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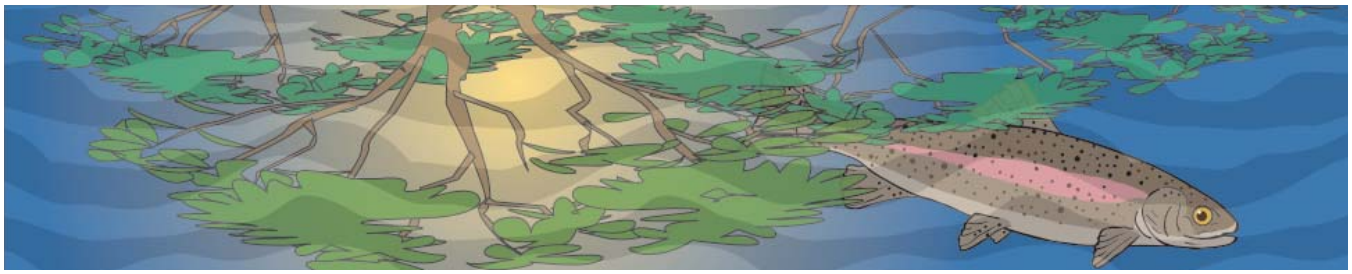
Riparian forest buffers for trout habitat improvement

Benefits of riparian forest buffers

Phyllis Bongard and Gary Wyatt[1]



What is a riparian forest buffer?

A riparian forest buffer is a planned combination of trees, shrubs, grasses and forbs planted along a stream or river. It can include many different species and perform several different functions. The most common design includes three zones: an unmanaged woody zone nearest the stream which is followed by a woody zone that can be managed for income and is bordered by a zone of grasses that may include forbs (Figure 1). A well-designed riparian forest buffer protects water quality, enhances aquatic and wildlife habitats and can provide income opportunities for landowners.

Riparian forest buffers improve trout and wildlife habitats

Minnesota is home to more than 450 miles of Department of Natural Resources designated trout streams. As a cold water species, trout are sensitive to warm stream temperatures. Trees in the riparian buffer improve trout habitat by limiting how much solar radiation can reach the stream surface. As a result, stream water temperatures are lower and they fluctuate less during the day compared to non-shaded portions of the small stream. Trees also provide woody debris for the stream, an important component of trout habitat.

Riparian forest buffers (RFBs) can be designed to enhance wildlife habitat. Depending on a landowner's objectives, plant materials for the buffer can be selected to provide food, shelter or nesting areas for various wildlife species. As a rule, wider buffers are needed to enhance wildlife habitat. While narrow buffers may provide a travel corridor, wide RFBs are more likely to support a greater diversity of wildlife (Table 1).

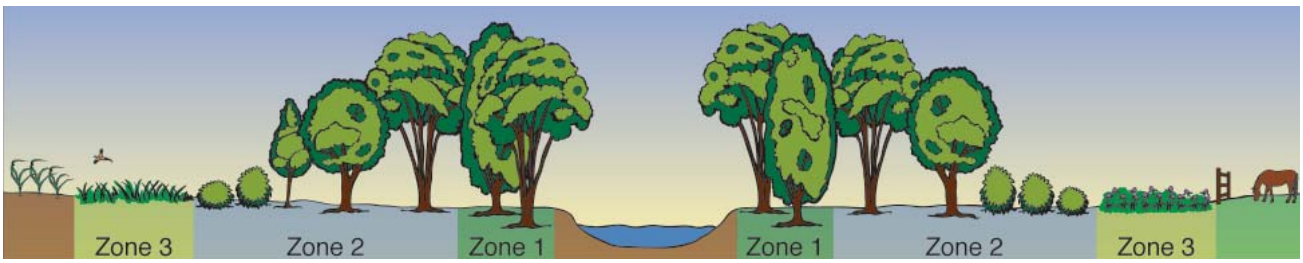


Figure 1. Example of a three-zone riparian forest buffer that is bordering cropland on the left side of the stream and pasture on the right. A strip of alfalfa may be substituted for the warm-season grasses in Zone III when the buffer borders pasture.

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Table 1. Minimum buffer widths for wildlife (not site specific)

Wildlife species	Buffer width (ft.)
Bald eagle, cavity nesting ducks, heron rookery, sandhill crane	600
Common loon, pileated woodpecker	450
Beaver, dabbling ducks, mink, and to maximize bird species diversity	300
Deer	200
Lesser scaup, harlequin duck, muskrat	165
Frog, salamander	100

NRCS – Conservation Practice Standard for Riparian Forest Buffer, Code 391

Riparian forest buffers improve water quality

Riparian forest buffers play a significant role in improving water quality by filtering sediment, nutrients and pesticides. Sediment entering a stream through soil erosion or field runoff negatively affects both the numbers and types of fish that can be found. An RFB protects the aquatic environment by significantly reducing the amount of sediment that can reach the stream. In a three-zone buffer, most of the sediment is trapped in the grass zone where dense stems slow and diffuse runoff. Tree roots also play a significant role in stabilizing stream banks and reducing erosion.

In agricultural areas, runoff of excess nutrients and pesticides into streams can be a significant concern. While narrow buffers are effective at trapping sediment, wider buffers (66 feet) are much better at transforming nutrients and pesticides. Nitrate-nitrogen and phosphorus (P) are frequently the agricultural nutrients of most concern. Riparian forest buffers have been shown to significantly reduce nitrate concentrations, largely through denitrification and vegetative uptake. RFBs are also very effective in reducing phosphorus concentrations. Since P is primarily attached to soil particles, reducing sediment loss through an RFB is the most effective way to reduce nonpoint source P pollution.

RFBs are also effective in both filtering and degrading pesticides. Pesticides are degraded more quickly in an RFB than in the field, largely due to enhanced soil characteristics in the buffer. Higher organic matter contents, greater infiltration capacity and higher microbial populations help bind and degrade pesticides more quickly.

Riparian forest buffers provide income opportunities

Multi-species, multi-use RFBs offer landowners an opportunity to not only improve stream habitat and water quality, but to explore income producing options from the buffer itself. When markets are identified, the buffer can be designed to produce income on both short- and long-term bases. High value hardwoods, such as walnut, oak or maple, may be planted in the managed woody zone (Zone II) and become a sustainable source of long-term income. Hybrid poplars are another option for Zone II and may be harvested for pulpwood, sawlogs or biomass. Shorter-term income may come from specialty forest products, such as fruits and nuts and decorative woody florals. In Zone III, the warm season grasses may be harvested annually for hay or biomass. (Note: Harvest may not be allowed depending on financial assistance programs used; check policies as part of the planning process.)

An example of how this might work comes from the Chesapeake Bay region. Based on a Mayan multi-layered, multi-species tropical forest practice, the model produces several sustainable forest products that can be marketed locally. In the Chesapeake Bay region, the adapted model included five species of fruit, four species of edible nuts and three woody ornamentals. The economic forest model provides both income production and environmental protection.

Government and other agency programs that provide technical and financial assistance to conserve and enhance soil and water resources may also be a source of income. Refer to *Financial assistance opportunities for riparian forest buffers* in this series for more detailed information about the types of programs available for establishing and maintaining riparian forest buffers.

For more information

Other publications in this series:

- Design of riparian forest buffers
- Establishment of riparian forest buffers
- Maintenance of riparian forest buffers
- Financial assistance opportunities for riparian forest buffers

Find the full series as well as additional resources at the University of Minnesota Extension website, **extension.umn.edu/buffers.**

Reviewers: Brian Nerbonne, Minnesota Department of Natural Resources and Ken Brooks, Department of Forest Resources, University of Minnesota.

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