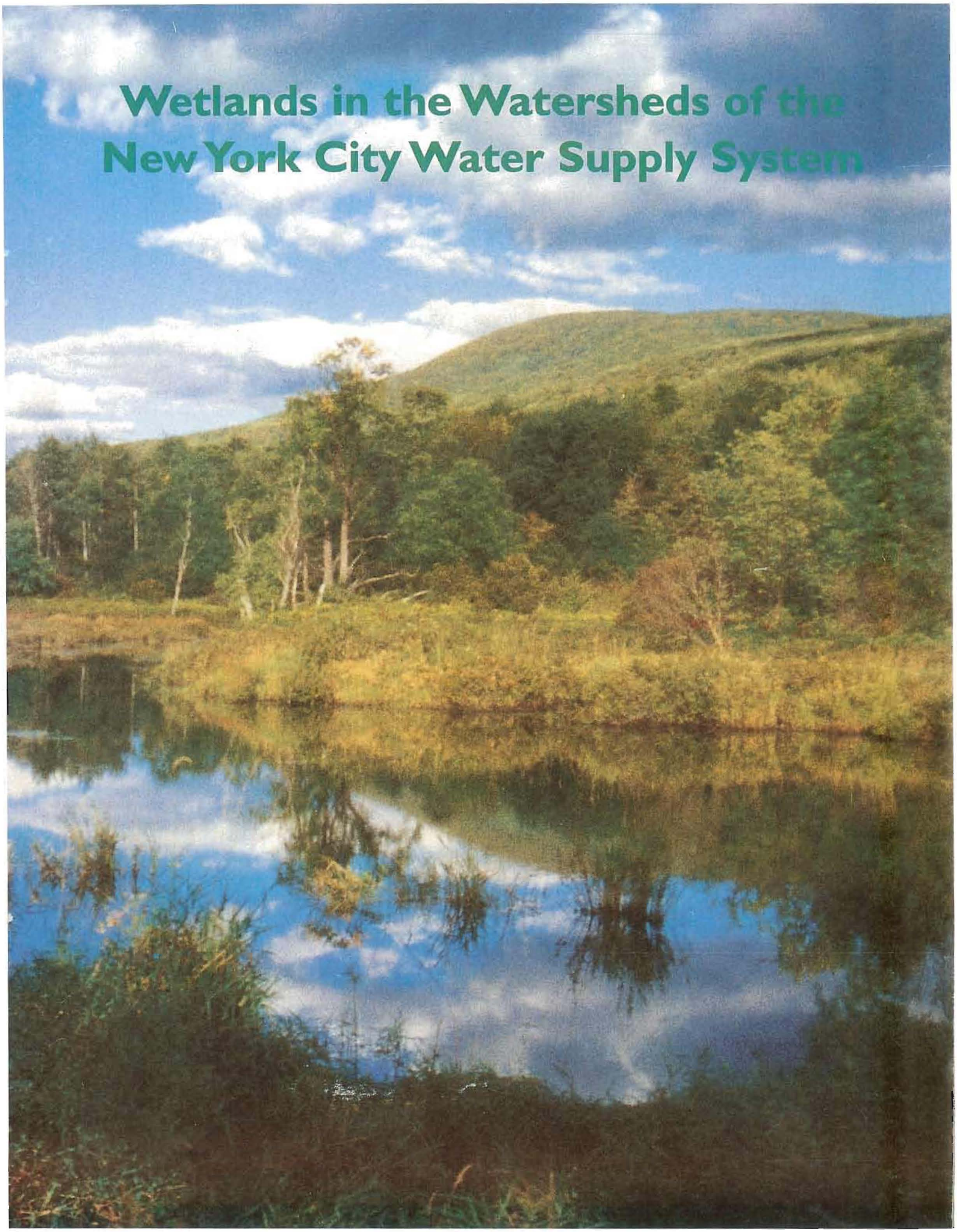
Wetlands in the Watersheds of the New York City Water Supply System



Acknowledgments

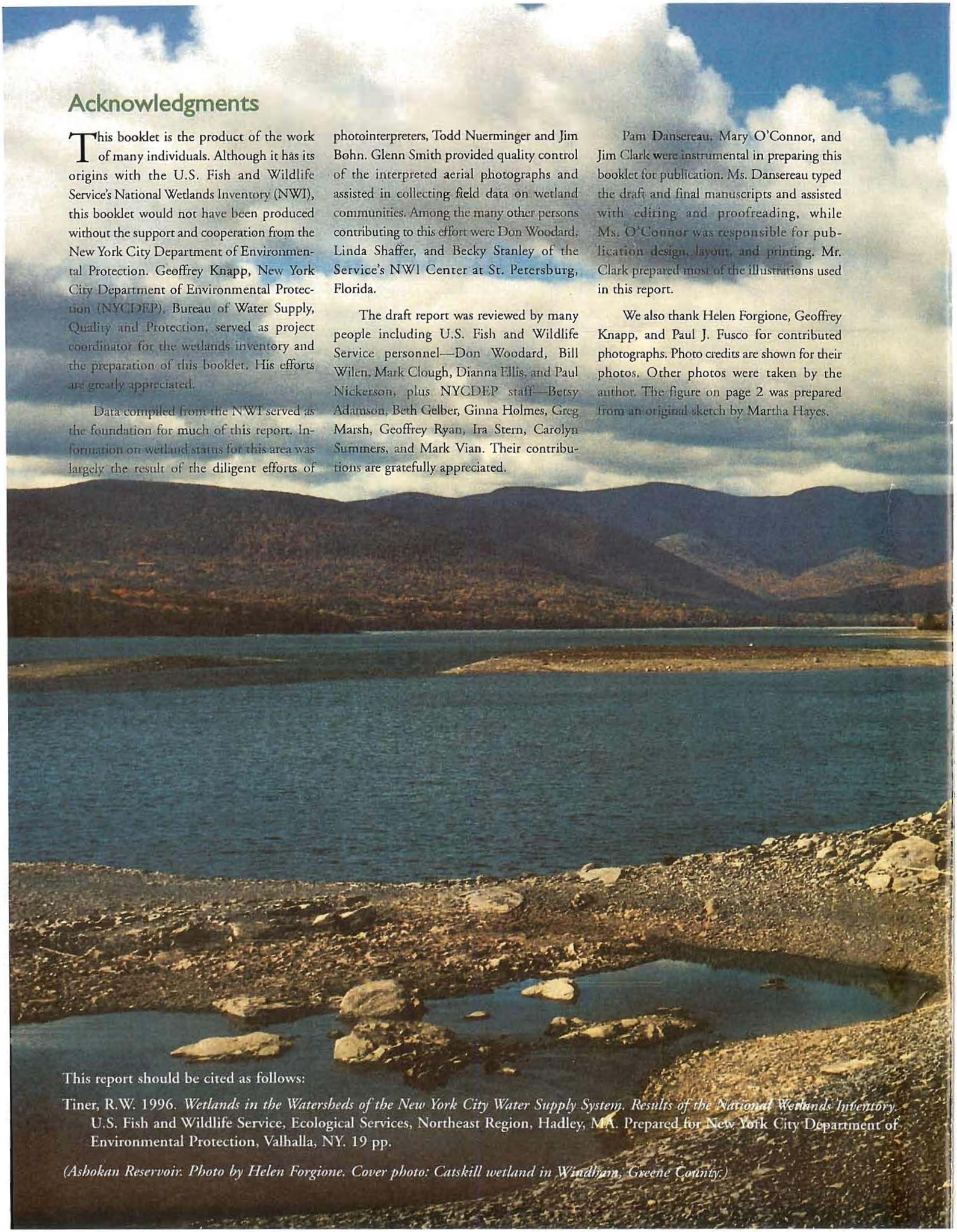
This booklet is the product of the work of many individuals. Although it has its origins with the U.S. Fish and Wildlife Service's National Wetlands Inventory (NWI), this booklet would not have been produced without the support and cooperation from the New York City Department of Environmental Protection. Geoffrey Knapp, New York City Department of Environmental Protection (NYCDEP), Bureau of Water Supply, Quality and Protection, served as project coordinator for the wetlands inventory and the preparation of this booklet. His efforts are greatly appreciated.

Data compiled from the NWI served as the foundation for much of this report. Information on wetland status for this area was largely the result of the diligent efforts of photointerpreters, Todd Nuerminger and Jim Bohn. Glenn Smith provided quality control of the interpreted aerial photographs and assisted in collecting field data on wetland communities. Among the many other persons contributing to this effort were Don Woodard, Linda Shaffer, and Becky Stanley of the Service's NWI Center at St. Petersburg, Florida.

The draft report was reviewed by many people including U.S. Fish and Wildlife Service personnel—Don Woodard, Bill Wilen, Mark Clough, Dianna Ellis, and Paul Nickerson, plus NYCDEP staff—Betsy Adamson, Beth Gelber, Ginna Holmes, Greg Marsh, Geoffrey Ryan, Ira Stern, Carolyn Summers, and Mark Vian. Their contributions are gratefully appreciated.

Pam Dansereau, Mary O'Connor, and Jim Clark were instrumental in preparing this booklet for publication. Ms. Dansereau typed the draft and final manuscripts and assisted with editing and proofreading, while Ms. O'Connor was responsible for publication design, layout, and printing. Mr. Clark prepared most of the illustrations used in this report.

We also thank Helen Forgione, Geoffrey Knapp, and Paul J. Fusco for contributed photographs. Photo credits are shown for their photos. Other photos were taken by the author. The figure on page 2 was prepared from an original sketch by Martha Hayes.



This report should be cited as follows:

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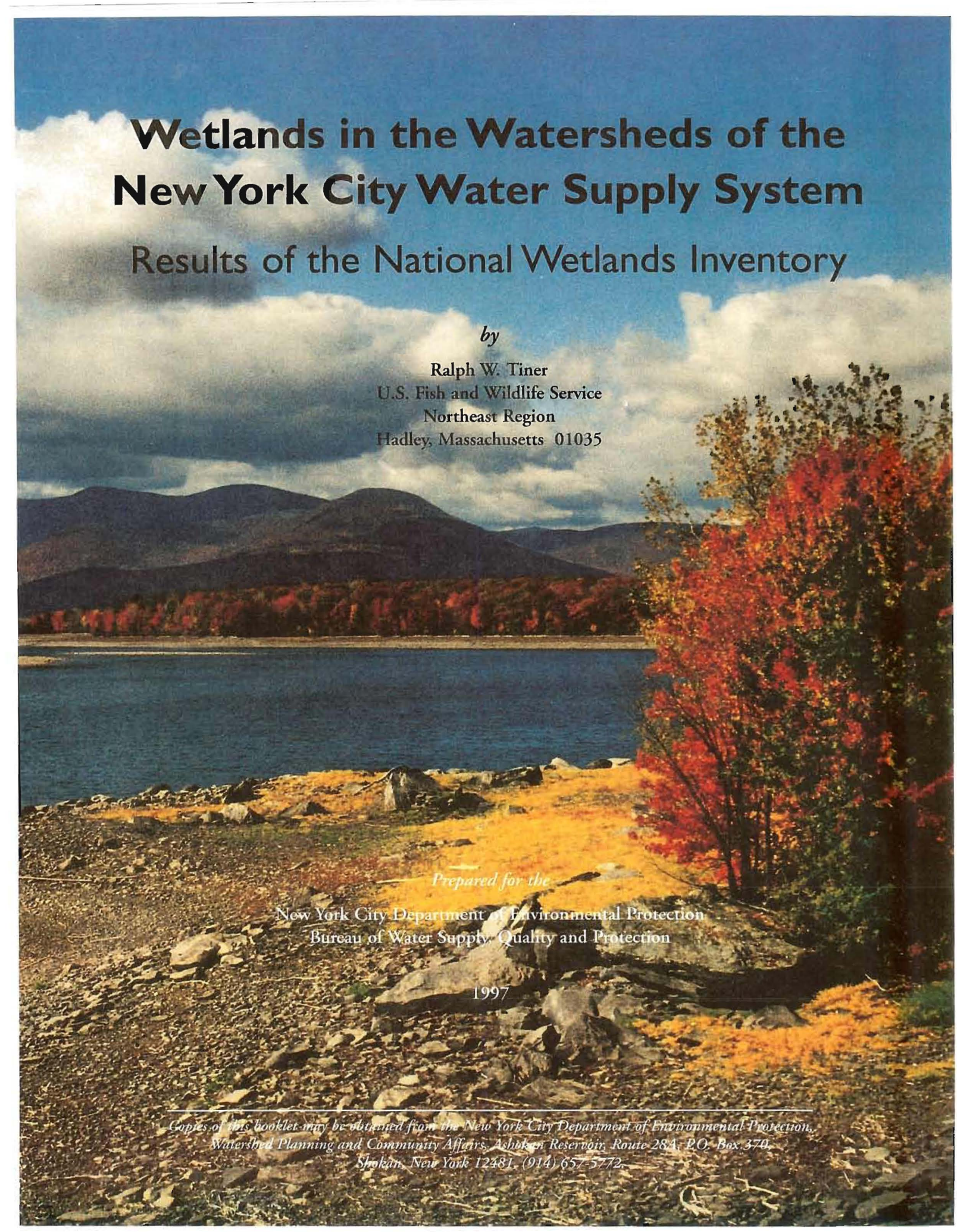
(Ashokan Reservoir. Photo by Helen Forgione. Cover photo: Catskill wetland in Windham, Greene County.)



Wetlands in the Watersheds of the New York City Water Supply System

Results of the National Wetlands Inventory

by

Ralph W. Tiner
U.S. Fish and Wildlife Service
Northeast Region
Hadley, Massachusetts 01035

Prepared for the

New York City Department of Environmental Protection
Bureau of Water Supply, Quality and Protection

1997

Copies of this booklet may be obtained from the New York City Department of Environmental Protection, Watershed Planning and Community Affairs, Ashokan Reservoir, Route 28A, P.O. Box 370, Shokan, New York 12481, (914) 657-5772.

Preface

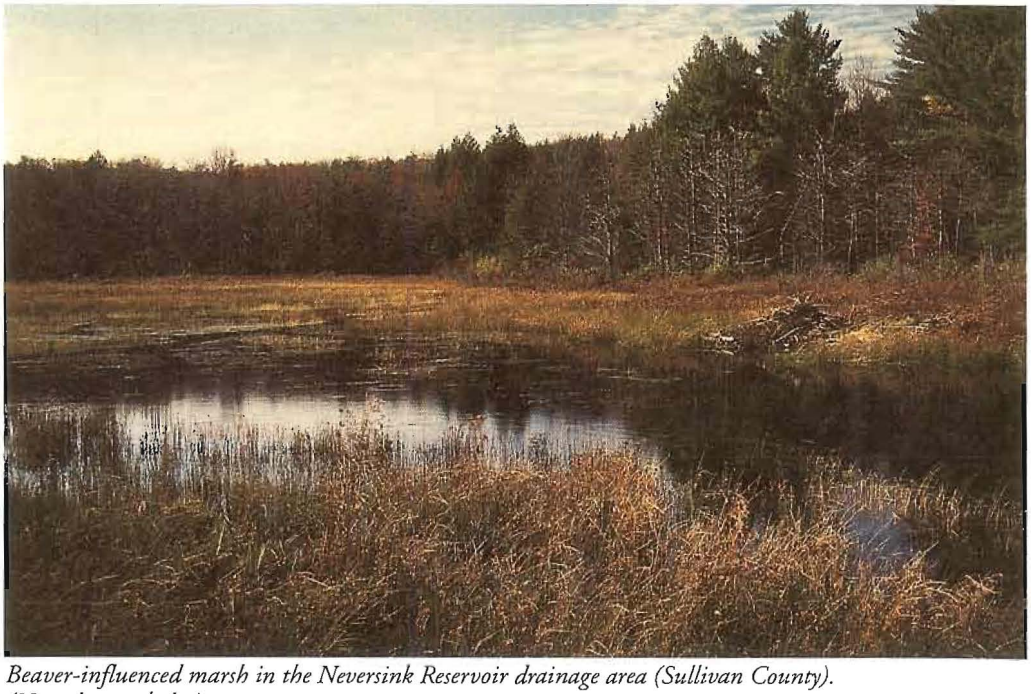
American tree sparrow. (Photo © Paul J. Fusco)

This report is based on a wetlands inventory of three watersheds of New York City's water supply system. This area supplies New York City's 19 upstate reservoirs. The nearly 2,000-square mile area is divided into three reservoir systems. West of the Hudson River, the Catskill and Delaware systems are located in portions of Delaware, Greene, Schoharie, Sullivan, and Ulster Counties. East of the Hudson River, the Croton system lies in portions of Dutchess, Putnam, and Westchester Counties and a small area of Fairfield County, Connecticut. An inventory of wetlands in the Catskill, Delaware, and Croton watersheds was conducted because wetlands play a major role in the protection of water quality in both the surface waters of streams and rivers that feed the City's reservoirs and the groundwater that supplies local residential and municipal wells. Further loss or degradation of remaining wetlands in the watersheds could jeopardize regional water quality. The wetlands survey was completed by the U.S. Fish and Wildlife Service's National Wetlands Inventory with support from the New York City Deparment of Environmental Protection.

The inventory was designed to determine the current status of wetlands and deepwater habitats in portions of three watersheds (Croton, Catskill, and Delaware) that are part of New York City's water supply system. The inventory answers several questions, including: How much wetland acreage exists in each watershed? Where are wetlands most abundant? 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 wetlands larger than 1-3 acres in size) and this booklet. The inventory utilized 1:58,000 color infrared aerial photography from 1982-1987 to interpret wetlands. Wetlands were classified to various types, including emergent, scrub-shrub, and forested wetlands. Farmed wetlands were not mapped.

For a full description of the NWI mapping process, including the classification system, please refer to the *Atlas of National Wetlands Inventory Maps for the Watersheds of the New York City Water Supply System.* A list of specific locations where the Atlas is available for review can be found in the Resource Guide section on page 18 of this booklet. Copies of individual maps can be ordered from: CLEARS, Resource Information Laboratory, 462 Hollister Hall, Cornell University, Ithaca, New York 14853, (607) 255-6529.

This booklet summarizes the results of the wetlands inventory for the three watersheds. It provides brief descriptions of the area's wetlands, their distribution, and their values. In addition, the booklet presents some recommendations to improve management and conservation of wetlands.



Beaver-influenced marsh in the Neversink Reservoir drainage area (Sullivan County). (Note: beaver lodge)

What are Wetlands?

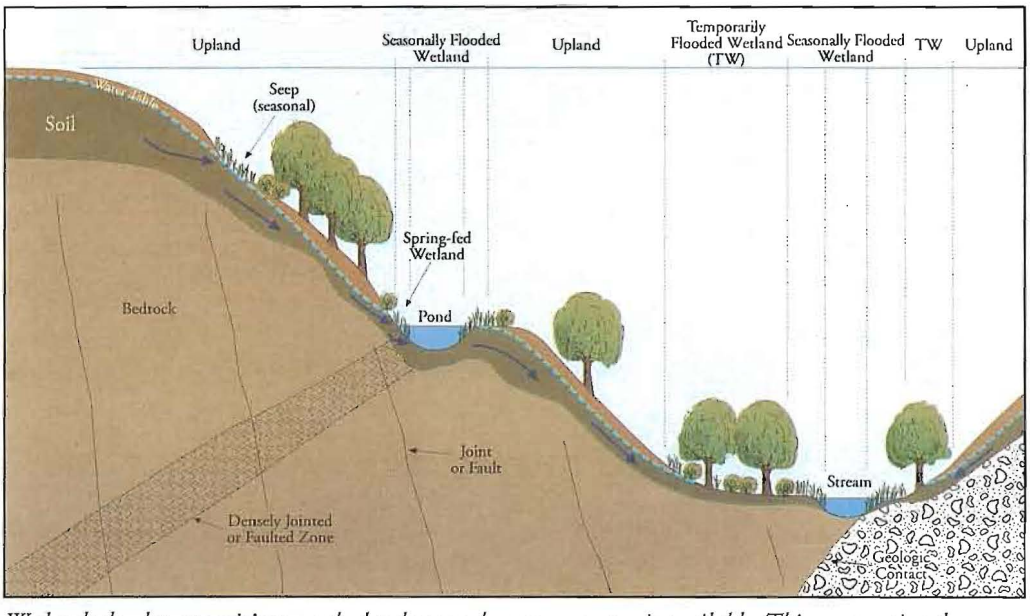
Wetlands are largely lands that are flooded or saturated at or near the ground surface for varying periods of time during the year. The term "wetland" is derived from two words, "wet" and "land." This implies that wetlands are lands that are at least periodically wet enough to limit uses of the land (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 marshes, wet meadows, swamps, bogs, and seasonally flooded floodplains. Ponds and the shallow water zones of lakes are also considered wetlands, while the deeper zones (beyond 6.6 feet) are classified as deepwater habitats.

Wetlands form where there is at least a prolonged excess of water on a recurring basis. This excess typically occurs at some frequency, such as every other year, and for a significant duration, usually more than 2 weeks of saturation near the surface—within 1 foot of the ground surface where most of the plant roots exist.[1] Water can come from rainfall, snowmelt, river overflow, springs, and other groundwater discharges. Water is likely to collect in depressions, low-lying relatively flat areas along rivers and streams, pond and lake shores, the toes of slopes, and even on slopes in association with drainageways, seeps, and springs. Recognizing these landscape positions will help you locate places where wetlands are likely to occur.

American bittern. (Photo © Paul J. Fusco).

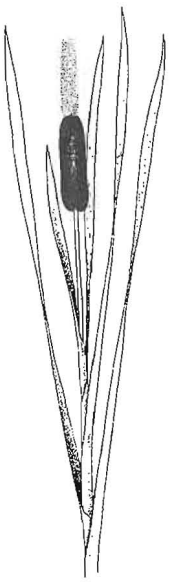
The U.S. Fish and Wildlife Service, with wide scientific peer review, developed a technical definition of wetland for the purposes of conducting a nationwide inventory of wetlands:

"*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 develop at positions on the landscape where excess water is available. This cross-sectional diagram shows groundwater flow paths that create wetlands at different locations—valleys, depressions, and hillside slopes (vertical scale greatly exaggerated).

[1]The National Research Council recently concluded that wetlands typically are saturated within 1 foot of rhe soil surface for at least 14 days during the growing season in most years. Further, they recognized that there may be regional differences, but no data to the contrary presently exist. National Research Council. 1995. *Wetlands Characteristics and Boundaries.* National Academy Press, Washington, DC.



Broad-leaved Cattail

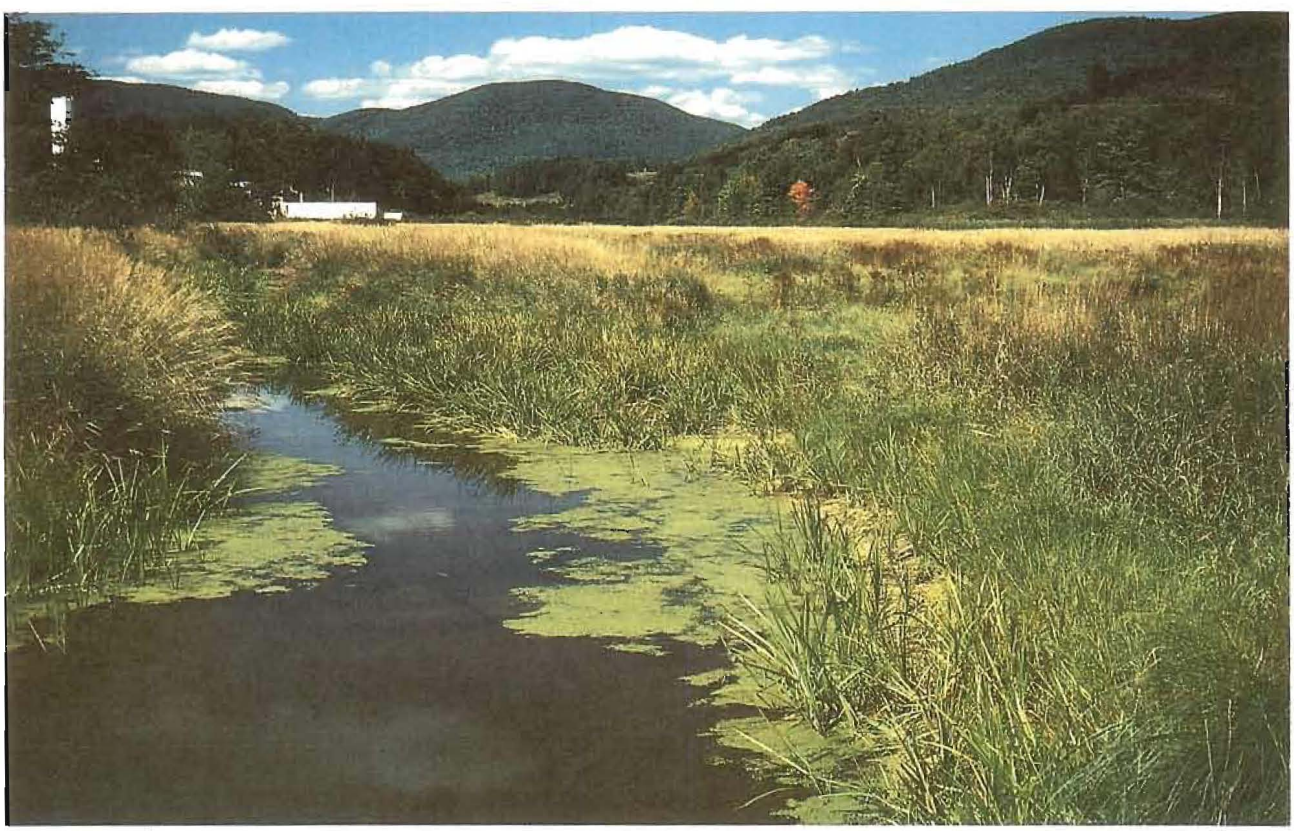
wetlands must have one or more of the following three attributes: (1) at least periodically, the land supports predominantly hydrophytes; (2) the substrate is predominantly undrained hydric soil; and (3) the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season of each year." (Cowardin *et al.* 1979)[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 wetland must have enough water at some time during the growing season to stress plants and animals not adapted for life in water or periodically saturated soils.

When soils are flooded and/or saturated for a few days or longer, they usually become oxygen-deficient. Since all plants require oxygen for survival and growth, only plants with special adaptations can live in these soils. These plants are called "hydrophytes." Out of all the plants that grow in the United States, only a third can tolerate the prolonged oxygen-deficiency associated with most wetlands. Soil development is also affected by these conditions. Such soils typically lose the reddish to orangish color of iron oxides characteristic of well-drained (oxygen-rich) soils. Instead, many "hydric soils" are gray-colored below the topsoil. In soils frequently flooded for very long periods, peat or muck accumulate at the surface because leaves and other organic matter do not readily decompose.

Most wetlands are characterized by the presence of hydrophytes and hydric soils. The federal government presently uses these features plus other signs of prolonged water saturation to identify "regulated wetlands" subject to the Clean Water Act regulations. Not all wetlands are vegetated—mud flats along exposed shores and shallow bottoms of rivers, lakes, and ponds may not be colonized by plants, but are still considered wetlands by many people.

[2]Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. *Classification of Wetlands and Deepwater Habitats of the United States.* U.S. Fish and Wildlife Service, Washington, DC. FWS/OBS-79/31.



Emergent wetland along the East Branch of the Delaware River.

Wetland Types

Wetlands are represented by vegetated wet areas (e.g., marshes, swamps, and bogs) and shallow waterbodies (including ponds and the littoral zone of lakes). Their periodic wetness or shallow water habitat distinguishes them from deepwater habitats (lakes, rivers, and reservoirs). A variety of wetland types exist throughout the three watersheds due to differences in soil, hydrology, pH, vegetation, and other factors. All of the wetlands, however, are inland (nontidal) wetlands—freshwater marshes, swamps, and bogs beyond the reach of ocean-driven tides. They usually occur on floodplains along rivers and streams, along the margins of lakes and ponds, and in isolated depressions surrounded by upland. Some wetlands are formed on slopes where groundwater seeps out from below ground.

Red maple swamp in the Croton watershed (Westchester County). Cinnamon fern is the dominant herb.

Freshwater wetlands are divided into three ecological systems (palustrine, lacustrine, and riverine). The majority of inland wetlands are called palustrine wetlands. Palustrine wetlands are mostly vegetated wet areas called marshes, swamps, and bogs, but they also include small, shallow ponds. Most of the other freshwater wetlands are associated with lakes and reservoirs. They are called lacustrine wetlands. Lacustrine wetlands are generally limited to aquatic beds, marshes, and the shallow water zone (less than 6.6 feet deep). Riverine werlands may be similarly vegetated, but are contained within the river channel. Most of the riverine wetlands are nonvegetated periodically exposed shores, such as cobble-gravel bars.

Vegetated wetlands may be separated into three major types based on their dominant vegetation: (1) **emergent wetlands** (commonly called marshes and wet meadows) characterized by grasses, sedges, and other nonwoody plants, (2) **scrub-shrub wetlands** (including shrub swamps and bogs) represented by low- to medium-height (less than 20 feet tall) woody plants, and (3) **forested wetlands** (mostly wooded swamps and bottomland forests) dominated by trees (woody plants 20 feet or taller). Often, wetland types are named after the dominant plant species, such as cattail marsh, red maple swamp, alder swamp, leatherleaf bog, and hemlock swamp.

Emergent Wetlands

Emergent wetlands are represented by marshes and wet meadows. Marshes are usually flooded for extended periods and have organic soils. Wet meadows are more temporarily inundated, with many being rarely flooded. They have mineral soils that are saturated for long periods by high groundwater tables.

Dominant emergent species include broad-leaved cattail, tussock sedge, purple loosestrife, reed canary grass, spotted Joe-Pye-weed, and rough-stemmed goldenrod. Common reed is a dominant species in marshes of the Croton watershed. Pickerelweed and arrow arum may be observed in shallow water areas, adjacent to or sometimes intermixed with aquatic beds of white water lily, duckweeds, and water shield.

Other species occurring in varying amounts in wet meadows are jewelweed, swamp aster, blue vervain, various goldenrods, soft rush, arrow-leaved tearthumb, smartweeds, bittersweet nightshade, sensitive fern, rice cutgrass, wool grass, and asters. Sweet flag appears to be less common.

Soft Rush

Hemlock swamp in the Delaware watershed.

Shrubs and saplings of trees typical of woody wetlands may be interspersed in many emergent wetlands.

Speckled Alder

Scrub-Shrub Wetlands

Shrubby vegetation (up to 20 feet tall) typifies scrub-shrub wetlands. Northern arrowwood, speckled alder, silky dogwood, winterberry, willows, highbush blueberry, red-panicled dogwood, broad-leaved meadowsweet, and spicebush are typical species. The latter species is also particularly common as an understory plant in seepage forested wetlands in the Croton watershed. Shrubs in lesser abundance, but of local importance, include buttonbush, steeplebush, northern wild raisin, and common hazelnut. Buttonbush is often found in shallow water along pond margins and lake shores.

Red Maple

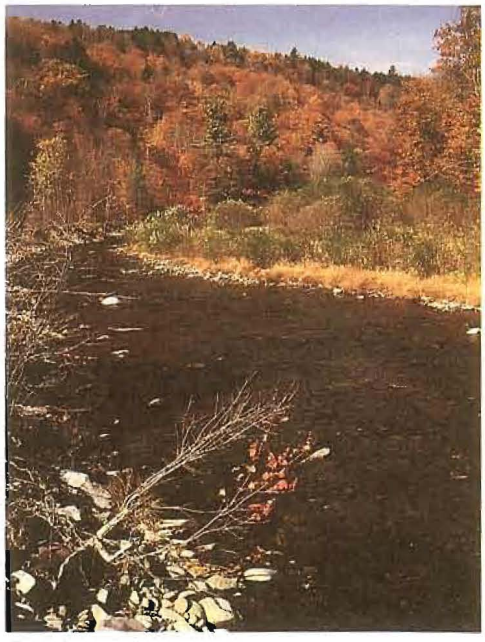
Forested Wetlands

Many wetlands are wet forests dominated by deciduous (lose their leaves each fall) and/or evergreen trees (20 feet or taller). Red maple swamps and hemlock swamps are the typical forested wetland communities in all three watersheds. Red maple swamps are by far the most abundant type. Less common forested wetlands are silver maple floodplain forests and white pine swamps in the Catskill and Delaware watersheds and Atlantic white cedar swamps in the Croton system.

Hemlock

Common trees occurring in red maple swamps include yellow birch, hemlock, green ash, and American elm. They may even be co-dominant with red maple in some stands. Trees of minor importance are white pine, black gum, and trembling aspen. Associated shrubs include spicebush, northern arrowwood, silky dogwood, highbush blueberry, and winterberry. Sweet pepperbush, a shrub characteristic of Coastal Plain swamps, is a common understory shrub in red maple swamps of the Croton watershed. Common elderberry, red-panicled dogwood, maleberry, and red osier are other frequently observed shrubs. Many herbs cover the ground in maple swamps: skunk cabbage (most evident in spring/early summer), tussock sedge, several ferns (sensitive, marsh, cinnamon, and royal) and jewelweed are most common. Peat mosses are abundant in wetter swamps.

Hemlock swamps have a less diverse assemblage of plants associated with them. Several trees may be found here, including the ubiquitous red maple, yellow birch, white pine, and trembling aspen. Black gum may occur in the Croton watershed in mixed stands of hemlock, red maple, and yellow birch. Shrubs of hemlock swamps include winterberry and northern arrowwood. Typical herbs are Canada mayflower, goldthread, and peat moss—plants characteristic of acidic habitats created by decomposing hemlock needles.



Seasonally flooded shrub swamp along the West Branch of the Neversink River near Claryville.

Watershed Wetlands Inventory Acreage Summaries

Acreages of wetlands and deepwater habitats for each watershed were compiled from digital National Wetlands Inventory (NWI) map data using a geographic information system. They include wetlands and deepwater habitats generally 1–3 acres in size and larger—the minimum mapping unit of the NWI maps prepared for this geographic 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 mapped during the survey are also reported for each watershed. These numbers should not, however, be considered the total stream miles, since many intermittent and smaller streams were not inventoried.

Locus map showing subject watersheds.

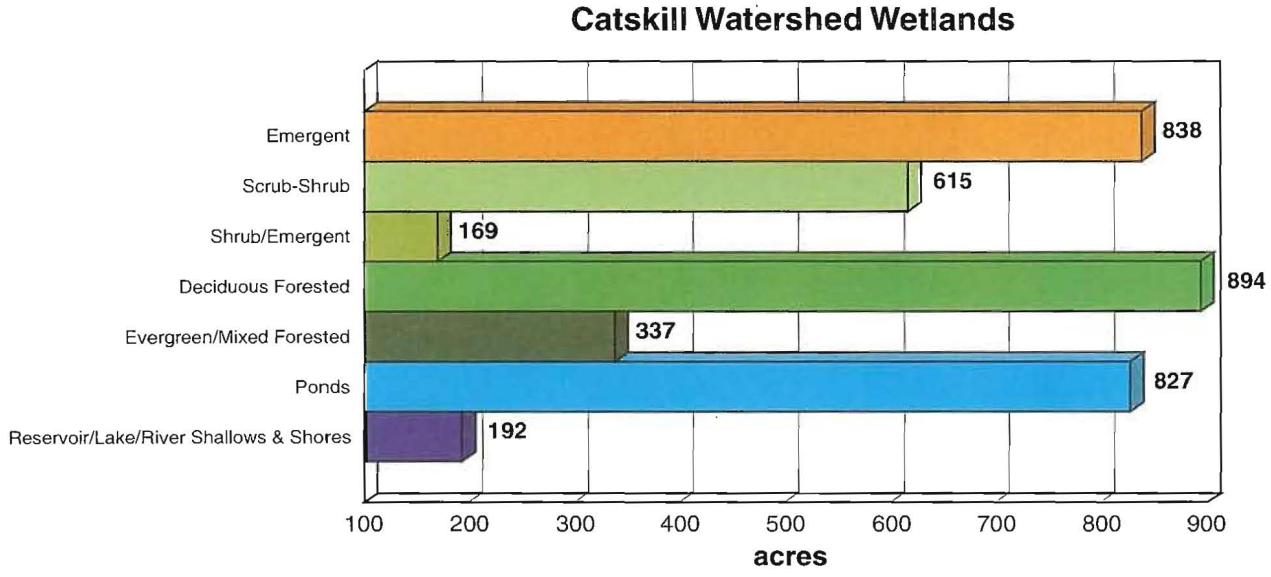
Wet meadow in Jewett (Catskill watershed).

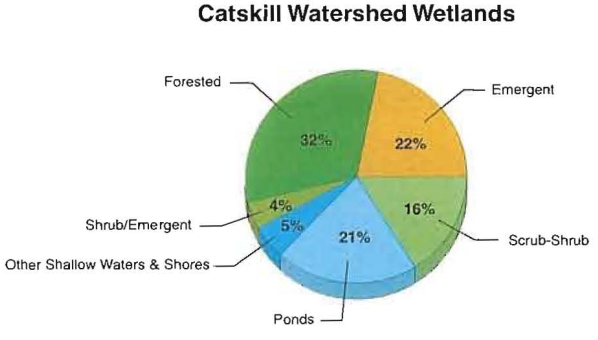
Catskill Watershed

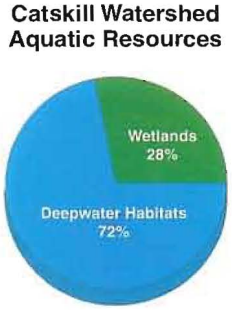
The Catskill watershed encompasses 571-square miles in southern New York. Major rivers and streams in this watershed are Schoharie Creek, Esopus Creek, Stony Clove Creek, Batavia Kill, and Rondout Creek. Aquatic resources (wetlands and deepwater habitats) are not particularly abundant, representing only 4 percent of the area. Most of the watershed is upland—forests, agricultural lands, and villages.

Wetlands alone occupy only 3,872 acres of the Catskill watershed. This amounts to about 1 percent of the watershed. Vegetated wetlands predominate with 2,853 acres (only 0.8 percent of the watershed). Forested wetlands are the most abundant type, but emergent wetlands, ponds, and shrub swamps are also common.

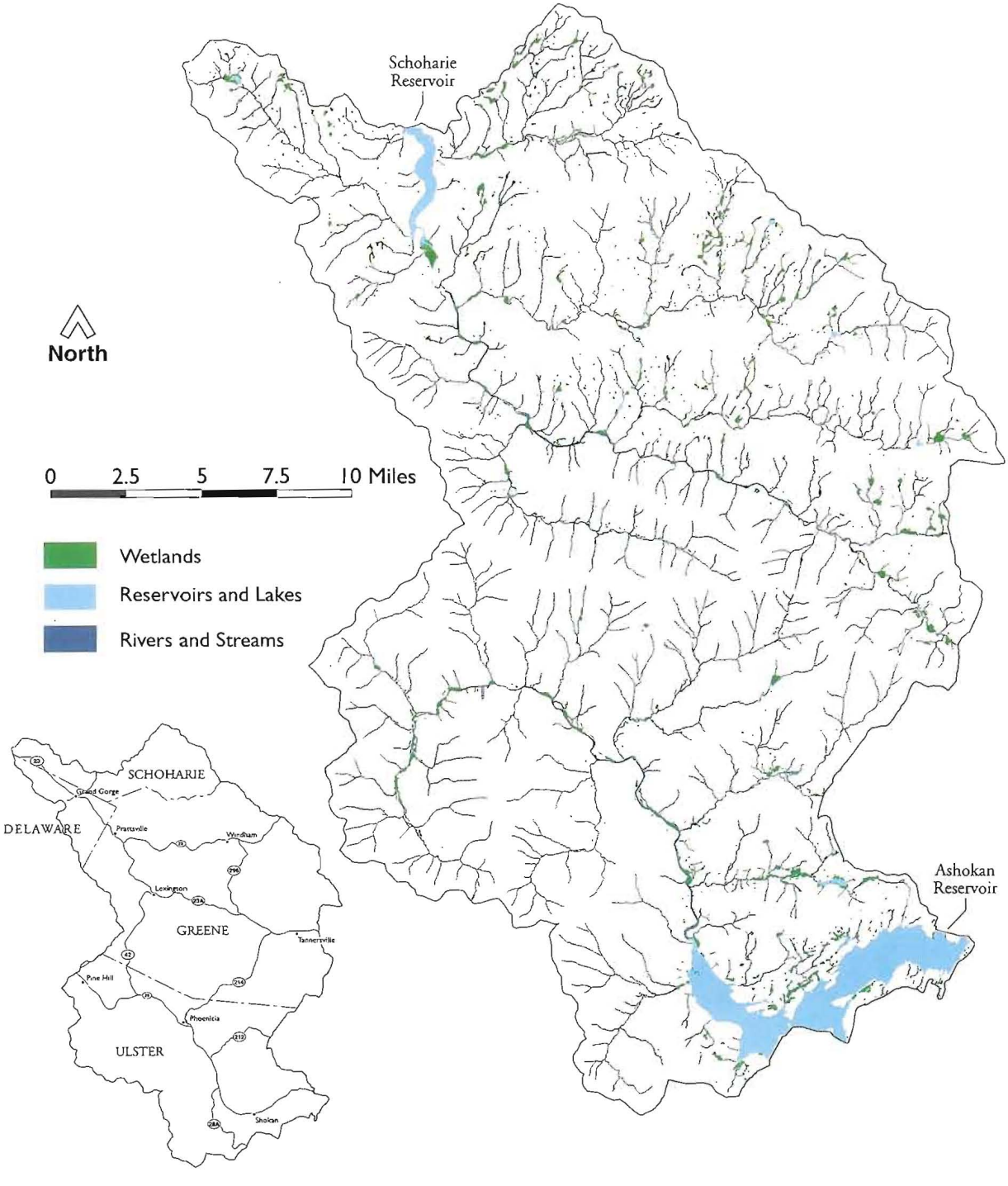
Deepwater habitats represent 9,891 acres or almost 3 percent of the watershed. Most (96%) of these habitats are the Ashokan and Schoharie Reservoirs, with about 4 percent being rivers and streams. The watershed also includes over 700 miles of streams.







General Distribution of Wetlands and Deepwater Habitats in the Catskill Watershed



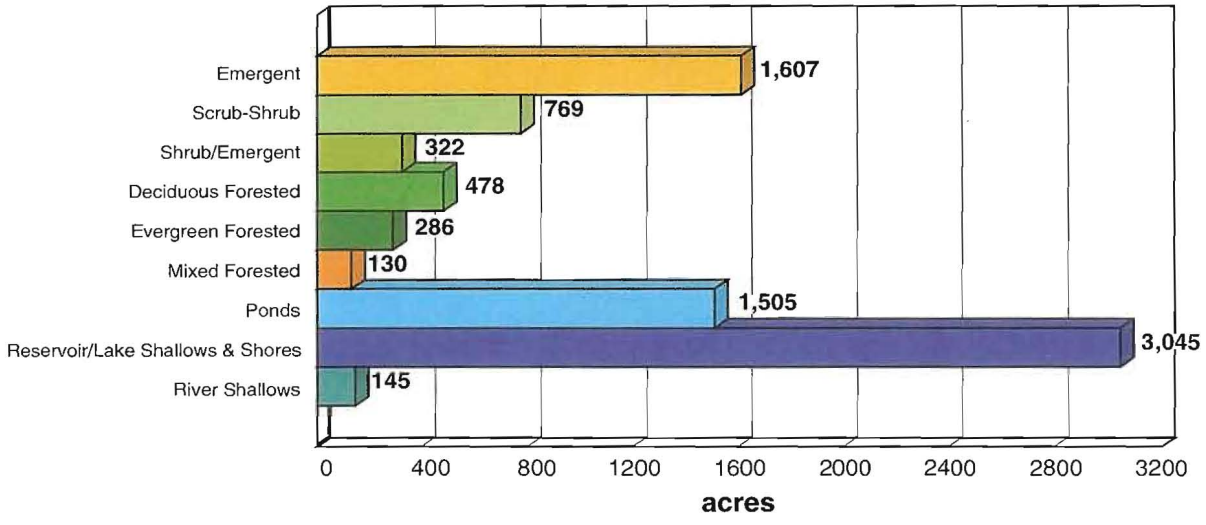
Delaware Watershed

The Delaware watershed contributing to New York City's water supply system is approximately 1,013-square miles in area. Major rivers and streams draining this watershed are the East and West Branches of the Delaware River and the Neversink River which provide water to four reservoirs (Cannonsville, Neversink, Pepacton, and Rondout). Aquatic resources (wetlands and deepwater habitats) represent about 3 percent of the watershed, while most (97%) of the watershed is upland—forests, farms, and villages.

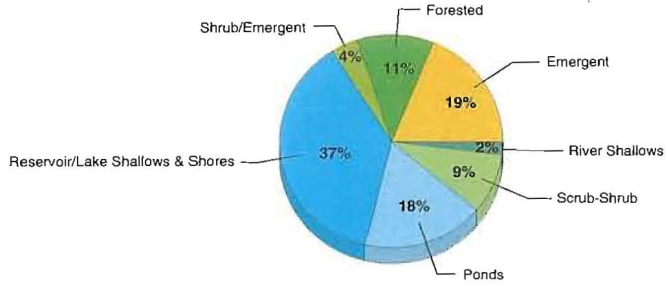
Wetlands occupy 8,287 acres of the Delaware watershed. This amounts to 1.3 percent of the watershed's land surface area. Vegetated wetlands represent about 43 percent of the wetlands. These wetlands occupy 3,592 acres (about 0.5 percent of the watershed). Most (57%) of the other wetlands are shallow waterbodies, including 3,045 acres of periodically exposed shores of reservoirs and 1,505 acres of ponds.

Deepwater habitats represent 11,579 acres or 1.8 percent of the watershed. Reservoirs account for about 96 percent of these habitats, while the rest of these waters are rivers and streams. Over 1,200 miles of small streams also flow through this watershed.

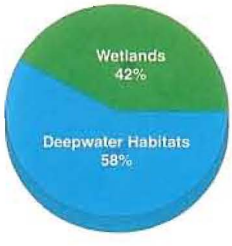
Delaware Watershed Wetlands



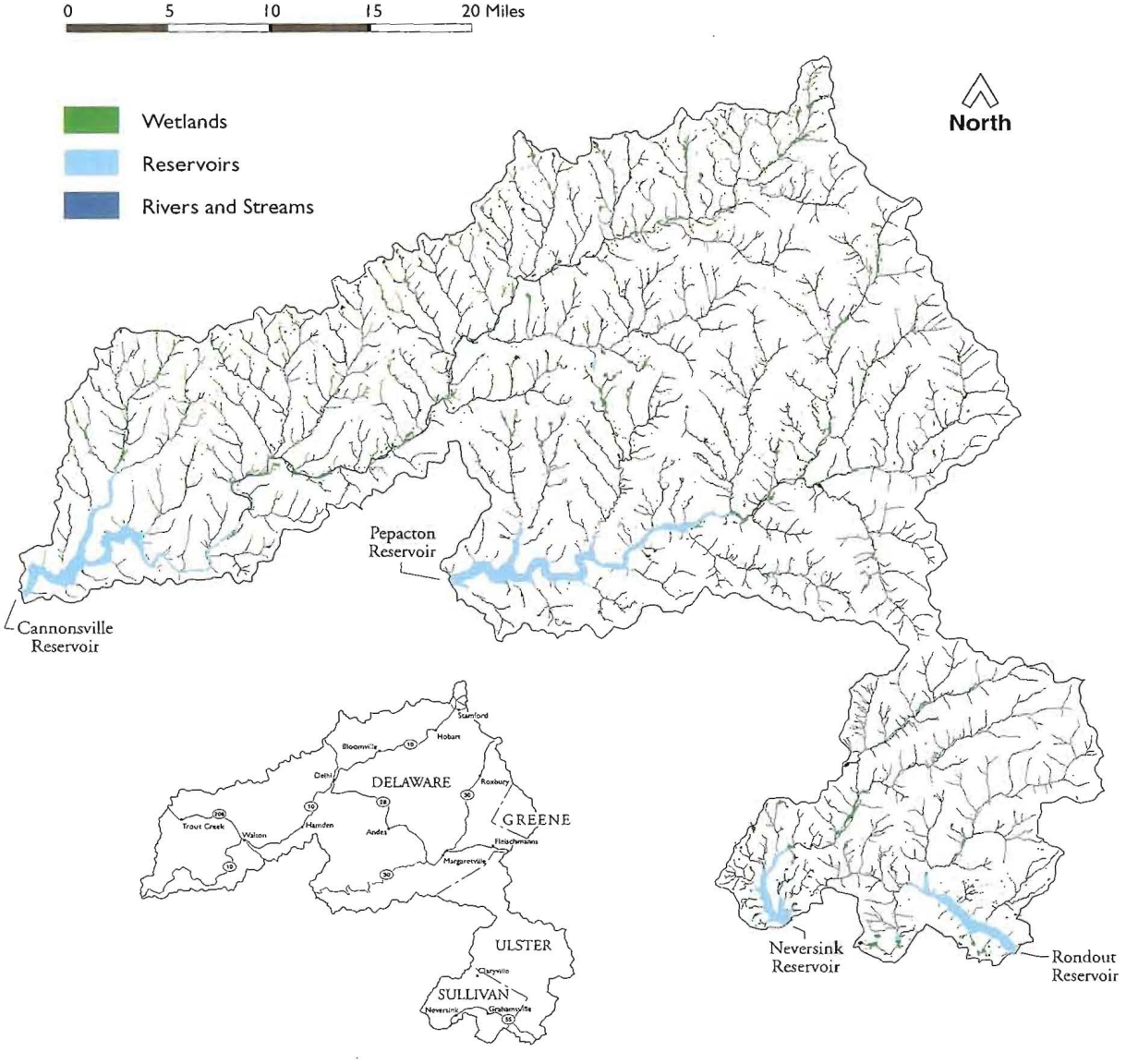
Delaware Watershed Wetlands



Delaware Watershed Aquatic Resources



General Distribution of Wetlands and Deepwater Habitats in the Delaware Watershed



Wetland Resource Guide

For information on federal, state and watershed wetland regulations and programs, contact the following agencies:

FEDERAL

U.S. Army Corps of Engineers [A],[M]
Regulatory Branch
New York District
Jacob K. Javirs Federal Building
New York, NY 10278-0090
(212) 264-3996

U.S. Environmental Protection Agency
Region II [A],[M]
Wetlands Protection
290 Broadway
New York, NY 10007-1866
(212) 637-3801

EPA Wetlands Information Hotline
1-800-832-7828

U.S. Fish and Wildlife Service [A],[M]
New York Field Office
3817 Luket Road
Cortland, NY 13045
(607) 753-9334

STATE

New York State Department of
Environmental Conservation [A],[M]
Wetlands Program
50 Wolf Road
Albany, NY 12233-4756
(518) 457-9713

NYSDEC Region 3 [A],[M]
21 South Putt Corners Road
New Paltz, NY 12561
(914) 256-3000

NYSDEC Region 4 Sub-Office [A],[M]
Route 10, Jefferson Road
Stamford, NY 12167
(607) 652-7364

NEW YORK CITY DEPARTMENT OF ENVIRONMENTAL PROTECTION

Drinking Water Quality Control [A],[M]
Natural Resources Section
465 Columbus Avenue, Suite 190
Valhalla, NY 10595
(914) 773-4422

Watershed Planning and Community Affairs [A],[M]
Ashokan Reservoir
Route 28A, P.O. Box 370
Shokan, NY 12481
(914) 657-5772

Catskill District Office [A],[M]
Ashokan Reservoir
Route 28A, P.O. Box 370
Shokan, NY 12481
(914) 657-2304

Delaware District Offices [A],[M]
Roures 55 & 42
Grahamsville, NY 12740
(914) 985-2275

Route 30 [A],[M]
Downsville, NY 13755
(607) 363-7501

Croton District Office [A],[M]
5 Jay Street
Katonah, NY 10536
(914) 232-5171

DELAWARE COUNTY

County Planning Board [A],[M]
Page Avenue, P.O. Box 367
Delhi, NY 13753
(607) 746-2944

Soil & Water Conservation District [A]
44 West Street, Suite 1
Walton, NY 13856
(607) 865-7161

Cornell Cooperative Extension [A]
44 West Street
Walton, NY 13856
(607) 865-7090

DUTCHESS COUNTY

Department of Planning and Development [A],[M]
27 High Street
Poughkeepsie, NY 12601
(914) 486-3600

Soil & Water Conservation District [A]
Farm & Home Center
P.O. Box 37, Route 44
Millbrook, NY 12545
(914) 677-8011

Cornell Cooperative Extension [A]
P.O. Box 259
Millbrook, NY 12545
(914) 677-8223

GREENE COUNTY

County Planning Department [A],[M]
County Office Building
HCR3, Box 909
Cairo, NY 12413
(518) 622-3251

Soil & Water Conservation District [A]
County Office Building
HCR3, Box 907
Cairo, NY 12413-9502
(518) 622-3620

Cornell Cooperative Extension [A]
HCR3, Box 906
Cairo, NY 12413
(518) 622-9820

PUTNAM COUNTY

Division of Planning [A],[M]
RR #9, Fair Street
Carmel, NY 10512
(914) 878-3480

Soil & Water Conservation District [A]
RR #9, Fair Street
Carmel, NY 10512
(914) 878-7918

Cornell Cooperative Extension [A]
Terravest Corpotate Park
10 Geneva Road
Brewster, NY 10509
(914) 278-6738

SCHOHARIE COUNTY

Planning & Development Agency [A],[M]
RD 1, Box 12
6 Mineral Spring Road
Cobleskill, NY 12043
(518) 234-3751

Soil & Water Conservation District [A]
Agricultural HQ, 41 South Grand Street
Cobleskill, NY 12043
(518) 234-4092

Cornell Cooperative Extension [A]
41 South Grand Street
Cobleskill, NY 12043
(518) 234-4303

SULLIVAN COUNTY

Division of Economic Development,
Promotion & Planning [A],[M]
Government Center
100 North Street
Monticello, NY 12701
(914) 794-3000 ext. 5028

Soil & Water Conservation District [A]
69 Ferndale-Loomis Road
Liberty, NY 12754
(914) 292-6552

Cornell Cooperative Extension [A]
69 Ferndale-Loomis Road
Liberty, NY 12754
(914) 292-6552

ULSTER COUNTY

Planning Board [A],[M]
244 Fair Street, Box 1800
Kingston, NY 12401
(914) 340-3340

Soil & Water Conservation District [A]
380 Washington Avenue
Kingston, NY 12401
(914) 334-8465

Cornell Cooperative Extension [A]
74 John Street
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Michaelian Office Bldg., Room 432
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Valhalla, NY 10595
(914) 285-4630

[A] Agency locations for the *Atlas of National Wetlands Inventory Maps for the Watersheds of the New York City Water Supply System.*

[M] Agency locations for full-sized *National Wetlands Inventory* maps.

Beaver

Additional Readings

For further information on wetlands, go to your local library or one at a nearby college. Some noteworthy readings are listed below.

Wetlands, An Audubon Society Nature Guide (1985) by William A. Niering, Alfred P. Knopf, New York, NY. (good layperson's guide)

Pond Life, a Golden Guide (1967) by George Reid, Golden Press, New York, NY and Western Publishing Company, Racine, WI. (good layperson's guide)

Wetlands (1993) by William J. Mitsch and James Gosselink, Van Nostrand Reinhold, New York, NY. (textbook on ecology)

Wetlands: Guide to Science, Law, and Technology (1993) by Mark Dennison and James Berry (editors), Noyes Publications, Park Ridge, NJ. (textbook on ecology, wetland delineation, and regulations)

Wetlands of the United States: Current Status and Recent Trends (1984) by Ralph W. Tiner, Jr., U.S. Fish & Wildlife Service, Hadley, MA. (report on national wetland trends)

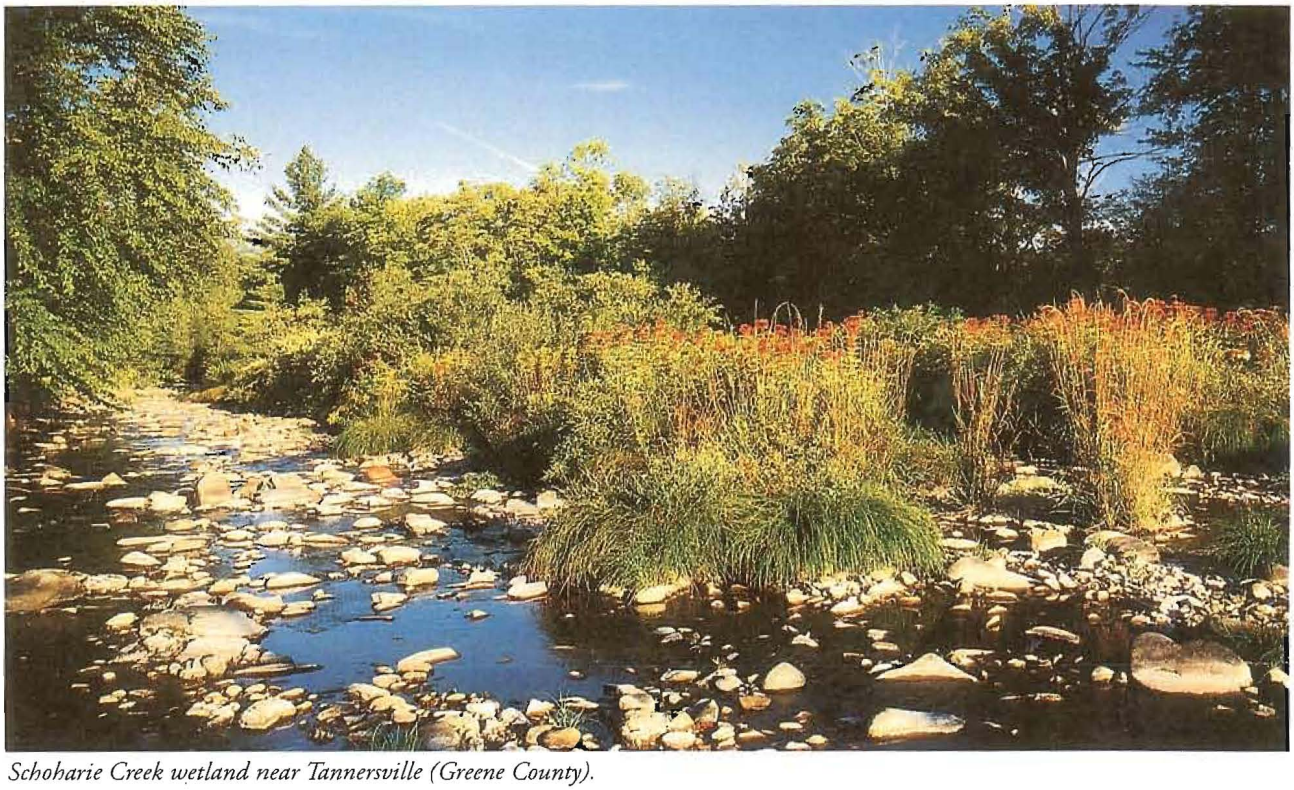
Wetlands Status and Trends in the Conterminous United States: Mid-1970s to Mid-1980s (1991) by Thomas E. Dahl and C.E. Johnson, U.S. Fish and Wildlife Service, Washington, DC. (report on recent national wetland trends)

National Wetlands Newsletter, Environmental Law Institute, Washington, DC. (current events)

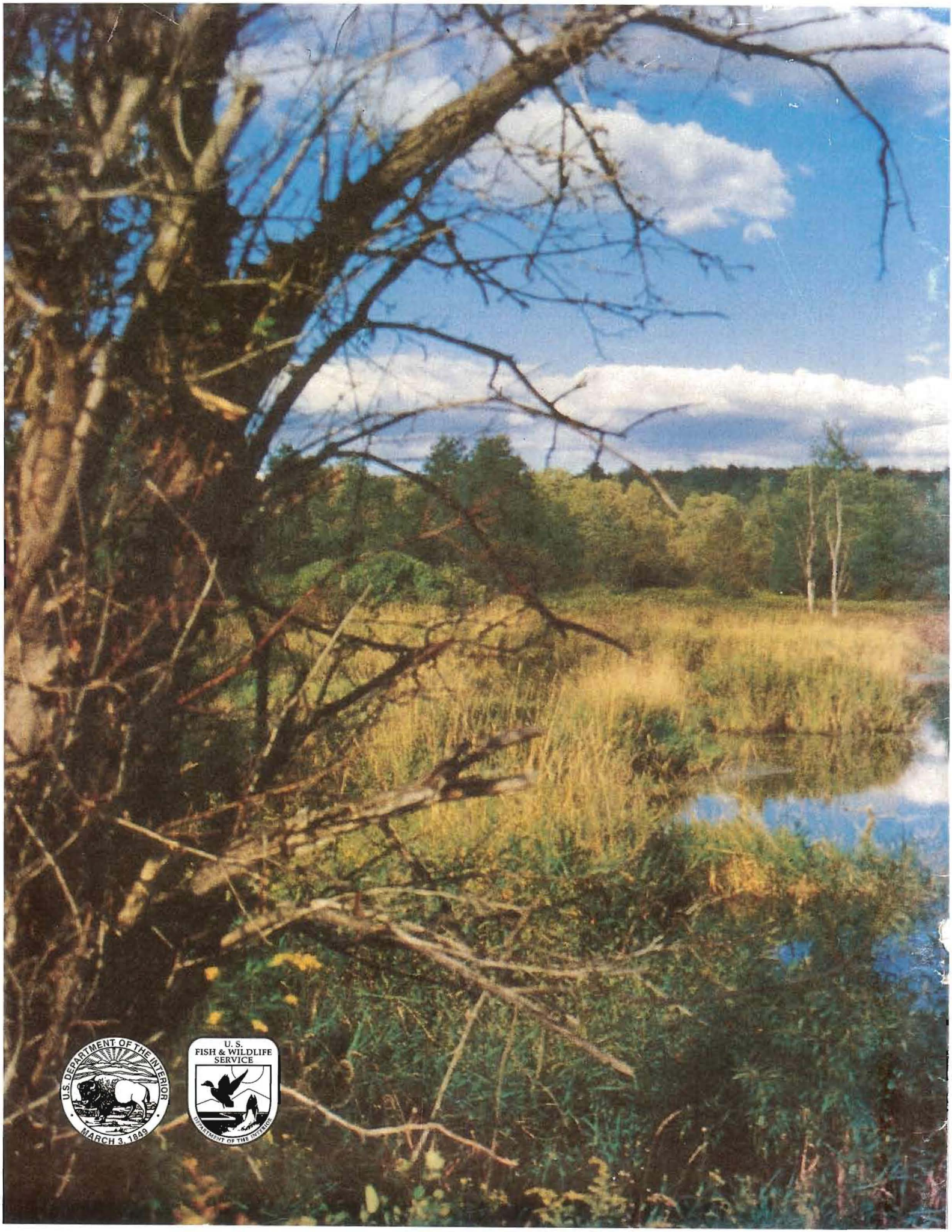
"Our Disappearing Wetlands" by John G. Mitchell, National Geographic Vol. 182, No. 4 (October 1992). (article on wetland losses)

Classification of Wetlands and Deepwater Habitats of the United States (1979) by Lewis M. Cowardin and others, U.S. Fish and Wildlife Service, Washington, DC. (technical report on national wetland classification system)

Green-backed heron. (Photo © Paul J. Fusco)



Schoharie Creek wetland near Tannersville (Greene County).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