

The Importance of Riparian Forests

By Jean Llewellyn

Monroe County is the second fastest growing county in Pennsylvania. This rapid growth can be problematic because uncontrolled and unregulated growth negatively effects the environment and our water quality. This does not mean we shouldn't grow. The county will unavoidably grow, but growth should occur in an environmentally sound way entailing the preservation of certain environmentally critical areas. One of these critical areas is the riparian forest. The riparian forest is important in preserving water quality, maintaining stream integrity, providing wildlife habitat, and controlling floods and storm water runoff. This article focuses on the functions of the riparian forest and the reasons they should be preserved. I hope after reading it, you too will be convinced that riparian forests are worthy of conservation.

What is a Riparian Forest?

A riparian forest is the forested area of land adjacent to a body of water, stream, river, bay, or marsh. (In this article when I refer to streams, I am also referring to all these water bodies.) Riparian forests form the transition between the aquatic and the terrestrial environment.

Riparian Forests Have Many Important Functions

Sediment Filtering

Sediment is carried to streams from various sources such as cropland erosion, pasture erosion, range erosion, road and construction sites, and stream bank deterioration. Such sediment has many detrimental effects. Sediment suspended in water can reduce the penetration of sunlight into the stream, adversely effecting the growth of beneficial aquatic plants. Sediment can make the water cloudy, and thus interfere with the ability of aquatic organisms to find food. Sediment can damage or clog the gills of fish. Sediment can also be deposited on the stream bottom, which can negatively affect the bottom dwelling fish and insects and destroy fish spawning areas. Large sediment deposits can fill in stream channels and greatly increase the potential for flooding. Riparian forests can help reduce the amount of sediment reaching streams. Riparian forests protect this through several

mechanisms. Sediment settles out when the speed of water flow is reduced as it enters the riparian forest due to contact with vegetation, decaying leaves, twigs, and branches. Additional sediment is removed as water runoff and sediment infiltrate into and are incorporated into the porous forest floor. In fact, it has been shown that mature riparian forests can reduce the sediment load of water flowing from upland crop fields by eighty percent. Thus, riparian forests function as efficient sediment filtering systems that are environmentally sound and economically advantageous.

Flood Control

When water passes through a riparian area, the roughness of the forest floor and the presence of vegetation help reduce the energy of the water flow and therefore allow some of the water to infiltrate into the ground and to be stored in areas such as wetlands thus reducing down stream flooding, recharging groundwater, and maintaining stream baseflow during the summer months. It has been shown that riparian forests can save significant amounts of money by providing protection from floods and management of storm waters. Consider the following examples:

** In the flood of 1993 in the Midwest, the forested floodplain areas had less damage to the levee system and river than grass or farmland areas. A savings of \$50,000 to \$250,000 per mile in property damage was calculated.*

** Storm water treatment options that integrate natural systems and bio-retention areas, like riparian forests, are less expensive to construct than storm drain systems and provide better environmental results. In fact, costs of engineered stormwater best management practices range from \$500 - \$10,000 per acre and will cost that much again in 20 years. It is much more cost effective to manage storm waters by including the preservation and maintenance of riparian forests in the stormwater management plan. In these ways, riparian forests have valuable economic benefits.*

Nutrient Control, Pollutant Control, and Water Quality Maintenance

Nitrogen and phosphorus are found naturally in the environment and are necessary for aquatic plants and algae to grow and reproduce. Anthropogenic sources of nitrogen and phosphorus include fertilizers, septic leachate, sewage treatment plants, urban runoff, detergents,

road dust, grass clippings, and yard debris. When these nutrients are found in excess of natural conditions, they can cause the rapid growth of algae and aquatic plants. The abundance of algae can reduce the amount of light penetrating the water, which can cause valuable aquatic plants to die. When the algae itself dies, it is decomposed by bacteria. Bacteria use oxygen during this process leading to a great reduction of oxygen in the water. The depletion of oxygen can cause taste and odor problems in drinking water and can cause fish and other aquatic organisms to die or move. Organisms that thrive in low oxygen environments release hydrogen sulfate and methane. These chemicals can be toxic to aquatic life and therefore, can compound the problem of an oxygen-deprived environment. For these reasons, excess nitrogen and phosphorus are detrimental to the aquatic environment.

Riparian forests reduce the amount of nutrients reaching streams by several mechanisms. They act as nutrient filters, sinks, and transformers.

Eighty percent of phosphorus is bound to small soil particles. As the soil is filtered out by the mechanisms mentioned earlier, the phosphorus is also filtered out. The 15% of the phosphorus that is not soil bound is not removed by filtration. It can, however, be removed by several other mechanisms.

The riparian forest can function as a nutrient sink by sequestering nitrogen and phosphorous in biomass and by improving the ability of soils to hold nutrients by adding organic material to the soil. As water flows over the surface or as shallow groundwater moves within the root zone of riparian plants, the plants actively uptake nutrients and incorporate them into plant material. This plant material can then be removed from the riparian forest when it is eaten by herbivores or incorporated into animal biomass. Nutrients are also stored for periods of time in soil organic materials. It can be stored for very long periods of time in wetlands in the form of peat. Studies have shown riparian forests can remove 88% of nitrate (a form of nitrogen) and 76% of phosphorus from agricultural runoff. The storage of nitrogen and phosphorous in the riparian forests effectively reduces the amount of these nutrients ultimately reaching streams and lakes.

Riparian forests can act as nutrient transformers when they change the chemical composition of nutrient compounds. When soil moisture is high enough to create anaerobic conditions in surface soil layers,

bacteria can convert dissolved nitrate to gaseous nitrogen, releasing it safely into the atmosphere and reducing the amount reaching streams.

Riparian forests are also capable of transforming toxic chemical and pesticides to nontoxic forms through microbiological decomposition, oxidation, reduction, hydrolysis, and solar oxidation. For all of the above reasons, riparian forests are very valuable in maintaining the high water quality needed for supplying drinking water and maintaining diverse forms of aquatic life.

Shade and Temperature

The riparian forest forms a canopy, which shades the stream. The shade moderates water temperature and protects the water against fluctuations in temperature that can be detrimental to the stream ecosystem's health. Elevated temperatures also reduce the amount of dissolved oxygen in the water. Elevated temperatures and reduced dissolved oxygen in the water can reduce fish spawning and survival. Studies have shown when stream surface shade is reduced to 35%, trout population drop as much as 85%. The amount of light reaching the stream also affects the types of algae produced in the stream. Wooded areas tend to contain diatoms while open sunny areas have filamentous green algae. The filamentous green algae are not a preferred food for macroinvertebrates (which are in turn eaten by fish). Therefore, the dominance of filamentous algae affects the types of food available for fish and other aquatic organisms. Temperature also has water quality implications. Elevated temperature increased the rate at which nutrients attached to suspended solids are converted to readily available forms. As a stream temperature increases above 60 degrees, phosphorus is released from the sediments, aggravating nonpoint source pollutant effects. For these reasons, a riparian forest is essential for the maintenance of proper stream temperature and a healthy ecosystem.

Stream Channel Stability

Riparian forests stabilize stream banks by providing deep root systems which hold the soil in place and by providing a degree of roughness capable of slowing runoff velocities and spreading flow during storm events. Riparian forests also help prevent erosion of stream banks and the production of sediments. Without forest buffers, stream flow scours the streambed and banks leading to bank erosion and channel straightening. The straight channels lead to accelerated stream flow velocity and additional stream bank erosion. This can lead to the

development of wide shallow streams that have elevated temperature and support a low diversity of aquatic species. Therefore, the conservation of riparian forests is important in stabilizing stream banks, reducing erosion, and providing high quality wildlife habitat.

Habitat and Food

The riparian forest provides important habitats. Many kinds of plants including grasses, shrubs, vines, and trees grow in the riparian forest. These plants provide nesting areas for birds and other animals and provide a variety of food items for wildlife. The unbroken riparian forest also provides a pathway for the movement and migration of animals and a connection between isolated blocks of forests.

Woody debris that falls into the stream benefits the stream in several ways. It provides cover for fish and invertebrates. It forms debris dams that cause the formation of pools, important areas for fish and fish fry. These pools provide space, cover, protection from high flow, and a diversity of microenvironments for fish and other aquatic life. Debris dams also block the transport of sediment and smaller litter materials. This delay in transport of organic material down stream allows sufficient time for aquatic organisms to utilize it. The slowing of transport also helps protect the sudden deposition of sediments down stream. Studies have shown a direct link between the presence of large woody debris and habitat quality, population growth of fish, and a diversity of fish and other aquatic organisms.

The woody debris, stems, leaves, buds, flowers, etc., that fall into the stream from the riparian forest form the basis of the aquatic food chain. Aquatic insect larvae, crayfish, and other invertebrates break down the plant material into small pieces. Bacteria and fungi break these small pieces into very fine material known as detritus. Detritus is used for food by many small aquatic animals. The small aquatic animals are in turn eaten by larger animals such as game fish. Thus, the stream riparian forest functions as an important source of food and energy for numerous forms of life and also provides diverse and high quality wildlife habitat.

What Can You Do?

In Tobyhanna and Tunkhannock Townships, local ordinances require a 50 foot set back for the construction of buildings. These ordinances do not however, require the preservation of riparian vegetation. Many people are unaware of the importance of retaining the riparian

vegetation and therefore clear the land right to the edge of the stream. I hope after reading this article, you become aware that the maintenance of the riparian vegetation is essential for preserving high water quality for drinking and other purposes, for controlling floods, and for maintaining a healthy riparian ecosystem. Therefore, if you or your property owners' association own riparian areas, please maintain the riparian forest in its native state. Most studies indicate 100 feet of riparian forest is needed to ensure the forest functions in the ways mentioned in this article. If you have riparian areas that are cleared, and you want to replant them, please call the TC/TC Watershed Association, and we may be able to help you get grants or assistance in replanting the riparian forest.

Remember, as always, individuals ***DO MAKE A DIFFERENCE.***