

SECTION 3.3 BIODIVERSITY

Significance of Biodiversity to Watershed Planning: Watershed planning provides an ideal opportunity to consider conservation of biological resources. The plants, animals, and habitats — or *biodiversity* — of the Rondout watershed are a significant part of the region’s character, natural infrastructure, and economy, and contribute directly to the quality and quantity of drinking water available to residents living in the region.

The term “biodiversity” is used to describe all the components of nature that are needed to sustain life. While people often associate the term biodiversity with threatened and endangered species, it actually encompasses much more. Biodiversity refers to all living things, both rare *and* common, the complex relationships between them, as well as their relationship to the environment. Biodiversity includes genetic variety, species diversity, and variability in natural communities, ecosystems, and landscapes. All of these parts and processes comprise the web of life that contributes to healthy ecosystems. For example, soil organisms convert leaves, twigs, and other organic litter into humus, and affect the infiltration and distribution of water in the soil.

Why is biodiversity important to the people living in the Lower Non-tidal Rondout Creek watershed? For starters, the watershed has a diverse and rich natural heritage, with species and ecological communities of regional, statewide, and global significance. These natural systems are the scenery and living fabric that provides the Rondout Creek watershed with a regional identity, and creates a sense of place for its residents. And healthy, natural systems are in essence a “green infrastructure,” supplying services that support life as we know it, through purification of drinking water, control of floodwaters, replenishment of aquifers, pollination of crops, creation of fertile soil, control of insect pests, and adaptation to a changing climate. They also provide opportunities for hunting and fishing, outdoor recreation, and environmental education and research. All of these services and benefits to the community cost less than the artificial or built alternatives, contribute to local economies, and are widely recognized as important assets by a variety of stakeholders.

Threats to Biodiversity and Associated Impacts to Watershed Health: Two of the greatest threats to biodiversity are habitat loss and invasion of non-native species (Wilcove et al. 1998). In particular, land use changes that degrade and destroy natural habitats pose the most significant threats to native biodiversity. Suburban sprawl, for instance, fragments the landscape into smaller and smaller patches of habitat, and surrounds these fragments with development, often having lethal effects on wildlife species that require large, connected natural areas. Furthermore, the resulting patchwork of land uses and human activity creates ideal conditions for invasive species to take hold. For example, the recent discovery of the invasive emerald ash borer in the Catskill Forest Preserve may have serious impacts on North American ash tree species, which comprise nearly 7% of all trees in the state. (State Expands Quarantine For Emerald Ash Borer, 2010) Increasingly, global climate change presents a new array of conservation challenges and variables, such as shifts in habitat availability and timing of natural events.



Photo 3.3.1 Emerald ash borer.

Land-use decisions made at the municipal and regional level will have lasting impacts on the function of natural systems in the Lower non-tidal Rondout Creek watershed, and their ability to support its human communities. For example, loss of habitat can lead to a corresponding loss in basic watershed functions, such as water infiltration and purification by forests and grasslands, erosion control along stream banks, and flood attenuation in wetlands. Habitat loss and fragmentation also creates unsuitable conditions for many native plants and animals, and leads to increased populations of more common, nuisance species such as white-tailed deer, Canada geese, mosquitoes, and black-legged tick, which carries Lyme disease. The effects of widespread deer browse, for instance, are a major cause of regeneration failure and change in forest composition in the region.

Additional threats to biodiversity include impacts associated with human development, many of which can be prevented or managed to reduce harmful effects, such as from light pollution, failing septic systems, waste from household pets, and pollution of natural areas from contaminants such as road salt, pesticides, fertilizers, and household chemicals and pharmaceuticals.

Biodiversity of the Lower Non-Tidal Rondout Creek Watershed: The rich biodiversity of the Lower Non-tidal Rondout Creek watershed is a result of the variable landscape included within its boundaries.

To the north are the forested Catskill Mountain foothills, where several headwater streams, like Sappush Creek in Rochester, originate in the Catskill Forest Preserve. To the south are the steep rocky slopes of the Shawangunk Ridge, supporting another large forested area that is the source of several headwater streams like the Stony Kill in Wawarsing. The higher-elevation tributaries flow to the more level terrain of the Upper Rondout and Rondout Creek valley, where farmland and fields are more common, such as where Kripplebush Creek meets the Rondout in southern Marbletown. To the east, before the non-tidal Lower Rondout becomes tidal, the watershed holds the limestone caves and Binnewater Lakes of Rosendale.

The biological resources of the Lower non-tidal Rondout Creek watershed have been recognized on many levels as having high conservation value:

- The *New York State Open Space Conservation Plan* (2009) recognizes the Lower Hudson Valley for its extremely diverse natural landscape, and identifies several “Regional Priority Conservation Areas” in the Rondout watershed. These conservation priorities include the:
 - “Great Rondout Wetlands,” which includes the Great Pacama Vly and Cedar Swamp;
 - “Karst Aquifer Region” which is characterized by caves, sinkholes, mines, springs, lakes, and sinking streams;
 - “Catskills Unfragmented Forest;” and
 - “Shawangunk Mountain Region.”

The Plan also prioritizes the protection of natural linkages between the Shawangunk Ridge and other significant biodiversity areas in close proximity. In the Rondout watershed, such linkages include a Catskills/Shawangunk connection in Wawarsing

(NYS Department of Correctional Services – Wawarsing farmlands) and a Shawangunk/Karst Aquifer connection surrounding the Wallkill Valley Rail Trail in Rosendale.

- The Rondout watershed includes portions of three Significant Biodiversity Areas (SBA) described in the NYSDEC's *Hudson River Estuary Wildlife and Habitat Conservation Framework* (Penhollow et al. 2006). Much of the Shawangunk Ridge SBA is within the watershed, and all of the Rosendale Cave Complex SBA falls within its boundaries. The southern end of the Catskill Mountain SBA is within the northern limits of the watershed.
- The Shawangunk Mountains Scenic Byway region is a 134,000-acre area that is largely defined by the 88-mile state scenic byway that encircles the northern Shawangunks and lands in the Rondout and Wallkill Valleys. The northern half of the Byway region lies within the Rondout watershed. The *Shawangunk Mountains Regional Open Space Plan* (December 2008) outlines strategies to preserve valuable resources, including the waterways, wetlands, forests, grasslands, and landscape connections that support the region's rich biodiversity and maintain clean air and water.
- The Nature Conservancy's report, *Identifying Conservation Priorities in the Hudson River Estuary Watershed* (Shirer and Tear 2005), identifies ecoregional aquatic conservation targets (priority watersheds) within the Hudson River Estuary watershed, and the Rondout Creek Watershed is listed as one of these priorities.
- The Nature Conservancy recognizes that the Shawangunk Ridge's scenic cliffs, plateaus and talus fields make it one of Earth's "Last Great Places." Since the first gift of land in 1969, the Conservancy has helped preserve more than 12,000 of the 40,000 protected acres on the ridge. Popularly called the "Gunks" by locals, they support more than 35 natural communities, including one of only two ridgetop dwarf pine barrens in the world, chestnut oak forests, hemlock forests, pitch pine forests, lakes, rivers and wetlands. Twenty-seven rare plant and animal species have been documented here (www.nature.org/wherewework/northamerica/states/newyork/preserves/art12373.html). TNC hold and/or helps manage land in or near Minnewaska State Park Preserve in Rosendale and Sam's Point Dwarf Pine Preserve in Wawarsing, which is home not only of rare dwarf pines and birches, but it harbors one of the least known lakes of the chain of lakes in the area: Martanza Lake (www.nature.org/wherewework/northamerica/states/newyork/preserves/art12373.html).
- The Catskills Mountains, protected in large measure by the NYC DEP, are part of a vast unfragmented forest that provides important habitat to many species, including timber rattlesnake, a threatened species in New York.

Priority Habitats of the Watershed: The underlying geology, soils, topography, surface and groundwater, and land use history of the Rondout Creek watershed all weave together to shape a diversity of habitats that support an equally diverse array of plant and animal communities. The biodiversity of the creek mouth and lower, tidal portion of the Rondout will be described in the tidal Rondout Creek watershed plan underway by the City of Kingston – and the *Upper Rondout*

Creek Stream Management Plan (2010) describes the biodiversity of the upper Rondout Creek watershed from the Peekamoose Gorge to the Rondout Reservoir.

The priority habitats of the lower non-tidal Rondout watershed, discussed in this plan, include streams and riparian corridors; forests; a variety of wetlands; grasslands, shrublands, and farms; and cliffs and caves. Lists of breeding birds, amphibians, reptiles, rare species, and ecological communities have been documented in the Towns of Marbletown, Rochester, Rosendale, and Warwarsing.

While the entire watershed has not been studied to locate and map all biological resources, there is a growing body of information on where important habitats are, and what plants and animals they support, as a result of local and regional initiatives:

- The Shawangunk Ridge Biodiversity Partnership's *Green Assets* project developed a series of maps that show important ecological community types or "conservation targets" on the Ridge, along with elevation/slope, protected areas, and tax parcels. The maps were designed to help land use decision-makers identify and protect ecologically important habitat, unfragmented forest, and connections between natural areas. Parts of the four municipalities in the Lower Non-tidal Rondout watershed are included on these maps. (2006)
- The Town of Marbletown has detailed habitat maps for approximately 6,000 acres in the Catskill foothills and along the Rondout Creek (Hudsonia 2007), and an additional 7,500 acres of habitat mapped in an adjacent area by a volunteer community group in 2006. Both maps are described in companion reports, which also include habitat profiles and specific conservation recommendations. Further discussion of the Town's forests, streams, and wildlife habitats are contained in the Marbletown Natural Heritage Plan. (2008)
- The Town of Rochester completed a Draft Natural Resource Inventory in 2006 that has maps and information on resources and features such as geology, wetlands and streams, and slope. Biological data are largely limited to information from the *Green Assets* program and New York Natural Heritage Program for the portion of the town south of the Rondout Creek.
- The Town of Rosendale completed a Natural Resource Inventory in 2010 that incorporates maps and information about the town's geology, groundwater, surface water, and biological communities, including a detailed habitat map of 4,300 acres in the Binnewater Lakes region completed by a volunteer training group in 2004. Maps of ecological communities are included for other parts of the town. Habitat mapping for the remaining one-third of the town is underway and will complete a larger town-wide biodiversity assessment, "The Natural Wealth of Rosendale."

How to Use This Information: Knowing what habitats and species occur in the Rondout watershed can be useful not only for watershed planning, but for taking conservation action at the municipal level, as well. It is likely that many of the habitats that have been identified and mapped in the watershed occur elsewhere where underlying conditions are similar. Future

assessments can take into consideration what is known about important habitat occurrences in the watershed, to predict and assess their distribution in other unstudied areas, and to proactively plan for the associated rare species. Such information can provide a starting place for habitat maps, natural resource inventories, open space plans, and other conservation and smart growth plans. This approach will also contribute to keeping common species in the watershed common, and maintaining overall ecosystem function. Finally, many of the planning and conservation recommendations discussed in this plan for the watershed also apply to land-use decision making at the local level.

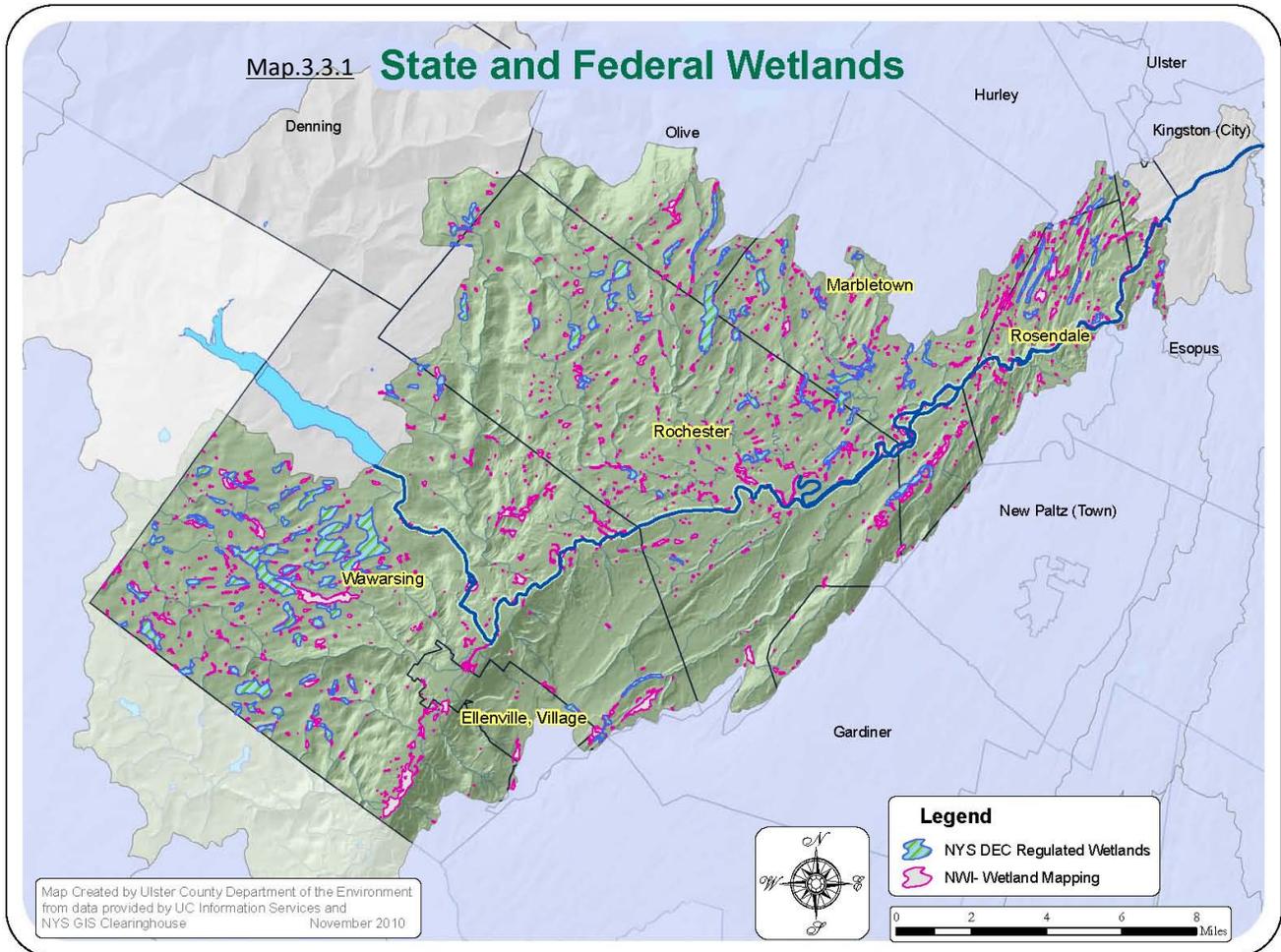
Stream Corridors and Wetlands: Streams in a watershed start at high elevations, called headwaters; sometimes these begin as merely rivulets or small waterfalls. When a first order stream is joined by another, it becomes a second order stream, and the order increases each time another confluence occurs. Because they tend to be located in more pristine areas headwater wetlands, often a mosaic of riparian habitat, ponds, emergent marshes and fens, are especially important habitats to support biodiversity. Extensive wetland complexes also occur in lower terrain, but may support different species. A wetland complex is any group of adjacent and nearby swamps, marshes, wet meadows or other wetland types and associated streams or ponds. Wetland complexes with especially high habitat value include extensive complexes, those with a wide variety of wetland types, and those that have intact upland habitat between the wetlands. There are many wetland complexes of special conservation interest in the watershed. These should be noted because of the connections they provide for native species to move through the various stages and seasons of their life cycle. Section 3.4 discusses in depth the importance of protecting streams with a buffer of riparian vegetation.

Of special importance are isolated wetlands are wetlands that are not connected. These wetlands can be easy to overlook: they are usually too small to appear on maps, they may be dry in late summer or fall, and their extent varies from year to year. Even if found on National Wetlands Inventory (NWI) maps, they are no longer protected by the Army Corps of Engineers, and are usually too small to be listed on NYS DEC wetland maps. (Wetlands should always be field delineated in any case). Isolated wetlands can also be part of a larger wetland complexes can consist of scattered water bodies that appear isolated from above but are hydrologically connected below ground. Modification of part of such a complex can lead to unforeseen effects on other parts of the complex. These can include seasonal pools such as intermittent wetlands and kettle shrub pools.

- **Intermittent Woodland Pools** are areas of shallow standing water that form in depressions in upland forest habitats that hold water in winter and spring but dry up by mid-late summer; also called “vernal pools” as they are active in the spring. They usually lack surface water inlets and outlets. Because of the seasonal drawdown and the absence of surface water connection to other water bodies, fish are unable to survive. The fishless environmental is a critical habitat feature, protecting the eggs for a group of amphibians that cannot reproduce successfully in the presence of fish.



Photo 3.3.2 Marbled Salamander depends on Intermittent Woodland Pools to reproduce. (Photo Tim Kerin)



- **Intermittent Streams** flow only part of the year or after rain or snowmelt. They support invertebrates, stream salamanders, and other organisms. The stream channel is typically small--only one to several meters wide -- and often flows into a perennial stream, pond, or wetland. Flows range from scouring, during heavy rains or snow melt, to dry in late summer. Even when the stream has stopped flowing it may contain small pools that hold water and support aquatic invertebrates and small fish. They are especially vulnerable to human disturbance, alteration, or pollution, which then affects the watercourse and wetlands into which they flow. To protect stream banks and channel prevent alteration by unfortified vehicle crossings, siltation or channelization, or polluted discharges.
- **Perennial Streams** provide essential water sources for wildlife throughout the year, and are critical habitat for many plant, vertebrate, and invertebrate species. (See Section 3.4 for more information on riparian buffers needed to protect streams and other waterbodies.



Photo 3.3.3 Second Binnewater Lake. (Photo by Michael Montella)

Lakes, Ponds and Open Water: The LNT Rondout Creek watershed also has many lakes, including the clear Sky Lakes of the Shawangunk Ridge and the chain of Binnewater Lakes in Rosendale. In addition to naturally occurring ponds, man-made ponds are used for watering animals, crop irrigation, and as retention basins to hold stormwater.

Forests: The value of forests to the ecology and economy of the LNT Rondout watershed is detailed in Section 3.5, along with specific recommendations for sustainable management. Listed here are the major forest types found in the region in both upland and wetland areas:

Upland Habitats

- **Upland Deciduous Forests** are found adjacent to and punctuated by hardwood swamps, rock outcrops, streams, intermittent woodland pools, springs and seeps, and areas of coniferous and mixed forest. They have more than 75% deciduous cover, including maple, oak, beech, ash and tulip.
- **Upland Conifer Forests** have more than 75% coniferous cover, such as pine, hemlock, and spruce.
- **Upland Mixed Forests** have between 25-75% deciduous or coniferous cover.
- **Young woods** are a subset of the upland deciduous forest category, characterized by wooded areas in which all or most trees are small in size, less than 12 inches diameter at breast height. They can develop quickly from abandoned mowed fields, and generally show less variety in tree species than do the mature forests.



Photo 3.3.4 Hardwood swamp. (Photo by Tim Kerin)

Wetland Forests

- **Hardwood swamps** are characterized by a damp to submerged muck floor with raised hummocks of trees, shrubs, and ferns. The dominant vegetation types are deciduous trees and shrubs.
- **Hemlock-Hardwood swamps** have an overall firmer swamp floor, and more elongated, distinct, and somewhat drier hummocks with many exposed tree roots. They are dominated by white pines and eastern hemlocks.

In general, forested areas with the highest conservation value include large forests, mature and relatively undisturbed forests, and those with a lower proportion of edge to interior habitat. Smaller forests that provide connections between other forests, such as linear corridors or patches that could be used as “stepping stones,” are also valuable in the

landscape context. Keeping the larger landscape perspective is critical. Forest patches, meadows and other pieces of habitat that may well extend beyond municipal boundaries may have great value by providing connectivity corridors for wildlife moving between larger, more obvious core areas and should not be disregarded (http://hudsonia.org/wp-content/files/Habitat%20map%20reports/Washington_Cons_Zones.pdf).



Photo 3.3.5 Barred owl living in Hardwood Swamp.

Grasslands, Shrublands, and Farms: Valuable habitat and open

space is provided by grasslands, meadows and farms. Many species like to alternate between the edge of forests, which can provide shelter from weather and predators, and open fields, however fragmentation of habitat leading to increased edges (edge effect) can also be detrimental. Here are a few habitats found in meadows and fields:

- **Upland meadows** are characterized by croplands, pastures, and mowed grasslands. Dominant vegetation includes pasture grasses, clovers, goldenrods, asters, spotted knapweed, and other forbs. Animal species include bluebirds, prairie warblers, red-tailed hawks, many types of butterflies, woodchucks, and deer.
- **Wet Meadows** are open, shallow wetlands dominated by herbaceous vegetation that have little or no standing water for much of the growing season. They are primarily home to grasses, sedges, and forbs, and are especially important for rare plants and butterflies. If standing water is present, the area is referred to as a marsh.
- **Shrubby oldfields** are a successional stage in the transition that occurs when cropland, pasture, or mowed fields have been abandoned. As grasses, forbs, shrubs, and saplings, as usually less than 6 feet high, move in, these areas provide habitat for diverse plants and wildlife. Eventually, as trees become larger and more prevalent, these oldfields become young forests. Sometimes found under power line rights of way or in areas that have been cleared for logging or other purposes, shrubby oldfields are a great resource for bird watchers, and unfortunately also for ATV enthusiasts, who may not understand their habitat value. Plants include goldenrods, berries, multiflora rose, sumac, eastern red cedar, red maple, black locust, oaks, quaking aspen, and white pine, dogwood and birches. In addition to a variety of songbirds, this habitat supports many butterflies.



Photo 3.3.6 Shrubby Oldfield. (Photo by Tim Kerin)

Cliffs and Caves: Two specialized habitats found in the watershed are crest, ledge and talus that prevalent features of the Shawangunk cliffs and the limestone cave complex that extends from the northern edge of the Shawangunks in Rosendale to Kingston.

- **Crest, Ledge and Talus** habitats typically have sparse vegetation, shallow soils, and large areas of bare rock. Talus is the accumulation of rock fragments and boulders on or at the base of steep ledges or cliffs. They can differ with respect to their bedrock chemistry and may support rare plants, amphibians, reptiles, birds, and mammals despite their harsh

conditions. Talus at the base of the Shawangunk cliffs is likely to be composed of Shawangunk conglomerate, but will be more calcareous (calcium-containing) in the Karst region.

- **Caves and Mines:** Scattered through the LNT Rondout Creek watershed are caves and abandoned mines, containing limestone formations that store huge quantities of underground water and provide roosting and hibernating habitat for bats, including the small brown bat and the endangered Indiana Bat. From 1826 to 1915 cement mining was a major industry in Rosendale, with the last mine closing in 1970. Now, one of the abandoned mines, the Widow Jane Mine on the former Snyder Estate now owned by the Century House Historic Society, also doubles as a performance space.



Photo 3.3.7 Entrance to “The Cave” – which is actually a mine – at Williams Lake. (Photo by Laura Heady)

Natural caves may also be home to algae, bacteria, and crustaceans adapted to the dark environment. There are two natural caves (considered by cavers large enough for a human to enter): one is Pompey’s Cave in Kripplebush off Lucas Avenue; another small dry cave in Rosendale is located between the Snyder Estate and Turco Brothers’ Water Service, which takes water from the karst aquifer adjacent to Route 213 to fill pools. There are also two caves near the Bashakill: Surprise Cave and Rhoades Cave (Neversink watershed) and Salamander Cave in Kingston (Tidal Rondout watershed). The Northeast Cave Conservancy is a good resource for information on caves (www.necaveconservancy.org).



Photo 3.3.8 Indiana bat hibernaculum in Karst Aquifer Region. (Photo: Tim Kerin)

The NYS DEC Open Space Plan of 2009 has designated a narrow band of carbonate rocks that extend throughout Ulster County, generally parallel with the Hudson River and trending south-southwest, through portions of Saugerties, Kingston, Esopus, Marbletown, Rosendale, Rochester and Ellenville, continuously outcropping just northwest and along the flank of the Shawangunk Mountain Ridge as the Karst Aquifer Region. The region is characterized by such features as caves, sinkholes, mines, springs, lakes and sinking streams. The area is rich in biological, geological and historical resources, provides diverse outdoor recreational opportunities and critical water reserves (p. 71).

Conclusions and Recommendations: Among the major threats to preserving biodiversity and the ecological services intact and connected habitats in the LNY Rondout Creek Watershed provide are:

- Development of open space and farmland causing loss of habitat, with resulting increase in



Photo 3.3.9 Endangered Indian Bat (Photo: Tim Kerin)

fragmentation of existing habitat, pollution and impervious surface.

- Invasive species, climate change and acid rain threaten areas of special significance such as Sam's Point and the Karst Aquifer Region.

While the threats to the watershed's rich biodiversity may be challenging to address, the economic benefits of conservation-oriented planning are many. An excellent example is the NYC DEP far-sighted decision to use watershed protection practices to preserve water quality and avoid the major cost of filtration, cited earlier. Increased property values and quality of life benefits accompanied these avoided costs. Sustainable development means integrating ecological preservation with economic prosperity, wisely and equitably.

Whatever the scale, from making decisions at a site-plan review, to developing a town open space plan, or setting watershed protection goals, the key steps to conserving biodiversity resources are as follows:



Photo 3.3.10 Endangered cricket frog. (Photo by Tim Kerin)

- 1) identify resources
- 2) prioritize resources
- 3) plan, protect, and manage resources.

The Lower Non-Tidal Rondout Creek Watershed Plan is a tool that residents, municipalities, conservation groups, county agencies, and other stakeholders can use to learn about the rich diversity of plants, animals, and habitats in the watershed, and set priorities so that implementation efforts are effective and efficient, and reflect community values. It also can be used to identify gaps in information and set goals for future study and research. Finally, it can provide a planning framework to protect the biodiversity of the Rondout watershed, so that future generations will be able to live in healthy, quality communities and enjoy their natural heritage for a long time to come.

Many of the recommendations outlined here reflect general conservation principles for protecting biodiversity. They include (adapted from Kiviat and Stevens 2001):

- Consider habitat and biodiversity concerns early in the planning process.
- Direct human uses toward the least sensitive areas, and minimize alteration of natural features, including vegetation, soils, bedrock, and waterways.
- Protect large, contiguous, and unaltered tracts of habitats wherever possible.
- Protect contiguous habitat areas in large, circular or broadly-shaped configurations within the larger landscape.
- Preserve links between habitats on adjacent properties via broad connections, not narrow corridors.
- Create, 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.

- Maintain buffer zones between development and land intended for habitat.
- Prioritize higher-quality habitats for protection, as degraded habitats decrease the biological value of the larger ecological landscape.
- Preserve natural processes such as forest fires, floodplain flooding, and beaver flooding to maintain the diversity of habitats and species dependent on such processes.
- Preserve farmland potential.
- Protect habitats associated with resources of special economic, public health, or aesthetic importance to the community. These include aquifers or other sources of drinking water, active farms, and scenic views.
- In general, encourage development of altered land instead of unaltered land.
- Concentrate development along existing roads; discourage construction of new roads in undeveloped areas.
- Promote clustered and pedestrian-centered development wherever possible, to maximize extent of unaltered land and minimize expanded vehicle use.
- Minimize extent of impervious surfaces (roofs, roads, parking lots, etc.), and maximize onsite groundwater infiltration. Minimize areas of disturbance.

Municipalities in the watershed might consider including similar principles in their comprehensive plans or in future intermunicipal agreements. If followed by communities in the Rondout watershed, these general guiding principles may contribute to the realization of the watershed plan's goals for smart growth, water resource protection, and biodiversity conservation.



Photo 3.3.11 Winter wren. (Photo by Tim Kerin).