TOWN OF ESOPUS
ENVIRONMENTAL BOARD
MEETING MINUTES – SEPTEMBER 18, 2019

MEMBERS PRESENT:	MEMBERS EXCUSED:	ALSO PRESENT:
Mark Ellison, Chairman	Laurie Sheridan	Councilperson Kathie Quick
Susan Barbarisi		Legislator Laura Petit
Susan Leiching		Ingrid Haeckel, Guest
Don Carragher		
Cynthia Mcvay		
Noel Russ		

Presentation:

Ingrid Haeckel, Conservation & Land Use Specialist with NYS DEC Hudson River Estuary Program working in partnership with Cornell University, Department of Natural Resources. Ms. Haeckel presented report that had been previously provided to the Town during the Comprehensive Plan Review and is an appendix to the Town of Esopus Comprehensive Plan (report annexed hereto and made a part hereof).

Regular Business of Environmental Board – Commenced at 7:58 p.m.

Old Business:

Membership - There currently are still two (2) open positions on the Board. Karen Helgers had submitted her resignation.

UC Environmental Management Council update – There had been no meeting.

Zoning Update Committee – The first meeting of the Zoning Update Committee was scheduled for September 25, 2019 and members from Town Boards, hamlet representatives, Department Heads and Planning Consultants were all to be a part of the Committee. Mark Ellison noted that if the regular meetings were to be held on the 4th Wednesdays of the month, he had a conflict and wouldn't be able to attend. Don Carragher also had a conflict if the meetings were to remain on that particular Wednesday. Cynthia McVay expressed an interest in representing the Environmental Board.

New Business:

Compost Campaign – Mark Ellison and Laura Petit were organizing an additional Composting 101 for the community – date to be determined. Eight (8) composting units had been distributed at the last session and there were 16 left.

Climate Smart Task Force – Commenced at 8:20 p.m.

Don Carragher opened the floor for discussion.

Draft Law battery storage had been requested by the Town Supervisor.

Don Carragher noted that the NYSERDA portal was on accessible 3 times a year for a certain amount of time and the Task Force needed to gather all information (including composting from Laura Petit) for entry into the portal.

NEXT ENVIRONMENTAL BOARD MEETING: October 16, 2019

The meeting ended at 9:52 p.m.

Respectfully submitted: October 4, 2019

Lisa K. Mance

Lisa Mance, Board Secretary

NATURAL AREAS AND WILDLIFE IN YOUR COMMUNITY

NEW YORK STATE OF OPPORTUNITY. | Hudson River Estuary Program

A Habitat Summary Prepared for the Town of Esopus

This summary was completed in March 2019, providing information for land-use planning and decision-making as requested by the Town of Esopus. It identifies significant ecosystems in the Town, including coastal habitats, streams, forests, wetlands, and other natural areas with important biological values. This summary is based only on existing information available to the New York State Department of Environmental Conservation (DEC) and its partners, and, therefore should not be considered a complete inventory. Additional information about habitats in our region can be found in the *Wildlife and Habitat Conservation Framework* developed by the Hudson River Estuary Program (Penhollow et al. 2006) and in the *Biodiversity Assessment Manual for the Hudson River Estuary Corridor* developed by Hudsonia and published by DEC (Kiviat and Stevens 2001).

Ecosystems of the estuary watershed—wetlands, forests, stream corridors, grasslands, and shrublands—are not only habitat for abundant fish and wildlife, but also support the estuary and provide many vital benefits to human communities. These ecosystems help to keep drinking water and air clean, moderate temperature, filter pollutants, and absorb floodwaters. They also provide opportunity for outdoor recreation and education, and create the scenery and sense of place that is unique to the Hudson Valley. Local land-use planning efforts are instrumental in balancing future development with protection of these resources. By conserving sufficient habitat to support the region's astonishing diversity of plants and animals, communities can ensure that healthy, resilient ecosystems—and the benefits they provide—are available to future generations. For more information on local conservation approaches, see *Conserving Natural Areas and Wildlife in Your Community: Smart Growth Strategies for Protecting the Biological Diversity of New York's Hudson River Valley* (Strong 2008).

The Estuary Program works toward achieving key benefits:

- Clean water
- Resilient communities
- Vital estuary ecosystem
- Fish, wildlife & habitats
- Natural scenery
- Education, access, recreation, and inspiration

This document was created by the New York State Department of Environmental Conservation's Hudson River Estuary Program and Cornell University's Department of Natural Resources. The Estuary Program (http://www.dec.ny.gov/lands/4920.html) protects and improves the natural and scenic Hudson River watershed for all its residents. The program was created in 1987 and extends from the Troy dam to upper New York Harbor.

The Estuary Program is funded by the NYS Environmental Protection Fund. The Biodiversity Outreach Program was created in partnership with Cornell University to help Hudson Valley communities learn what plants, animals, and habitats are found locally; understand the value of these resources; and increase their capacity to identify, prioritize, and conserve important natural areas through informed decision-making. Additional information about habitats in the Hudson Valley can be found on DEC's webpages, starting with www.dec.ny.gov/lands/5094.html.

CONTACT INFORMATION

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NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation

Cornell University

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Introduction

The Hudson River Estuary and its watershed is a region of remarkable beauty, historical and economic significance, and high biological diversity. The region, comprising only 13.5% of the land area in New York, contains nearly 85% of the bird, mammal, reptile, and amphibian species found in the state (Penhollow et al. 2006). Local municipalities can play a key role in conserving this natural heritage and the ecological processes that sustain it. By identifying important areas for habitat and wildlife, municipalities are better equipped to pursue conservation opportunities and make informed land-use decisions. This proactive approach to planning can help municipalities avoid the costs of urban and suburban sprawl, maintain community character and quality of life, and preserve the many benefits, or ecosystem services, that healthy, natural systems provide to present and future generations.

*An **ecosystem** is a community of animals and plants interacting with one another and with their physical environment. **Ecosystem services** are life-sustaining benefits we receive from nature, such as food, medicine, water purification, flood control, and pollination. Many of these services are provided for "free," yet are worth many trillions of dollars.*
- Ecological Society of America

Summary Content

This summary includes complementary text, maps, and tables. The Habitat Summary text describes what is known about the town's important natural areas and habitats based on information in databases of the New York State Department of Environmental Conservation (DEC) and the New York Natural Heritage Program (NYNHP) and a review of local studies available at the time of writing. The text details the information in the maps, including the ecological importance of the data and its sources. There are six habitat maps for the Town of Esopus, which follow the text headings:

Figure 1: **Regional Context** of Esopus, NY
Figure 2: **Significant Ecological Features** in Esopus, NY
Figure 3: **Hudson River Coastal Habitats** in Esopus, NY
Figure 4: **Streams and Watersheds** in Esopus, NY
Figure 5: **Wetlands** in Esopus, NY
Figure 6: **Large Forests** in Esopus, NY

Descriptions of shrubland and young forest habitats and grasslands are included in the text but not mapped. Following the maps, Table 1 lists known **Species and Ecosystems of Conservation Concern** that have been recorded for Esopus, including species listed in New York (NY) or federally (US) as endangered, threatened, special concern, rare, a Species of Greatest Conservation Need (SGCN), or a Hudson River Valley Priority Bird species. SGCN are species identified in the State Wildlife Action Plan that are experiencing some level of population decline, have identified threats that may put them in jeopardy, and need conservation actions to maintain stable population levels or sustain recovery (NYSDEC 2015). High priority SGCN are species in need of timely management intervention or they are likely to reach critical population levels in New York within 10 years. Audubon New York identified the Hudson River Valley priority birds by assessing continental, national, and regional bird planning initiatives in addition to state and federal priority designations.

At the end of the summary, references identify the sources of information in this document and places to find more information. General conservation measures for protecting natural areas and wildlife are also provided.

Links in the summary will direct you to websites, publications, and fact sheets for supplemental information. In addition, Adobe Reader will enable you to zoom in and turn off data layers to customize your view of the maps. Most of the GIS layers shown in the habitat summary maps are available for free from the New York GIS Clearinghouse; others are available upon request from the Estuary Program. A complementary online map application, the Hudson Valley Natural Resource Mapper, can be used for more interactive viewing of

mapped features in the habitat summary. Attribute information for many of the individual features is available in the mapper, along with links to more information, including GIS data sources.

Please note that some habitats and species identified in this document may be protected by state or federal programs. The Environmental Resource Mapper on DEC's website can help identify those resources. Please work with DEC's Region 3 Office in New Paltz and other appropriate entities as necessary.

How to use this summary

This summary provides a starting point for recognizing important natural areas in the town and surrounding areas, but is limited to existing information and is not a substitute for on-site survey and assessment. Information provided should be verified for legal purposes, including environmental review. Effective conservation occurs across property and political boundaries and, therefore, necessitates a broader view of natural landscapes. By identifying areas with high-quality resources, this summary will be especially useful for setting priorities to inform municipal planning. Habitat summaries like this have been used by communities for open space plans, comprehensive plans, natural resource inventories, and other conservation and planning actions. One Hudson Valley town used the species lists in its comprehensive plan's generic environmental impact statement, another to designate critical environmental areas. Some communities have incorporated their summaries directly into plans, while others refer to the information when writing their own documents.

Though this summary does not contain adequate detail for site planning purposes, it can be useful for environmental review. First, by identifying high quality habitats on a municipal-wide scale, it helps land-use decision-makers and applicants understand how a proposed site plan might relate to important natural areas

Limitations of Maps in this Summary

Maps included here were created in a geographic information system or GIS. Information on the maps comes from different sources, produced at different times, at different scales, and for different purposes. It is often collected or developed from remote sensing data (i.e., aerial photographs, satellite imagery) or derived from paper maps. For these reasons, GIS data often contain inaccuracies from the original data, plus any errors from converting it. Therefore, maps created in GIS are approximate and best used for planning purposes. They should not be substituted for site surveys. Any resource shown on a map should be verified for legal purposes, including environmental review.

on- and off-site. Second, the summary highlights areas that may require more detailed assessment to evaluate potential impacts. Third, the tables identify species of conservation concern that may warrant special attention during reviews. If it's not already a routine step, the planning board should consider requiring applicants to produce a current letter from the New York Natural Heritage Program that identifies rare plants, rare animals, and significant ecosystems that are known to be on or near a proposed development site. The planning board and applicants should also work closely with DEC Region 3 Permits staff to ensure regulatory requirements are met.

How to find more information

Most of the GIS data presented in the Habitat Summary maps may be obtained for free from the New York State GIS Clearinghouse or from other public websites. The summary can be enhanced by local knowledge. Local studies, maps, plans, and knowledgeable residents can provide details and may reveal previously unknown, high-quality ecosystems. Biological information in environmental impact statements may also be useful, especially when a municipality has habitat standards for environmental review. For help with incorporating additional information into the summary or questions about obtaining GIS data used in the maps, please contact Ingrid Haeckel, Hudson River Estuary Conservation and Land Use Specialist.

Guidance and suggestions for developing a more comprehensive natural resources inventory is available in *Creating a Natural Resources Inventory: A Guide for Communities in the Hudson River Estuary Watershed* (Haeckel and Heady 2014). This handbook outlines how to inventory valuable natural and cultural assets and strategies for using natural resource information in local land-use and conservation planning. Limited hard copies are available upon request for municipalities.

Conservation

Once important habitats and natural areas are identified, municipalities have numerous options to strengthen their protection, such as incorporating maps and data into comprehensive plans and zoning, developing critical environmental areas or conservation overlay districts, adopting resource protection regulations, and acquiring conservation easements for sensitive habitats, such as floodplains or wetlands and their buffers.

Included with this summary are General Conservation Measures for Protecting Natural Areas and Wildlife that can help guide Esopus' plans and land-use decisions. Additional information on the how and why of local habitat conservation is available in *Conserving Natural Areas in Your Community: Smart Growth Strategies for Protecting the Biological Diversity of New York's Hudson River Valley* (Strong 2008). This handbook was published by DEC and details why towns should conserve their biological resources, as well as the tools and techniques local governments can use to conserve natural areas and wildlife. Chapter 5 covers habitat conservation. The document is available on a CD or in hard copy upon request.

The ability of private forest landowners to periodically harvest timber provides an important source of income that can help landowners avoid land parcelization or conversion to non-forest uses. Working forests also contribute to the local economy and demand very little in the way of community services in return for the property taxes their owners pay. DEC's Municipal Guide to Forestry in New York State (Daniels 2005) offers guidance to encourage local governments to actively support and promote multiple forest uses and stewardship of the land.

Technical assistance is available through the Estuary Program, including help with incorporating natural resource conservation principles and information into municipal land-use planning procedures, plans, and policies. The Estuary Program and its partners also provide training to local leaders to recognize and map ecologically significant habitats and communicate their importance to the community. The Hudson River Estuary Grants program supports projects that continue to raise the capacity of municipalities, land trusts, and non-profits to identify and assess watershed biodiversity, promote stewardship and conservation of vital habitats, and create local conservation programs. For more information on technical assistance opportunities, please contact Ingrid Haeckel.

Important Habitats in the Town of Esopus

Regional Context (Figure 1)

The first step to understanding the natural areas and habitats of Esopus is to consider how the town relates to its surrounding area. The town spans approximately 42 square miles including underwater lands in the Hudson River. All land in Esopus ultimately drains to the Hudson River Estuary. Western portions of Esopus lie within the Wallkill River watershed and Rondout Creek watersheds. Central and eastern Esopus drain primarily via Black Creek, or via small streams directly to the Hudson River Estuary.

*A **watershed** is the area of land where all of the water that is under it, or drains off of it, goes into the same stream, river, lake, or other waterbody.*

– U.S. Environmental Protection Agency

Esopus's eastern boundary is defined by over 13 miles of shoreline along the tidal Hudson River. Tidal wetlands, tributary mouths, and shallow water habitats in the estuary encompass some of the town's most biologically significant habitats. The Upper Hudson River Estuary is identified as a Significant Biodiversity Area (SBA) by the DEC Hudson River Estuary Program and is a globally rare ecosystem that supports many rare species as well as regionally important fisheries (Penhollow et al., 2006):

> "The Hudson River Estuary contains significant freshwater and brackish tidal wetlands, as well as other riverine and estuarine habitats, islands, riparian zones, and important tributaries. These habitats support a high diversity of fish, birds, and mammals....The open water, tidal wetlands, and tributaries in the upper reach of the Hudson are regionally important fish spawning habitats for anadromous fish, especially American shad, striped bass, Atlantic sturgeon and shortnose sturgeon, and provide habitat for all life stages of resident freshwater species. The numerous creeks and tidal freshwater marshes in this stretch serve as breeding, nursery, and migration corridors supporting waterfowl, shorebirds, herons, raptors, and passerine birds. Regionally and globally rare tidal communities include freshwater tidal swamp, freshwater tidal marsh, freshwater intertidal mudflats, and freshwater intertidal shore."

***Significant Biodiversity Areas (SBAs)** are locations of high concentration of biological diversity or value for regional biodiversity, described in The Hudson River Estuary Wildlife and Habitat Conservation Framework (Penhollow et al. 2006).*

The town's Hudson River and tidal Rondout and Black Creek shorelines and tidal wetlands are within the SBA and support occurrences of several rare plant species and important habitats for migratory fishes. These areas are also designated Significant Coastal Fish and Wildlife Habitats by the New York State Department of State, discussed further in the Hudson River Coastal and Shoreline Habitat section.

In addition to significant coastal features, the southern half of the Town lies in the Esopus/Lloyd Wetlands and Ridges SBA, recognized for wetland and upland habitat that is of particular importance to amphibian species and breeding waterfowl (Penhollow et al. 2006). Significant wetland resources of this area are discussed further in the Wetlands section.

Significant Ecological Features (Figure 2)

Figure 2 shows the major ecological features known to occur in Esopus, including the significant coastal fish and wildlife habitats, known important areas for rare animals and rare plants, significant natural communities, matrix forest blocks and linkage zones, and stream habitat for migratory fishes. Note that Figure 2 and the corresponding descriptions below are based on limited existing information. Overlapping layers in the map may be viewed in greater detail using the Hudson Valley Natural Resource Mapper.

Significant Coastal Fish and Wildlife Habitats. The DEC has identified and evaluated coastal habitats throughout the state's coastal regions, providing recommendations to the NYS Department of State so that the most important or "significant" habitats may be designated for protection in accordance with the Waterfront Revitalization and Coastal Resources Act. There are four designated significant coastal fish and wildlife habitats in Esopus: Black Creek, Esopus Meadows, Rondout Creek, and the Kingston-Poughkeepsie Deepwater. They are described under Hudson River Coastal and Shoreline Habitat.

Significant Natural Communities. Seven exemplary natural community types have been mapped in Esopus by NYNHP including upland forests, forested and shrub wetlands, vernal pools, and tidal wetlands. NYNHP describes the complex of Hemlock-Northern Hardwood Forest running from Shaupeneak Mountain south to Illinois Mountain as large, mature, and relatively undisturbed, though threatened by hemlock loss due to wooly adelgid infestation. Adjacent Appalachian Oak-Hickory Forest occurs on the rolling hills and south and west slopes of Shaupeneak Mountain and the ridges to the south and is described as large, good-quality, maturing to mature, but beginning to show impacts from invasive plants, forest pests and deer browse pressure. Excellent examples of small Red Maple-Hardwood Swamps occur in depressions within these forest communities. Louisa Pond supports an uncommon Dwarf Shrub Bog in a small, glacially carved bowl near the summit of Shaupeneak Mountain. A complex of 15 high quality Vernal Pools is documented at Black Creek Preserve (not mapped in Figure 2). Rare Freshwater Tidal Marsh and Freshwater Intertidal Shore habitats are mapped in Sleightsburg Marsh, but are described as moderately to extremely disturbed. NYNHP guides are available through linked text and offer detailed descriptions of the habitats and conservation recommendations. The large extent and diversity of these habitats suggests that other high quality examples of natural communities likely occur in Esopus.

Known Important Areas for Rare Plants and Rare Animals. The New York Natural Heritage Program (NYNHP) has identified areas of importance for sustaining populations of rare plants and rare animals based on existing records and the species' habitat requirements. Known important areas include the specific locations where species have been observed, as well as areas critical to maintaining the species' habitat. Proactive planning that considers how species move or disperse across the landscape, with careful attention to maintaining connected habitat complexes, will contribute to the long-term survival and persistence of rare species. NYNHP has identified known important areas in Esopus for migratory fishes, Bald Eagle, Indiana Bat, Kentucky Warbler, Northern Cricket Frog, Red-Headed Woodpecker, and Wood Turtle, in addition to known important areas for several rare plants. A complete list of state rare plants and animals known from Esopus is shown in Table 1.

> **Atlantic Sturgeon** (US-Endangered, High Priority SGCN) and **Shortnose Sturgeon** (NY-Threatened, SGCN) and other SGCN including Blueback Herring and Alewives are migratory fishes that return from the ocean to spawn in Esopus' freshwater habitats. Threats include dredging and other potentially harmful activities that take place in spawning and nursery areas, as well as historic overfishing/bycatch. Streams used by American eel, a migratory species that returns to the ocean to spawn, are shown in Stream Habitat for Migratory Fishes.
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> **Bald Eagle** (NY-Threatened, SGCN) nesting is known in Esopus along the Hudson River and the Wallkill River. While Bald Eagle breeding and non-breeding populations are increasing in New York, development pressure and its impacts on habitat remain significant threats. Nesting sites are sensitive to human disturbance.
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> **Indiana Bat** (US-Threatened, High Priority SGCN) and **Northern Long-eared Bat** (US-Threatened, High Priority SGCN) have been documented foraging in a forested area of Esopus and are known to overwinter in caves and abandoned mines just outside of the Town. Bats will forage for insects throughout wooded areas and along streams, and female bats will roost in snags and dying trees.

Since 2006, the spread of white-nose syndrome (a fungal disease) has devastated bat colonies throughout the northeast, resulting in die-offs of up to 99%. Retaining forest canopy, mature trees, and minimizing fragmentation of mature forest patches may be important for local bat populations. Some restrictions protect threatened bat species from tree-cutting, especially during the period when mothers are birthing and raising pups.

The **Comet Darner** damselfly (SGCN) inhabits small ponds with an abundance of floating and submerged vegetation and has been documented near Black Creek in Esopus. It is sensitive to alterations in hydrology and water quality, as well as herbicide use.

Kentucky Warbler (High Priority SGCN) is a bird of forest interiors that was last documented nesting in woodlands of Ulster Park in 1994. The species reaches its northernmost extent in New York and is declining in the state. Kentucky Warblers and other woodland bird species are most threatened in New York by forest fragmentation and excessive deer browse, which reduces the amount of dense, low vegetation needed during the breeding season. See Table 1 for a list of other forest bird species of conservation concern occurring in Esopus.

Least Bittern (NY-Threatened, SGCN) is a marsh bird with a preference for large emergent wetlands with cattails, bulrushes, and sedges, and large open water areas. Least bittern nesting was last documented near the mouth of Rondout Creek in the 1980s. The species is threatened by continued wetland loss in the Hudson Valley and by habitat degradation due to fragmentation, exotic plant invasions, and nutrient enrichment in wetlands.

Lyre-tipped Spreadwing (SGCN) is a damselfly species that inhabits small ponds and marshy wetlands, often in open, temporary situations that dry up in mid-summer. It has been documented using vernal pool habitat near Black Creek in Esopus.

Northern Cricket Frog (NY-Endangered, High Priority SGCN) relies on ponds, lakes, and emergent wetlands with floating mats of mosses, water lilies and other aquatic plants. They move between the wetlands and adjacent upland habitat areas for overwintering and are vulnerable to nearby development and alteration of wetland habitat including changes in water quality and hydrology. Cricket frogs have been documented in at least three locations of the Wetlands and Ridges SBA in Esopus since 2010.

Red-headed Woodpecker (NY-Special Concern, High Priority SGCN) occurs in open swamps with dead, standing trees, and other open areas with scattered trees and has been documented in the Wetlands and Ridges SBA in Esopus. Dead trees with cavities provide nesting habitat and should be preserved where feasible.

Wood Turtle (NY-Special Concern, High Priority SGCN) occurs along low gradient streams and adjacent forested and open uplands in the Wetlands and Ridges SBA in Esopus. Wood Turtles are threatened by habitat loss, stream degradation, nest predation, and the pet trade.

Note: Rare animals may occur in more locations than are currently known by NYNHP or DEC. The DEC Region 3 Office in New Paltz should be contacted at 845-256-3098 with any concerns or questions about the presence of protected species in the Town of Esopus.

Matrix Forest Blocks and Linkage Zones. The Nature Conservancy and New York Natural Heritage Program have identified globally-rare "matrix forests" at the statewide level -- forests large enough to withstand major natural disturbances, maintain important ecological processes, and support populations of forest-interior wildlife and plants (Anderson and Bernstein, 2003). The nearly 26,000-acre Shaupeneak matrix forest block covers much of Esopus west of US Rt 9W and is crucial for regional habitat connectivity. Its

importance is disproportionate to its size: the region's larger, forested mountain and ridge areas–the Catskills, Shawangunks, Taconics, and Hudson Highlands–all connect via relatively intact forest linkage zones through the Shaupeneak forest matrix block. The proximity of this forested area to the Hudson River Estuary is unusual, as is the presence of several large forest blocks over 500 acres in size along the Hudson River shoreline. Large forested areas provide many ecosystem services, and support vulnerable groups such as forest interior (area-sensitive) breeding birds who are able to find suitable habitat in this largely forested landscape. These attributes are discussed further in the Forest section.

Stream Habitat for Migratory Fishes. Esopus's main Hudson River tributaries provide important stream habitat for migratory fishes according to DEC Bureau of Fisheries data and an aquatic habitat connectivity study by NYNHP (White, et al., 2011). American Eel occur along the full length of Rondout Creek and Black Creek in the Town. River herring (Alewife and Blueback Herring) spawn in reaches of Rondout Creek below the Eddyville dam and lower reaches of Black Creek support one of the most important Alewife spawning runs in the region. American Eel is in decline throughout much of its range, and though eels are able to bypass certain dams, culverts, and other aquatic barriers, they rely on aquatic connectivity along streams to complete their life cycle and return to the sea to spawn. River herring spend most of their time in coastal waters and return to the fresh water of the Hudson River each spring to spawn before returning back to ocean waters. NYSDEC fisheries biologists have monitored herring spawning in Black Creek since 2013, identifying as many as 590,000 Alewives in a given year (Eakin et al. 2014). See the Streams and Watersheds section, below, for additional information on stream habitat in Esopus.

Hudson River Coastal and Shoreline Habitats (Figure 3)

Connections to upper watersheds, the Atlantic Ocean, and the changing tides make the coastal and shoreline zones of the Hudson River Estuary a dynamic area. Conditions throughout this reach of the estuary are entirely freshwater, supporting globally rare natural communities such as freshwater tidal marsh and swamp. The Town of Esopus's coastal habitats and general shoreline type along the tidal Hudson are shown in Figure 3.

Significant Coastal Fish and Wildlife Habitats. Diverse coastal habitats occur in New York that provide critical habitat and feeding areas for animals as well as economic values. As previously mentioned, the DEC has identified and evaluated coastal habitats throughout the state's coastal regions, providing recommendations to the NYS Department of State so that the most important or "significant" habitats may be designated for protection in accordance with the Waterfront Revitalization and Coastal Resources Act. The Significant Coastal Fish and Wildlife Habitats are useful for planning at the local level because they describe the highest quality habitats on the Hudson, outlining fish and wildlife values and activities that may have large impacts on the habitats. State and federal law requires that some projects may be reviewed for consistency with coastal policies on significant fish and wildlife habitat. Contact the NYS Department of State Office of Planning & Development for more information on the protection and regulation of these habitats. Esopus has a Local Waterfront Revitalization Program, adopted in 1987 with federal concurrence in 1988.

There are four designated Significant Coastal Fish and Wildlife Habitat areas in Esopus (Figures 2 and 3). Detailed habitat assessments of the Kingston-Poughkeepsie Deepwater, Rondout Creek, Esopus Meadows, and Black Creek sites discuss their value to fish and wildlife, and information on potential impacts to their habitat values. See Table 1 for more information on the documented rare species associated with Esopus's coastal habitats.

The **Kingston-Poughkeepsie Deepwater** area encompasses a 25-mile stretch of nearly continuous deepwater habitat ranging in water depth from 20 feet to 50 feet or greater. It supports a diversity of freshwater and migratory species and is one of the largest and most well-known spawning areas for Atlantic

Sturgeon (NY-Endangered) and overwintering areas for Shortnose Sturgeon (NY-Endangered) in the Hudson River.

The **Rondout Creek** area encompasses a four-mile tidal segment of the tributary from the Hudson River to the Eddyville dam. It includes Sleightsburg Marsh at the mouth of the creek and habitats such as flats, tidal wetlands, and shallows, especially behind Gumaer Island. The warmwater stream has experienced considerable human disturbance but remains important for migratory and resident freshwater fish and is a major spawning area for Alewife and Striped Bass. Sleightsburg Marsh and other wetlands at the mouth of the creek are productive feeding areas during spring and fall migrations for a variety of species including mallard, black duck, and wood duck. Banks of the Rondout also provide habitat for Map Turtles and Common Snapping Turtles.

Esopus Meadows is a shoal of freshwater shallows (less than 10 feet deep at mean low water), and intertidal mudflats with extensive submerged aquatic vegetation beds, historically dominated by water celery. The shallow, subtidal beds provide spawning, nursery, and feeding habitats for migratory species such as Striped Bass and American Shad, as well as many resident freshwater species. Significant concentrations of waterfowl also occur in the Esopus Meadows area during spring and fall migrations, attracted to the valuable feeding areas. Invasive, non-native water chestnut has expanded in the habitat in recent years.

The mouth of **Black Creek** is flanked by forest and opens to freshwater tidal wetland and swamp with submerged aquatic vegetation beds where the creek meets the Hudson River. The creek has historically supported one of the largest river herring spawning runs in the Hudson Valley, most recently dominated by Alewives. American Eel are also present in the creek and Map Turtles are found along the banks at the creek mouth.

Underwater (Subtidal) Habitats. Beds of submerged aquatic vegetation (SAV), primarily water celery, occur along most of Esopus's Hudson River shoreline and in the shallows of Esopus Meadows, Sleightsburg Marsh, and the tidal Rondout Creek. SAV improves water quality by trapping fine sediment and organic matter and adding oxygen to the water. It also provides essential habitat for organisms like insects, worms, and snails that feed fish and birds in the estuary, and serves as nursery habitat for young fish. Native species of SAV in the Hudson such as water celery currently compete for habitat with invasive, non-native water chestnut. Water chestnut does not provide the same water quality benefit as native SAV because its floating leaves release oxygen into the air rather than into the water.

Figure 3 shows areas where SAV has been found since 1997. DEC's most recent survey in 2014 found 58 acres of SAV in Esopus, about one quarter of the area documented with SAV in 2007. An additional 173 acres of water chestnut were found primarily in Esopus Meadows and Sleightsburg Marsh. A dramatic decline in SAV (90% loss) was seen throughout the Hudson River Estuary following Hurricanes Irene and Lee in 2011. The habitat loss was believed to be due to the large amount of sediment entering the estuary from the storms, which blocked light and prevented plant growth. Since 2016, signs of SAV recovery have been seen throughout the estuary. Even if SAV is not present today, the areas shown in Figure 3 could support it in the future.

Tidal Hudson River Estuary Wetlands. The wetlands at the mouth of the Rondout Creek and Black Creek are both freshwater and tidal, a globally rare ecosystem type. Tidal wetlands serve a very important purpose in the river, providing habitat for rare plants and young fish and other benefits for people like wastewater dilution/purification and protecting shorelines from waves and strong storms. Figure 3 shows tidal wetlands mapping from a 2007 inventory by DEC, which identified about 31 acres of tidal wetlands in Esopus at Sleightsburg Marsh and in the mouth of Black Creek. A variety of rare plant species have been documented from these coastal habitats and are listed in Table 1.

Tidal Shoreline Status. Natural shorelines are an important transition zone between water and land and provide habitat for diverse plants, fish and wildlife. Tidal shorelines comprise lands directly on the Hudson River as well as the shorelines of tidal wetlands, tidal tributaries, and coves, including both naturally vegetated and hard engineered shoreline. Esopus has approximately 13.2 miles of tidal shoreline directly along the Hudson River, and an additional 4 miles along the tidal Rondout Creek. Figure 3 shows general shoreline type according to a 2005 inventory of Hudson River shoreline status by NYSDEC and the Hudson River National Estuarine Research Reserve. The study identified 2.1 miles of hard engineered shoreline in Esopus, including bulkhead and rip-rap revetment. The remaining 11.1 miles of natural shoreline support primarily woody vegetation or unvegetated rock, sand, and gravel.

Towns can evaluate tidal shoreline status to identify places where natural shorelines can be conserved or where the ecology of engineered shorelines could be enhanced. There are opportunities to conserve, restore, and manage shoreline habitats throughout the Esopus waterfront area. Parks, preserves, and regulated wetlands may offer a starting point to conserve or restore natural shorelines that will allow tidal wetlands to move with sea level rise. Even along working waterfronts there are ways to improve the habitat value of bulkheads and rip-rap revetments. The Hudson River Sustainable Shorelines Project provides information and tools on enhancing the ecology of built shorelines as well as how to conserve natural shorelines.

Potential Tidal Wetland Pathways. The Hudson River Estuary is connected to the Atlantic Ocean and affected by sea level rise (SLR) due to climate change. The Hudson has already risen by one foot since 1900 and is likely to rise an additional 3-6 feet due to SLR by 2100 (Horton et al. 2014). Such a rapid change in water levels threatens waterfront development and infrastructure as well as the future of tidal wetlands. Tidal wetlands along the Hudson River will disappear with SLR unless they can build up in place or move to higher ground. However, wetlands bordered by steep shorelines or existing development may have no place to go. Potential tidal wetland loss threatens the health of the entire estuary. A recent study by Scenic Hudson shows areas along the Hudson most likely to support tidal wetlands in the future as sea level rises (Tabak et al. 2016). The study shows that the location of Esopus's tidal wetlands will likely change by 2100.

The **Potential Tidal Wetland Pathways** in Figure 3 show where tidal wetlands are likely to move by 2100 as sea level rises. Tidal wetlands are projected to expand in low lying areas along Rondout Creek and the mouth of Black Creek, while being lost from portions of Sleightsburg Marsh as water becomes too deep. Steep shorelines are a barrier to wetland movement in many areas; in others, existing roads, railroads, and development pose a physical barrier. The wetland pathways do not account for all of the barriers that may be present; for example, bulkheads and revetment may be a barrier to inland wetland migration along some stretches of Esopus's Hudson River shoreline. Tidal wetland pathway data may be viewed in more detail using the Protecting the Pathways interactive map

The most effective way for a municipality to conserve tidal wetlands in the face of these changes is to protect and manage the areas where wetlands may move. Minimizing future development in the pathways and designing public waterfronts to allow for these changes will ensure that tidal wetlands have room to adapt to rising sea levels. This strategy will also reduce risks to communities and property owners in the changing Hudson River flood zone. For more information, see *Protecting the Pathways: A Climate Change Adaptation Framework for Hudson River Estuary Tidal Wetlands* (Tabak and Spector 2016). Sea level rise projections for the town's waterfront can be viewed using Scenic Hudson's Sea Level Rise Mapper.

Streams (Figure 5)

Streams, their floodplains, adjacent wetlands, and other "riparian" or streamside habitats that occur along their channel provide important ecosystem services to communities, including clean water, flood management, and recreational opportunities like fishing and kayaking. In addition, Hudson River tributary streams and their associated shoreline and floodplain areas provide some of the most productive wildlife

habitat in the region. The health of the Hudson River Estuary is closely linked to the health of its tributaries and their watersheds (Penhollow et al. 2006).

All of the land in Esopus ultimately drains to the Hudson River Estuary (Figure 4). Black Creek drains 13.7 square miles of land in the center and east of the town. To the west, 11.3 square miles of land drain via the Swarte Kill and the Wallkill River to Rondout Creek. An additional 8 square miles of land in northern Esopus drain directly to Rondout Creek, and a narrow area east of US Rt 9W drains directly to the estuary via minor streams along the town's Hudson River shoreline.

In addition to watershed boundaries, Figure 4 shows streams, waterbodies, floodplains, and riparian buffer areas. Streams and waterbodies in Figure 4 and other maps in this summary are from the USGS National Hydrography Dataset (NHD) and were digitized from air photos. Note the resulting maps have inherent inaccuracies and do not capture most intermittent streams. Intermittent streams are in fact widespread, accounting for an estimated 59% of total stream length in the United States. The US Environmental Protection Agency and has compiled extensive scientific reviews highlighting their essential role in maintaining water quality and overall watershed function or health (US EPA 2015). Intermittent streams also play a vital role in dissipating stream energy during storms and reducing erosion and downstream flood impacts. Visiting sites and creating more accurate maps are methods to pursue to ensure that intermittent streams are identified and considered during planning processes.

Intermittent streams *only flow seasonally or after rain. They can easily be overlooked when dry, but have great impact on larger downstream waters and warrant attention. Many flow directly into the Hudson and its tributaries, wetlands, and other water bodies, influencing water quantity and quality.*

The largely intact forested landscape and riparian corridors surrounding Black Creek and the Swarte Kill support unusually pristine stream habitats and water quality for this region of the Hudson Valley. Black Creek is one of the few low-elevation coldwater streams the region, with ability to support Brown Trout and other coldwater-dependent species. In addition to important habitat for migratory fishes shown in Figure 2, streams in Esopus provide important habitat areas for NY-Special Concern Wood Turtle.

Effective stream conservation and restoration occurs beyond stream channels and banks. Figure 4 shows riparian areas, which were mapped by the New York Natural Heritage Program (Conley et. al. 2018) using the Riparian Buffer Delineation Model (Abood et al. 2012). The riparian areas highlight important streamside areas that influence stream dynamics and health. Riparian buffers intercept stormwater runoff, filter sediment and nutrients, and help attenuate flooding. Forested buffers provide organic matter that supports the in-stream food web and shade that helps maintain cool water temperatures. They also support unique and diverse habitats, and serve as wildlife travel corridors (Knab-Vispo and Vispo 2010). The riparian areas were mapped around streams based on digital elevation data, known wetlands, and modeling for the 50-year flood zone. The riparian areas overlap with FEMA floodplain data in the map and will soon be available for viewing in greater detail using the Hudson Valley Natural Resource Mapper. Note that the riparian buffers were developed through modeling and have not been field verified. They may not capture all of the areas important to stream health and habitat values; nevertheless, they can provide a starting point to inform land use strategies and stream protection efforts. The Hudson River Estuary Program's "Trees for Tribs" initiative offers free consultation and native trees and shrubs for qualifying streamside buffer planting projects in the estuary watershed.

Floodplains are a particularly important component of riparian areas, especially where forested or undeveloped. Natural floodplains provide space streams need to expand, contract, and sometimes change course, and they promote groundwater recharge. Furthermore, they safeguard human settlement from the damaging impacts of flood events. Floodplain information included in Figure 4 comes from the Federal Emergency Management Agency (FEMA) Digital Flood Insurance Rate Map (DFIRM) Database. Areas estimated by FEMA to have a 1% chance or greater probability of being inundated in any given year (often

referred to as the "100-year flood"), include low-lying areas along Rondout Creek and the Wallkill River, Esopus and Mirror Lakes, and the Black Creek and Swarte Kill wetlands. Some narrow additional areas are mapped by FEMA with a 0.2% chance or greater probability of flooding in any given year (referred to as the "500-year flood"). It is important to note that the FEMA-mapped floodplains and their statistical flooding intervals are estimations based on the data and technology available at the time of mapping. Due to many variables, such as the unpredictable nature of some kinds of floods, local drainage problems, and the variable intensity of land development in watersheds, some flood-prone areas may not appear on the maps. Nonetheless, the mapped floodplains provide a starting point for proactive conservation planning.

__Floodplains__ are low-lying areas adjacent to streams and rivers that can become inundated during heavy precipitation or snow melt. __The floodway__ is the channel of a stream or river that carries the deepest, fastest water downstream.

There are a number of initiatives directed at watershed protection in Esopus's watersheds. The Rondout Creek Watershed Council published *An Interim Watershed Management Plan for the Lower, Non-Tidal Portion of the Rondout Creek, Ulster County, New York* (2010), which address watershed protection upstream from Eddyville Dam; and the *Tidal Rondout Creek Watershed Management Plan* (2015), which addresses the 11.25 square mile watershed of the tidal portion of the Rondout that flows along Esopus's northern border. Since 2015, the Wallkill River Watershed Alliance has been actively working to restore the Wallkill River and improve opportunities for recreation. Their actions are guided by a Science-Based Action Plan (2018), which prioritizes projects to improve water quality, public access and engagement, and capacity building. This work also builds off of previous planning efforts, including the Wallkill River Watershed Conservation and Management Plan (2007), which continues to serve as a valuable reference.

Wetlands (Figure 5)

There are many types of wetlands in the Hudson River Estuary watershed, including wet meadows, emergent marsh, forested and shrub swamps, vernal pools, floating and submerged vegetation, and open water, as well as the variety of tidal wetland types in the estuary discussed in the Coastal and Shoreline Habitat section (Figure 3). In addition to providing critical habitat for many plants and animals, wetlands help to control flooding and reduce damage from storm surge, recharge groundwater, filter and purify surface water, and provide recreation opportunities. The upland area surrounding a wetland is essential to its survival and function; both may diminish when a wetland is surrounded by pavement, buildings, and pollution-generating or other incompatible land uses (Environmental Law Institute 2008).

__Wetlands__ are areas saturated by surface or groundwater sufficient to support distinctive vegetation adapted for life in saturated soil conditions.

Knowing about local wetlands enables municipalities to proactively plan to conserve this critical part of our life support system. Although several existing maps provide approximate locations and extent of wetlands, they are inherently inaccurate and not a substitute for site visits and on-the-ground delineation. Nonetheless, towns can use these maps as a starting point for inventorying local wetlands and supplement them with more refined data as they become available.

In Figure 5, "known wetlands" are shown from the U.S. Fish and Wildlife Service's (USFWS) National Wetlands Inventory (NWI). DEC's Freshwater Wetlands Program maps (which only include wetlands larger than 12.4 acres, unless designated "of unusual local importance") are shown as a hatched overlay. Open water habitats including the Hudson River are symbolized in blue as "waterbodies." NWI data and NYS freshwater wetland maps can be viewed using the Environmental Resource Mapper. County soil maps are also a good source for predicting the location of potential wetlands. "Probable wetland areas" are soils classified as very poorly drained or poorly drained, and "possible wetland areas" are soils classified as somewhat poorly drained (after Kiviat and Stevens 2001). Note that the probable and possible wetland areas cover a greater area than NWI and DEC wetland layers. NWI maps often underestimate wetland area and

omit smaller and drier wetlands (Zucker and Lau, unpublished report). In particular, vernal pools, wet meadows, and swamps are often under-represented on maps. Many of DEC's regulatory maps are outdated and have similar inaccuracies (Huffman and Associates 2000). Likewise, note that soil units are only mapped to an approximate area of about two acres, and that soils within the unit may not be homogeneous. Areas shown as supporting probable or possible wetlands should always be verified in the field for the purposes of environmental review.

In addition to significant coastal wetlands described in Figure 3, the Esopus/Lloyd Wetlands and Ridges Significant Biodiversity Area supports outstanding wetland resources unique in the Hudson Valley region. The intricate topography of ridges and valleys in this area coupled with relatively low development intensity has enabled the persistence of a rich complex of upland and wetland habitats. Below the dramatic talus and rock outcrops of Hussey Hill and Shaupeneak Ridge the valleys and lowlands abound with wetlands, many of which form sizeable assemblages. Large Red Maple-Hardwood Swamps in this area are often calcareous (calcium-rich), and some have been identified as exemplary from a statewide perspective. One such swamp is home to one of the healthiest populations of NY-Endangered Large Twayblade orchid in the northeast. A variety of other rare wetland plants in Esopus are listed in Table 1. Uncommon wetland community types also occur here: Circumneutral Bog Lakes and Dwarf Shrub Bogs are notable for supporting a rich array of plants and animals, including rare and uncommon species. Several populations of the NY-Endangered Cricket Frog persist in this area, relying on calcareous vegetated wetlands as well as the intervening upland forest areas for overwintering. Ongoing research is still documenting the Cricket Frog's particular habitat needs, and in recent years has found that it can disperse farther into uplands than previously thought. Local planning to maintain large, connected wetland and forest ecosystems and reduce polluted runoff near wetlands will help to conserve these valuable resources. A variety of other High Priority Species of Greatest Conservation Need are known to occur in Esopus's wetlands and are listed in Table 1, including Red-headed Woodpecker, the Stinkpot turtle, and Four-toed Salamander, among others.

Numerous vernal pools are embedded within forested areas throughout much of Esopus, although they have only been formally mapped on Scenic Hudson properties (e.g. Black Creek Preserve, Shaupeneak Ridge, and Esopus Meadows Preserve). Vernal pools are small, isolated wetlands that are often dry in summer. They provide habitat for many animals, including forest amphibians documented in Esopus like NY-Special Concern Marbled Salamander and Jefferson Complex Salamander, as well as common species such as Spotted Salamander and Wood Frog. These pool-breeding amphibians depend on vernal pools to breed and later disperse to the surrounding forested uplands as adults. Vernal pools often go undetected in the forest due to their small size and seasonal drawdown. Vernal pools and other small, isolated wetlands are also vulnerable due to limited regulatory protection (see Conserving Small Wetlands in the Hudson Valley for more information). Knowing there are unmapped vernal pools in Esopus, outreach to landowners with potential habitat may help promote stewardship and land-use decisions that protect the pools, surrounding forest habitat, and associated wildlife. Specific management recommendations can be found in *Best Development Practices: Conserving Pool-Breeding Amphibians in Residential and Commercial Development in the Northeastern United States* (Calhoun and Klemens 2002) and *Maine Municipal Guide to Mapping and Conserving Vernal Pool Resources* (Morgan and Calhoun 2012). Biodiversity assessment may reveal additional wetland habitat types in the town and provide detail on quality and habitat use.

Large Forests (Figure 6)

Large forests provide numerous benefits including wildlife habitat, clean water, climate moderation, and forest products. In general, larger forests provide higher quality habitat and greater benefits than smaller ones. However, the value of each forest is relative to the values of surrounding habitats. For example, a series of forest patches along a stream helps maintain water quality while creating a wildlife travel corridor. Conserving Esopus's large forest areas and connections between them will help sustain the town's rich diversity of forest plants and animals and the numerous other benefits that forests provide residents.

Esopus lies in one of the most intact forested regions of New York State. Significant forest areas of Shaupeneak Ridge and the Black Creek Corridor have been protected by state and non-profit organizations, but most forest land in the town remains in private ownership. There are opportunities to support and promote forest stewardship throughout the town, and to guide future land use in ways that maintain large forest tracts and minimize impacts to interior forest habitat.

Figure 6 shows large forest patches in Esopus. The map was created from 2010 land cover data developed for the National Oceanic and Atmospheric Administration's Coastal Change Analysis Program. Land cover categories considered 'forest' for this analysis included deciduous forest, evergreen forest, mixed forest, and palustrine forested wetland. Roads were buffered and removed from forest patches to show results of development-related fragmentation. Interstate roads were buffered by a total of 300 feet and state and county roads by 66 feet. Forest patch size classifications follow the Orange County Open Space Plan (Orange County Planning Department 2004) as cited in Strong (2008).

The largest contiguous forest block in Esopus extends from Old Post Road south into neighboring Towns of New Paltz and Lloyd and is mapped as "globally significant." Forests of this size are considered large enough to withstand catastrophic natural disturbances, such as hurricanes or wildfires, and to maintain important ecological processes, such as nutrient and water cycling. Such forests are also big enough to support breeding populations of forest-interior species, including numerous forest songbirds, raptors, and far-ranging mammals like black bear, fisher, and bobcat. These characteristics will likely contribute to resilience in a changing climate. Conserving large, high quality forest areas such as these and natural connections between them will also allow plants and animals to move northward and higher in elevation as the climate warms.

***Forest fragmentation** is the process of breaking large patches of forest into smaller areas, often by clearing it for new roads or development. Fragmentation decreases forest habitat quality and health, disrupts wildlife movement, and facilitates the spread of invasive species. These impacts are greatest at forest edges but can extend for hundreds of feet into forest patches, often displacing sensitive species that depend on interior forest.*

Two additional major forest areas are mapped to the north: the Shaupeneak Ridge forest block, measuring over 5,200 acres; and the Hussey Hill forest block, measuring over 3,000 acres. Forest-dependent birds often require a least 2,500 acres of intact interior forest habitat to maintain viable populations. Though classified as "locally significant," they comprise important sections of the "matrix forest" of statewide and global significance shown in Figures 1 and 2 and should be considered of high significance based on low density of development and the presence of extensive exemplary forest communities described previously. Two additional "stepping stone" forest blocks are mapped east of US Rt 9W and are in fact rare occurrences of forests greater than 500 acres along the Hudson River, and important components of regional forest linkage zones connecting matrix forests of the Catskills, Hudson Highlands, and Taconic Mountains. The 200-acre threshold is often considered a minimum size for intact forest ecosystems able to support some but not all forest interior-nesting bird species. Smaller forests have limited habitat value for sensitive forest species and suffer greater impacts from development. Forest edge disturbances dominate small forests, such as invasive species, increased predation levels, and micro-climatic differences. Regardless of size or habitat values, all forests and trees in the town help to manage stormwater, moderate temperature, and improve air quality, among other ecosystem benefits.

It's important to note that the large forest blocks are mapped from a regional perspective and do not capture fragmentation by local roads, driveways, or low-density residential development. Figure 6 also shows "High" to "Outstanding" Intact Habitat Cores for Ulster County, which identify the most intact areas of undisturbed habitats and highlight valuable interior forest habitat present in Esopus. The habitat cores were identified through a study by the Green Infrastructure Center (Firehock 2013) in collaboration with Ulster County and NYSDEC staff. Cores are ranked based on habitat size and shape, species diversity, and water quality and

quantity values. These areas represent significant natural "green infrastructure" on the landscape providing clean air and water and valuable ecological functions that are otherwise costly to replicate through engineering. They can be used to inform local planning and prioritization for conservation.

Wildlife records confirm the availability of high-quality forest habitat in Esopus. The *2000-2005 NYS Breeding Bird Atlas* documented numerous forest-interior bird species of conservation concern in the town, including many NY-Species of Greatest Conservation Need such as Scarlet Tanager, Worm-eating Warbler, and Wood Thrush (Table 1). Two NY-Special Concern raptors were also documented in Esopus: Red-shouldered Hawk and Sharp-shinned Hawk. Audubon New York's website has specific information on managing habitat for forest birds. Esopus forests also provide important summer foraging habitat for NY-Endangered Indiana Bat and mostly likely for other bat species of conservation concern. Rare forest and open woodland plants have been documented in Esopus including the NY-Endangered Side-oats Grama; see Table 1 for a complete list.

One of the greatest threats to forests in Esopus today is the introduction of tree diseases, forest pests, and other invasive species inadvertently brought in by people through landscaping and international commerce. Hemlock woolly adelgid and emerald ash borer have already done much damage in the town, and are expected to eventually kill most large trees of these common species in the region. The Lower Hudson Partnership for Regional Invasive Species Management (PRISM) works to promote education, prevention, early detection and control of invasive species and is helping communities to prepare for and respond to this threat. Guiding future development to minimize forest fragmentation and loss will help minimize the spread of invasive species into interior forests and conserve important habitats in the town.

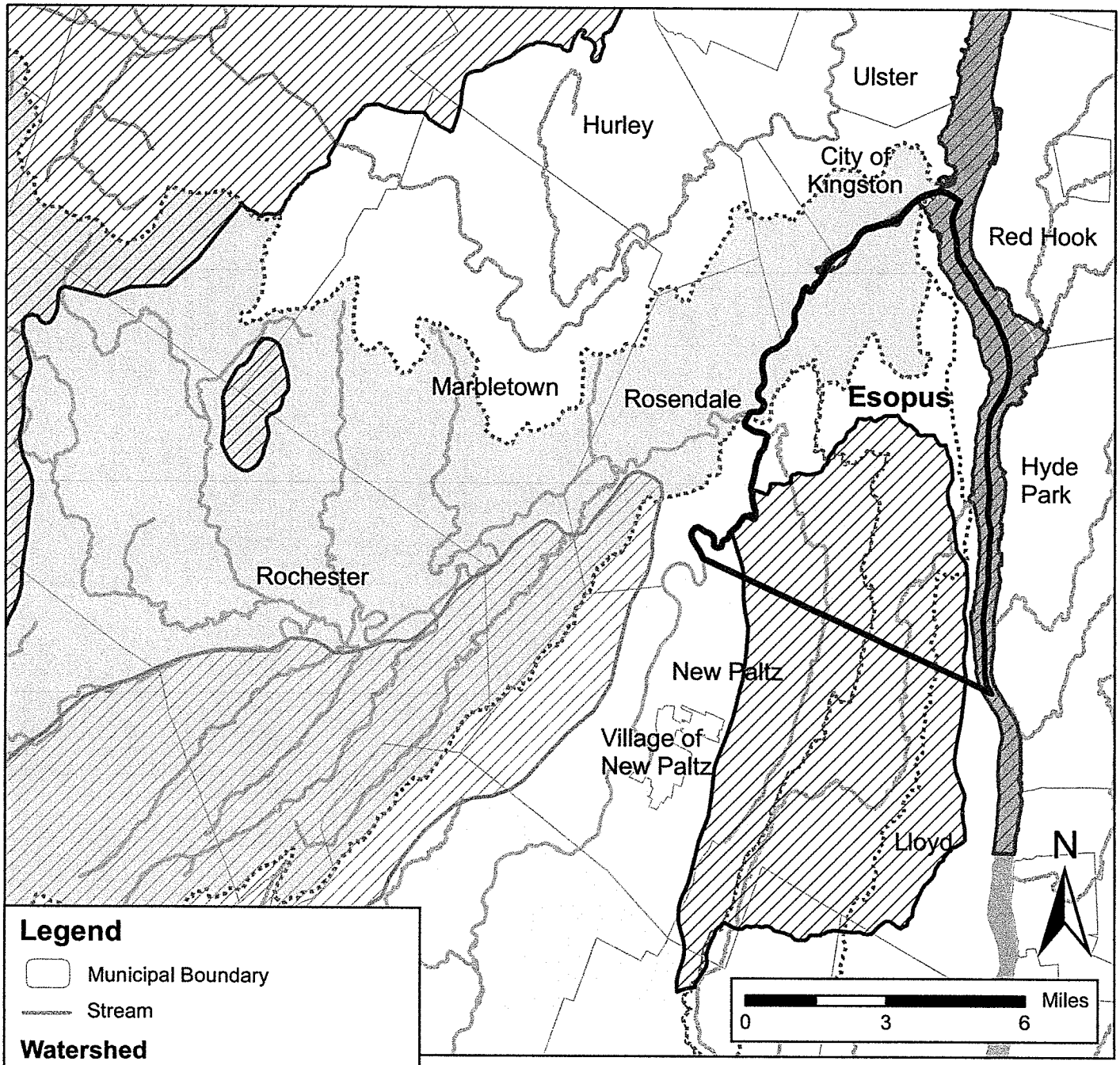
Grasslands, Shrublands, and Young Forests (not mapped)

Recently disturbed sites, such as hayfields, abandoned farm fields, or forest clearings, can provide important habitat for species that require grasslands, shrublands, and young forests. These successional habitat types are transitional and relatively short-lived, and typically require periodic maintenance to avoid becoming more densely vegetated, eventually developing a canopy and becoming forest. We can infer from aerial photography and breeding bird records that valuable grasslands, shrublands, and young forests occur in Esopus (see Table 1).

Grassland or meadow habitat can support a variety of life, including rare plants, butterflies, reptiles, and birds, in addition to providing agricultural uses and scenic values. The quantity and quality of grasslands for wildlife have rapidly decreased in the Northeast during the last century due to increased human population, changes in agricultural technology, and abandonment of family farms. This continuing trend threatens populations of grassland birds that have adapted to the agricultural landscape. Esopus is largely forested today, and the *2000-2005 NYS Breeding Bird Atlas* documented just one grassland bird species of conservation concern in the Esopus area: Barn Owl. Small grassland and meadow habitats nevertheless are known to occur in the Town, and enhance habitat and species diversity. Audubon New York offers guidance on managing habitat for grassland birds.

Shrublands and young forests are transitional habitats characterized by few or no mature trees, with a diverse mix of shrubs and/or tree saplings, along with openings where grasses and wildflowers grow. They can occur in recently cleared areas and abandoned farmland and are sometimes maintained along utility corridors by cutting or herbicides. These habitats are important for many wildlife species declining throughout the region because former agricultural areas have grown into forests, and natural forest disturbances that trigger young forest growth, such as fires, have been suppressed. Records from the *NYS Breeding Bird Atlas* support the presence of 11 species of conservation concern in Esopus that prefer young forest and shrubland habitat, including Blue-winged Warbler, Prairie Warbler, and Ruffed Grouse (see Table 1). For more information, see Audubon's guidance on managing habitat for shrubland birds.

Figure 1: Regional Context of Esopus, NY



Legend

- Municipal Boundary
- Stream

Watershed

- Black Creek
- Wallkill River
- Rondout Creek

Significant Biodiversity Areas

- Upper Hudson River Estuary
- Esopus/Lloyd Wetlands and Ridges
- Shawngunk Ridge
- Catskill Mountains

This map shows the location of the Town of Esopus, Ulster County, NY in relation to its major watersheds and significant biodiversity areas. This map was produced as part of a Habitat Summary for the town. For more information, please contact NYSDEC's Hudson River Estuary Program Conservation and Land Use Specialist Ingrid Haeckel at (845)256-3829 or ingrid.haeckel@dec.ny.gov.
http://www.dec.ny.gov/lands/5094.html

Data Sources:
NYSDEC and US Geological Survey: streams (2008)
USDA Natural Resources Conservation Service: watersheds (2009)
NYS Department of Environmental Conservation: significant biodiversity areas (2006)
NYS Office of Information Technology Services: municipal boundaries (2018)
Map Created 2018

NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation | Cornell University

Figure 2: Significant Ecological Features in Esopus, NY

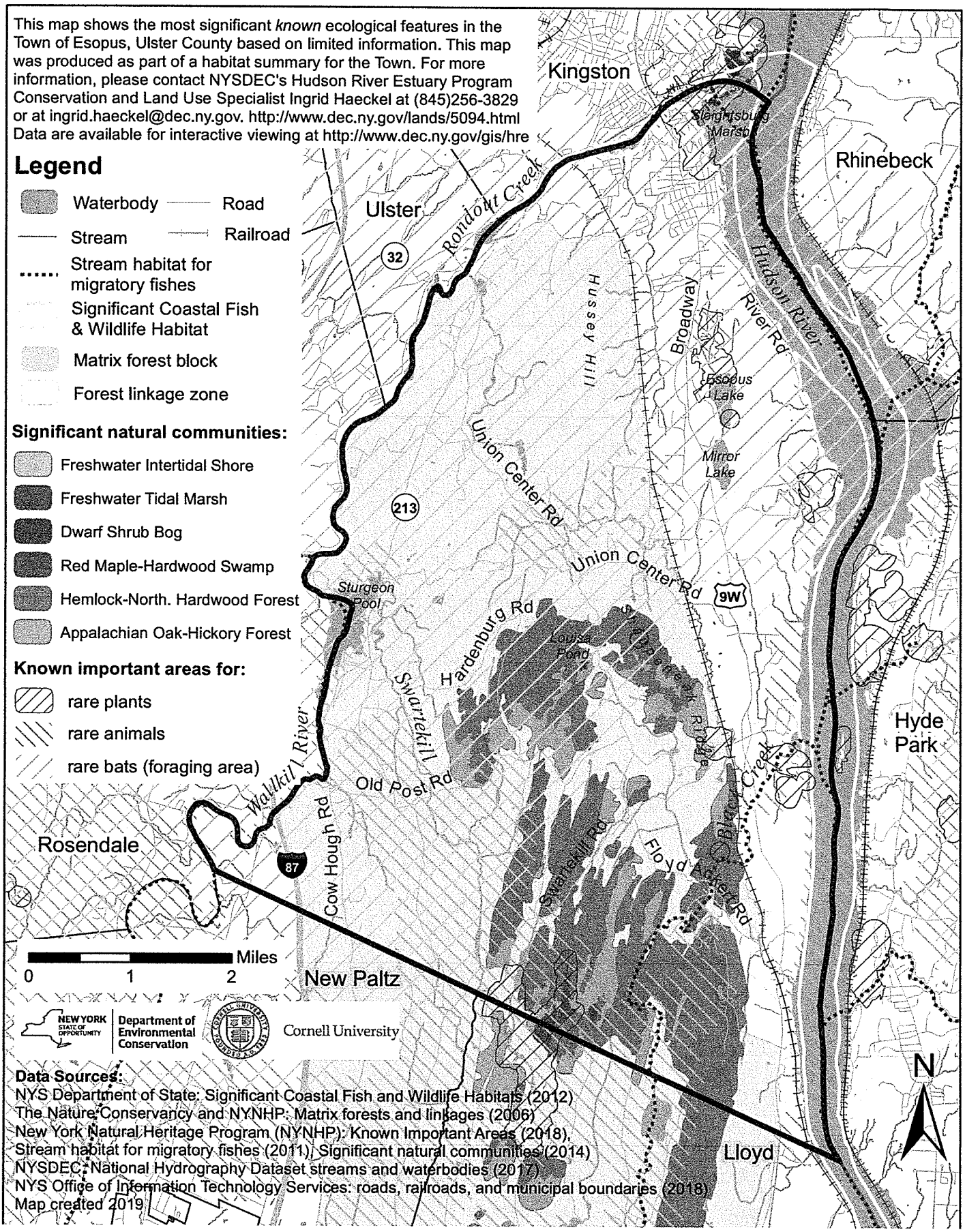
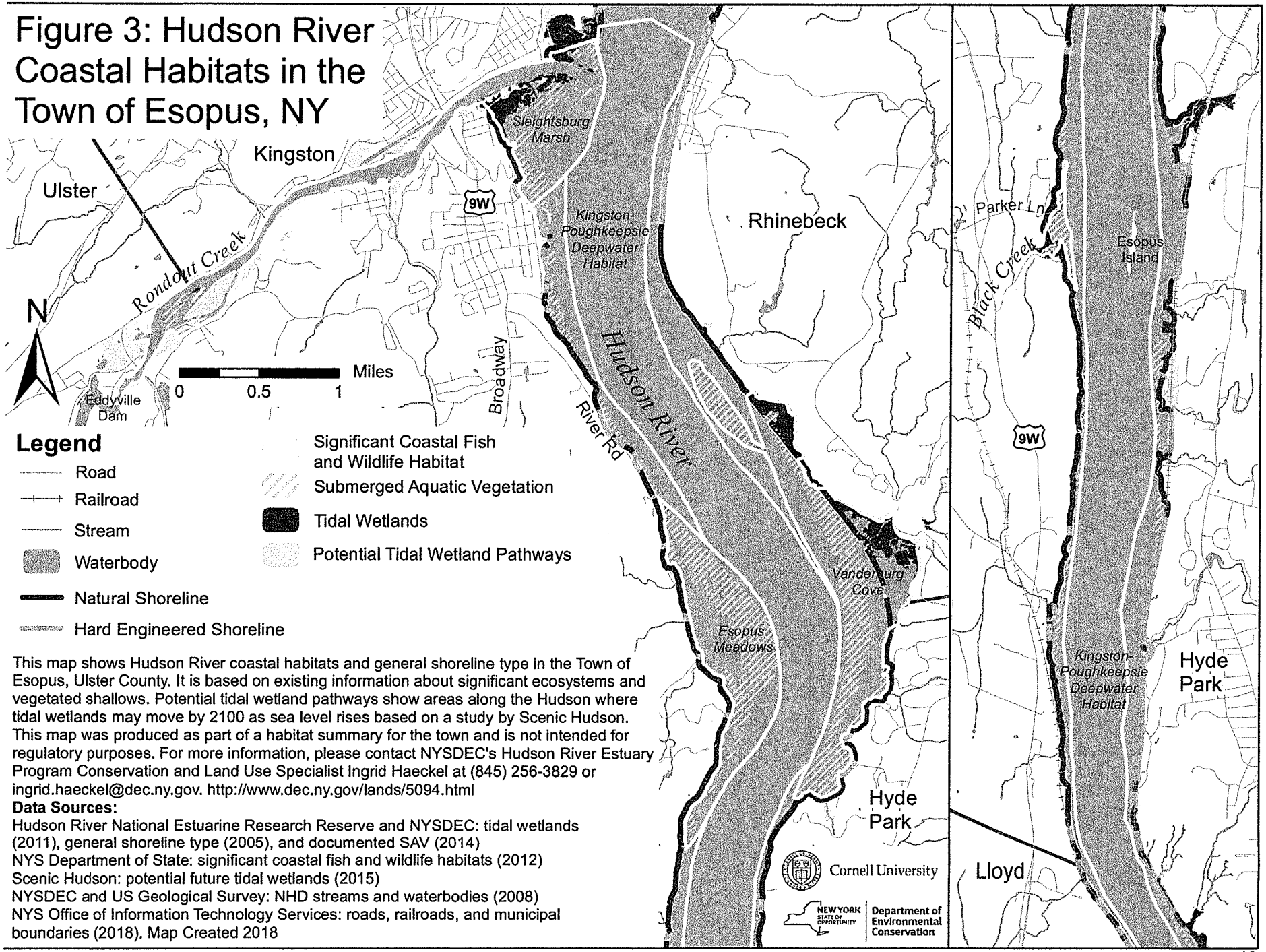


Figure 3: Hudson River Coastal Habitats in the Town of Esopus, NY



This map shows Hudson River coastal habitats and general shoreline type in the Town of Esopus, Ulster County. It is based on existing information about significant ecosystems and vegetated shallows. Potential tidal wetland pathways show areas along the Hudson where tidal wetlands may move by 2100 as sea level rises based on a study by Scenic Hudson. This map was produced as part of a habitat summary for the town and is not intended for regulatory purposes. For more information, please contact NYSDEC's Hudson River Estuary Program Conservation and Land Use Specialist Ingrid Haeckel at (845) 256-3829 or ingrid.haeckel@dec.ny.gov. http://www.dec.ny.gov/lands/5094.html

Data Sources:

Hudson River National Estuarine Research Reserve and NYSDEC: tidal wetlands (2011), general shoreline type (2005), and documented SAV (2014)
NYS Department of State: significant coastal fish and wildlife habitats (2012)
Scenic Hudson: potential future tidal wetlands (2015)
NYSDEC and US Geological Survey: NHD streams and waterbodies (2008)
NYS Office of Information Technology Services: roads, railroads, and municipal boundaries (2018). Map Created 2018

Figure 4: Streams and Watersheds in Esopus, NY

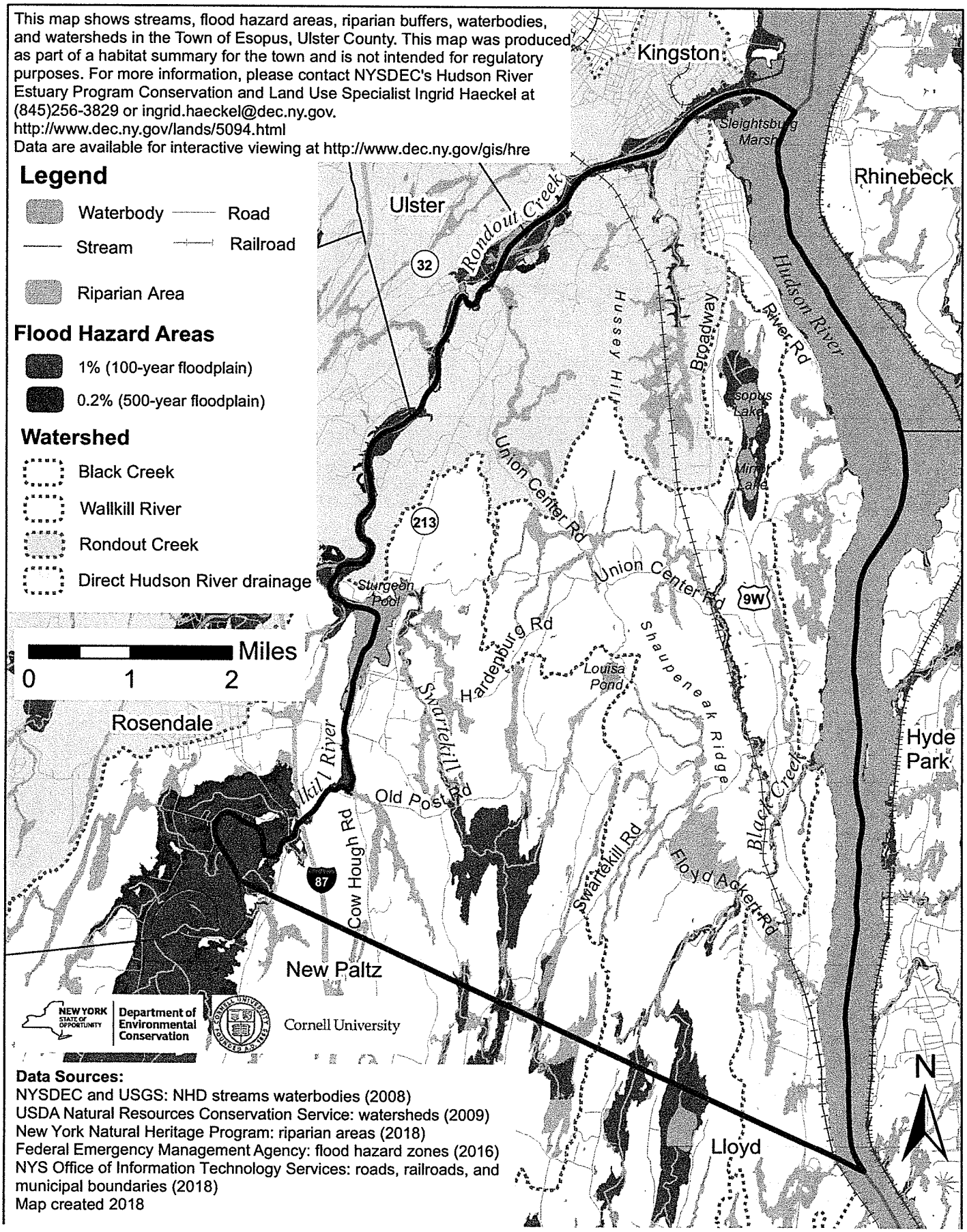


Figure 5: Wetlands in Esopus, NY

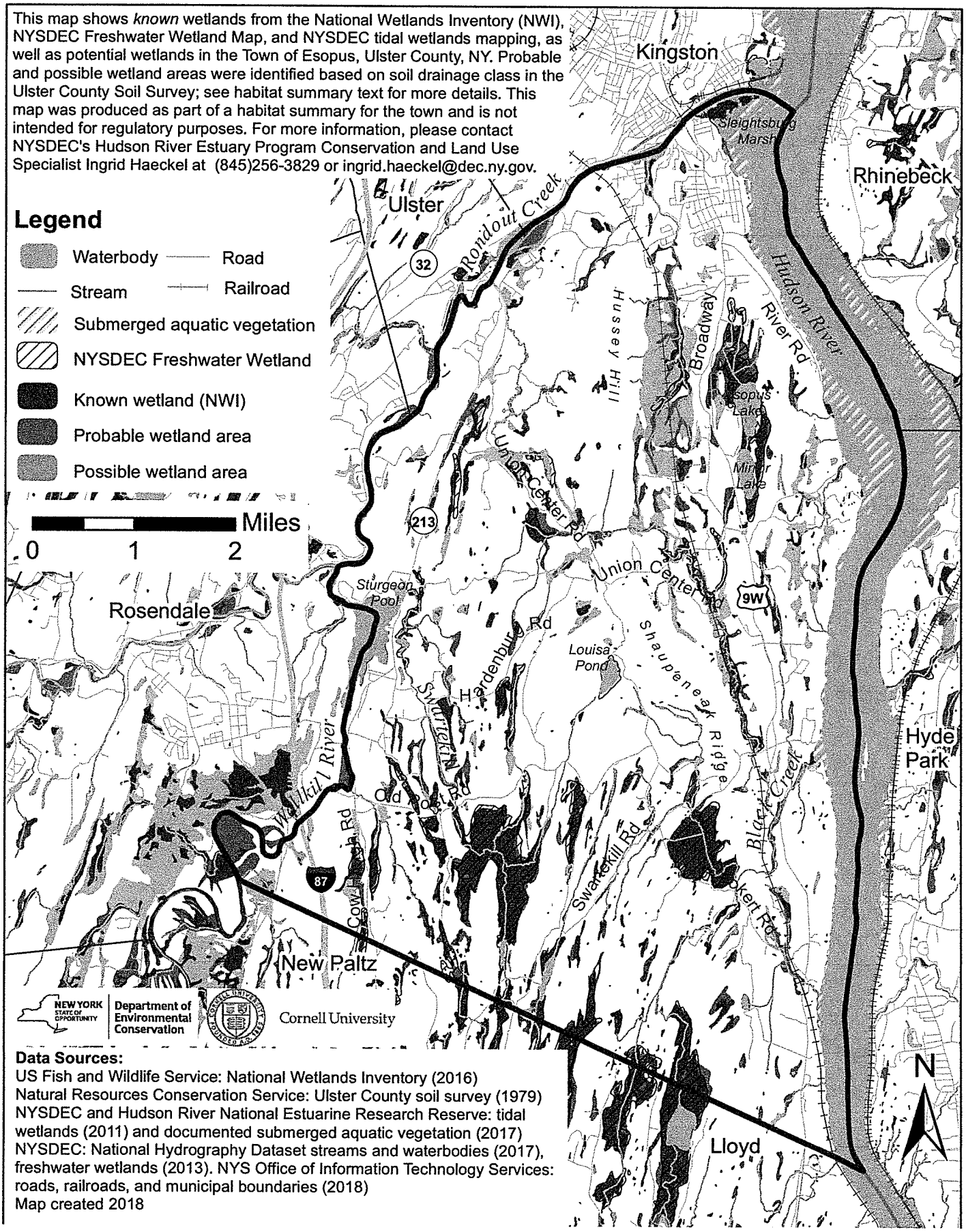
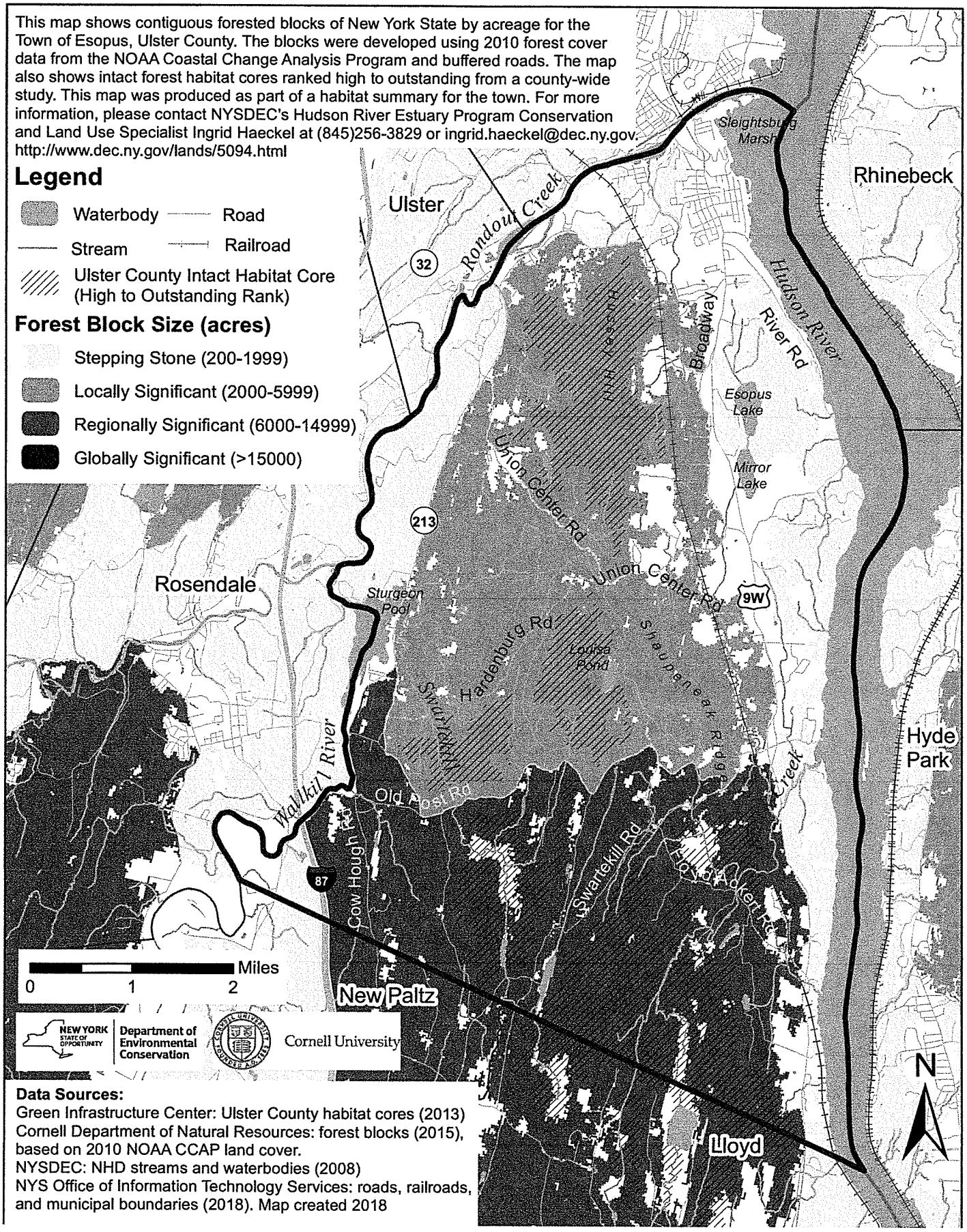


Figure 6: Large Forests in Esopus, NY



Data Sources:
Green Infrastructure Center: Ulster County habitat cores (2013)
Cornell Department of Natural Resources: forest blocks (2015), based on 2010 NOAA CCAP land cover.
NYSDEC: NHD streams and waterbodies (2008)
NYS Office of Information Technology Services: roads, railroads, and municipal boundaries (2018). Map created 2018

Species and Ecosystems of Conservation Concern in the Town of Esopus

Table 1. Species and Ecosystems of Conservation Concern in Esopus, NY

The following table lists species of conservation concern that have been recorded in Esopus, NY. The information comes from the New York Natural Heritage Program (NYNHP) biodiversity databases, the *1990-1999 New York Amphibian and Reptile Atlas* (NYARA), the *2000-2005 New York State Breeding Bird Atlas* (NYBBA), and survey records from Scenic Hudson, Inc. Species from the NYBBA are included in the table if they were documented in Atlas blocks that are more than 50% in Esopus. The table only includes species listed in New York as endangered (at the state (NYS) and/or federal (US) level), threatened, special concern, rare, Species of Greatest Conservation Need (SGCN), or a Hudson River Valley Priority Bird species recognized by Audubon New York. Historical records are provided from the NYNHP biodiversity databases. Generalized primary habitat types are provided for each species, but for conservation and planning purposes, it's important to recognize that many species utilize more than one kind of habitat. More information on rare animals, plants, and ecological communities can be found at http://guides.nynhp.org. **Note:** Additional rare species and habitats may occur in the Town of Esopus.

			NYS Conservation Status					
Common Name	**Scientific Name**	**General Habitat**	Hudson River Valley Priority Bird	Species of Greatest Conservation Need xx = high priority	Special Concern	Threatened	Endangered	**Data Source**
Mammals								
Indiana Bat	*Myotis sodalis*	cave, forest		xx			US NY	NYNHP
Northern Long-eared Bat	*Myotis septentrionalis*	cave, forest		xx		NY US		NYNHP
Birds								
Acadian Flycatcher	*Empidonax virescens*	forest	x					NYBBA
American Black Duck	*Anas rubripes*	wetlands	x	xx				NYBBA
American Goldfinch	*Spinus tristis*	young forest, shrubland	x					NYBBA
American Redstart	*Setophaga ruticilla*	forest	x					NYBBA
Bald Eagle	*Haliaeetus leucocephalus*	open water/ coastal	x	x		NY		NYNHP
Baltimore Oriole	*Icterus galbula*	forest	x					NYBBA
Barn Owl	*Tyto alba*	grassland	x	xx				NYBBA
Belted Kingfisher	*Megaceryle alcyon*	open water	x					NYBBA
Black-and-white Warbler	*Mniotilta varia*	forest	x					NYBBA
Black-billed Cuckoo	*Coccyzus erythropthalmus*	young forest, shrubland	x	x				NYBBA
Blue-Winged Warbler	*Vermivora pinus*	young forest, shrubland	x	x				NYBBA
Broad-winged Hawk	*Buteo platypterus*	forest	x					NYBBA

Common Name	Scientific Name	General Habitat	NYS Conservation Status					Data Source
			Hudson River Valley Priority Bird	Species of Greatest Conservation Need xx = high priority	Special Concern	Threatened	Endangered	
Chestnut-sided Warbler	*Setophaga pensylvanica*	young forest, shrubland	x					NYBBA
Chimney Swift	*Chaetura pelagica*	urban	x					NYBBA
Downy Woodpecker	*Picoides pubescens*	forest	x					NYBBA
Eastern Kingbird	*Tyrannus tyrannus*	young forest, shrubland	x					NYBBA
Eastern Towhee	*Pipilo erythrophthalmus*	young forest, shrubland	x					NYBBA
Eastern Wood-Pewee	*Contopus virens*	forest	x					NYBBA
Field Sparrow	*Spizella pusilla*	young forest, shrubland	x					NYBBA
Kentucky Warbler	*Geothlypis formosa*	forest	x	xx				NYNHP
Louisiana Waterthrush	*Seiurus motacilla*	forest	x	x				NYBBA
Northern Flicker	*Colaptes auratus*	forest	x					NYBBA
Northern Saw-whet Owl	*Aegolius acadicus*	forest	x					NYBBA
Prairie Warbler	*Dendroica discolor*	young forest, shrubland	x	x				NYBBA
Purple Martin	*Progne subis*	wetlands	x					NYBBA
Red-headed Woodpecker	*Melanerpes erythrocephalus*	forest	x	xx	x			NYBBA
Red-shouldered Hawk	*Buteo lineatus*	forest	x	x	x			NYBBA
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	forest	x					NYBBA
Ruffed Grouse	*Bonasa umbellus*	young forest, shrubland	x	x				NYBBA
Scarlet Tanager	*Piranga olivacea*	forest	x	x				NYBBA
Sharp-shinned Hawk	*Accipter striatus*	forest	x	x	x			NYBBA
Veery	*Catharus fuscescens*	forest	x					NYBBA
Willow Flycatcher	*Empidonax trailli*	young forest, shrubland	x					NYBBA
Wood Thrush	*Hylocichla mustelina*	forest	x	x				NYBBA
Worm-eating Warbler	*Helmitheros vermivorum*	forest	x	x				NYBBA
Yellow-billed Cuckoo	*Coccyzus americanus*	young forest, shrubland	x					NYBBA
Yellow-throated Vireo	*Vireo flavifrons*	forest	x					NYBBA

Reptiles

Common Name	Scientific Name	General Habitat	NYS Conservation Status					Data Source
			Hudson River Valley Priority Bird	Species of Greatest Conservation Need xx = high priority	Special Concern	Threatened	Endangered	
Common Snapping Turtle	*Chelydra s. serpentina*	wetlands, coastal		x				NYARA
Northern Map Turtle	*Graptemys geographica*	coastal		x				NYARA
Stinkpot	*Sternotherus odoratus*	wetlands, stream		xx				NYARA
Wood Turtle	*Clemmys insculpta*	stream		xx	x			NYARA
Amphibians								
Four-toed Salamander	*Hemidactylium scutatum*	wetlands		xx				NYARA
Jefferson Salamander Complex	*Ambystoma jeffersonianum x laterale*	vernal pool, forest			x			Scenic Hudson
Marbled Salamander	*Ambystoma opacum*	vernal pool, forest		x	x			NYARA
Northern Cricket Frog	*Acris crepitans*	wetlands		xx			NY	NYARA
Fish								
Alewife	*Alosa pseudoharengus*	coastal		x				NYSDEC
American Eel	*Anguilla rostrata*	stream		xx				NYSDEC
American Shad	*Alosa sapidissima*	coastal		xx				NYSDEC
Atlantic Sturgeon	*Acipenser oxyrinchus*	coastal		xx			US	NYNHP
Blueback Herring	*Alosa aestivalis*	coastal		x				NYSDEC
Shortnose Sturgeon	*Acipenser brevirostrum*	coastal		x			US, NY	NYNHP
Insects								
Comet Darner	*Anax longipes*	wetlands		x				NYNHP
Lyre-tipped Spreadwing	*Lestes unguiculatus*	wetlands, vernal pool		x				NYNHP
Plants								
Buttonbush Dodder	*Cuscuta cephalanthi*	wetlands					NY	NYNHP
Cat-tail Sedge	*Carex typhina*	wetlands					NY	NYNHP
Delmarva Beggar-ticks*	*Bidens bidentoides*	coastal						NYNHP
False Hop Sedge	*Carex lupuliformis*	wetlands				NY		NYNHP
Frank's Sedge	*Carex frankii*	coastal					NY	NYNHP

			NYS Conservation Status					
Common Name	**Scientific Name**	**General Habitat**	Hudson River Valley Priority Bird	Species of Greatest Conservation Need xx = high priority	Special Concern	Threatened	Endangered	**Data Source**
Globe-fruited Ludwigia	*Podilymbus podiceps*	wetlands				NY		NYNHP
Golden Club	*Orontium aquaticum*	coastal				NY		NYNHP
Large Twayblade	*Liparis liliifolia*	wetlands, forest					NY	NYNHP
Provancher's Fleabane	*Erigeron philadelphicus var. provancheri*	coastal					NY	NYNHP
Reflexed Sedge	*Carex retroflexa*	forest				NY		NYNHP
Side-oats Grama	*Bouteloua curtipendula var. curtipendula*	forest					NY	NYNHP
Spongy Arrowhead	*Sagittaria montevidensis ssp. spongiosa*	coastal				NY		NYNHP
Swamp Cottonwood	*Populus heterophylla*	wetlands				NY		NYNHP
Swamp Lousewort	*Pedicularis lanceolata*	wetlands				NY		NYNHP
Sweet Coltsfoot	*Petasites frigidus* var. *palmatus*	forest, wetlands					NY	NYNHP
*Rare plants in New York State								

Natural Communities								
Appalachian Oak-Hickory Forest								NYNHP
Calcareous Cliff Community								NYNHP
Dwarf shrub bog								NYNHP
Freshwater Intertidal Shore								NYNHP
Freshwater Tidal Marsh								NYNHP
Hemlock-Northern Hardwood Forest								NYNHP
Limestone Woodland								NYNHP
Maple-Basswood Rich Mesic Forest								NYNHP
Red maple-hardwood swamp								NYNHP
Tidal River								NYNHP
Vernal Pool								NYNHP

Common Name	Scientific Name	General Habitat	NYS Conservation Status					Data Source
			Hudson River Valley Priority Bird	Species of Greatest Conservation Need xx = high priority	Special Concern	Threatened	Endangered	
Historical Records								
Least Bittern	*Ixobrychus exilis*	wetlands	x	x		NY		NYNHP
Pied-billed Grebe	*Podilymbus podiceps*	wetlands	x	x		NY		NYNHP
American Bumble Bee	*Bombus (Thoracobombus) pensylvanicus*			xx				NYNHP
American Waterwort	*Elatine americana*	coastal					NY	NYNHP
Angled Spike Rush	*Eleocharis quadrangulata*	wetlands					NY	NYNHP
Cut-leaved Evening Primrose	*Oenothera laciniata*	grasslands					NY	NYNHP
Douglas' Knotweed	*Polygonum douglasii*	forest, rocky uplands				NY		NYNHP
Estuary Hatpins	*Eriocaulon parkeri*	coastal						NYNHP
Fernald's Sedge	*Carex merritt-fernaldii*	forest, rocky uplands				NY		NYNHP
Heart-leaved Plantain*	*Plantago cordata*	coastal						NYNHP
Hudson River Water Nymph	*Najas muenscheri*	coastal					NY	NYNHP
Northern Quillwort	*Isoetes septentrionalis*	wetlands					NY	NYNHP
Puttyroot	*Aplectrum hyemale*	forest					NY	NYNHP
*Rare plants in New York State								

General Conservation Measures for Protecting Natural Areas and Wildlife

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- **Protect large, contiguous, unaltered tracts** wherever possible.
- **Preserve links** between natural habitats on adjacent properties.
- **Preserve natural disturbance processes**, such as fires, floods, tidal flushing, seasonal drawdowns, landslides, and wind exposures wherever possible. Discourage development that would interfere with these processes.
- **Restore and maintain broad buffer zones** of natural vegetation along streams, along shores of other water bodies and wetlands, and at the perimeter of other sensitive habitats.
- In general, **encourage development of altered land** instead of unaltered land wherever possible.
- **Promote redevelopment of brownfields**, other post-industrial sites, and other previously-altered sites (such as mined lands), "infill" development, and "adaptive re-use" of existing structures wherever possible, instead of breaking new ground in unaltered areas.
- **Encourage pedestrian-centered developments** that enhance existing neighborhoods, instead of isolated developments requiring new roads or expanded vehicle use.
- **Concentrate development along existing roads**; discourage construction of new roads in undeveloped areas. Promote clustered development wherever appropriate, to maximize extent of unaltered land.
- **Direct human uses toward the least sensitive areas**, and minimize alteration of natural features, including vegetation, soils, bedrock, and waterways.
- **Preserve farmland potential** wherever possible.
- **Minimize area of impervious surfaces** (roads, parking lots, sidewalks, driveways, roof surfaces) and maximize onsite runoff retention and infiltration to help protect groundwater recharge, and surface water quality and flows.
- **Restore degraded habitats wherever possible**, but do not use restoration projects as a "license" to destroy existing habitats.

Source: Kiviat, E. & G. Stevens. 2001. Biodiversity Assessment Manual for the Hudson River Estuary Corridor. NYS Department of Environmental Conservation, Albany, NY.

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