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Conservation Practices Fact Sheet Series

Agricultural Riparian Areas in Southern Appalachia

Photo: Tammy Barnes, NCAT

Introduction

Have you ever walked along a beautiful stream bank that has lots of trees and plants? Did you notice the abundance of insects, birds, and frogs in this area? There's a special name for this vegetated zone by a creek, stream, river, wetland or pond: riparian area or buffer. In agricultural settings, riparian zones can look very different; some can be buffered by trees, shrubs, grass, or a combination of these vegetative covers. How these buffers look depends on the stream size and order, topography, and whether the riparian areas have been impacted by agricultural activities such as grazing or tree harvesting. In the mountainous areas of southern Appalachia, most of the riparian areas are forested, and they are often headwaters for ephemeral, steep, fast-flowing streams that drain to valley floors. The streams in the valley are usually bordered by a mix of trees, shrubs, forbs, and grasses. A highly functioning riparian area has species richness, which consists mostly of native species.

Benefits of a Riparian Zone

There are many benefits of establishing or improving riparian areas. First, they buffer surface water, such as wetlands (lentic systems) and streams, creeks, and rivers (lotic systems) from the possible negative impact of nearby land use. In general, they protect and stabilize stream and wetland environments. Riparian areas and their associated stream edge are where groundwater and surface water mix, a place sometimes called a hyporheic area. Hyporheic areas are where nutrients are exchanged in the stream and where stream base flow is maintained.

Healthy riparian buffers can provide the following benefits:

- Protect the stream banks from eroding and preserve the stream's winding characteristics
- Protect surface water from nonpoint pollutants such as sediment, livestock and wildlife feces, as well as nutrients (nitrogen and phosphorus) from upslope land use

- Help maintain acceptable water temperature through shading and groundwater recharge
- Provide habitat for animals, fish, insects, native plants, and trees

Function of a Riparian Area

Runoff from agricultural production can contain pollutants such as phosphorus, pesticides, and bacteria. The roles of riparian vegetation are the uptake and long-term storage of nutrients, sediment capture from runoff, and stream bank stabilization. Many factors determine the effectiveness of riparian buffers. In agricultural areas, the most important factor is the type and amount of native vegetation. Think of woody tree roots as the rebar of the bank and grass/ forb roots as the cement.

Roots from woody species can remove nutrients from surface and sub-surface water. The water-borne nutrients that the woody species uptake are turned into new plant material (wood and leaves). The roots of the woodies protect the stream bank from excessively eroding by providing bank stabilization. However, trees are less effective than grasses in capturing runoff sediment before it enters the stream. Grasses and forbs in riparian systems trap sediment from field erosion, slow runoff that carries nutrients with the sediment, and take nutrients into their leaves and fibrous roots. A well-functioning riparian buffer system has grasses integrated. Often, the grass zone is found at the field edge and adjacent to the woody riparian zone.

Buffer width influences the effectiveness of a riparian area. Grassed areas of 20 feet or more are more efficient in removing surface runoff nutrients than smaller widths (Mayer et al., 2005). Interestingly, grasses and trees are highly efficient in removing nitrates in subsurface water.

Because the most effective riparian buffers have both trees and grasses, riparian areas that contain both these types of vegetation don't need to be as wide as grass-only buffers. For example, grass buffers are 75% effective in removing nitrates at 154 feet in width, while grass/tree buffers have the same efficiency at just 66 feet (Mayer et al., 2005). Most agricultural riparian buffer systems are designed to be 20 to 35 feet wide and have both trees and grass zones.

Common Native Species Used in Riparian Areas

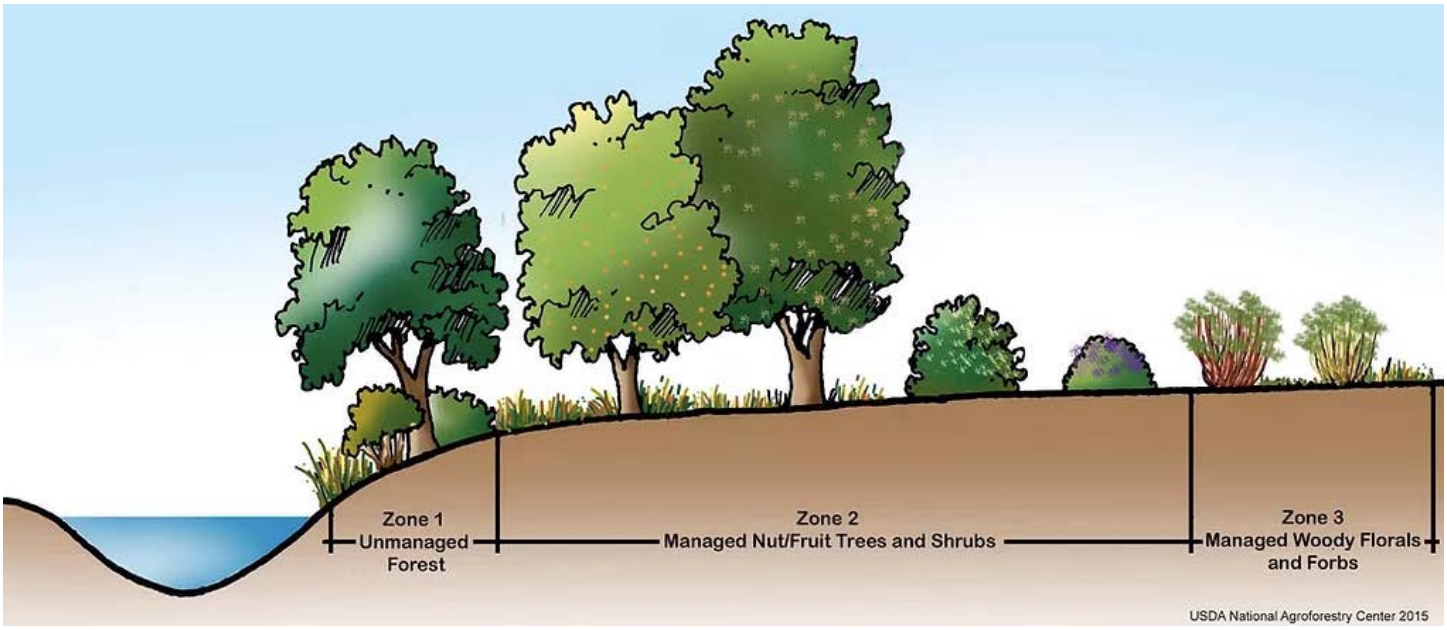
TREES
American sycamore
Swamp white oak
Swamp chestnut
Eastern cottonwood
Black walnut
Black willow
Red maple
Pin oak

TREES
Spicebush
Arrowwood viburnum
Eastern redbud
Buttonbush
Silky dogwood
Rough-leaf dogwood
Sumac
Elderberry

GRASSES
Switchgrass
Eastern gamma grass
Big bluestem
Riverbank wild rye
River oats
Deer tongue grass

PERENNIAL WILDFLOWERS
Great blue lobelia
Purple coneflower
Cardinal flower
New England aster
Swamp milkweed
Grey goldenrod
Greyheaded coneflower
Joe Pye weed

Figure 1



Riparian Forest Buffer Zones

Riparian forest buffers are commonly composed of three different vegetation zones:

- Zone 1 – The area that is closest to the stream bank, characterized by native trees, shrubs, and forbs that are adapted to floodplain soils and tolerate saturated conditions. The function of the plants in this area is to stabilize stream banks, provide shade to keep water cold, and provide woody debris and leaves for aquatic habitat.
- Zone 2 – This is a wider area, next to Zone 1, that consists of fast-growing trees and shrubs that can tolerate periodic flooding. Their primary function is to take up nutrients and store them. Woody plants can also slow floodwaters.
- Zone 3 – These are areas next to cropland or pastureland that spread runoff so water can be filtered, nutrients taken up by grasses, and sediment captured (if the width is appropriate). Native grasses and forbs, such as wildflowers and stiff-stemmed grasses, are the best choice, for their multiple ecological benefits. See Figure 1.

CREATING A FORESTED RIPARIAN BUFFER

Questions to consider before establishing a buffer system include the desired goals and how the buffer's function will be maintained. For example, one goal may be to stabilize the bank or prevent streambank erosion. Another goal may be to filter sediment and capture nutrients from agricultural working lands as they move toward the stream. Landowners should assess the site and identify problems such as invasive species, severe bank sloughing or caving, lack of native riparian vegetation, gullies, soil compaction in or near the stream from vehicle traffic or livestock, steep upright banks, or channelized, degraded stream beds. An assessment of the stream bed and bank by a professional will provide helpful information for planning.

Riparian buffers can be created naturally or by planting. The easiest and cheapest way to create a buffer is to define a no-graze or no-mow zone next to the stream. Fencing livestock out of the area and providing an alternative source of water and shade for them will improve the riparian area's function and water quality. Determine the width of the buffer area by identifying problem spots such as gullies and weighing treatment for those against the need to create straight lines for operating equipment.

Common Invasive Species

Bush honeysuckle *(Lonicera maackii)*
Chinese privet *(Ligustrum sinense)*
Common Reed *(Phragmites australis)*
English ivy *(Hedera helix)*
Garlic mustard *(Alliaria petolata)*
Japanese knotweed *(Fallopia japonica)*
Japanese honeysuckle *(Lonicera japonica)*
Japanese stiltgrass *(Microstegium vimineum)*
Kudzu *(Pueraria lobata)*
Multiflora rose *(Rose multiflora)*
Purple loosestrife *(Lythrum salicaria)*
Reed cannarygrass *(Phalaris arundinacea)*
Tree-of-Heaven *(Ailanthus altissima)*
Winter creeper *(Euonymus fortinei)*

Fenced riparian area in livestock field. Photo: Tammy Barnes, NCAT

Native riparian species in restored riparian area. Photo: Tammy Barnes, NCAT

If stream banks are steep and eroding, they may need re-grading; seek advice from an experienced professional and check on required permitting before undertaking this kind of treatment. In this situation, active restoration of the riparian buffer by planting may be the best choice, but it is more expensive. There are several steps for restoring or improving a forested riparian area after an assessment:

- Select a site based on the professional's recommendations and the hydrology in the area. For example, it may be a good idea to take part of a crop field out of production because of its persistent wet conditions and observed poor crop performance.
- Remove invasive species.
- Prepare the site before planting. This may include mowing, appropriate herbicides, and soil preparation.
- Take a soil test to determine if amendments are required.
- Consider which plants will be established in each of the three zones. Keep in mind that mature trees will cause thinning of grass and forb species, so planting shrubs between trees and the grass zone will promote their growth over the long run. Consider tree and shrub species that have the potential for marketable, value-added products, like blackberries. Warm-season grasses, native pollinator species, and native forbs are the best for this area in the zone next to the crop or pastureland.
- Protect seedlings from livestock and wildlife for successful establishment. Examples of protection are tree shelters (cylinders) tall enough to prevent browsing from above, exclusionary fencing, and fabric mats to prevent competition for water and nutrients from grasses and weeds.

Reference

Mayer, Paul, Steven Reynolds, and Timothy Canfield. 2005.Riparian Buffer Width, Vegetative Cover, and Nitrogen Removal Effectiveness: A Review of Current Science and Regulations. U.S. Environmental Protection Agency. EPA/600/R-05/118. epa.gov/sites/default/files/2019-02/documents/riparian-buffer-width-2005.pdf

Resources

For additional information on riparian buffer planting maintenance, contact your local Cooperative Extension Office, USDA Natural Resource Conservation Service (NRCS), USDA Farm Service Agency (FSA), local Soil and Water Conservation District, or State Department of Fish and Wildlife Resource Office.

For information about riparian buffers and agroforestry:

Agricultural Riparian Buffers
https://content.ces.ncsu.edu/agricultural-riparian-buffers

Agroforestry (ATTRA Topic Area)
attra.ncat.org/topics/agroforestry

Effects of riparian zone buffer widths on vegetation diversity in southern Appalachian headwater catchments. 2016. By Katherine J. Elliot and James M. Vose. Forest Ecology and Management. Vol. 376. p. 9-23

Establishing and Managing Riparian Forest Buffers
extension.missouri.edu/publications/af1009

Planting a Riparian Buffer
publications.ca.uky.edu/sites/publications.ca.uky.edu/files/id185.pdf

Protecting Riparian Areas: Farmland Management Strategies (ATTRA Publication)
attra.ncat.org/wp-content/uploads/2022/11/riparian.pdf

Restoring Streams
publications.ca.uky.edu/files/AEN122.pdf

Riparian Buffer Strips as a Multifunctional Management Tool in Agricultural Landscapes: Introduction. 2012. By Marc Stutter, Wim Chardon, and Brian Kronvang. Journal of Environmental Quality. Vol. 41. p. 297-303.

Riparian Buffers: A Livestock Best Management Practice for Protecting Water Quality
afs.ca.uky.edu/files/riparian_buffers.pdf

Riparian Buffers in Forest Management: Establishment, Effectiveness, and Recommendations
ncagr.gov/divisions/nc-forest-service/riparian-buffers-forest-management/download?attachment

Riparian Forest Buffers
fs.usda.gov/nac/practices/riparian-forest-buffers.php

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