Section 2.9
Fisheries & Wildlife

Because of its largely intact forest stands and small closely knit residential communities, the Neversink watershed provides an example of an interactive balance between humans and nature. The features of this watershed allow for the support of a diversity of life, including plants, insects, fish, animals, and people. The number and variety of organisms found in this geographic region, often referred to as biodiversity, are all connected in a fragile web of life.

The functioning of this web of life consists largely of interactions between living organisms, but it is also highly dependent on interactions with countless non-living factors in the surrounding environment. The system made up from these interactions, or ecosystem, includes factors such as energy from the sun, availability of water, balanced chemistry, and consistent climate cycles. Because of the delicate balance of all of these factors that is required for the survival of each individual organism, it is difficult to predict what would happen if any one factor was significantly altered or removed.

For example, the list of web interactions required for the life cycle of a single tree may be in the hundreds or thousands. Moreover, the list of animals that will utilize a single fallen tree is in the thousands - well-known creatures include squirrels, woodpeckers, grouse, bears, foxes, skunks, beavers, otters, mice, and shrews as well as worms, salamanders, beetles, ants, centipedes, sowbugs, and other insect larvae. There are twice as many species of beetles that live on dead and dying wood as there are species of mammals, birds, reptiles, and amphibians in the entire world (Kyker-Snowman, 2003). The fallen tree provides critical habitat, steady moisture, and food for a multitude of mosses, fungi, trees, and vascular plants. For each fallen tree removed either during land use changes or during cleanup efforts after falling, ramifications reverberate throughout the ecosystem. If enough fallen trees are removed, the structure of the overall community would likely change.

The fallen tree example demonstrates the complexity of the web of life, and how eliminating one organism or habitat ultimately affects many more. It is very difficult to predict the consequences of removing individual strands from the web of life. Recognizing these relationships, many people work toward the protection and preservation of the ecosystem functions we receive from nature, including cleaner air through vegetation respiration, cleaner water through soil and wetland filtration, soil formation from forests, pollination of food crops from our native insects, natural flood water retention/groundwater recharge, and pest control from our native bats, birds, and insects (e.g. dragonflies/damselflies).

Due to its status as a nationally renowned fly fishing stream, many efforts in the Neversink watershed are focused on the preservation of critical trout habitat. The Neversink River provides the clean, cold, and well oxygenated water that is critical to trout habitat. In turn, local residents and tourists alike flock to accessible fishing sites in hopes of enjoying the angling and natural beauty that is provided by this stream. Tourism related to fishing has played an important role in the economy of the Catskill region that continues to this day.

The New York State Department of Environmental Conservation (DEC) classifies the surface waters in New York according to their ability to sustain trout populations (T) or trout spawning (TS). These classifications indicate the presence of trout (T) throughout the Neversink River, with trout spawning (TS) documented in the headwaters of the West Branch. Trout spawning likely occurs in several other locations throughout the river, but has not yet been documented in the DEC classification. Proposals for updating these classifications have been prepared and are currently under review.

The fishing opportunities along the Neversink River have attracted several of the famous trout anglers of the 20th century. Theodore Gordon, renowned for his fly tying, fishing, and writing, moved to the Neversink in the early 1890's and became a familiar site along the river. Gordon's local fly fishing legacy was succeeded in 1918 upon the arrival of Ed Hewitt, who acquired much of the land along the main branch of the Neversink. Hewitt used the River as a laboratory for the invention of various fly fishing equipment and tying techniques. In his later years, he began to rent out his property to an exclusive few along a stretch of the river that contained some of the more pristine and productive trout pools (Francis, 2000). This location for fishing and outdoor recreation became known as the Big Bend Club, and is currently still in existence.

Figure 1 Northern Monk's-hood is a state and federally threatened species that occurs along streambanks in the Catskills.

The quality of fish habitat in the Neversink watershed can be attributed in part to the presence of dense and largely undisturbed forest. Forests that occur adjacent to the stream not only promote good water quality by offering temperature control, woody debris sources, and a buffer against upland contaminants, but also provides favorable habitat for many terrestrial creatures. This includes a wide range of small mammals, including rarely seen moles, voles, shrews, fox, weasel, mink, beaver, and muskrat. Abundant streams with cobble beds, undercut banks, and streamside wetlands and forests are habitat for damselflies, dragonflies, stream salamanders, turtles, frogs and the threatened Northern Monk's-hood (Fig. 1). Riparian forests are particularly important breeding habitat for birds such as the Louisiana waterthrush, yellow warbler and warbling vireo. Stream corridors are the preferred foraging habitat for the many bat species that are likely to occur in the watershed.

The change in elevation from stream valley floor to Catskill peaks, and the presence of both evergreen and deciduous forests contribute to the watershed's biodiversity. Forests with features such as talus slopes, cliffs, and mature forests are habitat for plants and animals adapted to these conditions. High altitude coniferous forests are habitat for unique bird species such as the Blackburnian warbler and the rare Bicknell's Thrush. The large, unfragmented nature of the forests creates favorable habitat for wide-ranging animals (such as black bear and bobcat) and wildlife that prefer forest interiors (such as hermit thrush and red-eyed vireo).

Grassy fields, open woods, and shrubby patches make important contributions to biodiversity of the watershed. These open and scrubby areas can provide nesting habitat for shrub land bird species, like the Veery, that are declining in New York State as old farms revert to forests. Young forests are habitat for Canada warbler, while open shrub lands and dense thickets are preferred by Northern cardinals. Many species, like Black-and-white warbler, require a complex of different habitats to complete breeding, foraging, over wintering, and migration portions of their life cycles. As a result, maintaining connectivity between the stream and the adjacent uplands is very important for biodiversity conservation

Threats to Ecosystem Health

Although the Neversink watershed supports a wide diversity of fish and wildlife, it does have its share of threats to ecosystem health. Most of these threats are human-induced changes to the ecosystem that can have catastrophic effects to natural health. Whether it's through the removal of key elements from the ecosystem, or the introduction of non-native factors, it's clear that humans can have a profound impact on the ever changing natural landscape.

Despite its popular standing as a trout fishery, aquatic ecosystem health in the Neverink River has experienced pressures, both past and present. Early settlers to the Neversink valley quickly realized the angling opportunities provided by the river and its native brook trout, and thought to enhance the fishing experience by introducing brown trout from Europe. Brown trout were known to grow larger in size and could withstand higher levels of habitat disturbance and fishing pressure than brook trout. Because of these abilities to adapt, it wasn't long before brown trout established themselves in the Neversink and out competed brook trout for habitat and resources. Many now view the brown trout as an important part of the ecosystem and support its increased presence. Currently, the NYS DEC annually stocks the Neversink Reservoir with approximately 3,000 brown trout (NYSDEC Spring Trout Stocking for Sullivan County).

Many alterations of the Neversink ecosystem can be sourced back to famous fly fishing residents of the watershed. One such resident by the name of Ed Hewitt was well known for importing salmon eggs and fry from Norway and Scotland in an attempt to establish a population in the Neversink River. Hewitt also tried to improve trout habitat by introducing invertebrate nymphs and larvae from England as an additional source of food, and by building large "log and plunk dams" in order to increase the frequency and depth of pools (Francis, 2000). These types of habitat alterations may improve fishing conditions, but can interfere with natural ecosystem functioning.

Fish and other aquatic organisms also face the ongoing threats associated with climate change. Recent studies suggest that precipitation has increased in the Catskill region over the past 50 years, with the sharpest increase occurring between the late 1990s and 2005. Air temperature has also increased significantly over this time period, averaging an increase of approximately 0.6° C per 50 years. Total subsequent runoff of all of this extra precipitation has not only increased in volume over this time period, but the high volume of runoff associated with the seasonal transition from winter to spring appears to be occurring earlier in the year (Burns et al.,

2006). This increase in water volume contributes to larger and more frequent flood events, which can have deleterious effects on aquatic organisms that are not adapted to consistent high flows, increased water temperature, and changes in water quality. Early season increases in temperature allow aquatic insects that trout rely on for food to emerge earlier and at smaller sizes. As a result, fewer insect offspring are produced and the food web is significantly altered (Williams et al., 2007).

As precipitation increases across the Catskill region, the exposure of the delicate ecosystems to acid rain also becomes higher. The mortality of brook trout in the Catskill Mountains has been linked to the acidification of streams, most notably in locations where the soils are poorly buffered such as in the Neversink watershed (Baldigo & Murdoch, 1997). Acid rain also negatively impacts bird populations, such as the Wood Thrush, in that the decrease in pH results in the loss of tree canopy, as well as the depletion of calcium in the soils which is relied on for the production of eggs (Hames et al., 2002). The atmospheric deposition of mercury, sourced from the coal industry and various forms of energy production, can also contribute to the lower levels of calcium in the soils and its inevitable impact on breeding birds.

Species imported from other areas that thrive in our region, often called invasive species, can also have dramatic effects on the landscape. If the concentration of greenhouse gases continues to increase in our atmosphere, climate change is likely to continue well into the 21st century. Not only will this have a negative impact on native species, but it also makes habitat in the Castkill region more suitable for invasive species. For example, Japanese barberry (Berberis thunbergii) is native to Asia, but has thrived in the Neversink basin choking out native species and diminishing recreational opportunities. The woolly adelgid (Adelges tsugae), a small aphid-like insect pest native to China and Japan, is threatening to decimate our eastern hemlock (Tsuga canadensis) populations. Once infested, hemlock mortality rates range between 50%-99% (Orwig, 2002).The plant species most likely to replace hemlocks are hardwood tree species and possibly non-native or invasive species. Ultimately, this will have a dramatic effect on the structure of these communities. For example, the distribution and abundance of brook trout and diversity of aquatic insects will likely decline with the hemlock forests (Evans, 2002). Hemlock forests maintain stable, lower water temperatures and more stable hydrologic regimes (i.e. they don't dry up as much) than the hardwood forests that will likely replace them (Snyder et al., 2002). These are just a few examples of how human actions can import and release invasive species.

Rare species located in the Neversink watershed, such as the Northern Monk's hood and the Bicknell's Thrush, are particularly susceptible to the previously described threats to ecosystem health because their populations are small in numbers and are very habitat specific. As critical habitat diminishes, rare species decline in numbers and become endangered, or disappear altogether.

Management Recommendations

Stream managers can consider the following general recommendations to maintain and protect important stream corridor habitats:

• Limit disturbance and protect both small and large stream corridor wetlands that provide significant habitat for amphibians, reptiles, and breeding birds in the watershed;

• Most shrub land breeding birds are relatively tolerant of human development if appropriate habitats exist, and unlike some grassland birds, do not require large habitat patches for breeding. Landowners who maintain shrubby thickets in uplands adjacent to stream corridors can support shrub land birds;

• Where possible, plant native species appropriate to the pre-existing or predicted ecological community for a site;

• Stream managers are encouraged to learn to recognize the Appalachian tiger beetle and other declining and threatened species and report observations to the NY Natural Heritage Program.

• Riparian buffer widths can be established to conserve habitat function, in addition to water quality, hydrologic, and geomorphic functions. It is particularly important to maintain habitat connectivity needed by wildlife to complete their life cycles. To evaluate connectivity, consider the needs of indicator species, or species of conservation concern in the watershed.

• The forest area within 300 ft of the forest edge is considered "edge" habitat. Edge habitats support increased densities of deer and invasive plants, and are avenues for nest predators to enter forests. A minimum 300 ft forested stream buffer will protect forest health and provide better breeding habitat for forest wildlife;

• Riparian forests at least 50 acres in size with an average total width of at least 300 ft can provide forest interior habitat and can thrive if highly valued. Breeding bird diversity increases substantially between 300 and 1,500 ft from the stream's edge;

• Most of the amphibian and reptile observations in this watershed are within or near stream corridors. Seeking to create a minimum 500 ft forested buffer around stream corridor wetlands will provide terrestrial habitat required by stream- and vernal pool breeding amphibians to complete their life cycles, and to protect wetlands from adjacent land uses;

• If Buffer widths of 30-100 ft are maintained, riparian forest canopies will provide enough shading and cooling of streams to maintain trout populations. These buffers need to be nearly continuous to be effective. Some studies suggest 80% of banks along a stream supporting trout populations must have forests at least 30 ft wide to provide sufficient shade for trout;

• Minimum buffers of 50-100 ft are often recommended to protect aquatic communities.

Large woody debris deposited into streams provides important shelter for fish, and in particular for trout. At a minimum, a 50 ft buffer appears necessary to maintain sufficient woody debris inputs to streams. Riparian vegetation provides leaves and other forms of litter that feed macroinvertebrates. In turn, aquatic macroinvertebrates are the major food source for most freshwater fish.

• A minimum 100 ft buffer is recommended to protect aquatic macroinvertebrate and fish abundance. A number of stream corridor species depend on the natural channel processes of a healthy stream to provide habitat during parts of their life cycles:

• Stream salamanders are generally sensitive to siltation, scouring, nutrient enrichment, channelization, and diversion of water. Maintaining natural stream processes and riparian buffers protects salamander habitats.

• There are only 10 rivers in NYS with populations of Appalachian tiger beetle. This beetle is typically found on riverside sand and cobble bars at the edges of forested streams where stream management practices maintain natural stream processes, including the natural flooding regimes that prevent dense plant growth on cobble bars. Gravel mining and off-road vehicle use of sand and gravel bars can destroy beetle larvae

Figure 2 Appalachian tiger beetles live on cobble stream banks and bars near forests. They have only been documented along 10 rivers in New York State. (Stephen Cresswell, NY Natural Heritage Program website)

Observed Breeding Birds (source: 2000-2005 Breeding Bird Atlas)

Breeding bird species known or suspected to be breeding within the watershed. The species list is derived from reports of observed breeding bird activity within the Breeding Bird Atlas Blocks 5263B, 5264A, 5364A, 5364C, 5363A, 5364B, 5364D, 5465C, and 5464A that overlap the watershed. Parties using these data for environmental review purposes do so at their own risk.

Common Name		
Acadian Flycatcher	Common Raven	Pine Warbler
Alder Flycatcher	Common Yellowthroat	Purple Finch
American Black Duck	Cooper's Hawk	Red-bellied Woodpecker
American Crow	Dark-eyed Junco	Red-breasted Nuthatch
American Goldfinch	Downy Woodpecker	Red-eyed Vireo
American Kestrel	Eastern Bluebird	Red-shouldered Hawk
American Redstart	Eastern Kingbird	Red-tailed Hawk
American Robin	Eastern Phoebe	Red-winged Blackbird
American Woodcock	Eastern Towhee	Rock Pigeon
Bald Eagle	Eastern Wood-Pewee	Rose-breasted Grosbeak
Baltimore Oriole	European Starling	Ruby-throated Hummingbird
Barn Swallow	Field Sparrow	Ruffed Grouse
Barred Owl	Golden-crowned Kinglet	Savannah Sparrow
Belted Kingfisher	Gray Catbird	Scarlet Tanager
Bicknell's Thrush	Great Blue Heron	Sharp-shinned Hawk
Black-and-white Warbler	Great Crested Flycatcher	Song Sparrow
Black-billed Cuckoo	Great Horned Owl	Spotted Sandpiper
Blackburnian Warbler	Hairy Woodpecker	Swainson's Thrush
Black-capped Chickadee	Hermit Thrush	Swamp Sparrow
Blackpoll Warbler	House Finch	Tree Swallow
Black-throated Blue Warbler	House Sparrow	Tufted Titmouse
Black-throated Green Warbler	House Wren	Turkey Vulture

Blue Jay	Indigo Bunting	Veery
Blue-gray Gnatcatcher	Killdeer	Vesper Sparrow
Blue-headed Vireo	Least Flycatcher	Warbling Vireo
Bobolink	Louisiana Waterthrush	White-breasted Nuthatch
Broad-winged Hawk	Magnolia Warbler	White-throated Sparrow
Brown Creeper	Mallard	Wild Turkey
Brown-headed Cowbird	Mourning Dove	Willow Flycatcher
Canada Goose	Nashville Warbler	Winter Wren
Canada Warbler	Northern Cardinal	Wood Duck
Cedar Waxwing	Northern Flicker	Wood Thrush
Cerulean Warbler	Northern Rough-winged Swallow	Worm-eating Warbler
Chestnut-sided Warbler	Northern Saw-whet Owl	Yellow Warbler
Chimney Swift	Northern Waterthrush	Yellow-bellied Flycatcher
Chipping Sparrow	Olive-sided Flycatcher	Yellow-bellied Sapsucker
Cliff Swallow	Osprey	Yellow-billed Cuckoo
Common Grackle	Ovenbird	Yellow-rumped Warbler
Common Merganser	Pileated Woodpecker	Yellow-throated Vireo

Table 1 Known or suspected breeding birds in the Neversink River Watershed

Rare Wildlife

Common Name	Scientific Name	State Protection	State Rarity Rank	Global Rarity Rank
Appalachian Tiger Beetle	*Cicindela ancocisconensis*	Unprotected	S2	G3
Bigleaf Yellow Avens	*Geum macrophyllum var. macrophyllum*	Not Listed	S1	G5
Jacob's-ladder	*Polemonium vanbruntiae*	Rare	S3	G3
Bicknell's Thrush	*Catharus bicknelli*	Special Concern	S2	G4
Bald Eagle	*Haliaeetus leucocephalus*	Threatened	S2	G5
Northern Monkshood	*Aconitum noveboracense*	Threatened	S1	G3

Table 2 Rare plant and animal species with known populations within the watershed and documented examples of rare and high quality ecosystems within the watershed

Significant Natural Forest Communities

Common Name	State Protection	State Rarity Rank	Global Rarity Rank
Beech-Maple Mesic Forest	Not Listed	S4	G4
Hemlock-Northern Hardwood Forest	Not Listed	S4	G4
Mountain Fir Forest	Not Listed	S2	G3
Mountain Spruce-Fir Forest	Not Listed	S2	G3
Spruce-Northern Hardwood Forest	Not Listed	S3	G3

Table 3 Documented examples of rare and/or high quality ecosystems within the watershed

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