Riparian Forest Buffers

Benefit and Value

Riparian forests are located adjacent to streams (both perennial and intermittent), and open bodies of water (Figure 1). They differ from upland forests in terms of topography, soils, function, and species mix. In general, riparian forests are located on deep soils and have a more diverse species mix than the drier upland forests. Hydrologically, these forests filter runoff and sediment from the adjacent lands, slow damaging flood waters, and recharge aquifers.

Figure 1. *Riparian forests are located on the banks of water bodies and filter runoff and sediment from the adjacent lands.*

Riparian forests trap nutrients and organic debris. As runoff from adjacent lands flows through a riparian forest, the water is slowed, allowing soil particles, nutrients, agricultural chemicals, and bacteria to settle. It is important for sediment to settle within the forest buffer to reduce sediment loads in streams and the filling of lakes and reservoirs. This settling process is especially effective at reducing phosphorus in runoff because 85 percent of available phosphates are bonded to small soil particles.

Soil bacteria and fungi break down nitrogen and organic debris into mineral nitrate forms. These nitrates are absorbed by plant roots, while other bacteria convert dissolved nitrogen into various nitrogen gasses that are returned to the atmosphere.

Maintaining streamside vegetation is an easy and cost-effective way to control nutrient problems in streams and rivers. By physically slowing runoff, riparian vegetation also increases infiltration, which stores flood water and recharges aquifers. In this way, damaging flood waters are released slowly, maintaining stream flow. Oxbow channels and adjacent wetlands also serve as overflow and storage basins during high flows.

Riparian forest buffers maintain streambank stability, especially during floods. Aerial photos taken before and after the 1993 flood in Kansas showed riparian forest buffers along 37 miles of the Kansas River were responsible for the deposition of an average of 10 feet of soil while grasslands and croplands lost an average of 78 feet and 155 feet of sediment respectively.

In Kansas, riparian forests serve as excellent wildlife habitat and support many game and nongame species of mammals, fish, amphibians, reptiles, and birds. They serve as travel corridors linking rivers, wetlands, and larger blocks of forestlands.

Trees provide shade, which cools the water flowing beneath them. This improves the aquatic habitat by lowering stream temperatures, increasing the amount of oxygen in the water, and reducing evaporation from the water. Overhanging roots and branches also provide good fish habitat and organic inputs into

stream systems from falling leaves and small branches. This organic matter serves as the basic food source for fish and other aquatic life.

Larger organic debris, such as large branches, root wads, and fallen trees also provide cover and serve as feeding and resting places for macroinvertebrates, amphibians, and reptiles.

Riparian buffers are aesthetically pleasing and provide many recreational opportunities such as hunting, fishing, bird watching, and wildlife photography. Well-managed riparian buffers also can provide economic returns from quality timber for commercial harvesting.

Maintaining and Enhancing Existing Riparian Forest Buffers

Maintaining existing riparian forest buffers is the most cost-effective means of protecting and improving the water resources in Kansas. An effective riparian forest buffer has easily recognizable characteristics, including adequate width, a diverse tree and shrub community, stable bank vegetation, a well-developed understory, deep forest litter layers, and runoff that moves through the buffer as sheet flow rather than concentrated flow.

The width of an effective riparian forest buffer depends on the slope of adjacent land, adjacent land use, and the purpose of the buffer itself. Given ideal conditions, buffers as little as 50 feet wide (measured from the streambank) may substantially reduce nonpoint source pollutants from agricultural and urban runoff. In general, buffer widths should increase as 1) slope increases, 2) agricultural or urban runoff increases in amount or toxicity, or if 3) providing wildlife habitat or recreational opportunities are purposes of maintaining the buffer strip.

An ideal riparian forest buffer consists of three horizontal zones along the streambank (Figure 2). The first zone, measured from the top of the streambank is the streambank stability zone. The purpose of this zone is to create a stable bank adjacent to the water's edge. This zone provides streambank stability and contributes organic matter and large woody debris to the stream channel. The recommended minimum width for this zone is 15 feet. Management in zone one should be limited to stabilizing the banks and removing potential problem vegetation. Occasional removal of high-value trees may take place where water quality will not be compromised and young replacement trees and shrubs exist.

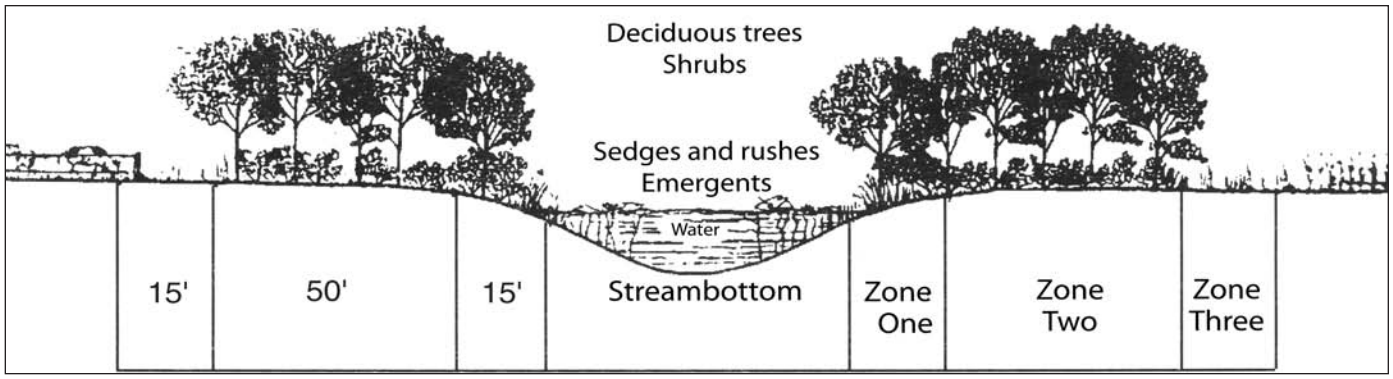
The second zone is the main filtration zone and will occupy an additional strip of land measured from the outside edge of zone one. Recommended width for zone two is a minimum of 50 feet. The purpose of this area is to allow the necessary contact time between runoff and the forest floor. Runoff in this zone should be sheet or subsurface flow rather than concentrated flow. Zone two also provides wildlife habitat and wood production. Management in zone two should include periodic harvesting and thinning.

The third zone is located at the outer edge of zone two and is called the initial filtration zone. The initial filtration zone converts concentrated flow to sheet flow. Zone three is comprised of dense grasses and forbs that are mowed or grazed to recycle trapped nutrients and maintain vigorous growth. The minimum width of zone three should be 15 feet. Installing structures or grading and shaping may be necessary to obtain uniform sheet flow into the riparian forest buffer.

All three zones serve a specific purpose and should occur in some form in an effective riparian forest buffer. Minimum buffer widths are strongly recommended, but narrower buffers can be managed to obtain some of the benefits.

Grazing in the riparian buffer, if not excluded, should be controlled through a combination of fencing, salt placement, alternative water sources, and rotational grazing. If livestock are allowed unlimited access, riparian benefits can be greatly reduced due

Figure 2. *Cross section of an ideal riparian forest*



to soil compaction and the loss of understory shrubs, forbs, and grasses. If properly managed, grazing can be a compatible use on these areas. However, during the period of tree and shrub establishment, livestock access should be completely restricted.

Existing riparian forests may need to be reinforced, enlarged, or brought under management to fully obtain the benefits that these areas can provide. Reinforcement and enlargement can be accomplished through planting suitable trees and shrubs. Often the same results can be achieved by simply altering grazing practices or letting an area return to native vegetation. One of the most important steps for achieving an effective buffer is to create even sheet flow or subsurface flow through these areas. If runoff is concentrated in gullies, pipes, or tiles, it will not come in contact with the forest litter layer and vegetation, thus bypassing the whole buffering process.

Implementation of Practice

In many cases, riparian forests have been cleared and converted to agricultural production. Removal of these forests has often resulted in increased soil erosion and decreased bank stability. Runoff occurs faster in converted areas, resulting in higher peak flows and flooding downstream. As the benefits associated with riparian forest buffers are better understood, landowners are reestablishing these areas as part of their overall farm conservation plan. Site-specific reestablishment recommendations will depend on many factors, such as adjacent land use, path of runoff, soil type, depth to water table, and landowner objectives, but some general recommendations are as follows.

1. Planting plans should contain a variety of tree and shrub species (See Table 1.) A typical design recommends flood-tolerant species such as willow, cottonwood, and sycamore near the stream and more drought tolerant species farther up the slope.
2. Plans should include bank stabilization recommendations if necessary. Bank stabilization practices and riparian forest buffer establishment are both needed to address bank instability (See Figure 3.)
3. Converting concentrated flow to uniform dispersed flow is an important factor in the establishment of an effective riparian forest buffer
4. Reestablishment plans should be based on landowner objective, such as treatment of field runoff, timber production, and wildlife habitat enhancement.

Table 1. *Recommended tree and shrub species for riparian forest buffer plantings in Kansas.*

Tree Species		
Baldcypress	Green ash	Pecan
Black walnut	Hackberry	Pin oak
Black willow	Honeylocust	River birch
Bur oak	Northern red oak	Silver maple
Eastern cottonwood	Peach-leaved willow	Sycamore
Shrub Species		
American plum	Fragrant sumac	Sandbar willow
Choke cherry	Golden currant	Sandhill plum

Figure 3. *Young riparian buffer with bank stabilization along the edge of a crop field.*

Several technical and financial assistance programs for reestablishing or enhancing existing riparian forest buffers are available through state and federal agencies. Practices that can be cost-shared include streambank stabilization, buffer planting, woodland management, riparian fencing, and development of alternative water sources. For additional information on riparian forest buffers, cost-share opportunities, or technical assistance contact the Kansas Forest Service, your local conservation district office, K-State Research and Extension office, Natural Resources Conservation Service office, or the Kansas Department of Wildlife and Parks.

References

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