

Appendix B: Natural Areas and Wildlife in New Paltz

NATURAL AREAS AND WILDLIFE IN YOUR COMMUNITY

A Habitat Summary Prepared for New Paltz

This summary was completed in November 2019 to provide information for land-use planning and decision-making as requested by the Town of New Paltz. It identifies significant ecosystems in the Town and Village, including streams, forests, wetlands, grasslands 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).



Photo Credit: Nate Nardi-Cyrus

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

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).

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 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

Nate Nardi-Cyrus

Conservation and Land Use Specialist

New York State Department of
Environmental Conservation

21 South Putt Corners Rd, New Paltz, NY 12561
845-256-3062 | nate.nardi-cyrus@dec.ny.gov



Cornell University



Department of
Environmental
Conservation

Table of Contents

■ Introduction.....	3
Summary Content.....	3
How to use this summary	4
Limitations of Maps in this Summary	4
How to find more information.....	4
Conservation.....	5
■ Important Habitats in New Paltz.....	6
Regional Context (Figure 1)	6
Significant Biodiversity Areas.....	6
Matrix Forest Blocks and Linkage Zones.....	6
Significant Ecological Features (Figure 2)	6
Northern Shawangunk Mountains Important Bird Area	6
Northern Wallkill Biodiversity Areas.	7
Significant Natural Communities.....	7
Known Important Areas for Rare Animals.....	7
Stream Habitat for Migratory Fishes.	9
Wetlands (Figure 3)	9
Streams and Floodplains (Figure 4)	10
Large Forests (Figure 5)	12
Grasslands, Shrublands, and Young Forests (Figure 6)	13
■ General Conservation Measures	21
■ Species and Ecosystems of Conservation Concern in New Paltz	22
■ References.....	29

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.

Summary Content

This summary includes complementary text, maps, and tables. The [Habitat Summary text](#) describes what is known about the New Paltz's important natural areas and habitats based on information in databases of the New York State Department of Environmental Conservation (DEC), the New York Natural Heritage Program (NYNHP), the Mohonk Preserve and other available local sources. 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 and Village of New Paltz, which follow the text headings:

[Figure 1: Regional Context](#) of New Paltz, NY

[Figure 2: Significant Ecological Features](#) in New Paltz, NY

[Figure 3: Wetlands](#) in New Paltz, NY

[Figure 4: Streams and Watersheds](#) in New Paltz, NY

[Figure 5: Large Forests](#) in New Paltz, NY

[Figure 6: Agricultural Habitats](#) in New Paltz, NY

Following the maps, [Table 1](#) lists known **Species and Ecosystems of Conservation Concern** that have been recorded for New Paltz, 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 (DEC 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 (Audubon NY 2009).

*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

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. 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 most

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 New Paltz 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.

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.

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 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. Other data was obtained from local studies conducted by the John Burroughs Natural History Society, Mohonk Preserve, Hudsonia, and the Metropolitan Conservation Alliance. Local studies, maps, plans, and knowledgeable residents 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 Nate Nardi-Cyrus, 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 New Paltz's 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 Nate Nardi-Cyrus.

Important Habitats in New Paltz

Regional Context (Figure 1)

The first step to understanding the natural areas and habitats of New Paltz is to consider how the Town and Village relate to their surrounding area. All land in New Paltz ultimately drains to the Hudson River Estuary. A small portion of the Town, along the Shawangunk Ridge, is within the Rondout Creek Watershed. The remaining land drains into the Walkkill River via the Lower Walkkill River and Shawangunk Kill watersheds.

*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

Significant Biodiversity Areas. The western quarter of New Paltz is within the Shawangunk Ridge Significant Biodiversity Area (SBA), a priority designation made by the DEC Hudson River Estuary Program (Penhollow et al. 2006):

“The Shawangunk Ridge contains an unusual diversity of plant communities and a high diversity of associated plant and animal species. The high diversity in the area is due in part to the wide range of topography and substrate. The area contains communities that range from wetland to ridgetop, slope, and cliff. The forest habitats are important as a migration corridor for raptors, other migratory birds, and wide-ranging mammals.”

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).

Along the eastern boundary of the Town lies 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.

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 occupies a portion of the northeast corner of New Paltz 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. In New Paltz, the Shaupeneak matrix forest block is linked to the Northern Gunks matrix forest block via the forested northern and western sections of Town. These attributes are discussed further in the [Large Forests](#) section.

Significant Ecological Features (Figure 2)

Figure 2 shows the major ecological features known to occur in New Paltz, including Audubon Important Bird Areas, the Northern Walkkill Biodiversity Areas, known stream habitat for migratory fishes, known important areas for rare animals and bats, and significant natural communities. Note that Figure 2 and the corresponding descriptions below are based on limited existing information. Many of the overlapping layers in the map may be viewed in greater detail using the [Hudson Valley Natural Resource Mapper](#).

Northern Shawangunk Mountains Important Bird Area. Audubon New York has identified a portion of the Shawangunk Ridge as an area of statewide importance for priority bird species. The IBA extends from just south of the hamlet of Cragsmoor to the headwaters of the Kleine Kill in New Paltz. An [ornithological](#)

[summary](#) from Audubon states that this area is an “exceptional example of a characteristic higher elevation forest bird community with particularly good representation of a pine woods community.” The summary recommends encouraging fire within the landscape, minimizing adjacent forest fragmentation, and managing recreational use within preserved portions of the IBA.

Northern Wallkill Biodiversity Areas. The Metropolitan Conservation Alliance (MCA) Northern Wallkill Biodiversity Plan (LaBruna and Klemens 2007) identified a mostly interconnected network of core habitat in the towns of New Paltz and Lloyd. Biodiversity areas within New Paltz are mostly situated to the west and north of the Village, but also include locations along the Swarte Kill, in the eastern portion of Town. The plan identifies priority species within these areas and bases their importance on documented sensitivity to development. Priority species include grassland breeding birds, amphibians and reptiles, and wetland specialists (See [Table 1](#)).

Significant Natural Communities. Four exemplary natural community types have been mapped in New Paltz by NYNHP including upland forests, forested floodplains, and vernal pools. NYNHP describes the complex of [chestnut oak forest](#) atop the Shawangunk Ridge as “a very large, diverse matrix-forming forest in good to excellent condition within an excellent landscape context. It has a high diversity of physiognomy and species with very low cover of exotic species.” Adjacent [hemlock-northern hardwood forest](#) occurs within the Chestnut Oak Forest matrix in ravines and other more mesic environments. One high quality [vernal pool](#) is documented on the Shawangunk Ridge and several more have been mapped by Mohonk Preserve staff but do not appear on Figure 2 (M. Napoli, personal communication, 2017). [Floodplain forest](#) occurs in small patches along the Wallkill River, surrounded by agricultural fields and low-density residential development. NYNHP recommends the restoration of adjacent lands to increase the size and ecological function of existing forest patches. Other significant natural communities identified within the town, but not mapped, can be found in [Table 1](#).

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 New Paltz.

Known Important Areas for Rare Animals. The New York Natural Heritage Program (NYNHP) has identified areas of importance for sustaining populations of rare animals, including rare bats, 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 New Paltz for bald eagle, diadromous fishes, eastern box turtle, Indiana bat, northern cricket frog, northern long-eared bat, peregrine falcon, pied-billed grebe, red-headed woodpecker, sedge wren, tawney emperor, timber rattlesnake, and wood turtle. A complete list of state rare plants and animals known from New Paltz is shown in [Table 1](#).

Bald eagle (NY-Threatened, SGCN) nesting has been documented in New Paltz along 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.

Diadromous fish refer to species that migrate between the sea and freshwater. American Eel (High Priority SGCN) is a diadromous fish of the Wallkill River and is discussed further in the following sections.

Eastern box turtle (NY-Special Concern, High Priority SGCN) occurs primarily in well-drained and open deciduous forests, but may also be found in field edges, shrublands, marshes, bogs, and along stream banks. New Paltz is near the northern limit of eastern box turtle's natural range, an area that is particularly important for stewardship as climate changes and suitable habitat shifts north. Box turtles are threatened by habitat loss and fragmentation, vehicle strikes, and the pet trade.

Northern long-eared bat (US and NY-Threatened, High Priority SGCN) and other rare bat species have been documented in New Paltz. The Rosendale Limestone Cave Complex SBA (about 2.5 miles north of New Paltz), hosts one of the top 10 overwintering sites in the U.S. for the federally endangered Indiana bat (Penhollow et al. 2006). In the summer, bats often use forested areas for shelter and to forage for insect prey. Female bats roost in trees and snags in maternity colonies to raise their young each summer; some restrictions protect threatened bat species from tree-cutting, especially during the period when mothers are birthing and raising pups.

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 one location of the Wetlands and Ridges SBA in New Paltz since 2010.

Peregrine falcon (NY- Endangered, SGCN) was extirpated from the state in the 1960s by DDT and PCB poisoning but has been steadily recovering since 1983. Peregrine Falcons have been documented nesting on the cliffs of the Shawangunk Ridge. Threats include habitat disturbance and loss, human recreation near nests, nest poaching, shooting by hunters, and effects of contamination.

Pied-billed grebe (NY-Threatened, SGCN) is a wetland bird with a preference for large wetland complexes including extensive marsh and open water habitat. Nesting by these species has been documented in Humpo Marsh, a large emergent wetland to the east of the Shawangunk Ridge. They are threatened by continued wetland loss in the Hudson Valley and by habitat degradation due to fragmentation, exotic plant invasions, and nutrient enrichment in wetlands.

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 wetlands adjacent to the Walkill River and in the northeastern corner of the Town. Dead trees with cavities provide nesting habitat and should be preserved where feasible.

Sedge wren (NY-Threatened, High Priority SGCN) is a wetland bird occurring in wet meadows with dense, tall grass and sedge clumps or hummocks. A nesting sedge wren was documented in a wet meadow close to the village in 2004. The species is threatened by habitat loss including draining wetlands for development and agriculture.

Timber rattlesnake (NY-Threatened, High Priority SGCN) inhabits mountainous or hilly forests, often with rock outcroppings, steep ledges, and rock slides. They migrate widely from their dens in summer to forage in the forest surrounding den sites. Extensive forest, ledges, and rocky barrens of the Shawangunk Ridge provides high quality habitat for timber rattlesnakes. Timber rattlesnakes are threatened due to habitat loss and fragmentation, illegal collecting, and malicious killing.

Wood turtle (NY-Special Concern, High Priority SGCN) occurs along low gradient streams and adjacent forested and open uplands in New Paltz. Wood Turtles are threatened by habitat loss, stream degradation, vehicle strikes, 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 New Paltz.

Stream Habitat for Migratory Fishes. New Paltz’s main Hudson River tributary provides important stream habitat for American eel, which occurs along the full length of the Walkill River in the Town. American eel is a fish species that begins life in the Atlantic Ocean and migrates to the headwaters of North American tributary streams as tiny "glass eels". This species 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. See the [Streams and Watersheds](#) section, below, for additional information on stream habitat in New Paltz.

Wetlands (Figure 3)

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 adjacent to the Hudson River. 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 recreational 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 the conservation of this critical part of our life support system. Although Figure 3 provides the approximate location and extent of wetlands, this map is inherently inaccurate and not a substitute for site visits and on-the-ground delineation. Nonetheless, towns can use this map as a starting point for inventorying local wetlands and can supplement it with more refined data as they become available.

In Figure 3, “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 are symbolized in blue as “waterbodies.” 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 (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. NWI data, NYS freshwater wetland maps, and wetlands soils can be viewed using the [Hudson Valley Natural Resource Mapper](#).

The Esopus/Lloyd Wetlands and Ridges SBA (see Figure 1) 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. At least one population of the NY-Endangered [northern cricket frog](#) persists in this area of New Paltz, relying on

calcareous vegetated wetlands as well as the intervening upland forest areas for overwintering. Ongoing research is still documenting the northern cricket frog's 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.

There are significant concentrations of identified and potential wetlands within the floodplains of the Walkkill River, Swarte Kill and their associated tributaries. MCA identified box turtles, wood turtles, and spotted turtles utilizing these wetlands during at least part of their lifecycle (LaBruna and Klemens 2007). Wetlands associated with floodplains are known to have other positive benefits including mitigating flooding and enhancing water quality (see [Streams and Watersheds](#) for more information).

Numerous [vernal pools](#) are embedded within forested areas of New Paltz. Vernal pools are small, isolated wetlands that are often dry in summer. They provide habitat for many animals, including forest amphibians documented in New Paltz such as wood frog and NY-Special Concern marbled salamander. 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 New Paltz, 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.

A variety of other High Priority SGCN are known to occur in New Paltz's wetlands and are listed in [Table 1](#), including [red-headed woodpecker](#), [pied-billed grebe](#), and four-toed salamander, among others. The NY-Endangered southern dodder and a variety of other rare wetland plants are also listed in [Table 1](#).

Streams and Watersheds ([Figure 4](#))

[Streams](#), their floodplains, adjacent wetlands, and other "riparian" or streamside habitats that occur along their channels 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).

Figure 4 shows streams, waterbodies, watersheds, floodplains, and riparian buffers. 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.

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.

Visiting sites and creating more accurate maps are methods to pursue to ensure that intermittent streams are identified and considered during planning processes.

While DEC classifies the Walkkill mainstem as ‘impaired,’ due to excess nutrients, the Kleine Kill and other tributaries are notably cleaner and support a higher diversity of aquatic life. Biologists from the Mohonk Preserve have identified Brook Trout populations within the headwater streams of the Kleine Kill watershed. In addition to important habitat for fishes, including American eel (see [Figure 2](#)), streams in New Paltz provide important habitat areas for NY-Special Concern wood turtle and the arrowhead spiketail, a rare dragonfly.

Although the Walkkill and its tributaries have been negatively impacted by human disturbance, recent DEC and local efforts are focused on improving its health. Since 2015, the [Walkkill River Watershed Alliance](#) has been actively working to restore the Walkkill 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 [Walkkill River Watershed Conservation and Management Plan](#) (2007), which continues to serve as a valuable reference. The DEC and local partners have recently begun long-term water quality monitoring of the Walkkill and Mill Brook in order to evaluate the success of water quality improvement efforts.

Effective stream conservation and restoration occurs beyond stream channels and banks. Figure 4 shows riparian buffer zones, which were developed by the New York Natural Heritage Program (Conley et. al. 2018) using the Riparian Buffer Delineation Model (Abood et al. 2012). The riparian buffers 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 buffer zones were mapped around streams based on digital elevation data, known wetlands, and modeling for the 50-year flood zone. They overlap with FEMA floodplain data in the map and are 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. Nevertheless, they can provide a starting point to inform land use strategies and stream protection efforts. The Hudson River Estuary Program’s “[Trees for Tribes](#)” 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 the space streams need to expand, contract, and sometimes change course, and they promote groundwater recharge (See [Figure 2](#) for more information on the Walkkill River’s Floodplain Forests). 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 the Walkkill River and the 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.*

Large Forests (Figure 5)

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 blocks along a stream helps maintain water quality while creating a wildlife travel corridor. Conserving New Paltz's large forest areas and connections between them will help sustain the rich diversity of forest plants and animals and the numerous other benefits that forests provide residents.

Figure 5 shows large forest blocks in New Paltz. 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 blocks 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).

New Paltz is situated between two significant forested areas; the Shawangunk Ridge SBA to the west and the Esopus/Lloyd Wetlands and Ridges SBA to the east. While large areas of forest have been conserved along the Shawangunk Ridge, most of the forest land in New Paltz remains unprotected. There are opportunities to support and promote forest stewardship and to guide future land use in ways that maintain large forest tracts and minimize impacts to interior forest habitat.

The largest area of contiguous forest in New Paltz consists of two adjacent blocks, separated by County Route 6 (Mountain Rest Road) and situated atop the Shawangunk Ridge. Separately these two forest blocks are classified as "Regionally Significant" but, when combined, they constitute a much larger forested landscape (nearly 22,000 acres). Regionally significant forests provide habitat to many area-sensitive species and they can accommodate the large-scale disturbances that maintain forest health over time. Smaller blocks are often less able to maintain the entire range of needed habitats and successional stages after large-scale disturbances (Orange County Planning Department 2004). Large forests also support breeding populations of forest-interior species, including numerous forest songbirds, raptors, and far-ranging animals like black bear, timber rattlesnake, fisher, and bobcat. The Shawangunk Ridge forests are also significant because they are adjacent to a globally significant forest block to the south and have been identified by TNC as a Forest Linkage Zone, connecting the Shaupeneak and Northern Gunks Matrix Forest Blocks (see [Figure 1](#)). 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.

Another similarly large forest is within the Esopus/Lloyd Wetlands and Ridges SBA, an area designated, in part, because its forests harbor rare amphibian species. This forest is also mapped as "Regionally Significant" and has been identified by TNC as the Shaupeneak Matrix Forest Block because of its large size and limited fragmentation (See [Figure 2](#)).

Forest fragmentation is the process of breaking large blocks 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 blocks, often displacing sensitive species that depend on interior forest.

The remaining forest within New Paltz is classified as “stepping stone” forest blocks. 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, and can result in the introduction of invasive species, increased predation levels, and micro-climatic differences. The stepping stone forest blocks between Clearwater Road, Route 87 (NYS Thruway), Shivertown Road and the Wallkill River are part of the TNC Forest Linkage Zone between the two above identified forest areas (see [Figure 1](#)). Protection of these forests is crucial in maintaining connectivity between the above identified regionally important forest blocks. 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 5 also shows “Medium” 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 New Paltz. The habitat cores were identified through a study by the Green Infrastructure Center (Firehock 2013) in collaboration with Ulster County and DEC 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.

Available wildlife records confirm the presence of high-quality forest habitat in New Paltz. 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 New Paltz: red-shouldered hawk and sharp-shinned hawk. Audubon New York's website has specific information on [managing habitat for forest birds](#). New Paltz's forests also provide important summer foraging habitat for NY-Threatened [northern long-eared bat](#) and two NY-Species of Greatest Conservation Need ([tri-colored bat](#) and [little brown bat](#)). Rare forest forest plants have been documented in New Paltz including the NY-Endangered [downy wood mint](#); see [Table 1](#) for a complete list.

One of the greatest threats to forests in New Paltz today is the introduction of tree diseases, forest pests, and other invasive species inadvertently introduced by people through landscaping and international commerce. Hemlock woolly adelgid and emerald ash borer have already done much damage in New Paltz and are expected to eventually kill most of these now common trees in the region. The southern pine beetle, a recent arrival that threatens ridgetop pitch pine communities, has been recently documented in nearby Minnewaska State Park. The [Lower Hudson Partnership for Regional Invasive Species Management](#) (LH 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.

Agricultural Habitats ([Figure 6](#))

Farmland, both active and recently abandoned, encompasses many different unique habitats including meadows, grasslands, shrublands, and young forest. New York State has lost more than half a million acres of these habitats since the 1980s, much of that area converted to development (American Farmland Trust 2019). These regularly overlooked habitat types are transitional and relatively short-lived, typically requiring periodic natural disturbance or maintenance to avoid becoming mature forest. We can infer from aerial photography, local biological assessments, and breeding bird records that valuable grasslands, shrublands, and young forests occur in New Paltz (see [Table 1](#)).

Figure 6 shows patches of open habitat greater than 10 acres in New Paltz. The map was created using 2016 land cover data developed for the National Land Cover Database at a 30-meter pixel resolution. Land cover categories include shrub/scrub, grasslands/herbaceous, pasture/hay and cultivated crops. Areas adjacent to roads were not excluded from this analysis, however, these edge habitats can have detrimental effects on grassland bird breeding success and raptor prey populations (Strong et. al. 2014). Clusters of adjacent fragmented patches, regardless of their size, can offer many of the benefits of larger contiguous patches. Figure 6 does not specify current land use or the quality of those habitats for priority species. While the mapped patches might not all be high quality agricultural habitat, they indicate opportunities for protection or restoration that might benefit grassland, shrubland, and young forest dependent species.

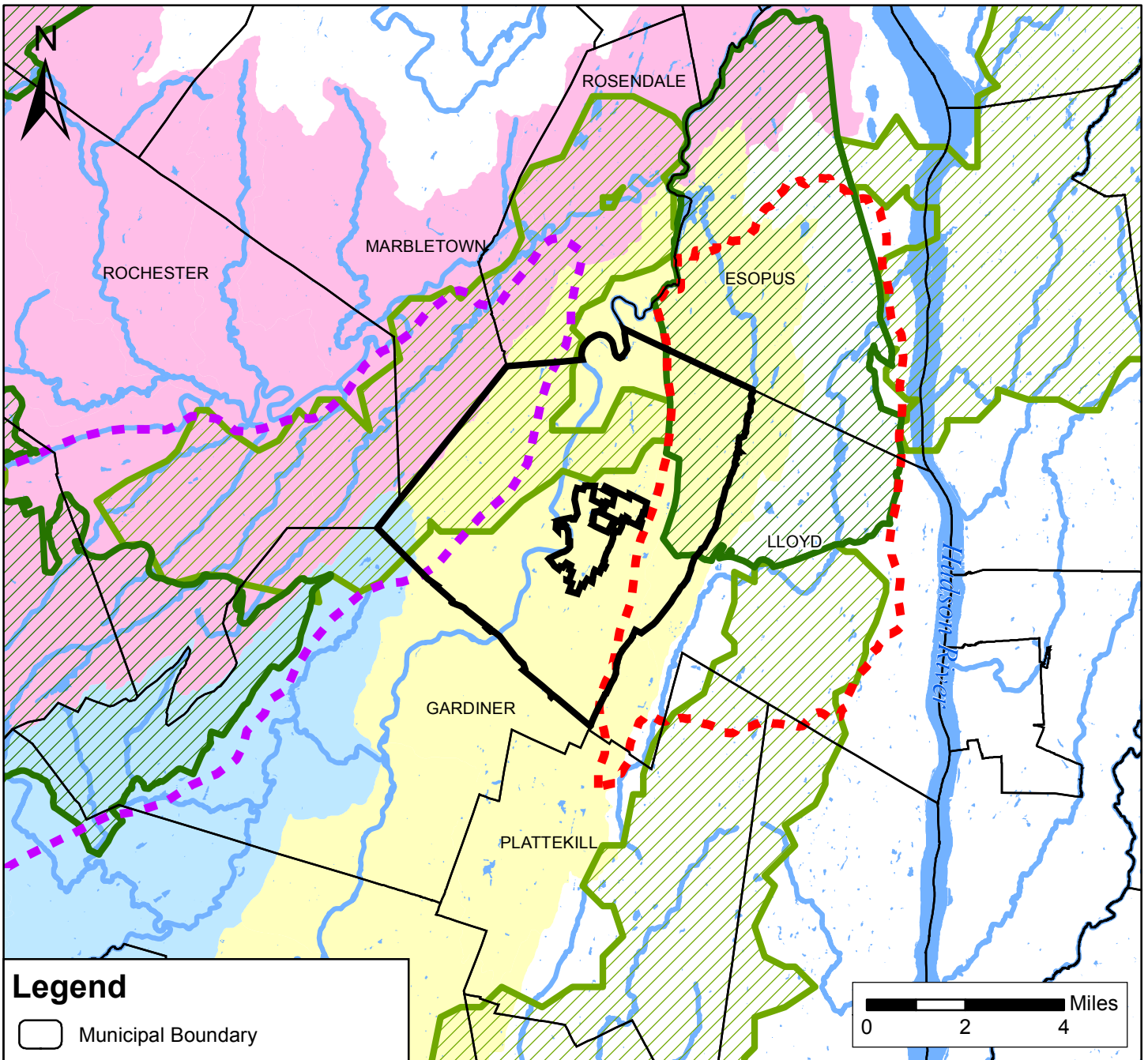
Grassland and meadow habitat can support a variety of life, including rare plants, butterflies, reptiles, and birds, in addition to providing agricultural uses and scenic values. The quantity and quality of grasslands for wildlife have rapidly decreased in the Northeast during the last century due to 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.

The [2000-2005 NYS Breeding Bird Atlas](#) documented many priority grassland birds, including NYS-Threatened sedge wren and Species of Greatest Conservation Need – High Priority bobolink, breeding in these open habitats. Other notable observations include species who aren't necessarily breeding but who use grasslands during another part of their life history. Examples include winter foraging by northern harrier (NY-Threatened) and summer foraging and possible breeding by NY- Special Concern vesper sparrow. Non-avian priority species that use both open habitats and associated forests and wetlands include NY-Species of Greatest Conservation Need Fowler's toad and NY-Threatened purple milkweed.

Many of the largest patches of grassland habitat are protected, especially those located adjacent to the Shawangunk Ridge. These patches are at the northern edge of a mostly contiguous successional landscape that includes the Shawangunk Grasslands National Wildlife Refuge, a critical resource for grassland dependent species. Much of the remaining open habitat in New Paltz is along the Wallkill River and in eastern portions of town where it is in active agricultural cultivation (e.g. row crops, livestock and orchards). Many of the largest agricultural patches, west of the Wallkill River, were identified in the Northern Wallkill Biodiversity Plan and are noted on Figure 6 as Grassland Biodiversity Areas. Grassland breeding birds respond to habitat structure rather than species composition, so even hayfields dominated by non-native grasses can provide suitable habitat for species of conservation concern if they are managed appropriately. 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 various surveys support the presence of 19 species of conservation concern including 5 species of warbler and reptiles including NY-Species of Greatest Conservation Need northern black racer and NY-Special Concern eastern box turtle (see [Table 1](#)). For more information, see Audubon's guidance on [managing habitat for shrubland birds](#).

Figure 1: Regional Context of New Paltz, NY



Legend

Municipal Boundary

Stream

Waterbody

Matrix Forest Block

Forest Linkage Zone

Significant Biodiversity Areas

Esopus/Lloyd Wetlands and Ridges

Shawangunk Ridge

Watershed

Lower Roundout Creek

Shawangunk Kill

Lower Wallkill River

This map shows the location of New Paltz, Ulster County, NY in relation to its major watersheds, matrix forests and linkages and significant biodiversity areas. This map was produced as part of a habitat summary for New Paltz. For more information, please contact NYSDEC's Hudson River Estuary Program Conservation and Land Use Specialist Nate Nardi-Cyrus at (845)256-3062 or at nate.nardi-cyrus@dec.ny.gov. <http://www.dec.ny.gov/lands/5094.html>

Data also available for interactive viewing at www.dec.ny.gov/lands/112137.html

Data Sources:

NYS Office of Information Technology Services: municipal boundaries (2018) - NYSDEC: NHD streams and waterbodies (2008) & significant biodiversity areas (2006) - USDA Natural Resources Conservation Service: watersheds (2009), The Nature Conservancy and NYNHP: Matrix forests and linkages (2005).

Map created 2019.

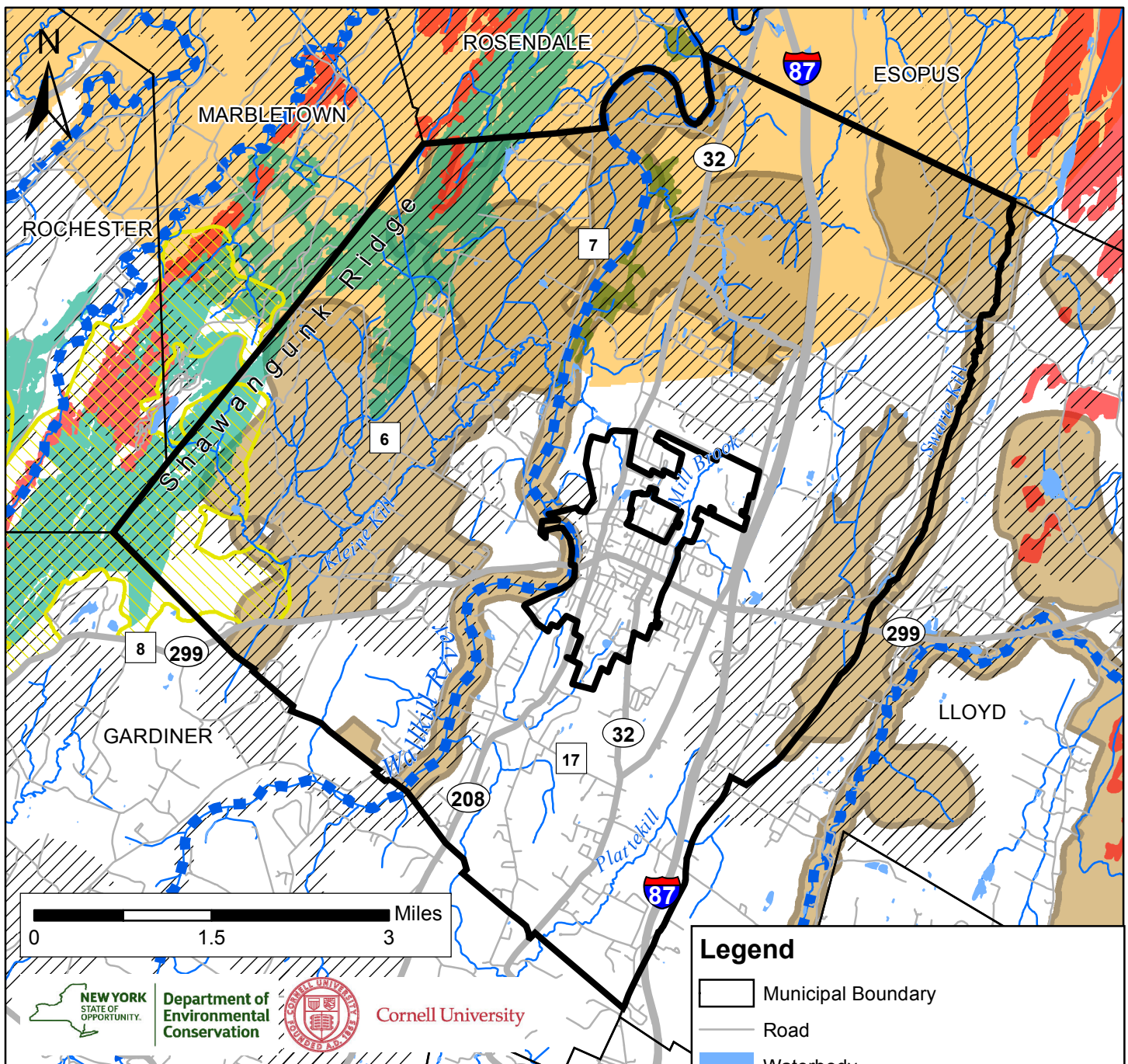


Department of Environmental Conservation



Cornell University

Figure 2: Significant Ecological Features in New Paltz, NY



This map shows the most important known ecological features in New Paltz, Ulster County, NY, based on limited information. This map was produced as part of a habitat summary for New Paltz. For more information, please contact NYSDEC's Hudson River Estuary Program Conservation and Land Use Specialist Nate Nardi-Cyrus at (845)256-3026 or at nate.nardi-cyrus@dec.ny.gov. <http://www.dec.ny.gov/lands/5094.html>

Data also available for interactive viewing at www.dec.ny.gov/lands/112137.html

Data Sources:

New York Natural Heritage Program (NYNHP): Known important areas (2018), Stream habitat for migratory fishes (2011), Significant natural communities (2019), NYSDEC: National Hydrography Dataset streams and waterbodies (2017) NYS Office of Information Technology Services: Roads and municipal boundaries (2018), Metropolitan Conservation Alliance: Northern Walkill Biodiversity Areas (2007), Audubon: Important Bird Areas (2002).

Map created 2019.

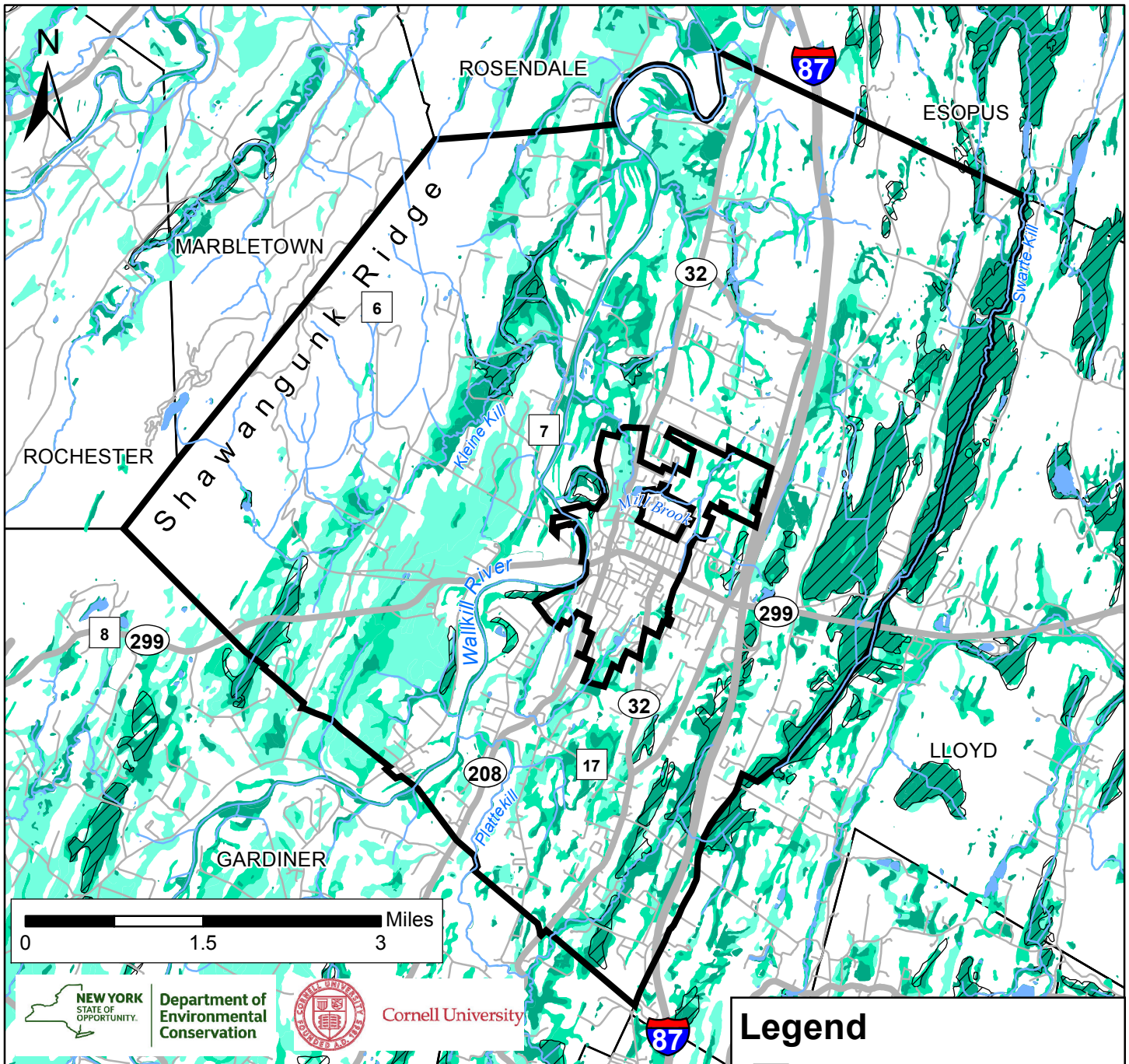
Legend

- Municipal Boundary
- Road
- Waterbody
- Stream
- Northern Walkill Biodiversity Area
- Audubon Important Bird Area
- Known Stream Habitat for American Eel
- Known Important Area for Rare Bats
- Known Important Area for Rare Animals

Significant Natural Communities

- Chestnut oak forest
- Floodplain forest
- Hemlock-northern hardwood forest

Figure 3: Wetlands in New Paltz, NY



Legend

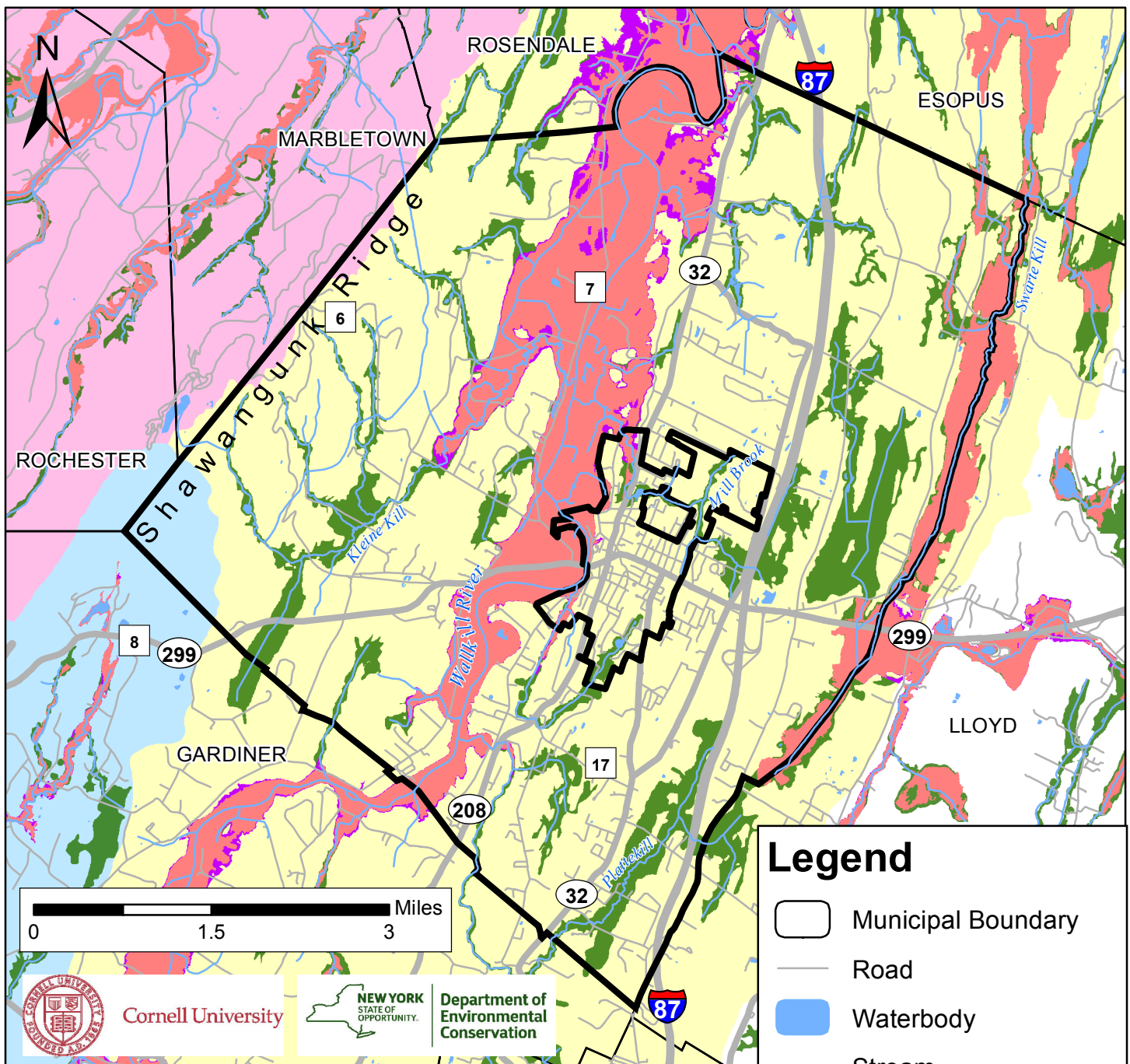
- Municipal Boundary
- Road
- Waterbody
- Stream
- NYSDEC Freshwater Wetland
- Known wetland (NWI)
- Probable wetland areas
- Possible wetland areas

This map shows known wetlands from the National Wetlands Inventory (NWI), NYSDEC Freshwater Wetland Map, as well as potential wetlands in New Paltz, Ulster County, NY. Probable and possible wetland areas were identified based on soil drainage class in the Ulster County Soil Survey; see habitat summary text for more details. This map was produced as part of a habitat summary for New Paltz. For more information, please contact NYSDEC's Hudson River Estuary Program Conservation and Land Use Specialist Nate Nardi-Cyrus at (845)256-3026 or at nate.nardi-cyrus@dec.ny.gov. <http://www.dec.ny.gov/lands/5094.html>
 Data also available for interactive viewing at www.dec.ny.gov/lands/112137.html

Data Sources:
 NYS Office of Information Technology Services: Roads and municipal boundaries (2018), NYSDEC: NHD streams and waterbodies (2008), US Fish and Wildlife Service: National Wetlands Inventory (2016), Natural Resource Conservation Service: Ulster County soil maps (current).

Map created 2019.

Figure 4: Streams and Watersheds in New Paltz, NY

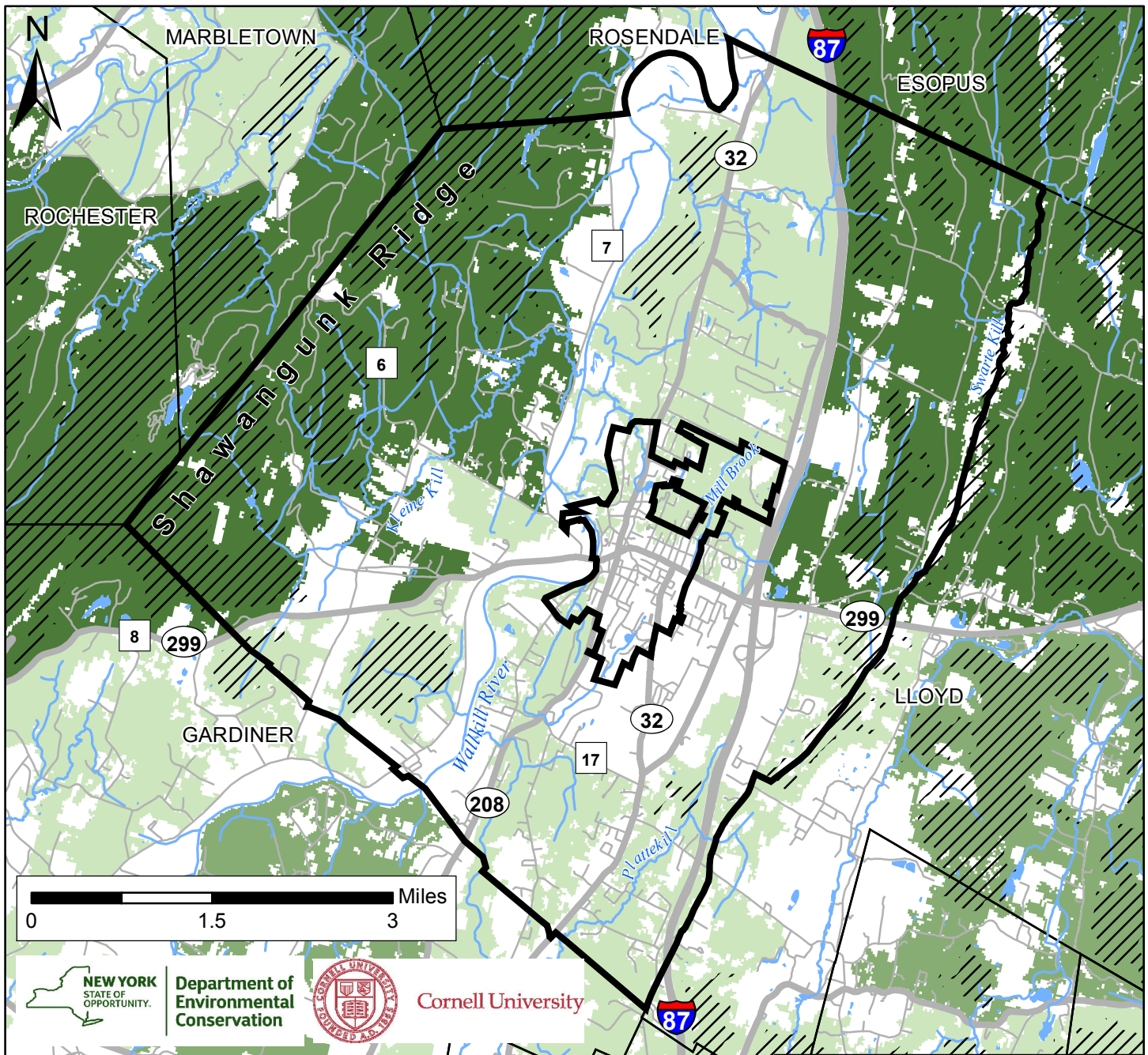


This map shows streams, flood hazard areas, riparian buffers, and waterbodies in New Paltz, Ulster County, NY. This map was produced as part of a habitat summary for New Paltz and is not intended for regulatory purposes. For more information, please contact NYSDEC's Hudson River Estuary Program Conservation and Land Use Specialist Nate Nardi-Cyrus at (845)256-3062 or nate.nardi-cyrus@dec.ny.gov.
<http://www.dec.ny.gov/lands/5094.html>
 Data also available for interactive viewing at www.dec.ny.gov/lands/112137.html

Data Sources:
 NYSDEC and USGS: NHD streams waterbodies (2008), New York Natural Heritage Program: Riparian buffers (2018), Federal Emergency Management Agency: Flood hazard zones (2009), NYS Office of Information Technology Services: Roads and municipal boundaries (2018).

Map created 2019.

Figure 5: Large Forests in New Paltz, NY



This map shows contiguous forested blocks of New York State by acreage for New Paltz, Ulster County, NY. The blocks were developed using 2010 forest cover data from the NOAA Coastal Change Analysis Program and buffered roads. The map also shows intact forest habitat cores ranked medium to outstanding from a county-wide study. This map was produced as part of a habitat summary for New Paltz. For more information, please contact NYSDEC's Hudson River Estuary Program Conservation and Land Use Specialist Nate Nardi-Cyrus at (845)256-3062 or nate.nardi-cyrus@dec.ny.gov. <http://www.dec.ny.gov/lands/5094.html>
 Data also available for interactive viewing at www.dec.ny.gov/lands/112137.html

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 InformationTechnology Services: Roads and municipal boundaries (2018).

Map created 2019.

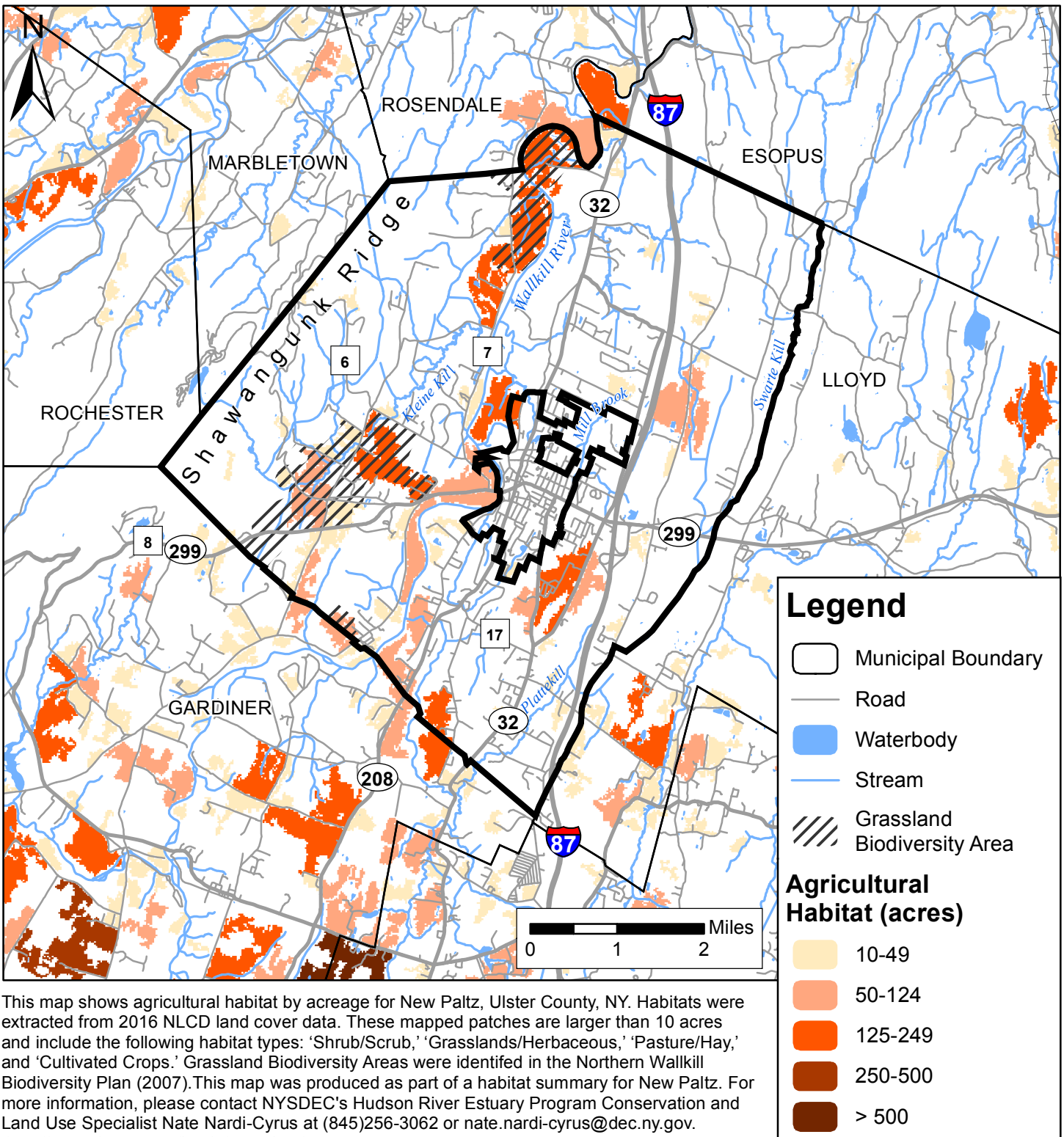
Legend

- Municipal Boundary
- Road
- Waterbody
- Stream
- Habitat Cores

Forest Block Size (acres)

- Regionally Important (6,000-14,999)
- Locally Important (2,000-5,999)
- Stepping Stone (200-1,999)

Figure 6: Agricultural Habitats in New Paltz, NY

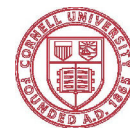


This map shows agricultural habitat by acreage for New Paltz, Ulster County, NY. Habitats were extracted from 2016 NLCD land cover data. These mapped patches are larger than 10 acres and include the following habitat types: 'Shrub/Scrub,' 'Grasslands/Herbaceous,' 'Pasture/Hay,' and 'Cultivated Crops.' Grassland Biodiversity Areas were identified in the Northern Walkill Biodiversity Plan (2007). This map was produced as part of a habitat summary for New Paltz. For more information, please contact NYSDEC's Hudson River Estuary Program Conservation and Land Use Specialist Nate Nardi-Cyrus at (845)256-3062 or nate.nardi-cyrus@dec.ny.gov. <http://www.dec.ny.gov/lands/5094.html>

Data Sources:

Agricultural habitat: (2019 - based on 2016 NLCD land cover), NYSDEC: NHD streams and waterbodies (2008), Northern Walkill Biodiversity Plan (2007), NYS Office of Information Technology Services: Roads and municipal boundaries (2018).

Map created 2019.



Cornell University

General Conservation Measures for Protecting Natural Areas and Wildlife



Hudsonia Ltd.

- **Protect large, contiguous, unaltered tracts of land** wherever possible. Avoid fragmentation of such areas by roads, drive-ways, and other developed uses.
- **Preserve broad 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 perimeters of other sensitive habitats.
- **Encourage development of altered land** instead of unaltered land wherever possible.
- **Promote redevelopment of brownfields** and other previously-altered sites, “infill” development, and “adaptive re-use” of existing structures wherever possible, instead of breaking new ground in unaltered areas.
- **Direct human uses toward the least sensitive areas**, and minimize alteration of natural features, including vegetation, soils, bedrock, and waterways.
- **Concentrate development along existing roads**; discourage construction of new roads in undeveloped areas.
- **Encourage pedestrian-centered developments** that enhance existing neighborhoods, instead of isolated developments requiring new roads or expanded vehicle use.
- **Preserve farmland potential** wherever possible.
- **Minimize areas of impervious surfaces** (roof surfaces, roads, parking lots, driveways, etc.), and maximize onsite retention and infiltration of stormwater runoff, to help protect the quality and quantity of groundwater and surface water resources. Design new development such that surface runoff from the site during and after construction does not exceed pre-construction runoff volumes.
- **Restore degraded habitats** wherever possible, but do not use restoration projects as a “license” to destroy existing high-quality habitats.
- **Consider environmental concerns early in the planning process** for new developments. Incorporate biodiversity conservation principles into the choice of development sites, the site design, and the construction practices.

Adapted from: Kiviat, E. and G. Stevens. 2001. Biodiversity assessment manual for the Hudson River estuary corridor. New York State Department of Environmental Conservation, Albany, NY. 508 p.

Species and Ecosystems of Conservation Concern in New Paltz

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

The following table lists species of conservation concern that have been observed in New Paltz and some adjacent areas. The information comes from the [New York Natural Heritage Program](#) (NYNHP) biodiversity databases, New York State Department of Environmental Conservation (DEC) wildlife biologists, the [2000-2005 New York State Breeding Bird Atlas](#) (NYBBA), the [1990-1999 New York Amphibian and Reptile Atlas](#) (NYARA), Mohonk Preserve species occurrence records (MP), Hudsonia Ltd. species occurrence records (HUD), John Burroughs Natural History Society (JBNHS) species occurrence records, and the [2007 Northern Walkkill Biodiversity Plan](#) (NYBP). Species from the NYBBA are included in the table if they were documented in Atlas blocks occupying more than 50% of the municipalities land area or other notable habitat features (e.g. large contiguous forest areas, grasslands or coastal areas). Note that the NYBBA blocks include records from areas outside of New Paltz. The table includes species listed in New York as endangered, threatened, special concern, or Species of Greatest Conservation Need (SGCN). Hudson River Valley Priority Bird species recognized by Audubon New York and those species considered rare by NYNHP are also included in the list. 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 New Paltz.

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	
Mammals								
little brown bat	<i>Myotis lucifugus</i>	cave, forest, wetland		xx				DEC
northern long-eared bat	<i>Myotis septentrionalis</i>	cave, forest		xx		US NY		DEC
tri-colored bat	<i>Perimyotis subflavus</i>	cave, forest, stream		xx				DEC
Birds								
Acadian flycatcher	<i>Empidonax vireescens</i>	forest	x					MP
American bittern	<i>Botaurus lentiginosus</i>	wetland	x	x	x			MP
American black duck	<i>Anas rubripes</i>	wetland	x	xx				MP
American goldfinch	<i>Spinus tristis</i>	young forest, shrubland	x					NYBBA
American kestrel	<i>Falco sparverius</i>	meadow	x	x				NYBBA
American redstart	<i>Setophaga ruticilla</i>	forest	x					NYBBA

Common Name	Scientific Name	General Habitat	NYS Conservation Status					Data Source
			<u>Hudson River Valley Priority Bird</u>	<u>Species of Greatest Conservation Need</u> xx = high priority	<u>Special Concern</u>	<u>Threatened</u>	<u>Endangered</u>	
American woodcock	<i>Scolopax minor</i>	young forest, shrubland	x	x				NYBBA
bald eagle	<i>Haliaeetus leucocephalus</i>	lake, stream, forest	x	x		NY		NYNHP
Baltimore oriole	<i>Icterus galbula</i>	forest	x					NYBBA
barn owl	<i>Tyto alba</i>	grassland	x	xx				MP
bay-breasted warbler	<i>Setophaga castanea</i>	forest	x	xx				NWBP
belted kingfisher	<i>Megaceryle alcyon</i>	lake, stream	x					NYBBA
Blackburnian warbler	<i>Dendroica fusca</i>	forest	x					MP
blackpoll warbler	<i>Setophaga striata</i>	forest	x					MP
black-and-white warbler	<i>Mniotilta varia</i>	forest	x					NYBBA
black-billed cuckoo	<i>Coccyzus erythrophthalmus</i>	young forest, shrubland	x	x				NYBBA
black-crowned night-heron	<i>Nycticorax nycticorax</i>	wetland	x	x				MP
black-throated blue warbler	<i>Dendroica caerulescens</i>	forest	x	x				NYBBA
black-throated green warbler	<i>Dendroica virens</i>	forest	x					NYBBA
blue-winged warbler	<i>Vermivora pinus</i>	young forest, shrubland	x	x				NYBBA
bobolink	<i>Dolichonyx oryzivorus</i>	grassland	x	xx				NYBBA
broad-winged hawk	<i>Buteo platypterus</i>	forest	x					NYBBA
brown thrasher	<i>Toxostoma rufum</i>	young forest, shrubland	x	xx				NYBBA
chestnut-sided warbler	<i>Setophaga pensylvanica</i>	young forest, shrubland	x					NYBBA
chimney swift	<i>Chaetura pelagica</i>	urban	x					NYBBA
Canada warbler	<i>Wilsonia canadensis</i>	young forest, shrubland	x	xx				NWBP
cerulean warbler	<i>Dendroica cerulea</i>	forest	x	x	x			NYBBA

Common Name	Scientific Name	General Habitat	NYS Conservation Status				Data Source
			<u>Hudson River Valley Priority Bird</u>	<u>Species of Greatest Conservation Need</u> xx = high priority	<u>Special Concern</u>	<u>Threatened</u>	
common loon	<i>Gavia immer</i>	open water	x	x	x		MP
common nighthawk	<i>Chordeiles minor</i>	mixed/urban	x	xx	x		MP
cooper's hawk	<i>Accipiter cooperii</i>	forest	x		x		NYBBA
downy woodpecker	<i>Picoides pubescens</i>	forest	x				NYBBA
eastern kingbird	<i>Tyrannus tyrannus</i>	young forest, shrubland	x				NYBBA
eastern meadowlark	<i>Sturnella magna</i>	grassland	x	xx			NYBBA
eastern towhee	<i>Pipilo erythrophthalmus</i>	young forest, shrubland	x				NYBBA
eastern wood-pewee	<i>Contopus virens</i>	forest	x				NYBBA
field sparrow	<i>Spizella pusilla</i>	young forest, shrubland	x				NYBBA
<u>golden-winged warbler</u>	<i>Vermivora chrysoptera</i>	young forest, shrubland	x	xx	x		MP
<u>grasshopper sparrow</u>	<i>Ammodramus savannarum</i>	grassland	x	xx	x		MP
<u>great egret</u>	<i>Ardea alba</i>	wetland		x			MP
greater yellowlegs	<i>Tringa melanoleuca</i>	mudflat	x	x			MP
horned lark	<i>Eremophila alpestris</i>	grassland	x	xx	x		MP
<u>Kentucky warbler</u>	<i>Oporornis formosus</i>	forest	x	xx			MP
<u>least bittern</u>	<i>Ixobrychus exilis</i>	wetland	x	x		NY	NWBP
least flycatcher	<i>Empidonax minimus</i>	forest	x				MP
Louisiana waterthrush	<i>Seiurus motacilla</i>	forest	x	x			NYBBA
northern flicker	<i>Colaptes auratus</i>	forest	x				NYBBA
<u>northern harrier</u>	<i>Circus cyaneus</i>	grassland	x	x		NY	MP
northern saw-whet owl	<i>Aegolius acadicus</i>	forest	x				MP
olive-sided flycatcher	<i>Contopus cooperi</i>	young forest, shrubland	x	xx			MP
osprey	<i>Pandion haliaetus</i>	open water, wetland	x		x		NYBBA

Common Name	Scientific Name	General Habitat	NYS Conservation Status					Data Source
			<u>Hudson River Valley Priority Bird</u>	<u>Species of Greatest Conservation Need</u> xx = high priority	<u>Special Concern</u>	<u>Threatened</u>	<u>Endangered</u>	
peregrine falcon	<i>Falco peregrinus</i>	cliff	x	x			NY	NYNHP
pied-billed grebe	<i>Podilymbus podiceps</i>	wetland	x	x			NY	NYBBA
prairie warbler	<i>Dendroica discolor</i>	young forest, shrubland	x	x				NYBBA
purple finch	<i>Carpodacus purpureus</i>	forest	x					NYBBA
purple martin	<i>Progne subis</i>	wetland	x					NYBBA
red-headed woodpecker	<i>Melanerpes erythrocephalus</i>	forest	x	xx	x			NYNHP
red-shouldered hawk	<i>Buteo lineatus</i>	forest	x	x	x			NYBBA
rose-breasted grosbeak	<i>Pheucticus ludovicianus</i>	forest	x					NYBBA
ruffed grouse	<i>Bonasa umbellus</i>	young forest, shrubland	x	x				HUD
rusty blackbird	<i>Euphagus carolinus</i>	wetland, agriculture	x	xx				MP
savannah sparrow	<i>Passerculus sandwichensis</i>	grassland	x					NYBBA
scarlet tanager	<i>Piranga olivacea</i>	forest	x	x				NYBBA
sedge wren	<i>Cistothorus platensis</i>	grassland	x	xx			NY	NYBBA
sharp-shinned hawk	<i>Accipter striatus</i>	forest	x			x		NYBBA
sora	<i>Porzana carolina</i>	wetland	x					MP
veery	<i>Catharus fuscescens</i>	forest	x					NYBBA
vesper sparrow	<i>Pooecetes gramineus</i>	grassland	x	xx	x			NWBP
whip-poor-will	<i>Caprimulgus vociferus</i>	young forest, shrubland	x	xx	x			MP
willow flycatcher	<i>Empidonax trailli</i>	young forest, shrubland	x					NYBBA
wood thrush	<i>Hylocichla mustelina</i>	forest	x	x				NYBBA
worm-eating warbler	<i>Helmitheros vermivorum</i>	forest	x	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	
yellow-breasted chat	<i>Icteria virens</i>	young forest, shrubland	x	xx	x			MP
yellow-billed cuckoo	<i>Coccyzus americanus</i>	young forest, shrubland	x					NYBBA
yellow-throated vireo	<i>Vireo flavifrons</i>	forest	x					NYBBA
Reptiles								
eastern box turtle	<i>Terrapene c. carolina</i>	forest, young forest		xx	x			NWBP
eastern hognose snake	<i>Heterodon platirhinos</i>	forest		xx	x			NYARA
eastern rat snake	<i>Pantherophis alleghaniensis</i>	forest		x				NYARA
eastern ribbon snake	<i>Thamnophis sauritus sauritus</i>	lake, stream, wetland		x				NYARA
northern black racer	<i>Coluber c. constrictor</i>	forest, shrubland, meadow		x				NWBP
northern copperhead	<i>Agkistrodon contortrix mokasen</i>	forest, rocky summit, wetland		x				NYARA
snapping turtle	<i>Chelydra serpentina</i>	wetland, stream, forest, lake		x				NYARA
spotted turtle	<i>Clemmys guttata</i>	wetland		xx	x			NWBP
timber rattlesnake	<i>Crotalus horridus</i>	forest, rocky summit		xx		NY		NYNHP
wood turtle	<i>Clemmys insculpta</i>	stream		xx	x			NWBP
Amphibians								
four-toed salamander	<i>Hemidactylium scutatum</i>	wetland		xx				NYARA
Fowler's toad	<i>Bufo fowleri</i>	forest, meadow		x				MP
Jefferson/blue-spotted salamander complex	<i>Ambystoma jeffersonianum x laterale</i>	vernal pool, forest			x			NWBP
marbled salamander	<i>Ambystoma opacum</i>	vernal pool, forest		x	x			NWBP
northern cricket frog	<i>Acris crepitans</i>	wetland		xx			NY	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	
Fish								
American eel	<i>Anguilla rostrata</i>	coast, stream		xx				DEC
brook trout	<i>Salvelinus fontinalis</i>	stream		x				MP
Insects								
arrowhead spiketail	<i>Cordulegaster obliqua</i>	forest		x				MP
Plants								
Appalachian sandwort*	<i>Minuartia glabra</i>	rocky summit, forest						MP
arctic rush	<i>Oreojuncus trifidus</i>	rock/cliff				NY		NYNHP
beakgrass	<i>Diarrhena obovata</i>	forest				NY		HUD
downy wood-mint	<i>Blephilia ciliata</i>	forest, rocky summit					NY	MP
mountain spleenwort	<i>Asplenium montanum</i>	cliff				NY		NYNHP
purple milkweed	<i>Asclepias purpurascens</i>	meadow, wetland, rocky summit				NY		MP
reflexed sedge	<i>Carex retroflexa</i>	forest				NY		JBNHS
rough avens	<i>Geum virginianum</i>	forest, wetland				NY		NYNHP
southern arrowwood	<i>Viburnum dentatum</i> var. <i>venosum</i>	coast				NY		MP
southern dodder	<i>Cuscuta obtusiflora</i> var. <i>glandulosa</i>	wetland, coast					NY	HUD
two-ranked moss*	<i>Pseudotaxiphyllum distichaceum</i>	forest						NYNHP
Natural Communities								
acidic talus slope woodland								NYNHP
chestnut oak forest								NYNHP
cliff community								NYNHP
dwarf pine ridges								NYNHP
floodplain forest								NYNHP
hemlock-northern hardwood forest								NYNHP
ice cave talus community								NYNHP
pitch pine-oak-heath rocky summit								NYNHP

Common Name	Scientific Name	General Habitat	NYS Conservation Status					Data Source
			<u>Hudson River Valley Priority Bird</u>	<u>Species of Greatest Conservation Need</u> xx = high priority	<u>Special Concern</u>	<u>Threatened</u>	<u>Endangered</u>	
vernal pool								NYNHP
Historical Records								
Allegheny woodrat	<i>Neotoma magister</i>	forest, cave, rocky summit		xx				NYNHP
American bumble bee	<i>Bombus (Thoracobombus) pennsylvanicus</i>	meadow		xx				NYNHP
dragon's mouth orchid	<i>Arethusa bulbosa</i>	wetland				NY		NYNHP
golden club	<i>Orontium aquaticum</i>	coast				NY		NYNHP
hyssop-skullcap	<i>Scutellaria integrifolia</i>	meadow, wetland					NY	NYNHP
large twayblade	<i>Liparis liliifolia</i>	wetland, forest					NY	NYNHP
prairie wedgegrass	<i>Sphenopholis obtusata</i>	coast, stream					NY	NYNHP
puttyroot	<i>Aplectrum hyemale</i>	forest					NY	NYNHP
riverbank quillwort	<i>Isoetes riparia</i>	wetland, coast					NY	NYNHP
scarlet indian-paintbrush	<i>Castilleja coccinea</i>	grassland, wetland, forest					NY	NYNHP

*Listed by NYNHP as a rare species in New York State

**Apparently extirpated from New York State

References

- Abood, S., A. Maclean, and L. Mason. 2012. Modeling Riparian Zones Utilizing DEMS and Flood Height Data. *Photogrammetric Engineering & Remote Sensing* 78:259–269.
- American Farmland Trust. Protecting Farms in New York. Saratoga Springs, NY. <https://farmland.org/project/protecting-farms-in-new-york/>. Retrieved October 3rd, 2019
- Anderson, M.G. and S.L. Bernstein (editors). 2003. Planning Methods for Ecoregional Targets: Matrix Forming Ecosystems. The Nature Conservancy, Conservation Science Support, Northeast & Caribbean Division, Boston, MA.
- Audubon NY. 2009. Bird Conservation in the Hudson River Valley [website]. <http://ny.audubon.org/conservation/udson-river-valley-conservation>. Ithaca, NY.
- Calhoun, A. and M. Klemens. 2002. Best development practices: Conserving pool-breeding amphibians in residential and commercial developments in the northeastern United States. MCA Technical Paper No. 5, Metropolitan Conservation Alliance, Wildlife Conservation Society, Bronx, New York. <http://www.maineaudubon.org/wp-content/uploads/2017/03/Best-Development-Practices-Conserving-Pool-breeding-Amph.pdf>
- Conley, A., T. Howard, and E. White. 2018. New York State Riparian Opportunity Assessment. New York Natural Heritage Program, State University of New York College of Environmental Science and Forestry, Albany, NY. Available at http://nynhp.org/files/TreesForTribes2017/Statewide_riparian_assessment_final_jan2018.pdf
- Daniels, K.H. 2005. A Municipal Official's Guide to Forestry. A joint publication of the New York Planning Federation, Department of Environmental Conservation, and Empire State Forest Products Association. Albany, NY. Available at http://www.dec.ny.gov/docs/lands_forests_pdf/guidetoforestry.pdf
- Ecological Society of America. 1990. Ecosystem Services Fact Sheet. Washington, DC. Available at <http://www.esa.org/ecoservices/comm/body.comm.fact.ecos.html>
- Environmental Law Institute. 2008. Planner's Guide to Wetland Buffers for Local Governments. Washington, DC. Available at www.eli.org/sites/default/files/eli-pubs/d18_01.pdf
- Firehock, K. 2013. Evaluating and Conserving Green Infrastructure Across the Landscape: A Practitioner's Guide for New York. Green Infrastructure Center, Charlottesville, VA. Ulster County case study available at <http://www.gicinc.org/PDFs/GIC%20NY-Practitioners%20Guide-Chapter%205-reduced.pdf>
- Haeckel, I. and L. Heady. 2014. Creating a Natural Resources Inventory: A Guide for Communities in the Hudson River Estuary Watershed. Department of Natural Resources, Cornell University, and New York State Department of Environmental Conservation, Hudson River Estuary Program, Ithaca, NY. Available at www.dec.ny.gov/lands/100925.html
- Huffman & Associates, Inc. 2000. Wetlands Status and Trend Analysis of New York State - Mid-1980's to Mid-1990's. Prepared for New York State Department of Environmental Conservation. Larkspur, California. Available at http://www.dec.ny.gov/docs/wildlife_pdf/wetstattrend2.pdf
- Kiviat, E. and G. Stevens. 2001. Biodiversity Assessment Manual for the Hudson River Estuary Corridor. NYS Department of Environmental Conservation, Albany, NY.
- Kiviat, E. 2003. Wetland Assessment of the Proposed Mill Brook Greenway. Hudsonia Ltd., Annandale, NY. Available at <http://www.wallkillalliance.org/wp-content/uploads/2016/04/Wetland-Assessment-of-Proposed-Millbrook-Greenway-2003.pdf>
- Knab-Vispo, C. and C. Vispo. 2010. Floodplain Forests of Columbia and Dutchess Counties, NY: Distribution, Biodiversity, Classification, and Conservation. Farmscape Ecology Program, Hawthorne Valley Farm, Ghent, NY. Available at http://hvfarmscape.org/sites/default/files/fep_floodplain_forest_report_nov_2010.pdf

LaBruna, D. T., and M. W. Klemens. 2007. Northern Wallkill Biodiversity Plan: Balancing Development and Environmental Stewardship in the Hudson River Estuary Watershed. MCA Technical Paper No. 13. Metropolitan Conservation Alliance, Wildlife Conservation Society, Bronx, N.Y. Available at http://www.townofnewpaltz.org/sites/newpaltzny/files/file/file/northern_wallkill_biodiversity_plan.pdf

Morgan, D. and A. Calhoun. 2012. The Maine Municipal Guide to Mapping and Conserving Vernal Pools. University of Maine, Sustainability Solutions Initiative, Orono, ME. Available at <http://www.maineaudubon.org/wp-content/uploads/2017/03/Maine-Municipal-Guide-to-Mapping-and-Conserving-Vernal-Pool.pdf>

New York Amphibian and Reptile Atlas. 1990-1999. New York State Department of Environmental Conservation, Albany, NY. Website: <http://www.dec.ny.gov/animals/7140.html>

New York State Breeding Bird Atlas 2000. 2000 - 2005. Release 1.0. [updated 2007]. New York State Department of Environmental Conservation, Albany, NY. Available at <http://www.dec.ny.gov/animals/7312.html>

New York State Wildlife Action Plan. 2015. New York State Department of Environmental Conservation, Albany, NY. Available at <http://www.dec.ny.gov/animals/7179.html>

New York State Department of Environmental Conservation and New York Cooperative Fish and Wildlife Research Unit at Cornell University. 2015. Species of Greatest Conservation Need List. Available at http://www.dec.ny.gov/docs/wildlife_pdf/sgnc2015list.pdf

New York Natural Heritage Program, New York State Department of Environmental Conservation. [data retrieved June 2018]. Biodiversity Databases, Element Occurrence Record Digital Data Set. Albany, NY. www.nynhp.org

New York Natural Heritage Program, New York State Department of Environmental Conservation. Biodiversity Databases, Important Areas Digital Data Set. [2013 update]. Albany, NY. www.nynhp.org

National Oceanic and Atmospheric Administration. 2010. Land Cover data for the Coastal Change Analysis Program. NOAA Coastal Service Center, Charleston, SC. Website: <https://coast.noaa.gov/dataregistry/search/collection/info/ccapregional>

Orange County (NY) Planning Department. 2004. Orange County Open Space Plan. Goshen, NY. Available at <https://www.orangecountygov.com/DocumentCenter/View/1484/Open-Space-Plan-2004PDF>

Orange County Soil and Water Conservation District. 2007. Wallkill Watershed Conservation and Management Plan. Available at http://waterauthority.orangecountygov.com/PROJECTS/WALLKILL_RIVER/Wallkill_Watershed_Management_Plan.pdf

Penhollow, M., P. Jensen, and L. Zucker. 2006. Wildlife and Habitat Conservation Framework: An Approach for Conserving Biodiversity in the Hudson River Estuary Corridor. New York Cooperative Fish and Wildlife Research Unit, Cornell University and New York State Department of Environmental Conservation, Hudson River Estuary Program, Ithaca, NY. Available at <http://www.dec.ny.gov/lands/5096.html>

Stevens, G. 2003. Wetlands in the Village of New Paltz, Ulster County, New York. Hudsonia Ltd. Annandale, NY. Available at <http://www.wallkillalliance.org/wp-content/uploads/2016/04/Wetlands-in-the-Village-of-New-Paltz-2006.pdf>

Stevens, G., L. Federman, P. Gambino, C. Graham, B. Haydasz, and E. Kiviat. 2014. Biological Assessment of the Mohonk Foothills Farm. Hudsonia Ltd. Annandale, NY.

Strong, K. 2008. Conserving Natural Areas and Wildlife in Your Community: Smart Growth Strategies for Protecting the Biological Diversity of New York's Hudson River Valley. New York Cooperative Fish and Wildlife Research Unit, Cornell University, and New York State Department of Environmental Conservation, Hudson River Estuary Program, Ithaca, NY. <http://www.dec.ny.gov/lands/50083.html>

Strong, K., R. VanSchaack, and I.Haeckel. 2014. Greene County Grassland Habitat Management Plan. Greene County Soil and Water Conservation District and Greene County Habitat Advisory Committee. Cairo, NY. 82 pp.

U.S. EPA. 2015. *Connectivity of Streams and Wetlands to Downstream Waters: A Review and Synthesis of the Scientific Evidence (Final Report)*. U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-14/475F. Available at <https://cfpub.epa.gov/ncea/risk/recordisplay.cfm?deid=296414>

Wallkill River Watershed Alliance. 2018. Science-Based Action Plan. Available at <http://www.wallkillalliance.org/wp-content/uploads/2016/04/Alliance-Action-Plan-2017-2019.pdf>

White, E.L., J.J. Schmid, T.G. Howard, M.D. Schlesinger, and A.L. Feldmann. 2011. New York State freshwater conservation blueprint project, phases I and II: Freshwater systems, species, and viability metrics. New York Natural Heritage Program, The Nature Conservancy, Albany, NY. Available at http://nynhp.org/files/FreshwaterBlueprint2011/NYS_Freshwater_Blueprint_30Dec2011.pdf

Zucker, L. and L. Lau. 2009. An analysis of the size and distribution of geographically isolated, small wetlands in the Hudson River Estuary watershed. Cornell University, Ithaca, NY. Unpublished report.