

Section 2.6

The Riparian Community

Although people value trees and other plants along a stream for their contribution to the beauty of the landscape, the vegetation in a watershed - especially in the streamside or *riparian area* - plays a critical role a healthy stream system. This streamside, plant community maintains the riverine landscape and moderate conditions within the aquatic ecosystem.

As rainfall runs off the landscape, riparian vegetation slows the rate of runoff; captures excess nutrients carried from the land; protects stream banks and floodplains from the erosive force of water; and regulates water temperature changes. It also provides food and cover to animals and fish and other aquatic life; and conserves soil moisture, ground water and atmospheric humidity.

Riparian vegetation serves as a buffer for the stream against activities on upland areas. Most human activities for example, agriculture, development, or recreation, can result in disturbances that can negatively impact the unprotected stream. Riparian vegetation captures and stores pollutants in overland flow from upland sources, such as salt from roadways and excess fertilizers from lawns and cropland. The width, density, and structure of the riparian vegetation community are important characteristics of the buffer and also affects how well it works in the watershed.

On bare soils, high stream flows can result in bank erosion and overbank flow can cause soil erosion and scour on the floodplain. The roots of vegetation along the bank hold the soil in place and protect against these erosive flows. On the floodplain, vegetation slows flood flows, reducing the energy of water and its potential to cause erosion and scour. Furthermore, as vegetation slows the water, the fine sediment and soil suspended in the water has more chance to settle on the floodplain (rather than carried away by the stream).

Vegetation intercepts rainfall and slows runoff, increasing the amount of precipitation that infiltrates into the soil and reduces overland runoff. This helps to decrease the occurrence of destructive flash floods, lowers the height of flood waters, and extends the duration of the runoff event. These benefits are evident in forested watersheds such as the upper Neversink when compared to watersheds of similar size which have high levels of urban development. The reduction in flood stage and duration ultimately results in fewer disturbances to stream banks and floodplains.

Streamside vegetation functions to provide climate, habitat, and nutrients necessary for aquatic and terrestrial wildlife. Trees shading a stream help maintain cool water temperatures needed by native fish. Low-hanging branches and roots on undercut banks create cover for fish from predators such as birds and raccoons. Natural additions of organic leaf and woody material provide a food resource needed by terrestrial insects and aquatic macroinvertebrates (stoneflies, mayflies, etc.) – the primary food source for fish.

Terrestrial wildlife depends upon vegetation for cover as they move from the upland community to the water's edge. A diverse plant community, one similar to the native vegetation of the upper Neversink, provides a

wide range of conditions and materials needed to support a diverse community of wildlife. If vegetation is continuous within the riparian zone along the length of a stream, a corridor is available for wildlife migration. Connectivity between the riparian and upland plant communities enhances the ability of upland and riparian plant and animal communities to thrive despite natural or human induced stress on either community.

A healthy riparian community is diverse, with a wide variety of plants, including trees, shrubs, grasses, and herbs (Fig. 1). The age of plant species are varied with a healthy regeneration rate so that new plants ensure the future of the community. Riparian communities are unique in that they must adapt to frequent disturbance from flooding. Consequently, many riparian plants including willow, alder, and sycamore, can re-grow from stump sprouts or reestablish their root system if up-ended. Also, seeds from these species are adapted to thrive in gravel bars and lower flood benches, where they can sprout in sediment deposited there during high flows.

Diverse Plant Types
(Trees, Shrubs, Grasses, Herbs)

+

Diverse Plant Ages
(young & old)

+

**Disturbance-adapted,
Moisture-loving Plants**
(accustomed to flooding & ice
flows)

=

Healthy Riparian Buffers



Figure 1 A healthy riparian community is densely vegetated, has a diverse age structure and is composed of plants that can resist frequent disturbance. Photo: East Branch Neversink River above New Hill Rd.

Catskill mountain forests have evolved since the ice age reflecting the changes in climate, competition and human land use. The first of these changes was the result of the climatic warming that occurred after the ice age which enabled warm climate adapted plant communities to replace the cooler climate communities. Following the retreat of the glaciers, the forest of the upper Neversink watershed gradually re-established and evolved from the boreal spruce/fir dominated forests, (examples of which can presently be found in Canada) to the maple-beech-birch northern hardwood forests (typical of the Adirondacks and northern New England) with the final transition of the lower elevations of the watershed to a southern hardwood forest dominated by oaks, hickory and ash (typical of the northern Appalachians). Dr. Michael Kudish provides an excellent documentation of evolution and site requirements of the region's forests in his book, [The Catskill Forest: A History](#) (Kudish, 2000).

More recently, human activities have affected the forest either through manipulation of forests through development or for maintenance of desirable species (high-grade wood) for wood products. Native Americans used prescribed burning as a means of allowing nut bearing oaks and hickories to establish dominance in the forests. European settlers in the 18th and 19th centuries contributed to a rising industrial economy by clearing vast areas of land for agriculture, harvest of construction materials, and hemlock bark harvesting for the extraction of tannin. The land cover in the upper Neversink began to revert to forest with the local collapse of these economies in the 20th century and the acquisition of much of the land by the State for the Catskill Forest Preserve (Kudish, 2000).

Prior land uses play a big role in what types of vegetation we find along the stream. Due to the steepness of the sides of the valley, the most intensive development activities were confined to the valley floor along the stream. Pastures and fields were created from cleared, forested floodplains. Abandoned, old fields have experienced a consistent pattern of recovery, with primary-colonizer species dominating the initial regrowth including sumac, dogwoods, aspens, hawthorns, and white pine. These species are succeeded by other light loving hardwood tree species such as ash, basswood and elm or in lower parts of the watershed, hickories, butternut, and oak. Hemlocks are largely confined to steeper stream banks and slopes where cultivation or harvesting of hemlocks for bark was impossible. More recent housing construction has re-intensified activity along the stream and been accompanied by the introduction of non-native vegetation typical of household lawns and gardens. While today the upper Neversink watershed is largely forested, agriculture and development activities are concentrated along the valley floor, leaving the riparian area predominantly herbaceous.

The Riparian Forest

Typically, riparian forest communities consist of species that thrive in wet locations and have the ability to resist damage or recover from flood disturbances. Extensive riparian communities typically exist in floodplain or wetland areas where a gentle slope exists. Many of the species present in these plant communities are exclusive to riparian areas. In areas where a steep valley slope exists, the riparian community may only occupy a narrow corridor along the stream and then quickly transition to an upland forest community. Soils, ground water and available sunlight may create conditions that allow the riparian forest species to occupy steeper slopes along the stream. This is especially true in the Neversink watershed where hemlock inhabits the northfacing slopes along the watercourse.

Proximity to water means that these forests are subject to extreme forces of nature and human development. Natural disturbances include floods, ice flows, and to a lesser extent, high winds, pest and disease epidemics, drought, and fire. Increased pressure from deer can also significantly alter the composition and structure of vegetation through browsing, which ultimately wipes out the understory in mature forests.

The flood of 2005 on the upper Neversink created and reopened numerous high flow channels, scoured floodplains and eroded formerly vegetated stream banks. Immediately following the flood, the channel and floodplains were scattered with woody debris and downed live trees. In the years since this event, the vegetation has made a strong recovery. Trees and shrubs, flattened by the force of floodwaters, have re-established their form. Gravel bars and sites disturbed in previous flood events became the seedbed for herbs and grasses. This type of natural regeneration is possible where the stream is stable and enough time passes between major flood events. Frequent floods and ice prevent large trees from establishing. In the area disturbed by runoff events that reach bankfull flow (expected to occur on average every 1.3 years). Ice flows can also cause channel blockages, resulting in erosion and scour associated with high flow channels and overbank flows. Typically this type of disturbance has a short recovery period.

Local geology and stream geomorphology may complicate the recovery process. A number of sites were found along Neversink River where vegetation has not been able to reestablish itself on bank failures created during recent flood events. On these sites, it will be necessary to understand the cause of the failure before deciding whether or not to attempt planting vegetation to aid in site recovery. In these instances, the hydraulics of flowing water, the morphological evaluation of the stream channel, the geology of the stream bank, and the requirements and capabilities of vegetation must be considered before attempting restoration.

Pests and diseases that attack vegetation can also affect changes in the ecology of the riparian area and could be considered a disturbance.

The hemlock woolly adelgid (*Adelges tsugae*) is an insect, which feeds on the sap of hemlocks (*Tsuga spp.*) at the base of the needles causing them to desiccate and the tree to take on a grayish color. Stress caused by this feeding can kill the tree in as little as 4 years or take up to 10 years where conditions enable the tree to tolerate the attack (McClure, 2001). This native insect of Japan was first found in the U.S. in Virginia in 1951 and has spread northward into the Catskills (Adams, 2002).



Figure 2 Hemlock woolly adelgid on the underside of a Hemlock branch

In the eastern United States, the adelgid attacks eastern hemlock (*Tsuga canadensis*) and Carolina hemlock (*Tsuga carolinianna* Engelman) and can affect entire stands of hemlock. Once a tree is infested, their population fluctuates, allowing for some hemlock re-growth in periods when their density is low. But this re-growth is stunted and later attacked as the adelgid population increases. With each successive attack tree reserves become depleted and eventually regrowth does not occur. The native predators of hemlock woolly adelgid have not offered a sufficient biological control, but recent efforts to combat the insect include experimentation with a native beetle from Northwestern forests, (*Laricobius nigrinus*) which is known to eat the adelgids. Initial experimental results have been positive, and in 2007 more than 3,000 Northwestern beetles were been released in the northeast. It is still too early to determine the effectiveness of this control method but researchers are hopeful.. The NYSDEC is also testing an Asian lady beetle (*Pseudoscymnus tsugae* Sasaji). The US Forest

Service provides extensive information about this pest at its Northeastern Area “forest health protection” webpage: www.na.fs.fed.us.

The loss of hemlocks along the banks of the Neversink River poses a threat to stream bank stability and the aquatic habitat of the stream. Wildlife, such as deer and birds, find the dense hemlock cover to be an excellent shelter from weather extremes. Finally, dark green hemlock groves along the stream are quiet, peaceful places that are greatly valued by the people who live along the river. The Olive Natural Heritage Society, Inc. is monitoring the advance of the hemlock woolly adelgid in the Catskills and is working in cooperation with NYS DEC on testing releases of *Pseudosymnus tsugae*. Initial results of the monitoring suggested a possible link between the presence of hemlock woolly adelgid on a site and the degree to which people use or access the site. Due to the widespread nature of the infestation, the use of chemical pest control options such as dormant oil would most likely provide little more than temporary, localized, control. The use of pesticides to control adelgid is not recommended in the riparian area due to potential impacts on water quality and aquatic life.

Without a major intervention (as yet unplanned), it is likely that the process of gradual infestation and demise of local hemlock stands by woolly adelgid will follow the patterns observed in areas already affected to the south. Reports from Southern Connecticut describe the re-colonization of hemlock sites by black birch, red maple and oak (Orwig, 2001). This transition from a dark, cool, sheltered coniferous stand to open hardwood cover is likely to raise soil temperatures and reduce soil moisture for sites where hemlocks currently dominate vegetative cover. Likewise, in the streams, water temperatures are likely to increase and the presence of thermal refuge for cool water loving fish such as trout are likely to diminish. Alternatives for maintaining coniferous cover on hemlock sites include the planting of adelgid resistant conifers such as white pine as the hemlock dies out in the stand (Ward, 2001).

Other forest pests are on the brink of infesting the Catskills that pose even greater risks than the woolly adelgid. Emerald Ash Borer (*Agilus planipennis*; EAB) and Asian Long-horned Beetle (*Anonplophora glabripennis*; ALB) are two particular insects that have ravaged forests elsewhere in the United States. In 2010 the presence of EAB was confirmed in northeastern Ulster County in the proximity of the Town of Saugerties. ALB threatens to invade from the south (New York City) or east (Worcester, MA). The high level of tourism and second home ownership in the Catskills makes this area particularly vulnerable to the transport of these species. Together, these two pests could seriously impact the forests that comprise the livelihood of so many creatures and humans. Statewide concerns about EAB and ALB have led to a recent ban on the movement of firewood within a 50 mile radius of where it was cut; quarantines are being updated regularly by New York State Department of Environmental Conservation. Currently DEC has quarantined sixteen counties in New York State including Ulster and Green Counties due to recent outbreaks of EAB.

Although natural events disrupt growth and succession of riparian vegetation growth, human activities frequently transform the environment and, as a result, can have long lasting impact on the capability of vegetation to survive and function. Presently, the most significant sources of human disturbance on riparian vegetation in the upper Neversink include the construction and maintenance of roadway infrastructure, the maintenance of utility lines, and the development of homes near the stream and its floodplain.

Due to narrow valley and steepness of valley walls, the alignment of Ulster County Route 47/Frost Valley Road and Denning Road closely follows the stream alignment of the upper sections of the West Branch and East Branch of the Neversink River. Use and maintenance of these roads has a significant impact on the riparian vegetation. The narrow buffer of land between the creek and the road receives runoff containing salt, gravel, and chemicals from the road that stunt vegetation growth or increase mortality. Road maintenance activities also regularly disturb the soil along the shoulder and on the road cut banks. This disturbance fosters the establishment of undesirable, invasive plants which establish more quickly than native vegetation in these areas. The linear gap in the canopy created by the roadway separates the riparian vegetation from the upland plant communities in some areas. This opening also allows light into the vegetative understory which may preclude the establishment of native, shade-loving plants such as black cherry and hemlock.

Utility lines parallel the roadway and cross the stream at various points requiring the utility company to cut swaths through the riparian vegetation at each crossing, further fragmenting essential beltways for animal movement from streamside to upland areas. Although the road right-of-way and utility line sometimes overlap, at several locations along the stream, the right-of-way crosses through the riparian area separate from the road. This further reduces the vigor of riparian vegetation and prevents the vegetation from achieving the later stages of natural succession, typified by climax species such as sugar maple, beech and hemlock

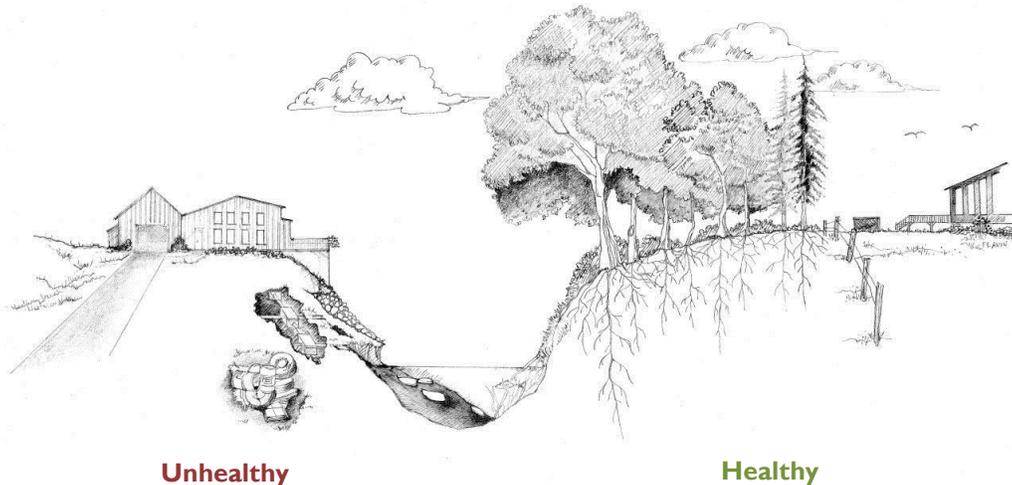


Figure 3 A healthy streamside buffer provides stability for streambanks, maintains cool water temperatures, and aids in filtering of upland pollution sources.

Residential land use and development of new homes can have a great impact on the watershed and the ecology of the riparian area. Houses require access roads and utility lines that frequently have to cross the stream. Homeowners who love the stream and want to be close to it may clear trees and shrubs to provide access and views of the stream. Following this clearing, the stream bank begins to erode, the channel overwidens and shallows. The wide, shallow condition results in greater bedload deposition and increases stress on

the unprotected bank. Eventually stream alignment may change and begin to cause erosion on the property of downstream landowners. Catskill stream banks require a mix of vegetation such as grasses and herbs that have a shallower rooting depth, shrubs with a medium root depth, and trees with deep roots. Grasses alone are insufficient to maintain bank stability in steeply sloping streams such as the Rondout Creek.

Many people live close to the stream and maintain access to the water without destabilizing the bank. By carefully selecting a route from the house to the water's edge and locating access points where the force of the water on the bank under high flow is lower, landowners can minimize disturbance to riparian vegetation and stream banks. Restricting access to foot traffic, minimizing disturbance in the flood prone area, and promoting a dense natural buffer provide property protection and a serene place that people and wildlife can enjoy.

Invasive Plants and Riparian Vegetation

Sometimes the attempt to beautify a home with new and different plants introduces a plant that spreads out of control and “invades” the native plant community. Invasive plants present a threat when they alter the ecology of the native plant community. This impact may extend to an alteration of the landscape should the plant destabilize the geomorphology of the watershed (Melanson, 2002).

The spread of Japanese Knotweed (*Fallopia japonica*), an exotic, invasive plant gaining a foothold in many streams in the Catskills, is an example of a plant causing such a disruption. As its common name implies, Japanese knotweed's origins are in Asia. It shades out existing vegetation and forms dense stands along the bank (Fig. 5 a-c). Although the impact of a Japanese knotweed invasion on the ecology of the riparian area is not fully understood, the traits of Japanese knotweed pose several concerns. Some of these concerns include:

- Knotweed appears to be less effective at stabilizing streambanks than shrubs and trees with deeper roots, possibly resulting in more rapid bank erosion.
- The shade of its broad leaves and the cover by its dead material limit the growth of native plants that provide food and shelter for associated native animals.
- Knotweed branches do not lean out over stream channels, providing little cooling from shade.
- Dead knotweed leaves (*detritus*) may alter food webs and impact the food supply for terrestrial and aquatic life.
- Large stands of knotweed impede access to waterways for fishing and streamside hiking.
- The presence of knotweed could reduce property value.
- Knotweed may alter the chemical make-up of the soil, altering soil microfauna and soil properties.



Figure 5, (a), (b), and (c) Stages of Japanese knotweed's growth throughout the growing season

Japanese knotweed is very difficult to control. One small fragment of stem or underground root can start a whole new stand, often spread by floods or inadvertent transport through fill or cutting. The broad use of herbicides, while partially effective, is not a viable option due to the threat chemicals pose to water quality and the fragile aquatic ecosystem. Mechanical control, by cutting or pulling, is labor intensive and requires regular attention to remove any re-growth. Biological controls are untested. While Japanese knotweed colonizes nearly five continuous miles of stream banks in some areas of the Catskills, there was no Japanese knotweed found along the banks of the entire Upper Neversink River.

Since Japanese knotweed has not taken root along the Upper Neversink River and its tributaries, it is particularly important to prevent additional spread of the aggressive plant by ensuring that fill material introduced to the riparian area is clean from knotweed fragments.

As part of the stream management planning process, physiognomic vegetation classes (e.g., open-canopy forest, shrub-brush, herbaceous) were mapped and the riparian vegetation assessed for the upper Neversink watershed. The purpose of this exercise was to provide the planning team with baseline information about plant communities present in the watershed, a description of the condition of vegetation in the riparian area, and recommendations related to the management of riparian vegetation along the stream.

Mapping of Physiognomic Classes

Mapping of physiognomic classes was loosely based on the Vegetation Classification Standard produced by The Federal Geographic Data Committee. The mapping was based upon 2009 digital-ortho pictometry and was confined to the riparian and near adjoining upland areas within 300 feet of the mainstem of the Rondout

Creek. This classification was selected because it allows identification of locations, such as herbaceous or cobble deposits, where the combination of channel morphology and riparian vegetation would indicate the greatest cost-benefit from riparian buffer plantings and bio-engineered bank stabilizations.

The mapping exercise included the approximate delineation of the classes through the photo interpretation of 2009 digital orthophotography. A physiognomic class GIS data layer was created using heads-up digitizing techniques with ESRI's Arcview software. The photo interpretation was field checked for class boundaries, and classifications were amended based upon field observations. The vegetation map resulting from this process is folded and included in the back of this section.

<u>Vegetation Classification</u>	<u>Area (acres)</u>	<u>Percent of Total Area</u>
Deciduous Closed Tree Canopy	1071.76	34.84
Mixed Closed Tree Canopy	639.60	20.79
Deciduous Open Tree Canopy	45.46	1.48
Evergreen Closed Tree Canopy	631.40	20.53
Herbaceous Vegetation	357.07	11.61
Shrubland	76.56	2.49
Bare Soil	57.07	1.86
Evergreen Open Tree Canopy	26.81	0.87
Impervious Surface	76.21	2.48
Unpaved Road	23.72	0.77
Mixed Open Tree Canopy	26.03	0.85
Water	42.36	1.38
Revetment	1.85	0.06
Total Area	2779.92 acres	100.00 %
Inadequate Vegetation	515.91 acres	18.55 %

Table 1 Summary of Physiognomic Vegetation Classification for the riparian corridor of the Rondout Creek mainstem

Summary of Findings

According to this riparian vegetation assessment, deciduous closed tree canopy (approximately 51 acres) and mixed closed tree canopy (approximately 30 acres) were the largest physiognomic classes within the 100 foot buffer, while deciduous open tree canopy and evergreen closed tree canopy occupied approximately 26 acres and 24 acres respectively (Table 1). Rondout Creek benefits greatly from this predominance of forest vegetation of the riparian area. Forested land cover helps to provide a high degree of stability to the watershed by slowing storm runoff and helping to protect against stream bank erosion. Protection of forest communities as well as planting riparian vegetation near the stream will help ensure long-term stream stability, but the effectiveness of stream protection provided by vegetative communities differs based on their width, plant density, vegetation type and the stream's geomorphic characteristics. Only 21 acres, or 12% of land area was considered to lack healthy vegetative cover; this included areas of herbaceous vegetation, bare soil and revetment.

Each management unit description has a section that discusses the current condition of the riparian area that includes maps of locations that could potentially benefit from vegetation improvements in the buffer. These maps were generated using general categories of vegetation cover (including areas of herbaceous vegetation, bare soil, and revetment) derived from analysis of aerial photographs. Because of the coarse nature of the analysis certain areas that are identified as poor vegetation are serving important ecological functions in the current condition. Field verification of this remote sensed analysis is necessary to tease out these ecologically important areas such as beaver impoundments and shrub dominated wetland areas.

Riparian ecosystems are an important component of watershed protection and resource conservation. Therefore, it is important to maintain and improve the riparian vegetation along the Neversink River and its tributaries. The Catskill Streams Buffer Initiative (CSBI) helps residential landowners use vegetation to protect property and preserve natural habitat along stream banks in the Catskill/Delaware watershed areas. CSBI is a funded initiative of the Stream Management Program. In partnership with coordinators at county Soil and Water Conservation Districts, CSBI's environmental experts diagnose streamside-related problems and recommend solutions to effectively manage streamside property. By cultivating strong streamside buffers that use vegetation native to the Catskill region, CSBI helps landowners create streamside habitat, reduce stream bank erosion, and improve water quality. Applications for this program as well as broader watershed management and stream basics can be found at www.CatskillStreams.org