

*From: Klapproth, J.C. and R. Tjaden. 1996. The Benefits of Riparian Forests. Forest Landowner Vol 55, No. 6: 28-31.*

## **The Benefits of Riparian Forests**

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The United States has more than 3 million miles of rivers and streams, most of which were once lined with trees. Today, many of these streams have been cleared of tree cover to make room for agriculture, home sites and urban activities. Trees in these streamside-or *riparian*-areas contribute to more than a beautiful landscape; they improve water quality, prevent soil erosion and provide habitat for many animals.

### **Water Quality Benefits**

Trees and forests protect streams in a number of ways. The leaves and branches of trees break the force of rain as it falls to the ground. As stormwater moves across the forest floor, fallen trees and branches slow it down so that it has more time to be absorbed into the ground. Meanwhile, tree roots anchor the soil in place and prevent its erosion into nearby streams.

Forest soils act as a natural "sponge" to intercept, store and slowly release this water into streams and underground aquifers. During this process, many chemical contaminants are trapped and transformed to nontoxic forms through microbial decomposition. At the same time, nitrogen, phosphorus and other nutrients are taken up by tree roots and converted into plant parts. As a result, streams and groundwater supplies are of higher quality if they are protected by forests.

The area of vegetation that lies directly along the stream bank is especially critical to stream quality. Here, trees anchor the streambank and provide protection from temperature extremes. Trees and branches that fall into the stream create many small in-stream habitats and reduce the force of flood waters that scour stream banks.

### **Wildlife Benefits**

Today we know that riparian forests are important for more than just their ability to produce clean water. Rich soils and readily available water promote quick and abundant plant growth. Grasses, vines, herbaceous plants, shrubs and trees fill every available space-from the forest floor to the tree tops. Still wetland pools, spring seeps and temporary (vernal) ponds provide conditions for the growth of wetland plants. This variety and abundance of vegetation makes riparian forests among the most productive and important of all forest lands.

Because of the proximity to water, diversity of plant life and complex structure, riparian forests provide critical habitat to hundreds of wildlife species. Many are permanent residents, while others move in and out of the area as food or cover is available. These areas are especially important to migratory birds, providing a place to rest and feed in their long journey. Others come to find relief from temperature extremes, or use them to travel from one habitat to another.

The riparian forest is divided by its wildlife inhabitants into many smaller environments based on their needs for food, water and shelter. The forest floor is home to hundreds of thousands of organisms; many of them invisible to the eye, but important because they decompose organic matter and provide food for larger animals. Reptiles, amphibians, small mammals and ground-dwelling birds are found living and feeding above the forest floor- where grasses wildflowers and other herbaceous plants grow - insects, birds, and larger mammals such as deer, rabbits, mice, raccoons and opossums feed and take shelter. Woody shrubs and understory trees grow higher in the canopy, and above them tower larger trees. These plants provide food, nesting cavities, and perches for animals that fly or climb - birds, insects and a few mammals, such as bats and squirrels. On the edge of the forest are found grasses and other vegetation that benefit upland game, such as quail.

Water, often missing from upland environments, is available on moist vegetation in wetland ponds and from the stream itself. The shallow wetland pools, both permanent and temporary, are particularly important for many amphibious species. The stream environment provides moving waters in which other species swim and feed, including mink, beaver, muskrat, otter, and birds such as osprey, bald eagles, herons, belted kingfishers and ducks.

In certain areas of the country, riparian forests offer the only remaining natural area for many wildlife species. This is especially true in urban areas and intensively managed agricultural areas. Riparian forests also serve as important travel corridors between isolated blocks of forest for wildlife that will not cross through large openings or cuts.

## **The Aquatic Environment**

The types of vegetation growing along the stream bank are just as important in determining the kinds and numbers of organisms present in a stream as they are in determining the kinds of birds and mammals that will occupy the land. In forested areas, riparian vegetation is an important link in the aquatic food chain. This is because the sunlight that reaches the stream surface is limited by the tree cover, which then reduces the amount of green plants that will grow in the stream itself. Bits of tree

leaves and bark (known as detritus) that fall into the stream make up a large part of the diet of aquatic insects, crustaceans, molluscs and other all organisms. These organisms, in turn, are fed upon by larger insects, amphibians and fish. Overhanging vegetation also contributes terrestrial insects that drop into the stream and are eaten by fish.

Besides providing most of the food to the aquatic community, riparian forests influence the stream's chemistry and temperature. Waters that flow through forests and into the stream are kept clear of silt, which will smother fish eggs and insects, clog fish gills and bury stream habitat. Likewise, these forests provide a buffer from chemical contamination and nutrient enrichment. Riparian forests are critical in moderating stream temperatures; without shading, stream temperatures are warmer in the summer and colder in the winter. These temperature extremes decrease the growth and survival of fish, affect their ability to reproduce and alter the types of invertebrates and microorganisms found in the stream.

The forest also contributes the most critical part of the stream's physical structure - large woody debris. When woody debris, such as trees or branches, falls into the stream it creates important habitat for many organisms - from small insect larvae to large predatory fish. Like terrestrial animals, fish require cover for many activities, including resting, hiding, nest building and "ambushing" other fish while feeding. As stems and branches decompose, they release important nutrients for the aquatic food chain.

### **The Three-Zone Buffer System**

Scientists are now trying to determine how wide the riparian forest should be, and just what it should look like to maintain stream quality and benefit aquatic and terrestrial organisms. Not surprisingly, they have found: it depends. It depends on the stream size, stream location (for example, is it a spring-fed mountain stream or a slow moving coastal plain stream), the land topography (flat or steep slope) and the benefits for which the landowner is managing. The U.S. Forest Service has issued a "Riparian Forest Buffer System Specification" as a guide to installing and managing stream buffers. This system is based on a three-zone concept that reflects the ecological functions the buffer provides. The first zone, closest to the stream, is a protected area of trees that provides shade, habitat and stability to the stream. The second zone is an area of managed forest and shrubs. Its primary function is to improve water quality by filtering out sediment and chemical contaminants. Trees may be selectively removed from this area, but for the buffer to do its best job, understory plants and forest floor litter must be left in place. The third zone provides a transition between the riparian forest and other land uses. The primary function of this zone is to slow the rate of storm flow and spread it more evenly over the area. Permanent vegetation such as perennial grasses or pasture makes up the third zone.

### **Creating a Riparian Buffer**

If your property is lacking a riparian buffer, consider creating one. Give high priority to installing buffers that will connect two isolated forest tracts to provide important travel corridors for animals. If the land is currently cleared, it may simply be a matter of planting several rows of trees and shrubs. Generally, the trees should be planted about 8 to 10 feet apart (about 4 to 680 trees per acre), depending

upon the species and your objectives. If weeds are a problem, it may be necessary to use mulch, weed mats, tree shelters or a pre-emergent herbicide to ensure seedling survival. And, the site may need to be mowed a couple of times a year until the seedlings have outgrown competing vegetation. When choosing trees for planting, give priority to native species that would commonly be found along streams. Scientists have found that the survival and reproduction of aquatic insects is directly related to the types of leaves that are available to them, and they do best on naturally occurring vegetation. If cattle are grazing the area, it will be necessary to fence them out before the trees are planted. Besides adding excess nutrients and sediment to the stream, cattle will reduce the survival of the planted trees by grazing and trampling them.

If wildlife or fisheries are of particular interest to you, decide which species you wish to manage for and what their particular needs are. Consider enhancing the area for wildlife species that are in special need of conservation in your area. While there are many plants that wildlife will consume, some plants are more preferred than others (see Tables 1 and 2). Dogwoods and oaks are particularly beneficial to wildlife. Others include serviceberry, blueberry, elderberry and evergreens for winter cover. A mix of tree species will provide tall, medium and short tree heights and a variety of foods, dens, roosts and nesting sites. There are also many warm season grasses that are recommended in combination with trees (see Table 3). Keep in mind that these areas are often wet and flood frequently, so the vegetation you select needs to include plants that can withstand these conditions.

### **Cost-Share and Technical Assistance**

There are a number of state and federal cost-share programs that not only encourage planting riparian buffers, but also help the costs. In addition, federal income deductions for reforestation include tree planting efforts in riparian areas. Some states offer additional tax incentives or conservation easement programs that apply to riparian areas. For information on these and other programs, contact your State Forester, the Natural Resource Conservation Service or Cooperative Extension Service office.

### **For More Information**

The University of Maryland Cooperative Extension Service has produced a video entitled *Riparian Forest Buffers: The Link Between Land and Water*. This 21-minute video provides an overview of the functions and values of riparian forests, demonstrates the 3-zone buffer design concept and provides examples in urban and rural settings. The video is a joint effort of various public, private and nonprofit agencies.

Copies of the video are available for \$15 from: University of Maryland Cooperative Extension Service, Wye Research & Education Center, P.O. Box 169, Queenstown, MD 21658; 410/827-8056.

**Table 1. Trees for Riparian Areas**

<b>Common Name</b>	<b>Site</b>	<b>Wildlife Value</b>
Flowering dogwood	Moist	High (food)
American holly	Moist, wet	High (food, nesting, cover)
Red maple	Moist	High (seeds, browse)
White oak	Moist	High
Overcup oak	Moist, wet	High
Swamp chestnut oak	Moist, wet	High
Water oak	Moist, wet	High
Cherrybark oak	Moist	High
Willow oak	Moist, wet	High
Pawpaw	Moist	High (food)
Persimmon	Moist, gravelly	High (food)
Serviceberry	Moist/dry	High
Redbay	Moist	Good (food)
River birch	Moist, silty	Good (cavity nesting)
Black gum	Moist, wet	Good (food)
Eastern hemlock	Moist	Good (nesting)
Eastern cottonwood	Moist	Moderate
Box elder	Moist/dry	Moderate
Bitternut hickory	Moist, wet	Moderate (food)
Loblolly pine	Moist, wet	Moderate
Black walnut	Moist	Moderate
Black willow	Moist, wet	Nesting
Green ash	Moist, wet	Fair
Sweetbay magnolia	Moist	Fair
Tulip poplar	Moist, wet	Fair
Sycamore	Moist, gravelly	Cavity nesting
Bald cypress	Moist, wet	Low
Hophornbeam	Moist, wet	Low
American hornbeam	Moist	Low
Silver maple	Moist, wet	Low

**Table 2. Shrubs for Riparian Areas**

<b>Common Name</b>	<b>Site</b>	<b>Wildlife Value</b>
Red-osier dogwood	Moist, wet	High
Silky dogwood	Moist	High
Elderberry	Moist, wet	High
Honeysuckle	Moist	High (cover)
Spicebush	Moist	High (songbirds)
Winterberry	Moist, wet	High (food/cover)
Buttonbush	Moist	Moderate
Grey dogwood	Moist/dry	Moderate
Sweet pepperbush	Moist	Moderate
Pussy willow	Wet	Moderate
Southern wax myrtle	Moist	Moderate
Witch hazel	Moist, wet	Moderate
Arrowwood viburnum	Moist	Low

**Table 3. Grasses for  
Riparian Areas**

Switchgrass  
Big Bluestem  
Indian grass  
Coastal Panic grass  
Weeping lovegrass