NRCS Natural Resources Conservation Service

WILDLIFE HABITAT COUNCIL™

Riparian Systems

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Introduction

Riparian areas are transitional zones between terrestrial and aquatic systems exhibiting characteristics of both systems. They perform vital ecological functions linking terrestrial and aquatic systems within watersheds. These functions include protecting aquatic ecosystems by removing sediments from surface runoff, decreasing flooding, maintaining appropriate water conditions for aquatic life, and providing organic material vital for productivity and structure of aquatic ecosystems. They also provide excellent wildlife habitat, offering not only a water source, but food and shelter, as well.

Soils in riparian areas differ from soils in upland areas because they are formed from sediments with different textures and subjected to fluctuating water levels and degrees of wetness. These sediments are rich in nutrients and organic matter which allow the soils to retain large amounts of moisture, affecting the growth and diversity of the plant communities.

Riparian areas typically are vegetated with lush growths of grasses, forbs, shrubs, and trees that are tolerant of periodic flooding. In some regions (Great Plains), however, trees may not be part of the historic riparian community. Areas with saline soils or heavy, nearly-anaerobic soils (wet meadow environments and high elevations) also are dominated by herbaceous vegetation. In intermittent waterways, the riparian area may be confined to the stream channel.

Threats to riparian areas have come from many sources. Riparian forests and bottomlands are fertile and valued farmland and rangeland, as well as prime water-front property desired by developers. Since the early 1900s, riparian areas have been cleared and converted to use as pastures, cultivated fields, and housing developments. Urban encroachment, channelization, and other water resource development activities have contributed to the destruction and alteration of native riparian areas. Symptoms of degraded riparian systems include erosion, hypoxia (or lack of oxygen), declines in water quality, colonization by invasive

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Riparian examples: California river (top); Maine lake (middle); and Wyoming intermittent stream (bottom)

plants which reduce habitat suitability for wildlife, and more frequent and expansive flooding.

The objective of this leaflet is to assist farmers, ranchers, watershed planners/managers, homeowners, and community members in understanding the importance of riparian areas and provide guidance in implementing land management practices to improve riparian health. Additionally, methods for assessing riparian conditions and identifying resources available to assist in management are provided.

Benefits and functions of riparian systems

Riparian systems look and function differently across the country. In spite of their differences, riparian areas possess some common ecological and hydrological characteristics; namely, water storage, flood control, nutrient cycling, and water quality protection. They provide recreational and economic benefits, as well.

Hydrology

The flooding is important to riparian ecosystems as it can affect stream morphology and vegetation. Water storage is recharged through seepage and channel overflow onto flood plains. Nutrients in riparian ecosystems are partially supplied by materials and water delivered during flood events. Additionally, overbank flooding ventilates soils and roots so that gases are exchanged more rapidly. Oxygen is supplied to roots and soil microbes, and the release of gaseous products of metabolism, such as carbon dioxide and methane, is enhanced.

Maine Department of Environmental Defense

Impervious surfaces, such as roads and parking lots, do not allow water to infiltrate the soil quickly. This increased runoff can quickly overflow storm drains, potentially causing flooding.

The hydroperiod, which includes duration, intensity, and timing of flooding, is the determinant of the ecosystem's structure and function. The timing of flooding is particularly important. Flooding in the growing season has a greater effect on ecosystem productivity than does flooding in the nongrowing season.

Ground water has a close relationship with surface water in streams and flood plains. The normal gradient and direction of ground water movement is toward surface water features through ground water discharge. During periods of high water, the gradient is reversed, and water moves from the stream to the aquifer. The recharge of ground water is vitally important. In the West, many streamside aquifers go dry late in the season due to poor livestock management in riparian areas, as well as beaver removal, mining, and poor upland watershed management as a whole.

Water storage and flood reduction

Riffles, pools, bars, and curves in the stream channel absorb the energy of flowing water. If the channel is not altered and remains in contact with the flood plain, floodwaters will spread out over the flood plain. As the floodwaters move through the riparian vegetation, plants dissipate erosive energy, reduce erosion, and increase the time for water to infiltrate the soils and be stored for slow release.

Nutrient cycling

When nutrient-rich sediment is deposited on the flood plain, it is modified by a number of different chemical and biological mechanisms and cycled through the system. Nutrients like nitrogen, phosphorus, calcium, magnesium, and potassium are rapidly taken up by shallow-rooted plants like grass. Easily dissolved nutrients that may leach downward through the soil into the ground water are taken up by deeper-rooted vegetation, such as trees. Some of the nutrients taken up by plants are returned to the system during autumn leaf fall or when the vegetation dies and is decomposed.

Energy transfer

Riparian areas are unique in the way in which energy contained in organic matter is transferred from organism to organism. Energy inputs from riparian vegetation are closely tied to the productivity of instream habitats. That is, energy contained in organic litter in the form of fallen leaves, twigs, and other dead plant parts, when transported laterally into waterways, provides fuel for instream animal communities both locally and downstream from the source of origin. As compared with purely aquatic or terrestrial ecosystems, organic matter produced in riparian ecosystems has the potential for supporting a diversity of food webs within the entire watershed.

Water quality protection

As flood waters spread over a flood plain, water velocity is reduced by the vegetation, which allows much of the sediment to settle, reducing the likelihood of its re-entering the stream. Riparian vegetation increases sedimentation of particulate matter in the flood plain by filtering additional sediment from runoff and floodwaters. The result is that riparian areas serve as effective sediment traps and reduce the amount of sediment that might otherwise enter a stream or downstream waterbody.

William Hohman, NRCS

Aerial photograph of a functional flood plain in northern Minnesota in spring. Meanders in the river help absorb the energy of flowing water. Functioning flood plains hold water and reduce downstream flooding.

Riparian vegetation also reduces sediments in the water by decreasing the rate of bank erosion. Deep-rooted woody vegetation has the greatest stabilizing affect on streams or riverbanks.

Nutrients, pesticides, and heavy metals are transported with sediment and trapped in the riparian area. Many of these are broken down by physical or biochemical processes and reduced to harmless forms. Some are taken up by riparian vegetation and incorporated into their living tissues during the growing season. Others bind to sediments and are permanently stored in the soils of riparian areas.

Recreational and economic benefits

Stable streams, made possible by an intact riparian system, protect and enhance river and lake environments for recreational uses such as hiking, camping, hunting, fishing, and boating. Clear water, free of noxious plant or algal growths, is important to swimmers and anglers. The scenic qualities of natural beauty, wildness, and privacy are enhanced by native streamside and lakeshore vegetation. In urban, residential, and campground areas, natural streamside and lakeshore vegetation provides a visual contrast and buffers the noise from nearby highways.

The ecological benefits, visual diversity, and aesthetic beauty of a riparian system can be considerable; however, there are some economic benefits to a riparian area, as well. In some cases, haying, logging, or alternative, low intensity agricultural enterprises (such as harvesting Christmas trees, strawberries, mushrooms, or nuts) can be conducted with minimal harm to the riparian area.

Washington State Department of Ecology

Black bears will utilize riparian areas for food and denning sites.

Wildlife use

General

Riparian areas are extremely valuable wildlife habitat. Site characteristics (high productivity, structural complexity) and landscape situation (habitats interwoven between terrestrial and aquatic systems throughout the watershed) contribute to the importance of riparian areas as wildlife habitat.

Vegetation (whether living, decaying or dead, standing or fallen) has a major influence on wildlife use of riparian areas. The shade, detritus, and coarse woody debris provided by streamside vegetation are very important for healthy fisheries. Leaves, branches, and even whole trees uprooted by rivers or other natural forces become food and shelter for aquatic organisms. Logs falling into streams often divert streamflow into new pathways, thereby increasing the complexity of the channel and helping to maintain a diversity of habitat niches for aquatic plants and animals. A multi-storied plant canopy of annual and perennial grasses and forbs, as well as juvenile and mature shrubs and trees, provides a variety of above-ground habitat for birds and other wildlife, and below-ground habitat for burrowing animals and soil organisms. Large numbers of migratory and resident birds rely on streamside habitat. More than 100 native species of land mammals in the United States are dependent on riparian zones.

Mammals

Mature riparian forests provide important habitat for small to large mammals. Black bears may be found in riparian areas, particularly where there is brushy cover for hiding and mature hardwoods for denning and food production. White-tailed deer make use of these areas for forage and cover. Land mammals use riparian areas as corridors for movement and routinely hunt along waterways. Many mammals use riparian areas as travel corridors as they disperse from their dens. Other mammals commonly associated with riparian areas are beaver, mink, muskrat, and river otter.

Reptiles and amphibians

Connections to uplands within and beyond the riparian area are important to reptiles and amphibians and need to be managed. Many species of amphibians rely on aquatic habitat during the breeding season and then spend most of their lives in upland habitat, often at a considerable distance away. The reverse is true for many reptiles as they need dry upland sites for nesting. Fallen trees and snags (remaining dead trees) are used as shelter and a source of food for many species of amphibians and reptiles.

Birds

Birds use riparian areas as nesting, migrational, and wintering habitat. Abundant invertebrate foods produced in riparian areas and adjacent aquatic zones are especially important to birds during migration and nesting, when nutritional demands are great. Winter flooding of riparian areas provides access to foods at southern latitudes. When large trees mature and die, the standing snags provide habitat for cavity nesting birds. Bird use of riparian areas has been shown to be positively associated with the number of snags, canopy layers, saplings, tree size, and diversity of vegetation. Residents use riparian corridors for local movements throughout the year.

Aquatic communities

Riparian areas provide organic matter and substrate required by instream organisms. Organic material in the form of twigs, branches, bark, leaves, nuts, fruits, and flowers originating in riparian vegetation adjacent to the stream is broken down by aquatic microorganisms and stream invertebrates.

Overbank flooding of streams and rivers also provides organic matter and nutrients used by aquatic communities. During periods of high water levels, rivers and streams expand into the adjoining riparian flood plain, picking up large amounts of organic matter, nutrients,

NRCS

Riparian areas serve as wildlife corridors providing important routes for the yearly migrations of land animals and birds. As seen in this image, connecting corridors allows wildlife to travel without entering farmland or developments.

and small organisms. When flood waters recede, this nutrient-enriched water further supports the growth of aquatic plants and microorganisms. At the same time, flooding allows fish to migrate from the stream channel to feed and spawn in the flood plain.

Riparian vegetation can have a great impact on water temperature, which is critical to many aquatic organisms. Reduced stream temperature can increase a stream's oxygen-carrying capacity. Vegetation shades the water from the sun, particularly important during the hot summer months.

Riparian system structure

The plant species of riparian areas vary depending on the location of the watershed, as well as the stream slope, light and water availability, flooding, and soil conditions. However, regardless of the species composition, the vegetation is organized into zones or ecosystem bands based largely on site-specific moisture regimes.

Riparian systems may have one to three zones, depending on the location and habitat structure. Some systems are very simple with a single zone of grasses and sedges. Other systems have additional zones of primarily woody vegetation and mixes of upland and riparian vegetation. The expression of zones in an area is a reflection of disturbance such as fire, wind, herbivory, and flooding. Each zone consists of vegetation adapted to survive in the specific moisture/disturbance regime of that area and able to perform specific ecological functions.

- Zone 1—This band hosts species found along the water's edge. The most prevalent species are sedges and rushes that are water-loving and capable of stabilizing streambanks with their deep, strong roots. These species are critical for promoting water recharge and decreasing depth to water table.
- Zone 2—This zone contains species that are found in wet ground and consist of shrubs, trees, moisture loving grasses, and water-tolerant broad leaved plants. These plants catch water and facilitate absorption of nutrients transported into the area by runoff and ground water and provide habitat for terrestrial animals.
- Zone 3—This zone is located where the riparian zone merges with the uplands and includes a mixture of riparian and upland species. The area is also host to many terrestrial animals including many early successional, edge-loving species.

AFS Fisheries Techniques Visuals

Zone 1 contains water-loving plants that help to stabilize streambanks and promote water recharge.

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Zone 2 is represented by the background trees in this image. Zone 2 contains species of shrubs, trees, and moisture-loving grasses and forbs.

Virginia Department of Game and Inland Fisheries

Zone 3 contains a mixture of upland and riparian species. As seen in this image, zone 3 can create a forest edge habitat and, thus, contains many early successional species.

Degraded riparian systems

When a riparian system is degraded, heavy runoff moves through the riparian zone directly into river channels. Fine sediments eventually fill up stream pools, altering the shape of the stream channels and covering rocky stream bottoms, thereby impairing important food-producing, shelter, and spawning areas. Runoff can bring seeds of nonnative and nonriparian plant species, reducing habitat for native species, and the water table can be lowered by crowding out more native riparian species. Degradation of the native plant community can create a fire risk by increasing fuel loads. Furthermore, streamsides lose their ability to buffer and protect streams, resulting in damage to aquatic habitat, increased costs for treating drinking water, and loss of aesthetic appeal.

Misuse of riparian areas

Forest management

Improper forest management practices can destroy riparian area benefits and functions. Sediment is the most prevalent pollutant coming from poorly managed forests. Sediment comes from erosion of exposed soils due to improperly constructed access roads that concentrate runoff. Improper harvesting practices can also impact riparian areas. Inadequate riparian buffers contribute to bank erosion and cause water temperatures to rise. Skidder traffic causes erosion of soils and soil compaction, which in turn affects the regrowth of vegetation on impacted areas.

Agricultural management

Grazing animals with unrestricted access to riparian areas may remove streamside vegetation, compact or disturb soils, and break down banks, resulting in both channel incision and widening of stream channels. Additionally, when grazing animals have free access to riparian areas, their manure is deposited or washed into streams. This results in excessive nutrients, organic matter, and pathogenic organisms.

Riparian areas have often been converted to cropland because of soil fertility and convenient access to irrigation water. Intensive use of the land for growing crops can have negative environmental consequences due to the scale of operation. Agricultural practices such as chisel-plowed row cropping and installation of surface and subsurface drains, adversely affect the hydrology and water quality of riparian areas. Agricultural processes can remove permanent vegetation, which reduces the rate at which water infiltrates through the soil and moves into the body of water.

Removal of vegetation increases sunlight that enters the channel resulting in increased water temperatures. Vegetation removal also exposes soil to raindrop impact runoff, increasing erosion.

Urbanization

Often sediment and erosion controls at development sites are inadequate for the type of land being developed. Some construction sites have improper erosion and sediment control measures from the beginning of work, and the remaining riparian areas are unable to mediate the sediment load entering the water.

Impervious surfaces, such as parking lots and roads, create a water movement system quite different from a natural watershed. Rain quickly runs off the impervious surfaces into river channels, resulting in earlier and higher peak flow. Runoff in watersheds with substantial amounts of impervious surfaces has the potential to carry increased sediment loads and other materials such as fertilizers, pesticides, trace metals, and other toxic materials that were improperly applied or disposed.

Water flow modifications

Dams, levees, and stream channelization significantly alter water movement and storage in riparian systems. Additionally, these modifications can severely alter the suitability of rivers and streams to spawning and migratory fishes such as cutthroat and bull trout.

Sally Letsinger

Bank sloughing, as seen in this image, is a sign of degraded riparian system.

In the Great Plains and arid West, diversions for irrigation are common and have important implications for plant life, as well as life cycles and movement patterns of aquatic organisms. In some cases, the withdrawals are indirect, resulting from extensive pumping of ground water in close proximity to the stream or river reducing flows.

Wetland loss

Since European settlement, many wetlands have been lost or degraded for agricultural, commercial, and industrial developments. Additionally, wetland habitats have been affected by the invasion of nonnative plants and introduced animals. On many sites, these nonnative species have become well established, commonly replacing native species or exerting large influences on the functional dynamics of existing native habitats. Wetland loss and degradation in the watershed is an important planning consideration when seeking to reestablish riparian functions.

Riparian assessment

A large number of riparian classification, inventory, and evaluation procedures have been developed; however, most of these were created to fit local needs or specific programs. Some are comprehensive, requiring detailed onsite surveys; others are very general. Currently, the Stream Visual Assessment Protocol, developed by the NRCS, is used in all 50 states by landowners and field staff. This protocol includes riparian areas and can be found at *http://www.nrcs.usda.gov/technical/ECS/aquatic/svapfnl.pdf*.

Asolin County Conservation District

Once decisions are made, the plan should be implemented, paying close attention to detail. In this image, revegetation is taking place along a streambank.

The appearance of unstable riparian areas is often quite different from that of stable systems. When assessing for system stability, indicators such as bank sloughing, seepage in the banks, lack of vegetation, straightened channels, and invasions from nonnatives should be addressed. A more detailed description of instability indicators can be found in table 1.

Management and restoration

Restoration and enhancement projects are often complicated as the hydrology at both local and watershed scales, climate, and current and historic plant and animal communities must be considered. Extensive planning must be done before a riparian restoration or enhancement project can be implemented.

Landowners must first identify and understand the problems (loss of vegetation, overgrazing) and opportunities (how lost functions can be restored). Local landscape and historical factors that led to the creation and function of the riparian ecosystem must first be understood. These factors may include land use, topography, water quality, climate, and precipitation.

Once the problems and opportunities are identified, objectives for restoration must be outlined. Objectives might include planting riparian buffers, fencing livestock from riparian areas, and conducting controlled grazing or burning. The available resources required to undertake the restoration or enhancement project must be identified and analyzed to formulate a plan of action and any alternative plans of action that might be considered. Available resources might include riparian restoration expertise or financial resources. Armed with all this information, landowners will be well equipped to decide on the proper plan of action for their riparian restoration or enhancement project.

Before implementing their plan, landowners and managers are strongly urged to discuss their riparian restoration or enhancement plans with experts from Federal, State, or local government agencies or qualified personnel from conservation organizations. Evaluation of the plan throughout the planning process, as well as during and after its implementation, is vital to the success of the project, as well as future riparian restoration and enhancement projects.

Riparian buffers

A riparian buffer is an area of varying size managed to reduce the impact of adjacent land uses on aquatic ecosystems. With careful design, buffers can serve several important riparian functions. Like a natural

Table 1 Signs of a degraded riparian system

Headcutting and downcutting	A headcut is a discontinuity in the base of the stream. Downcutting occurs when something causes the stream to increase its velocity and erode away the channel bottom. As the channel cuts downward, the ground water table is lowered. Consequently, water-loving plants isolated on the old flood plain and streambanks may no longer get the moisture they need
Bank sloughing	Localized bank collapse indicates a stability problem. Bank sloughing may be caused by undercutting of the toe (bottom of the bank), bank seepage, or saturation of very loosely deposited material
Steep banks	Steep banks indicate that the stream is adjusting laterally or that the bank toe has been lost. This often occurs in channels that have been downcut and are reestablishing a flood plain
Seepage in banks	Seepage often affects incised channels. When water tables rise, the seepage exits through the streambank. Soil particles are dislodged if seepage forces are sufficient. Even if soil is not removed, the saturated area represents a weak point the next time high flows occur
Lack of vegetation	Lack of vegetation covering the banks can indicate that the area was recently subject to scour or deposition or the area has unfavorable moisture patterns for plant growth. Sparse vegetation or changes in species composition may be due to lack of moisture resulting from severe degradation or a dropping water table
Straightened channels	Frequently, streams and other waterbodies are altered to facilitate farming activities. This increases the slope by reducing the length. Streams often downcut to return to the original slope or original natural meandering pattern. Straightening can increase the speed of sediment and water movement and can reduce viable habitat for many aquatic organisms
Shallow-rooted vegetation with relatively low productivity	Riparian vegetation must have deep, strong roots to provide bank support. Shallow roots will not perform this function, and bank sloughing and erosion will become more common
Lack of shade and overhanging vegetation	Shade protects the water temperature in a riparian system. The absence of shade is an indicator of poor riparian health due to lack of shade-producing vegetation
Wide stream channel with shallow, muddy water	Waterbodies in riparian systems should be clear and free from floating sediment. If water appears muddy or murky, sediment is being disturbed by increasing flow or other factors
Invasion of undesirable plant species	Riparian vegetation has adapted to the moist, flooded environment situated near the banks. Many invasive species have not adapted to the specific ecology of riparian systems and may indicate a change in soil regimes

system, well-designed buffers can preserve the characteristics of the waterbody, protect water quality, and improve habitat for wildlife in the surrounding area. To optimize their effectiveness in controlling agricultural contaminants, riparian buffers should be designed with awareness of adjacent land uses and management. For severely eroded banks or deeply entrenched creeks, stream restoration, in addition to buffers, may be required.

A well-designed buffer system may include not only a buffer area established on land next to a stream, but also plantings that stabilize the streambank and wetlands constructed to absorb stream runoff. Buffer design techniques are outside the scope of this leaflet; however, for more information on riparian buffer creation and management, reference the Stream Corridor Restoration Manual at *http://www.nrcs.usda.gov/technical/stream_restoration/newgra.html* and the Grassed Waterways Job Sheet at *http://efotg.nrcs.usda.gov/references/public/IL/waterway.pdf*.

Assessing stream stability and sensitivity

Assessing existing stream conditions is imperative before initiating riparian restoration or management projects. Assessing the stability of the existing system and the sensitivity of the waterway to management practices requires examination of upstream and downstream areas.

Stability assessment

There are a number of visual indicators that can reveal the stability of a waterbody. Healthy streams generally have a meandering pattern with alternating areas of shallow water with rapid flow and areas of calmer, deeper water. Additionally, stable riparian areas have vegetated banks and an established flood plain.

Sensitivity to management practices

Riparian area sensitivity to management practices (such as grazing or timber management) is determined primarily by its dominant bank and bed material, the relative height and steepness of its banks, and its vegetative cover. Field reviews should be certain to document these factors.

Water courses comprised primarily of gravel, sand, silt, or low-plasticity clay are much more sensitive to outside influence than cobble-, boulder-, or bedrock-dominated streams. Likewise, streams with low, relatively flat banks are not as susceptible to change as those with high, steep banks.

Vegetation also plays a critical role in streambank and riparian area protection. Its importance becomes even more apparent in systems with easily disturbed soil materials. As previously mentioned, vegetation provides a number of functions, including bank stabilization, moderating moisture regimes, and protecting banks from streamflow. A dense mixture of vegetation over the entire bank is desired to reduce sensitivity. Various age classes and plant types should be represented with little or no exposed soil.

Vegetation management

Haying and Mowing

Haying at appropriate times of the year using suitable methods can be an effective way to maintain warm-season grasses. Grasses should be cut to a minimum height of 6 inches, and it is important to rotate harvested areas on an annual basis.

NRCS

Bear Creek buffer demonstration site in central Iowa

Mowing warm-season grasses can also be used as a maintenance plan; however, this is not the most desirable alternative. Mowing keeps woody growth from encroaching, but repeated mowing creates a layer of litter on the ground that eventually crowds out grass seedlings. Additionally, this litter layer hinders the movement of young birds on the ground and makes the area less attractive to the insects they feed on. If mowing is necessary, a third of the area should be mowed every year. Additionally, it may be necessary to lightly disk the stand every 3 to 4 years to turn over the litter layer, destroy woody growth, and encourage germination of dormant native vegetation. For more information, see Fish and Wildlife Habitat Management Leaflet Number 25: Native Warm-season Grasses and Wildlife.

Controlled burning

Established, prescribed, or controlled burning is a very effective way to maintain and rejuvenate a stand of warm-season grasses. A third of the area should be burned annually which will help ensure a cleaner, more valuable stand over a longer period of time. Permits are required, and caution must be exercised during the burning process. Consultation with a fire management specialist is highly recommended. Local NRCS or Conservation District offices can offer additional assistance in developing a prescribed burn management plan to meet specific objectives.

Controlled grazing

Controlled grazing can be an effective vegetative management plan when used correctly. However, riparian areas are very sensitive to unmanaged grazing. Generally, riparian areas tend to be more productive than surrounding uplands because of the additional moisture available to plants. Thus, even if forage is readily available in upland areas, livestock may congregate and overuse riparian zones. Because of this, simply reducing the number of animals is not the answer. Unrestricted access can create trails which cause erosion and compromise the integrity of the streambanks. When overgrazed or trampled, remaining plants become widely spaced. Continuous grazing eliminates young plants and weakens established ones. Many of these effects are site specific, so it is recommended that land managers consult with wildlife professionals to establish a location appropriate grazing program.

There are four controlled grazing options to consider for vegetation management. Each option should be considered after inspection of the specific site.

- Encourage livestock to use upland areas—Moving salt/minerals and feeding locations, oilers, dust bags, shelters, shade facilities, and water sources to upland areas can attract livestock away from the riparian area. Improving upland forage can encourage livestock to graze away from streambanks.

Greg Sneider

Livestock trampling and loitering can create trails and cause serious bank damage.

NRCS

Controlled access points made from crushed rock or other suitable materials can reduce the amount of riparian damage by only allowing livestock passage through certain areas.

- Fencing riparian areas into separate pastures—Reserving the fenced riparian areas for forage or dormant season grazing can reduce stress to the area while benefiting the riparian plant community.
- Total exclusion—Erecting fencing to exclude livestock from the entire riparian area (being sure to provide alternative water sources) is a means to completely eliminate grazing stress to the system, but also eliminates grazing benefits.
- Construction of controlled access points—Ramps made from crushed rock or other suitable materials prevent damage to streams from trampling. Electrical fencing has been successfully used for this purpose.

There are several other management practices that will help maintain a successful grazing program in riparian areas.

- Allow plants to reach height of 4 to 12 inches before introducing grazing animals.
- Rotational grazing strategies used at different times of the year can have a positive impact on vegetation. Consulting with a wildlife professional to establish site-specific needs can help prevent unsuccessful or detrimental grazing practices.
- Select a key plant by which to judge the extent of grazing. This plant may change as the plant community changes. The key plant or plants should receive a significant amount of grazing and be important to the riparian community.
- Monitor riparian areas for suitable times to rotate livestock. Stake heights can be set that become visible when grasses are grazed to the proper height signaling the time to rotate.
- Grazing management should provide ample time for key plants to recover.

Timber harvest

Harvesting fast-growing trees as early as possible removes the nutrients and chemicals stored in the woody stems and promotes continued vigorous growth. Logging should not be conducted within the first 15 feet from the top of the streambank; however, when banks have been undercut or the channel is deeply incised, the careful harvest of a large bank tree can help protect bank stability. When harvesting trees, stream crossings should be minimized, and roads should not be built except those required to cross the stream. Skidders should be kept away from the streambanks and not skidded across stream channels. Avoid rutting during wet weather, and use cable and chokers to skid logs.

Upland practices

In addition to the creation and management of riparian areas, there are several upland practices that can be implemented to minimize the movement of nutrients, chemicals, and sediment into riparian systems. Maintaining vegetative cover over the soil throughout the year will reduce the amount of sediment and erosion. Minimizing animal trampling and vehicle traffic on wet soils will protect the soil and vegetative integrity. Avoiding the overuse of fertilizer, herbicides and other agricultural chemicals, and manure will reduce the risks of harmful chemicals and nutrients entering the system. Managing riparian areas to favor native plants will help to maintain their attractiveness and suitability for wildlife. Finally, avoiding practices that artificially alter stream hydrology will help maintain watershed integrity and riparian management. Sound upland practices, as reflected in proper function and condition of streams, are essential for healthy and productive watersheds.

Case studies

Fox Creek riparian zone restoration project

The upper two-thirds of Fox Creek Canyon in Oregon was severely degraded by open-range cattle grazing. Affected landowners, working in collaboration with adjoining Daybreak Ranch, U.S. Department of Interior, Bureau of Land Management, and a number of other partnering agencies, developed and implemented a restoration plan for Fox Creek Canyon. The restoration project also set the stage for reintroduction of beaver into the canyon.

In 2003, 4,000 cuttings and seedlings were planted including willow, redosier dogwood, cottonwood, mock orange, ponderosa pine, aspen, plum, walnut, and golden current. The planting was followed by the installation of 7 miles of fencing to exclude cattle from sensitive areas. Additionally that year, 16 acres were seeded with native grasses. Beaver will be reintroduced once there is sufficient habitat.

The project received a Conservation Reserve Program (CRP) contract along with advice, grants, and support from a number of other groups and agencies.

Fox Creek Farm

Fox Creek Farm

The top photo was taken at Fox Creek in 2002 and shows trampling and dung deposits from cattle. The bottom photo was taken at the same location in 2004 after restoration and shows grasses and forbs closely surrounding the creek.

Buffalo Creek riparian buffer restoration

The Buffalo Creek Watershed, which is located in western Pennsylvania and empties into the Monongahela River in West Virginia, covers approximately 107,000 acres across the two states. The creek has long suffered from nonpoint source pollution, especially from cattle wandering along riverbanks, degrading the riparian zone and damaging water quality. Currently, more than 60 miles of riparian fencing has been installed. Other activities include instream restoration, construction of cattle crossings and alternate watering sources, and planting of native grasses on less productive areas to expand forage and provide better wildlife habitat.

The U.S. Fish & Wildlife Service Partners for Fish and Wildlife Program is encouraging farmers to fence streambanks to keep cattle out of streams, allowing trees and brush to regenerate and keeping excess sediment, nutrients, and bacteria out of the water. New vegetation shades the stream, making it more hospitable for fish, plants, and animals.

Landowner assistance

Landowners may need financial or technical assistance to manage riparian areas on their property. There are a number of governmental agencies and other organizations willing to provide assistance to landowners wishing to manage riparian systems. Landowners are encouraged to begin their riparian management activities by contacting these organizations. Table 2 lists programs that can provide technical and/or financial assistance for riparian management practices.

Conclusion

The ultimate solution to maintaining/re-establishing watershed health is proper management of upland and riparian systems. Awareness of current conditions and relationships between land uses and resource goals is essential for successful restoration of riparian systems.

Table 2 Assistance programs for riparian systems management

Program	Land eligibility	Type of assistance	Opportunities for riparian area management	Contact
Conservation Reserve Program (CRP)	Highly erodible land, wetland, and certain other lands with cropping history. Streamside areas in pasture land, filter strips, forest buffers, and flood plain wetlands	50% cost-share for establishing permanent cover and conservation practices and annual rental payments for land enrolled in 10- to 15-year contracts. Additional financial incentives are available for some practices	Annual rental payments may include an additional amount up to $5 per acre per year as an incentive to perform certain maintenance obligations including riparian habitat	NRCS or FSA State or local office
Environmental Quality Incentives Program (EQIP)	Conservation practices such as riparian buffers, grazing systems, filter strips, manure management buildings, and wildlife habitat improvement	Up to 75% cost-share, as well as incentive payments to landowners who employ nutrient, manure, and integrated pest management practices. Also provides technical assistance and education to landowners	Incentive payments may be provided for up to 3 years to encourage producers to carry out management practices such as prescribed burning, that may not otherwise be carried out	NRCS State or local office
Partners for Fish and Wildlife Program (PFW)	Wetlands retained, created, or managed for wildlife	Up to 100% financial and technical assistance to restore wildlife habitat under minimum 10-year cooperative agreements. This program is used in conjunction with CREP to provide financial assistance in establishing riparian buffers	Restoration projects may include restoring wetland hydrology and wildlife habitat	Local office of the U.S. Fish & Wildlife Service
Wetlands Reserve Program (WRP)	Previously degraded wetland and adjacent upland buffer, with limited amount of natural wetland and existing or restorable riparian areas	Technical and financial assistance to address wetlands, wildlife habitat, soil, water, and related natural resource concerns in an environmentally beneficial and cost-effective manner; 75% cost-share for wetland restoration under 10-year contracts and 30-year easements; 100% cost-share on restoration under permanent easements	Can provide technical and financial assistance for riparian corridors providing the protected wetlands are no more than 1 mile apart; corridors must be used to connect two or more wetlands; and corridors must average no more than 200 feet wide on one side. Also restoring wetland hydrology and native vegetation	NRCS State or local office
Wildlife at Work	Corporate land	Technical assistance on developing habitat projects into a program that will allow companies to involve employees and the community	Can provide state-specific advice and/or contracts for prescribed burning, managed grazing, or other practices for riparian area management	Wildlife Habitat Council
Wildlife Habitat Incentives Program (WHIP)	Habitat restoration on private lands. Projects for outdoor education on locally owned public lands are also eligible	Up to 75% cost-share for conservation practices under 5- to 10-year contracts	Technical assistance is provided to help the participant maintain wildlife habitat	NRCS State or local office
Stewardship Incentive Program (SIP)	Acreage between 1 and 1,000 in nonindustrial private forest land	Up to 65% cost-share and technical assistance	Can provide technical and financial assistance for forest management plan development, tree planting, riparian and wetland improvement, and recreation and wildlife habitat improvement	NRCS State or local office

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