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Riparian Buffers: Functions and Values

Kyle Cunningham
Associate Professor
of Forestry

Water quality is an ever-growing concern in Arkansas. This concern has been demonstrated by the designation of nutrient surplus areas within Arkansas by Legislative Act 1061 of 2003. Nutrient levels in these areas are such that continued application of fertilizer or nutrients could negatively impact waters in Arkansas. Stormwater runoff from agricultural fields and urban areas can deposit significant quantities of sediment and nutrients into drainages, streams and rivers. These pollutants can have significant impacts on aquatic organisms. A method for reducing pollutant deposition to these waterbodies is the implementation of riparian buffers. Riparian buffers can take on various forms, depending on the goals for the buffer. This fact sheet discusses the different functions and values of riparian buffers and their importance to water quality and beyond.

What Are Riparian Buffers?

A riparian area is the land adjacent to a stream, river or other waterbody (Figure 1). This land could be naturally vegetated, utilized for agriculture or developed for urban use. These land areas affect and are affected by the stream or waterbodies. In areas where vegetation has not been significantly disturbed, riparian areas help to maintain high water quality and healthy aquatic communities.

Riparian buffers are strips of vegetation established next to waterways in managed landscapes and are designed to capture runoff, nutrients and sediment and to restore a more natural aquatic environment. Riparian buffers typically range in width from 30 to 300 feet from stream banks. The vegetation utilized may include grasses, shrubs and/or a variety of trees. Each vegetation type performs unique functions in the system. These functions directly and indirectly generate different types of value.

Figure 1. A riparian buffer.

Photo by USDA NRCS

Advantages of Riparian Buffers

- ✓ *Reduced stormwater runoff*
- ✓ *Reduced sediment and nutrient runoff*
- ✓ *Improved water quality*
- ✓ *Ecological benefits*
- ✓ *Economic benefits*
- ✓ *Multiple-use benefits*
  - *Timber production*
  - *Wildlife habitat*
  - *Aesthetics*
  - *Recreation*
  - *Social value*

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What Is the Purpose and Function of Riparian Buffers?

Riparian buffers provide several important ecosystem services. These services can be classified into two broad categories. The first category relates to their ability to limit or reduce the environmental impact of management practices in upland portions of the landscape on water quality and aquatic organisms. The term buffer can be defined as "something that serves to separate two items" or "to lessen the shock." Thus, riparian buffers separate aquatic ecosystems from managed lands and maintain water quality by acting as filters to lessen the amount of pollutants entering streams from the managed areas. The second category relates to a much wider array of riparian functions. In Arkansas the dominant vegetation in natural riparian areas is usually trees. Thus, forested buffers also provide wildlife habitat, stream temperature moderation, stream bank stabilization, and food and habitat for aquatic organisms. A more detailed explanation of these categories is below.

Buffering and Filtering

Sediment and Pollutant Removal. One of the primary purposes of riparian buffers is to reduce the amount of sediment, chemicals and other pollutants entering streams and waterbodies. Water draining from croplands, pastures, managed forests or even urban developments can contain sediment, fertilizer, pesticides and other pollutants (Figure 2). Riparian buffers intercept and filter these materials in several ways. Vegetation, such as grass or dead foliage and branches from trees on the soil surface, reduces the velocity of surface runoff as it enters the buffer. Sediment and particulates contained in runoff are deposited in the buffer rather than in a stream as this runoff velocity is reduced. The reduction of velocity also allows the surface water to better infiltrate the soil, carrying pollutants and chemicals below the soil surface. Roots of vegetation in the buffers absorb excessive nutrients and other chemicals contained in the subsurface water. Trees and grasses utilize the excess nutrients (nutrients which originate from fertilizer applications or livestock operations outside the buffer) to grow. These nutrients, especially in trees, can be stored in biomass for many decades. In addition, microbial organisms in the soil degrade chemicals and pesticides, reducing the potential for these materials to enter streams. Anaerobic soil microbes (organisms that live in wet soils) can convert excessive nitrogen from fertilizer to a gas which is dissipated to the atmosphere rather than entering streams. Where fertilizer or pesticides are applied by aircraft, buffer edges clearly delineate the boundaries of a field or managed forested stand from that of the stream or waterbody. Thus, direct application of agrochemicals to the stream can be avoided. All of these attributes help to maintain or improve water quality within the landscape.

Figure 2. Unprotected waterways are vulnerable to degradation.

Riparian Ecosystem Services

Aquatic Habitat. Since riparian vegetation occurs at the edge of streams or waterbodies, it is a source of food and structural habitat for aquatic organisms. Foliage and branches that fall into the stream provide a source of food to benthic invertebrates (small organisms without backbones that live in streams and lakes). Many of these organisms have specialized features that allow them to shred the tissues of this vegetation for consumption. In small streams and headwaters, these invertebrates are at the bottom of the aquatic food chain. Restoration of this vegetation to stream banks ultimately increases the productivity of streams. Large woody debris (LWD) such as fallen trees and limbs provide structural habitat for aquatic communities in the waterbodies. LWD provides a location for benthic invertebrates to cling to, reduces stream velocity and thereby provides resting areas for fish. It helps to add diversity to streambed habitat.

Bank Stability and Erosion Protection. Vegetation and especially tree buffers stabilize the banks of streams and reduce the ability of streams to erode banks. Roots of trees and other vegetation bind the soil together. Vegetation is especially important in securing point bars that are typically formed by streams or rivers. Reduction of bank erosion maintains the stream's depth and width. Canopies of both grass and trees as well as the forest floor in forested buffers intercept precipitation and shield the soil surface from erosion. Raindrops that hit the ground without striking vegetation contain more energy than do those that drip off vegetation. These raindrops more frequently detach and erode soil particles. Buffers reduce erosion and ensure that soil located in riparian areas does not become a source of sediment in streams.

Alteration of Stream Climate. Trees in buffers help to reduce stream temperatures (Figure 3). Studies have indicated that clearing of trees around streams can increase maximum summer water temperatures by 7º to 21ºF. Retention of forested strips along streams, even when trees outside this strip are removed, can limit these increases to less than 2ºF. Reductions in temperatures are important for maintaining high levels of dissolved oxygen in water, since cooler water can hold higher concentrations of O_2 than warm water. This is important for survival and growth of fish species that require higher levels of dissolved oxygen. For example,

Figure 3. Trees can be very beneficial to the stream climate.

growth of juvenile smallmouth bass has been found to decrease with water temperatures above 86ºF. Wind speed and humidity are also altered by riparian vegetation. Removal of forested riparian vegetation leads to an increase in wind speed and reduction of humidity which may have negative impact on aquatic and riparian communities. Therefore, it is recommended that managed forests include streamside management zones (SMZs) that reduce management activity in strips of existing forested areas adjacent to streams. Establishing forested riparian buffers in agricultural or urban areas can have positive impacts on aquatic and riparian communities by moderating the water temperatures and climate.

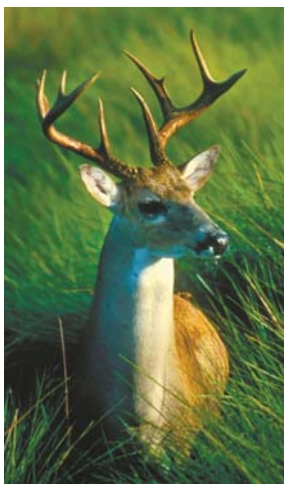

Figure 4. Riparian buffers greatly improve wildlife habitat.

Photo by U.S. Fish and Wildlife Service

Wildlife Habitat. Riparian areas are important habitat for a number of wildlife species (Figure 4). Since these areas are transitional zones that can be flooded or extremely dry at other periods of the year, they frequently are home to a diverse community of mammals, amphibians, birds and reptiles. In managed forest landscapes, riparian buffers are often a refuge for cavity-dwelling wildlife, such as flying squirrels, when upland forests are harvested. Riparian areas and buffers can also provide travel corridors for terrestrial wildlife, linking different habitats or portions of an animal's territory.

How Do Riparian Buffers Increase Property Value?

One might ask, "How can the removal of land from production increase the value of a property?" Fact is, there are many added values that are generated when riparian buffers are constructed on a property. These values may include timber, wildlife, recreation, aesthetics, social, economic, environmental and others. Depending on the goals for a buffer and the particular buffer type implemented, riparian buffers may achieve one or all of the aforementioned values.

Timber Value

Often there is a misconception that land put aside for riparian buffers is no longer productive and therefore does not generate an economic return. This notion could not be farther from the truth. Portions of riparian buffers that include a forested component may be managed for timber production and are often more productive than drier upland forests (Figure 5).

Figure 5. Riparian forest buffers can be managed for timber production.

Managing the timber in a buffer serves two purposes: (1) it allows the landowner to produce a commodity for economic gain, and (2) it aids in sustaining a vigorous, growing forest that optimizes nutrient uptake. Using a forested riparian buffer provides both economic and environmental benefits.

Non-Traditional Economic Values

Buffers may provide other economic benefits including potential biofuel feedstocks from grasses (such as switchgrass), carbon sequestration contracts, hunting leases, alternative agricultural products (fruits) and others.

Wildlife Value

Many landowners are very interested in increasing wildlife habitat on their property, often for the purposes of generating revenue. As stated earlier, riparian buffers can facilitate this role effectively. First, buffers can be designed to include vegetation structure and types that focus on providing food or other forms of habitat for a particular species (such as quail). Secondly, buffers can be designed to provide diversity in habitat structure that is critical for many game and non-game species (such as songbirds). Improving wildlife habitat increases recreational opportunities, revenue potential and property value.

Recreational Value

Riparian buffers greatly impact recreational opportunities for a property. The most obvious area of potential impact would be in urban areas where forested riparian buffers can be established to provide a park-like atmosphere for local residents to utilize. Often these "urban buffers" contain walking or biking trails to increase recreational opportunities. Other buffer types, on agricultural lands, could provide different types of recreational opportunities such as hunting or wildlife viewing.

Aesthetic Value

Riparian buffers of any type will increase the aesthetic value of a property. In agricultural areas, buffers can provide a break in the terrain. Alternately, in urban areas buffers can be used to create park-like areas or simply natural areas that separate urban structures. Also, different types of vegetation may be utilized that provide aesthetic quality, such as planting flowering tree species including dogwood, redbud or others. The aesthetic potential of buffers should never be underrated. Increased real estate values are frequently associated with forest and trees in urban areas. In this case, aesthetic value can frequently translate into long-term increased property values.

Social Value

The social value of riparian buffers could potentially provide the greatest benefit of all buffer attributes. In urban areas, the values of riparian buffers are obvious in that they assist in increasing the livability of urban areas such as subdivisions or commercial zones. In agricultural areas – particularly in nutrient surplus areas – the mere act of implementing riparian buffers could ease conflicting views toward agricultural practices and impacts on water quality, which could provide the largest overall social benefit.

Riparian buffers provide an excellent opportunity to provide multiple environmental, ecological and social benefits while assisting landowners in creating multiple-use opportunities for their lands. Establishing riparian buffers is currently a voluntary practice that has the potential to reduce pressures for increased regulation on land management methods for Arkansans. Landowners should examine how establishing riparian buffers on their property could enhance value and improve the livability for their families and their respective communities.

For additional information, see fact sheet FSA5027, *Riparian Buffers: Types and Establishment Methods*.

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KYLE CUNNINGHAM is Extension associate professor of forestry, University of Arkansas Division of Agriculture, Cooperative Extension Service, Little Rock.

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