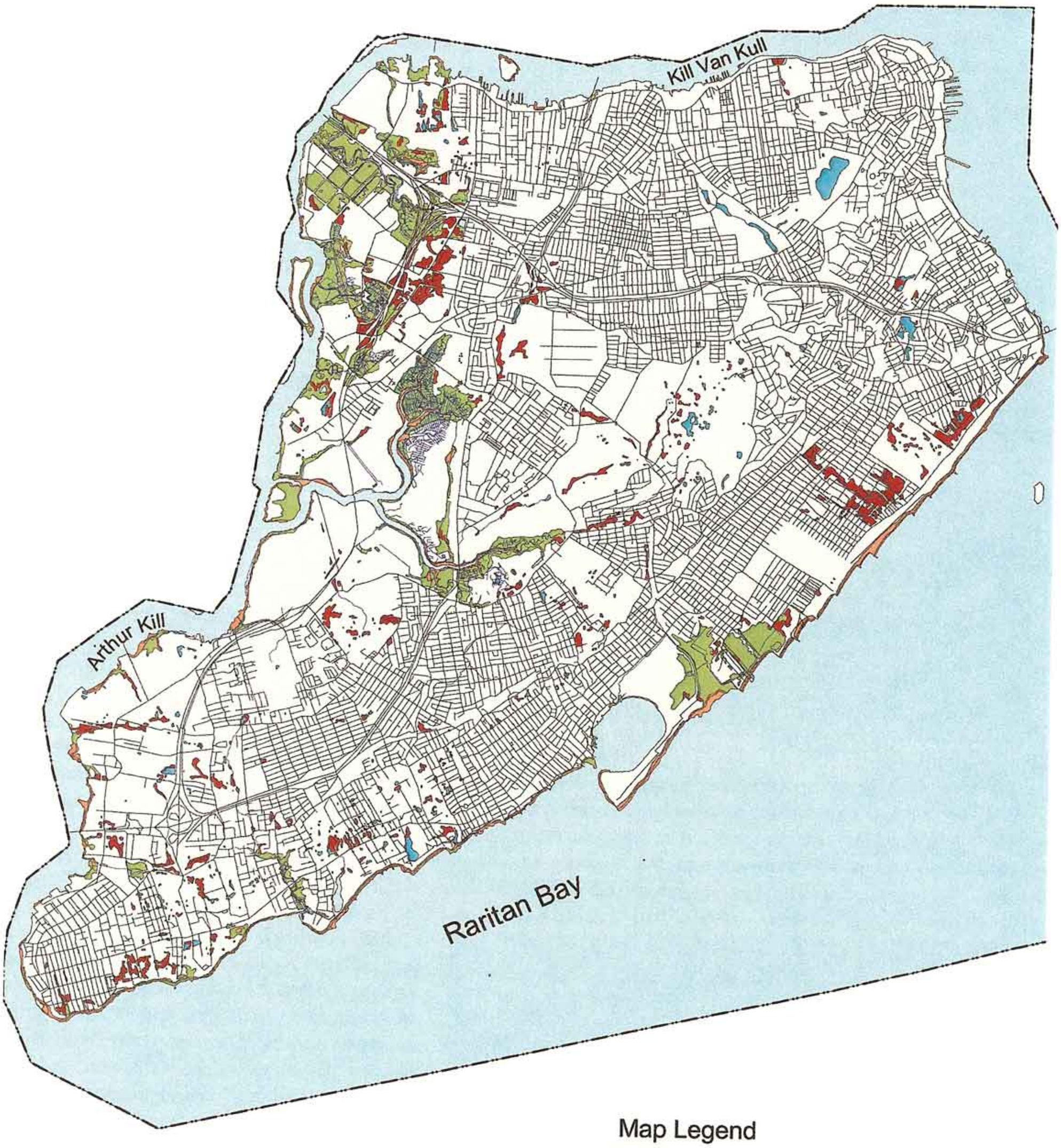
Estuarine waters surrounding Staten Island are the predominant deepwater habitat type. Only 65 acres of lacustrine waters were inventoried (e.g., Silver Lake Reservoir and Grasmere Lake). Most of the Island's rivers are tidal brackish (estuarine) ones including Richmond Creek, Main Creek, and Lemon Creek. About 14.5 miles of freshwater streams were mapped.





12 Percentages estimated from New York Multi-resolution Land Characteristics data set derived from satellite imagery (U.S. Geological Survey, EROS Data Center, Sioux Falls, SD).

General Distribution of Wetlands and Deepwater Habitats



Why Are Wetlands Worth Saving?

WETLANDS SUPPLY NUMEROUS ECOLOGICAL, economic, and cultural benefits to local communities, including water quality protection, flood control, erosion control, fish and wildlife habitats, aquatic productivity, and opportunities for recreation, aesthetic appreciation, and education. It must be recognized that all wetlands are not alike in form or function. Differences in vegetation, soils, hydrology, soil chemistry (e.g., brackish, fresh, acid, or alkaline), landscape position (e.g., estuarine, streamside, lakeside, or isolated), landform (e.g., depression, slope, and flat), and other factors greatly influence wetland functions. Different parts of a single wetland may be performing different functions or at different levels than the rest of the wetland. While functions are performed by individual wetlands, it must be recognized that each wetland works in combination with other wetlands as part of a complex, integrated hydrologic and ecological system. Consequently the value of the wetland resources in a given watershed or region is greater than the sum of the values of individual wetlands. Any assessment of a particular wetland must take this critical interrelationship into account.

Water Quality and Source Protection

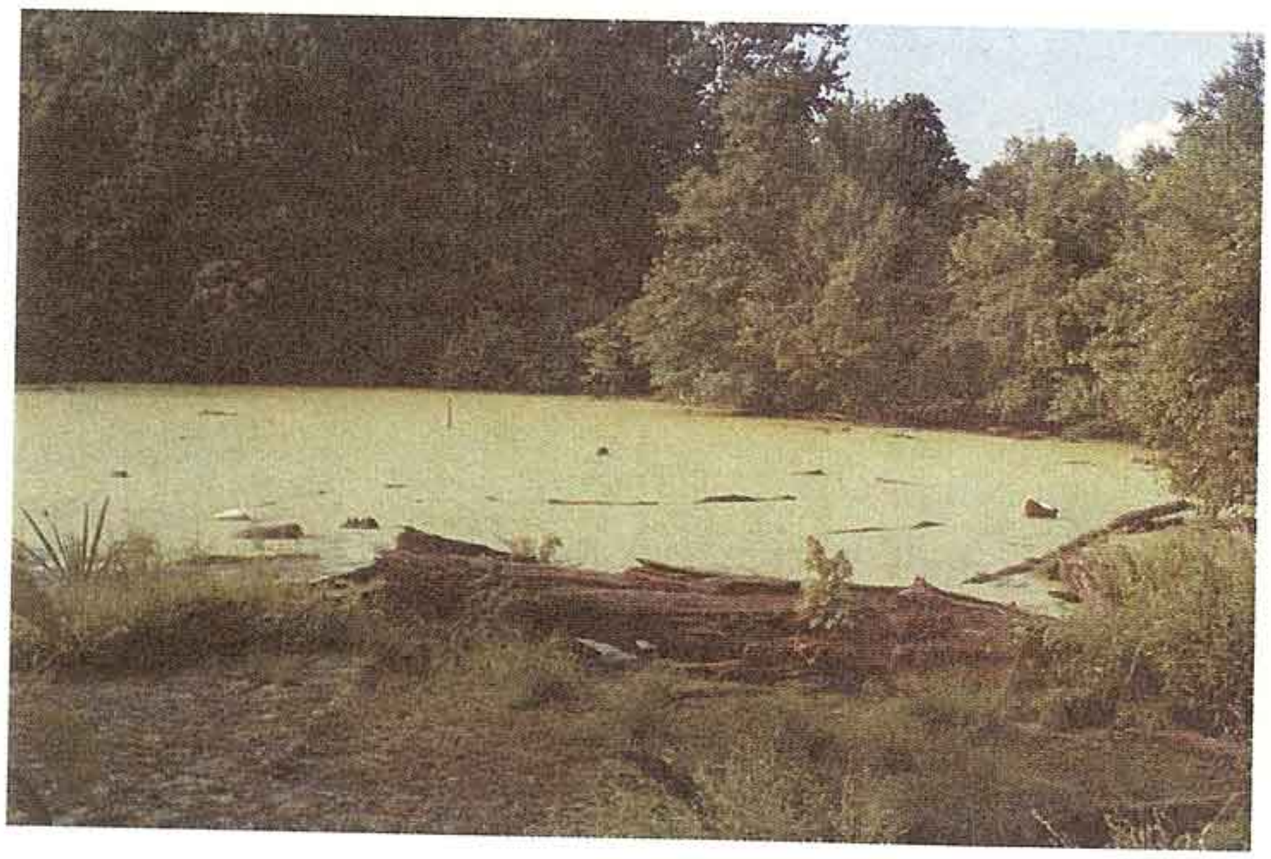
One of the most important functions of wetlands is their ability to help maintain good surface water quality in rivers, streams, and reservoirs and to improve degraded waters. Wetlands do this in several ways, by removing and retaining nutrients, processing chemical and organic wastes, and reducing sediment loads to receiving waters.

Wetlands are particularly good water filters. Due to their position between upland areas and deep water, wetlands can both intercept surface water runoff from land before it reaches open water and also help filter out nutrients, wastes, and sediments from flooding waters. A 100- to 150-foot vegetated buffer strip along a stream can significantly improve water quality in many areas. The value of wetlands, streams, and ponds in storing and filtering storm water has been recognized in Staten Island with the establishment of the Staten Island Bluebelt. New York City has purchased wetlands and waterbodies for stormwater management purposes. The Bluebelt watersheds include portions of Richmond Creek, Sweet Brook, Blue Heron/Seguine Pond, Arbutus Creek, Wolfe's Pond, Lemon Creek, Sandy Brook, and Mill Creek, and all of Jack's Pond and Wood Duck Pond.

In some places, wetlands contribute to the recharge of groundwater sources. During periods of heavy runoff, such as major storms or snowmelt in the spring, wetlands adjacent to streams and in depressions collect excess water. When the water table drops, the water held in the wetland may slowly percolate through the soil and eventually into the aquifer, replenishing groundwater. When streams are channelized and adjacent wetlands eliminated in the process of land development, stormwater moves off the landscape more quickly, and groundwater recharge is diminished. Whether obtaining drinking water from groundwater or from reservoirs fed by surface waters, it is important for communities to protect the many functions wetlands serve in maintaining water quality. Since wetlands can improve water quality, artificial wetlands are being constructed for stormwater management or tertiary treatment of wastewater in many places across the country. Numerous shallow marshes have been and are being built along Staten Island Bluebelt waterways as a common Best Management Practice to improve stormwater management and reduce sediment loading of the stream and lessen erosion downstream (e.g., Sandy Brook).

Many wetlands are active points of groundwater discharge. Some are the sources of streams and are aptly named "headwater wetlands." These wetlands provide a source of water important for aquatic life. Wetlands along "Twin Streams of the Lenape" in Tottenville are a source of freshwater

This marsh-pond complex, part of the Lemon Creek Bluebelt, is important for storaging water after heavy rains.



once used by native Americans. Seepage wetlands on slopes in Clay Pit Ponds State Park Preserve discharge groundwater that helps maintain Ellis Swamp and freshwater flows from its creek.

Flood Control

Wetlands have often been referred to as "natural sponges" that absorb flooding waters, yet they actually function more like "natural tubs," storing water overflowing riverbanks or collecting in isolated depressions. By temporarily storing flood waters, wetlands help protect adjacent and downstream property owners from flood damage (e.g., wetlands in Bloomingdale Woods). Trees and other wetland plants help slow the speed of flood waters. This action combined with water storage allows wetlands to lower flood heights and reduce the water's erosive force. Wetlands in and downstream of urban areas are especially valuable for flood protection, since urban development (impervious surfaces) increases the rate and volume of surface water runoff, thereby increasing the risk of flood damage downstream (e.g., Oakwood Beach and Prince's Bay neighborhoods).

Erosion Control and Shoreline Stabilization

Located between streams and high ground, many wetlands are in a good position to buffer the land against erosion. Wetland plants are most important in this regard, since they increase the durability of the sediment through binding soil with their roots, dampen wave action by friction, and reduce current velocity through friction. Tidal wetlands and lakeside and streamside wetlands are important shoreline stabilizers, thereby preventing erosion of sediments that could jeopardize important fish habitat and lower water quality. Wetland plants are so effective at stabilizing the soil that planting of wetland vegetation is being used to control shoreline erosion in many places across the country. Bioengineering techniques (e.g., biodegradable mats with wetland plants) are preferable to structural erosion control measures (e.g., rock rip-rap), especially from an environmental standpoint because they provide habitat and aesthetic values while protecting the shoreline. The New York City Parks & Recreation's Natural Resources Group has used a combination of mats and salt marsh grass planting to stabilize part of the shoreline of Arthur Kill. Wetlands have also been constructed at Great Kills, Main Creek, and Pralls Island for erosion control.

Aquatic Productivity

Wetlands are among the most productive natural ecosystems in the world and some types of wetlands may be the highest, rivaling our best cornfields in biomass production. Some marshes annually produce more than 10 tons of organic matter per acre. Wetlands can be regarded as the farmlands of the aquatic environment since great volumes of food (plant material) for aquatic organisms are produced every year. Although direct grazing of most wetland plants is generally limited, their major food value comes from dead leaves and stems that break down in the water to form small particles of organic material called "detritus." This detritus serves as the principal food for many small aquatic invertebrates and forage fishes that are food for larger predatory fishes, such as bluefish and striped bass. These larger fishes are, in turn, consumed by people. Thus, wetlands provide a source of food for people as well as for aquatic animals. About two-thirds of commercially and recreationally important coastal fishes in the U.S. depend on tidal wetlands.

Fish and Wildlife Habitat

Wetlands are critical habitats, providing food, water, cover, breeding grounds, or nursery areas for many species. Some wetland-dependent animals breed in wetlands and spend a considerable amount of time in uplands, such as vernal pool breeders (e.g., spring peepers, and spotted salamanders).[13] Others like painted and snapping turtles live in Staten Island wetlands and waterbodies and nest in uplands. Green frogs and bull frogs are

ELLEN HARTIG

NEW YORK CITY PARKS AND RECREATION/ CARL ALDERSON

NEW YORK CITY PARKS AND RECREATION/ ROBBIN BERGFORS

TOP TO BOTTOM

Collectively, small basin wetlands like this red maple-sweet gum swamp near Mount Loretto store much rainfall.

Destruction and channelization of wetlands severely reduce the water storage capacity of natural drainage systems. This plus increased stormwater runoff from urban development lead to more flood damage.

Salt marsh plantings help stabilize eroding shorelines. New York City's Salt Marsh Restoration Team in action.

13 For descriptions and illustrations of wetland animals, consult *In Search of Swampland* (listed under *Additional Readings*).

Fiddler crabs.

MICHAEL FELLER

Black-crowned night heron.

FWS/JOHN AND KAREN HOLLINGSWORTH

Nesting osprey.

FWS/ROBERT SHALLENBERGER

Great egret.

MICHAEL FELLER

Sharp-tailed sparrow.

also common in Staten Island ponds and associated marshes. Most coastal and freshwater fishes feed in wetlands or upon wetland-produced food and use wetlands as nursery grounds (e.g., bluefish, striped bass, Atlantic silversides, menhaden, flounder, American eel, killifish, and carp). Hundreds of invertebrates also live in wetlands, including fiddler crabs and salt marsh snails in estuarine wetlands and dragonflies, mosquitoes, aquatic beetles, water striders, and certain butterflies in freshwater wetlands. An estimated 43 percent of the nation's threatened and endangered species rely directly or indirectly on wetlands for their survival.

Birds are perhaps the most conspicuous animals associated with Staten Island's wetlands. Typical wetland species found in marshes, ponds, and creeks include herons (great blue and green), night herons (black-crowned and yellow-crowned), egrets (great and snowy), glossy ibises, waterfowl (wood ducks, mallards, Canada geese, moorhens, and pied-billed grebes), belted kingfishers, ospreys, and herring gulls. The wading birds are easily observed feeding on mudflats and exposed creek beds at low tide, while waterfowl are seen in open water bodies throughout the Island. Gregarious wading birds (night herons, egrets, and ibises) nest in colonies on islands surrounding Staten Island, especially on Isle of Meadows, Pralls Island, and Shooters Island (the "Harbor Herons Complex" in northwestern Staten Island). Many waterfowl overwinter in tidal areas around Staten Island (e.g., canvasback, black duck, bufflehead, teal, merganser, wigeon, scaup, gadwall, mallard, ruddy duck, northern shoveller, and brant). Red-winged blackbirds and marsh wrens nest in reed and cattail marshes. Barn swallows can be seen flying over marshes and ponds feeding on airborne insects. A large number of other songbirds feed, nest, and/or raise their young in Staten Island wetlands (e.g., swamp sparrow, song sparrow, yellow warbler, yellowthroat, gray catbird, and northern oriole). Woodpeckers hunt for insects in forested wetland trees. Woodcock and northern harrier (marsh hawk) are common in scrub-shrub and emergent wetlands, respectively. The latter species nests in *Phragmites*-dominated marshes in Bloomfield and feeds in salt marshes. Many songbirds migrating north (in spring) and south (in the fall) pass through Staten Island and seek out wetlands for food and shelter.

The muskrat is perhaps the most characteristic wetland mammal on Staten Island. Other mammals observed in wetlands include meadow voles, cottontail rabbits, raccoons, opossums, and white-tailed deer.

Rare Species Habitat

Some of Staten Island's wetlands are vital for maintaining biodiversity in the state by supporting state-listed rare and endangered species. Among the state-rare and endangered plants are three trees (willow oak, sweet bay, and swamp cottonwood), two shrubs (possum haw and American strawberry-bush), four herbs (primrose-leaf violet, soapwort gentian, square-stemmed spike-rush, and eastern gama grass), two parasitic herbaceous vines (buttonbush dodder and southern dodder), and one aquatic floating plant (American featherfoil). Sweet bay (magnolia) grows in wetlands protected in the Staten Island Corporate Park, while willow oak and rare hybrid oaks occur in privately-owned wetlands in Tottenville. Records show that the federally-listed American burying beetle and sea beach tiger beetle occurred in Staten Island wetlands.

Natural Products

A wealth of natural products may be derived from wetlands, including timber, fish and shellfish, wildlife, and blueberries. Forested wetlands may provide some firewood for local residents. Wetland wildlife may be hunted or trapped for food or supplemental income. These activities were probably more prevalent in the past when more open land existed on the Island. Blueberries may be gathered by local residents for pies and jellies or to eat fresh.

The Raritan Bay region has a long history of

providing fish and shellfish for commercial and recreational harvest. The Lenape Indians collected oysters from Arthur Kill and fished with seines and weirs made from reeds (probably marsh plants). Large shell middens (signs of former Indian settlements) were found by colonists in Tottenville. Colonists also harvested shellfish and fish from the Raritan Bay estuary. In the 1600s and 1700s, oysters were gathered at low tide in many places on Staten Island, including Arthur Kill. Oystering was the main industry of Tottenville in the 1800s. From 1900 on, water pollution increased in Raritan Bay which closed shellfishing. Today, shellfish are commercially harvested but must be relocated to eastern Long Island for depuration (purification) prior to going to market. Over time, fishing effort increased with more sophisticated means of harvest employed and a great rise in sport fishing. Dams constructed over many New Jersey rivers and other alterations led to significant declines in alewives, shad, and striped bass as they were separated from their native spawning grounds. Landfills converted tidal marshes along Fresh Kill, Main Creek, and Richmond Creek to trash-heaped hills, while marshes in Bloomfield were filled for oil storage facilities. These types of activities destroyed hundreds of acres of productive fish nursery grounds and further contaminated remaining habitats. While Raritan Bay is still an important resource, it is a mere shadow of what it was before increased water pollution, shoreline development, sedimentation, boat traffic, and overfishing took their toll on the Bay.[14] Nonetheless, commercial and sport fishing are still popular in the Bay.

Quality of Life

Outdoor recreational activities take place in and around wetlands: fishing, hunting, bird watching, nature photography, hiking, boating, ice skating, and cross-country skiing. Many Staten Islanders enjoy the beauty and sounds of nature and spend time walking on trails around and through wetlands at places like the William T. Davis Wildlife Refuge (New Springville), Clay Pit Ponds State Park Preserve (Charleston), or numerous New York City parks. Wetlands are great places for outdoor study and gaining an appreciation of natural history and ecology by students of all ages. In residential areas, wetlands often provide a privacy barrier between neighbors. Some neighborhoods in southern Staten Island have an almost rural feel to them due to surrounding large wetland and upland forest complexes. Many times, properties bordering wetlands have higher property values than those that do not. Urban wetlands are often among the few remaining pieces of "natural habitat" providing Staten Island residents with some sense of wildness and open space.

LEFT
Aerial view of the Arthur Kill locale showing tidal wetlands and former tidal wetlands (now landfills and oil tank farms).

BELOW, TOP TO BOTTOM
Muskrat lodge and heavily grazed marsh plants ("eat-out").

Swamp cottonwood, a rare wetland plant in New York, occurs on Staten Island.

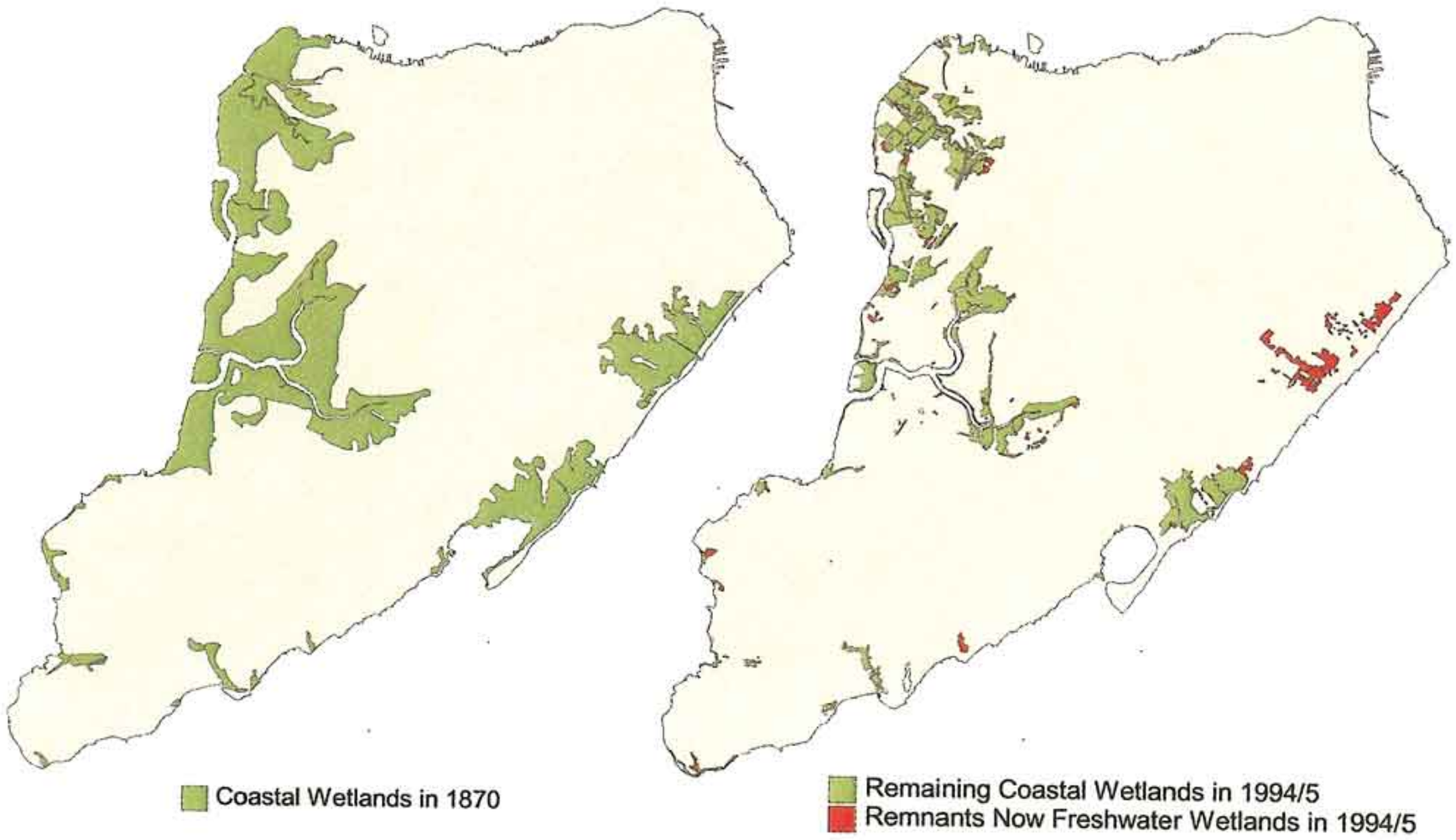
Wetlands provide opportunities for young and old to learn about nature.

MICHAEL FELLER

MICHAEL FELLER

STATEN ISLAND INSTITUTE OF ARTS AND SCIENCES

14 For more on the history of this estuary, consult *The Fisheries of Raritan Bay* by C.L. MacKenzie, Rutgers University Press, P.O. Box 5062, New Brunswick, NJ 08903.

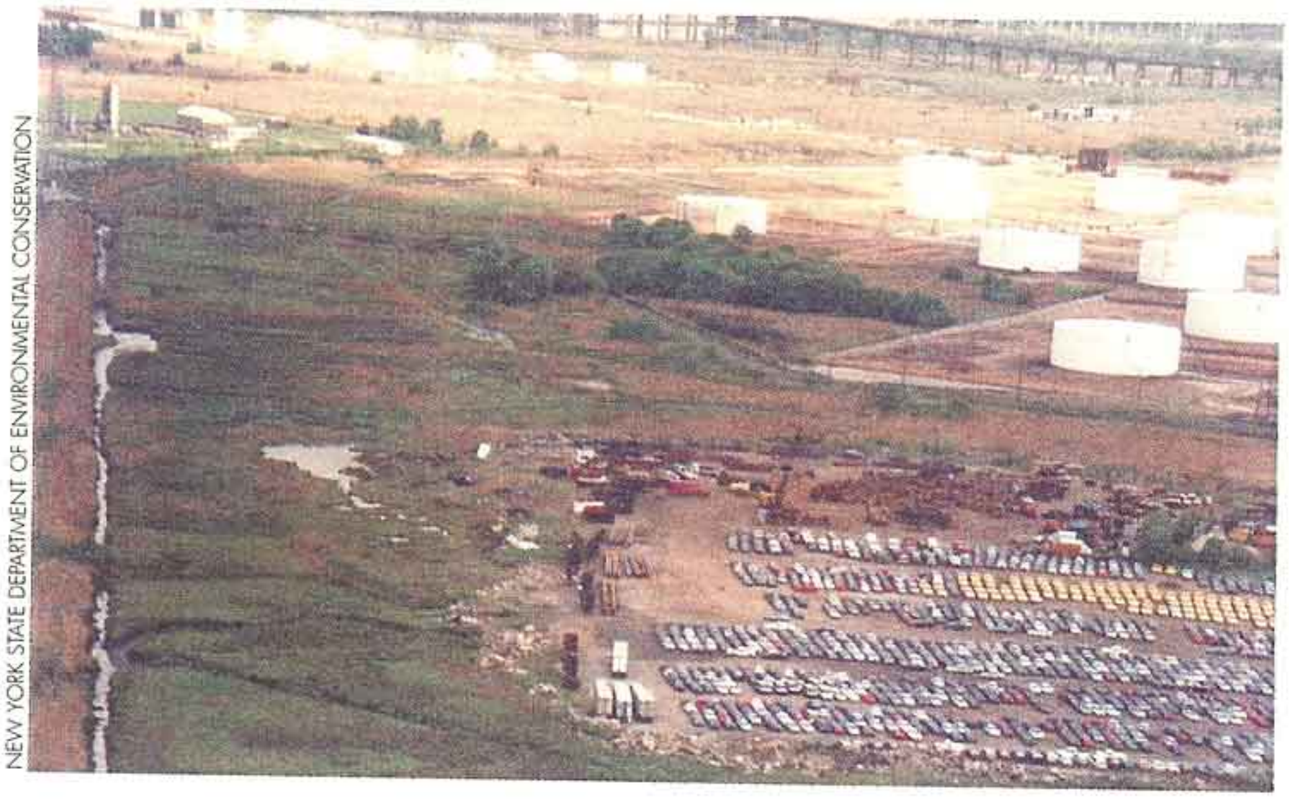


Staten Island once had an abundance of salt marshes, with nearly 5600 acres present in 1870. Since then, about two-thirds of them have been filled and many of the remaining ones are polluted to varying degrees. (1870 data compiled from historical map, courtesy of the U.S.D.A. Natural Resources Conservation Service)

How Are Wetlands Changing?

Natural processes and human actions affect wetlands in various ways. Changes in vegetation often result from natural events such as droughts, rising sea level, hurricanes, episodic floods, and animal actions (e.g., beaver and muskrat). Rising sea level also causes long-term changes in wetland hydrology and the extent of estuarine waters. People have both positive and negative impacts on wetlands. Unfortunately, most human activities cause a loss of wetland acreage or damage the quality of the remaining wetlands. For example, tidal wetlands were once a vast resource in Staten Island, comprising roughly 5600 acres in the late-1800s. Today, only about 1800 acres (32%) of these original wetlands remain tidal. An estimated 300 acres of former tidal wetlands (or 5%) have become nontidal freshwater marshes and swamps due to flow restrictions, mostly in the Midland Beach and South Beach neighborhoods. Nearly two-thirds (63%) of Staten Island's tidal wetlands (about 3500 acres) have been filled for various purposes. In some cases, people are having a positive effect on wetland acreage and quality through restoration and creation efforts, but these projects are rather limited undertakings considering the magnitude of historic wetland losses.

Major human impacts to Staten Island's wetlands include: (1) filling for commercial, industrial, and residential development, (2) filling for trash disposal (e.g., sanitary landfills), (3) filling for roads and highways, (4) filling for disposal of dredged material, (5) excavating and channelizing wetlands for navigation and flood control projects, (6) constructing ponds, (7) directly or indirectly discharging pollutants (e.g., oil, pesticides, herbicides and other chemicals, sediment, domestic sewage, and agricultural wastes), (8) altering wetland hydrology, and (9) spreading invasive species and exotic species (e.g., common reed, purple loosestrife, and Japanese knotweed). Use of motorized vehicles (e.g., dirt bikes) on trails through wetlands disturbs wildlife and vegetation, while local dumping has placed trash in many wetlands.



NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Filled tidal wetlands in the Bloomfield-Gulfport area. Tidal marsh filling was widespread in the 1950s and 1960s, but has been greatly reduced by federal and state laws that seek to protect water quality and wetlands.

How Are Wetlands Being Protected?

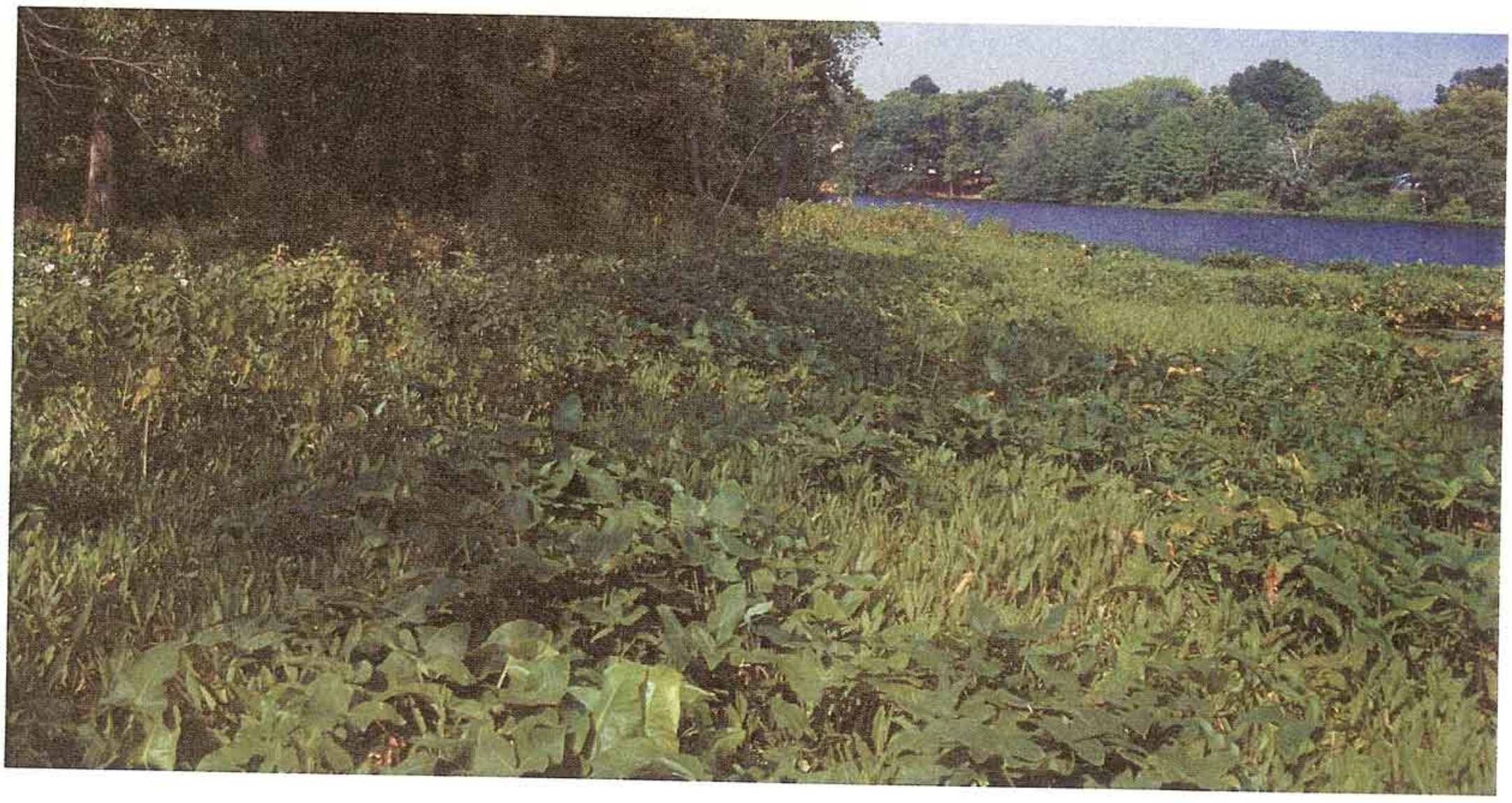
People are trying to improve the fate of wetlands through various means. Wetland protection efforts typically involve acquisition, regulation of impacts, and restoration. Public education is essential to increase awareness and understanding of the natural functions provided by wetlands, including the protection of local and regional water quality. An informed public should be able to make the best choices regarding natural resource utilization. Trained staff from numerous environmental agencies can provide information and sometimes technical assistance to local governments and community/environmental groups interested in developing local wetland protection strategies (see *Wetland Resource Guide).*

Wetland Acquisition

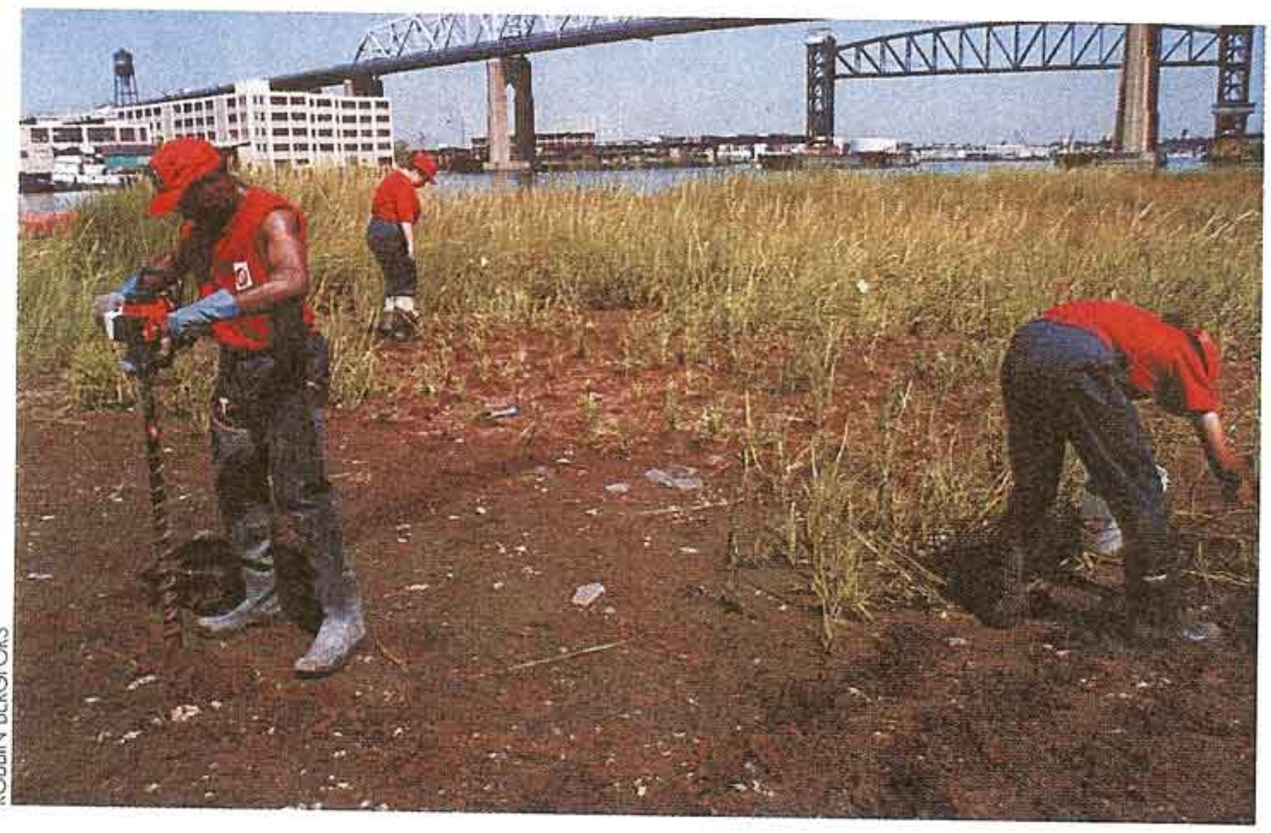
Acquisition of wetlands and other aquatic resources is the most effective way to protect vanishing natural resources. A wetland can be protected permanently by direct purchase or by securing conservation easements (e.g., acquiring specific development rights). Protected wetlands are often maintained as wildlife refuges, sanctuaries, parks, or conservation areas by government agencies and private conservation organizations. Stewardship agreements between property owners and various agencies can also promote wetland conservation if maintained over a long period. Acquisition of adjacent buffer areas is also important to protecting wetland functions and values. A 300-foot vegetated buffer around wetlands and along streams may provide adequate protection of wildlife habitat and help maintain high quality aquatic habitat.

The U.S. Fish and Wildlife Service has published a report entitled *Regionally Significant Habitats and Habitat Complexes of the New York Bight Watershed* that includes descriptions of numerous Staten Island wetlands and their ecological significance. Many of these sites are already in public ownership, but others remain privately owned and are high priorities for acquisition or other protection.

The City of New York is acquiring many wetlands, streams, ponds, and adjacent lands for its Bluebelt system. In addition to providing stormwater storage and natural filtration, this system protects wetlands for wildlife and to preserve open space for people to enjoy. The City has also established numerous parks on Staten Island that contain wetlands, including Blue Heron Park, Wolfe's Pond Park, Lemon Creek Park, and Bunker Ponds Park in the southern part; LaTourette Park, Basket Willow Swamp, and



Emergent wetland along the shores of Wolfe's Pond, part of the New York City park system.



NEW YORK CITY PARKS AND RECREATION/ ROBBIN BERGFORS

New York City's Salt Marsh Restoration Team utilizes volunteers such as the City Volunteer Corps (pictured), school groups, and others to restore salt marshes like this one at Old Place Creek that was damaged by an oil spill.

William T. Davis Wildlife Refuge within the Greenbelt in the middle of the Island; and Saw Mill Creek Park, Eibs Pond Park, and Mariners Marsh in northern section. The City has also acquired the rare sweet bay magnolia swamp at Teleport. State and federal governments maintain wetlands on their lands. Clay Pit Ponds State Park Preserve, and newly acquired St. Francis Seminary and Mount Loretto possess considerable freshwater wetland acreage. Gateway National Recreation Area contains significant acreage of estuarine wetlands.

Wetland Regulation

While acquisition is critical to protecting many wetlands, regulations that limit the adverse effects of various human activities on wetlands are also necessary to prevent degradation of natural resources and property. In the 1970s and 1980s, the federal government and several eastern states, including New York, enacted laws to regulate activities that adversely impact wetlands. These laws, plus local wetland zoning ordinances, provide government jurisdiction over certain uses of wetlands (e.g., filling, excavation, and impoundment) and require that permits be secured before engaging in such activities. For information on federal, state, and local regulatory requirements, contact the appropriate resource agency (see *Wetland Resource Guide).*

Through Section 404 of the federal Clean Water Act, the U.S. Army Corps of Engineers (Corps) regulates the discharge of dredged or fill material into waters of the United States, including wetlands. The U.S. Environmental Protection Agency (EPA) oversees this program given its mandate to protect and improve the quality of our nation's waters. Wetlands of virtually any size may be regulated if they meet certain regulatory criteria.

The New York State Department of Environmental Conservation (NYSDEC) has two separate programs for regulating wetlands: one for tidal wetlands and another for freshwater wetlands. Tidal wetlands of any size plus a contiguous 150-foot buffer are subject to state regulations. The freshwater wetland regulations apply to freshwater wetlands 12.4 acres or larger (plus smaller wetlands of unusual local importance) and an adjacent 100-foot buffer zone. All wetlands regulated by New York State are shown on two sets of official wetland maps (one for tidal wetlands and the other for freshwater wetlands), although boundaries may be modified based on field inspections. These maps may be reviewed at NYSDEC Regional Offices and county and local government offices. Permits are required for activities including filling, draining, dredging, excavation, erection of structures, clearcutting, and discharge of pollutants.

Because state regulations typically exclude most small freshwater wetlands, municipalities in New York State are encouraged to adopt local ordinances to regulate activities affecting freshwater wetlands smaller than 12.4 acres. These smaller wetlands play critical roles in the local environment (e.g., flood storage, streamflow maintenance, wildlife habitat, and open space), especially since most are part of a larger network of wetlands. Local wetland protection can also be achieved by including specific wetland protection provisions in zoning, subdivision, or site plan review laws.

Wetland Restoration

During the past decade, there has been increasing interest in restoring natural communities. It seems that we have reached a point in our history where we have developed a heightened sense of appreciation of the natural world around us. Nature, once viewed as an entity to be conquered and put into cultivation, habitation, or other human use, is now regarded by many people as desireable in its own right without human manipulation. Working within the natural fabric of the land is becoming a standard building practice in many areas, but this philosophy needs to be more widely adopted.

Wetland restoration involves returning a wetland to a place where one once existed or rehabilitating a damaged wetland whose functions are impaired in some way. The first situation requires locating former wetland sites (e.g., agricultural lands on drained hydric soils, filled areas lacking

Spatterdock (yellow pond lily) beds nearly fill Sharrotts Pond during a low water year at Clay Pit Ponds State Park Preserve.

any structures, impoundments not supporting wetland vegetation, and excavated areas in existing wetlands). The goal of restoration in these cases would be to re-establish a vegetated wetland of some kind at these sites. The second type of wetland restoration involves repairing a significantly altered wetland (e.g., diked wetlands, partly drained wetlands, wetlands subject to excess sedimentation, wetlands receiving leachate from a neighboring landfill, and wetlands invaded by exotic or invasive species) to improve its functions. There are many former tidelands on Staten Island that may be suitable for wetland restoration (e.g., South Beach and Midland Beach). The NYC Department of Parks & Recreation's Natural Resources Group has been restoring salt marshes for nearly a decade (e.g., Saw Mill Creek, Old Place Marsh, and Pralls Island), while the NYC Department of Environmental Protection has restored wetlands in the Richmond Creek drainage.

Riparian habitat restoration is the revegetation of streambanks to improve water quality and wildlife habitat. While a 100-foot buffer may provide adequate water quality protection, a 300-foot buffer is recommended to maintain sufficient habitat for wetland-dependent species and to protect areas designated as critical wildlife habitat. To protect fish and wildlife species associated with wetlands and other aquatic habitats, we need to think beyond the limits of those habitats and provide adequate buffers and connections between suitable habitat areas. By maintaining and restoring vegetated buffers around wetlands and waterbodies, we can greatly help preserve and improve their biological integrity and critical functions.

The Urban Resources Partnership consists of seven agencies/organizations including EPA, U.S. Housing and Urban Development, U.S. Forest Service, NRCS, National Park Service, Cornell Cooperative Extension, and NYSDEC. This partnership aims to provide grant money and technical assistance to under-served communities in New York City. One of the grants is going to a local tenants association for restoration of Eib's Pond. This project will enhance the existing site and will serve as a framework for educating youth and other local residents about environmental stewardship and their local environment.

The New York-New Jersey Harbor Estuary Program is one of 28 national estuary programs established by EPA. The program involves public agencies, private organizations, and citizens in natural resource planning. A comprehensive conservation and management plan has been prepared and signed by the governors of New York and New Jersey. The program is targeting sites for habitat restoration and acquisition (visit their website at *www.hudsonriver.org/hep*).

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MARCH 3, 1849

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