

What is a Riparian Buffer?

A riparian buffer is a strip of vegetation along the bank of a stream or river that spatially separates more-developed land from the water. Buffers help to provide shade, protect the water from human land use practices, and control erosion. Plants used in buffers can include various grasses, forbs, shrubs, and trees [1].

Environmental Benefits of Riparian Buffers

Water Quality Protection

Pollutants and nutrients from pesticides, fertilizers, and livestock practices can leach from farmland and be transported in surface runoff, which may damage aquatic ecosystems. Riparian buffers are physical barriers between streams and developed land, which trap these pollutants and decrease their harmful effects. Nutrients found in most fertilizers and animal waste—nitrogen and phosphorus—often bind to soil particles causing them to be trapped in the buffer. Once in the soil, both microorganisms and plants transform these pollutants into less harmful forms and/or store them as biomass. Specifically, it has been found that 50-100% of the sediments and nutrients can be trapped or absorbed in riparian buffers [2].

Bank Stabilization and Erosion Control

Plant roots grow down into streambanks, creating a complex system that holds soil and makes the bank more secure and stable. Plant stems and other debris work to deflect the cutting action of water from high stream flows and runoff, which decreases erosion [3].

Shade and Wildlife Habitat

Aquatic habitats are improved by increasing water quality, steadying water flow, and introducing shade. Shade produces regions of cooler water, which can hold more oxygen and lead to reduced stress on aquatic organisms [3]. Additionally, the buffer acts as a source of woody debris that provides shelter for fish, invertebrates, and amphibians [4]. Riparian buffers also provide habitat for various terrestrial species like water fowl, nesting animals, and browsing herbivores, as well as cover for predators.

Groundwater Recharge and Flood Control

Buffers work to slow the rate at which water enters a stream or river. This prevents surface runoff from entering the stream too quickly and allows water to percolate into the soil. The reduction of fast-flowing water decreases the chances of flooding while allowing more water to be transferred into the ground, thereby recharging the groundwater [6].

“Using riparian buffers allows farmers to be accountable for the nutrients and sediments they deposit onto the land and keep waterways clean for current and future generations, while stabilizing streambanks.”

- Drugge and Doty (2019)

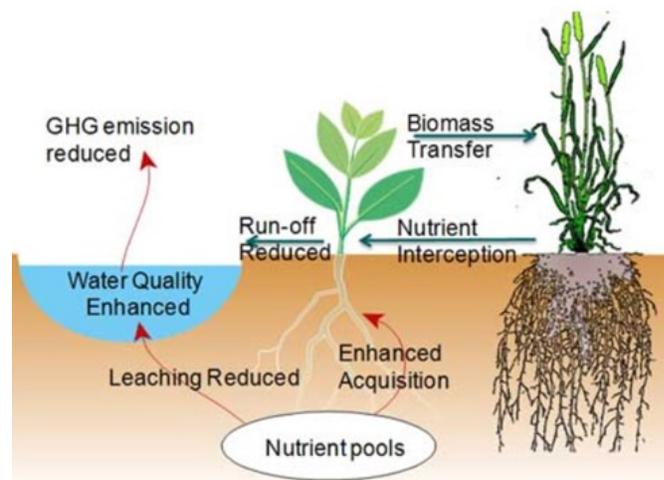


Figure 1: Functions of a Riparian Buffer [5]

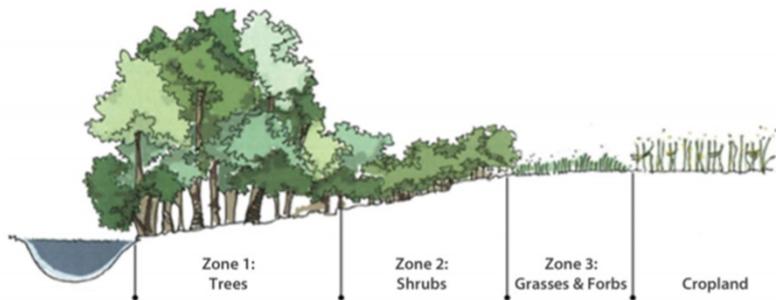


Figure 2: Riparian Buffer Zones [7]

What Plant Species Can Be Used?

Plants are chosen based on their ability to survive on site [8] and their contribution to the goals of the buffer. Trees and shrubs are better at capturing pollutants, providing wildlife habitats, and acting as an aesthetic barrier. Shrubs and grasses are used in low-no shade buffers but have less extensive root systems and are more easily smothered by sediment [3]. However, trees can have minimal shading if they can be coppiced—cut back to stimulate growth. *Populus* and *Salix* are genera commonly used for riparian buffers for this very reason [9].

Why is this Important to Farmers?

On organic and conventional farms, high levels of soluble and sediment-bound nutrients are transported from agricultural lands by surface runoff [10] and accumulate in rivers and streams. These nutrients are then carried and deposited into large surface waters (lakes and oceans), which can lead to eutrophication (algae blooms) and cause low dissolved oxygen levels deep in the water column. A lack of oxygen can result in dead zones and large fish kills. Using riparian buffers allows farmers to be accountable for the nutrients and sediments they deposit onto the land and keep waterways clean for current and future generations, while stabilizing streambanks. Tree-based buffers also invite wildlife into the region, which can potentially fend off pests (esp. birds) and provide woody biomass [10] that can be harvested and sold for profit.

Sources

1. U.S. Department of Agriculture, Natural Resources Conservation Service. 2011. Plants for riparian buffers. Aberdeen Plant Materials Center, Aberdeen, ID. 8p.
2. Coleman, J. 2007. Riparian buffers. *Habitat Herald*. 12(3).
3. Connecticut River Joint Commissions. 2000. Introduction to riparian buffers. Connecticut River Joint Commissions, Charlestown, NH. 4p.
4. West Virginia Department of Environmental Protection. 2019. Importance of riparian buffers. West Virginia Department of Environmental Protection.
5. Stutter, M.I. 2012. Phosphorus biogeochemistry in riparian buffer strips. The James Hutton Institute, Aberdeen, Scotland.
6. DeCecco, J.A., and Brittingham, M.C. 2005. Riparian buffers for wildlife. PennState Extension, The Pennsylvania State University, University Park, PA. 8p.
7. Agouridis, C.T., Wightman, S.J., Barton, C.D., and Gumbert, A.A. 2010. Planting a riparian buffer. Cooperative Extension Service, University of Kentucky College of Agriculture, Lexington, KY. 8p.
8. Westmoreland Conservation District. YOU CAN Stabilize a Streambank. Pennsylvania Department of Environmental Protection. 2p.
9. Isebrands, J.G., Aronsson, P., Carlson, M., Ceulemans, R., Coleman, M., Dickinson, N., Dimitriou, J., Doty, S., Gardiner, E., Heinsoo, K., Johnson, J.D., Koo, Y.B., Kort, J., Kuzovkina, J., Licht, L., McCracken, A.R., McIvor, I., Mertens, P., Perttu, K., Riddell-Black, D., Robinson, B., Scarascia-Mugnozza, G., Schroeder, W.R., Stanturf, J.A., Volk, T.A., Weih, M. 2014. Environmental applications of poplars and willows, pp 258-336 (Ch 6). In: *Poplars and willows: trees for society and the environment*. Isebrands, J.G., and Richardson, J. (Eds). FAO and CABI, Rome, Italy. 634p.
10. Osmond, D. and Burchell, M. 2017. Agricultural riparian buffers. NC Cooperative Extension, NC.

How Can I Develop a Riparian Buffer?

Numerous different buffer widths and types may be used. A basic buffer is 50 ft. away from the top of the streambank [2]. However, the wider the buffer the better. In fact, a 100 ft. buffer is known to remove 60% or more of the pollutants [3]. Greater buffer space may be needed if the riverside and/or land above the bank is sloped, land use (fertilizers, pesticides, construction) is intensive, soils are erodible, the region is on a floodplain, the streambank is meandering, or if the ratio of land drainage area to buffer area exceeds 60 to 1 [3].

Buffers are broken into three zones, as seen in Figure 2. Zone 1 is the closest to the water's edge, is planted with larger trees and shrubs, and provides bank stabilization and shade [6]. Zone 2 is landward of Zone 1 and contains managed forest [2] with diverse native trees and shrubs, which absorbs excess nutrients, protects water quality, and promotes groundwater recharge. Zone 3 contains native grasses, wildflowers, or other herbaceous species, and helps slow runoff, filters/traps sediments, and works to evenly distribute water throughout the buffer. Sizing of zones 1, 2, and 3 range between 35-50 ft., 50-75 ft., and at least 20 ft., respectively [6].

Additional Resources

Landowner Guide to Buffer Success

https://www.cbf.org/document-library/cbf-publications-brochures-articles/pa_buffer_guide-10-30-075717_1.pdf

Riparian Buffer Conservation Plan

https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_022756.pdf

Chesapeake Bay Riparian Handbook: A Guide to Establishing and Maintaining Riparian Forest Buffers

https://www.chesapeakebay.net/content/publications/cbp_13019.pdf