LS-4-05

THE OHIO STATE UNIVERSITY EXTENSION

Extension FactSheet

School of Environment and Natural Resources, 2021 Coffey Road, Columbus, Ohio 43210

Livestock and Streams

Best Management Practices to Control the Effects of Livestock Grazing Riparian Areas

James J. Hoorman
Extension Educator,
Water Quality/Grants
OSU Extension Center at Lima

Jeff McCutcheon
Extension Educator,
Agriculture and Natural Resources
Knox County

The focus on protecting our surface water has shifted to controlling nonpoint pollution. Livestock grazing riparian areas have been identified as a source of nonpoint pollution. Riparian areas are the green vegetated areas adjacent to a creek, stream, or river.

The impacts of livestock grazing riparian areas include manure and urine deposited directly into or near surface waters where leaching and runoff can transport nutrients and pathogens into the water. Unmanaged grazing may accelerate erosion and sedimentation into surface water, change stream flow, and destroy aquatic habitats. Improper grazing can reduce the capacity of riparian areas to filter contaminates, shade aquatic habitats, and stabilize streambanks.

Faced with the negative impacts, many recommend the total, permanent exclusion of livestock from riparian areas. Although this is one option, because of its cost-prohibitive nature, its adoption has not been widespread.

The negative impacts of livestock grazing riparian areas can be prevented, minimized, or improved by controlling when, where, how long, and with what intensity livestock graze the forages in the riparian area.

So far in this series of fact sheets we have looked at the issues around livestock grazing riparian areas. This

Photo courtesy of USDA Natural Resources Conservation Service. Fencing used as a barrier to exclude livestock from sensitive riparian zone areas.

Photo courtesy of USDA Natural Resources Conservation Service. Water tank to protect the stream from trampling.

fact sheet looks at what producers can do to protect our surface water resources.

Off-Stream Watering Tanks and Alternative Shade

Off-stream watering areas are an effective alternative to stream fencing. Off-stream watering reduces the time animals spend at the stream under small acreage grazing conditions. An animal-operated pasture pump that pulled water from the creek was demonstrated to be a viable off-stream watering device. Animal productivity increases by ensuring that animals have access to clean water while protecting the riparian area (Godwin and Miner, 1996).

When given the choice, cattle drank from an off-stream water trough 92% of the time, compared to the time that they spent drinking from the stream. Streambank erosion was reduced by 77%, as were concentrations of total suspended solids (90%), total nitrogen (54%), and total phosphorus (81%) when an alternative water source was provided. Similar reductions were observed in concentrations of bacteria (Sheffield et al., 1997).

A grazing cow returns 79% of the nitrogen, 66% of the phosphorous, and 92% of the potassium to the pasture. These nutrients do not always get recycled in the needed locations; and in continuously grazed pastures, nutrients are often deposited near the shade, the water tank, or the lane areas between the shade and water (B. Barlett, Great Lakes Basin Grazing Network). Streambank stability and riparian zone vegetation can be improved by locating shade and water away from the stream.

Livestock Stream Crossing and Livestock Exclusion

If livestock need to cross streams, provide them with controlled stream crossings. Cover the stream bottom with coarse gravel to provide animals with firm footing, while discouraging them from congregating or wallowing

Photo courtesy of USDA Natural Resources Conservation Service. Livestock stream water crossing.

in the stream (Undersander and Pillsbury, 1999). In areas where streambanks or riparian vegetation is degraded and livestock exclusion is necessary, high tensile fence, solar-powered electric fences, and woven fence can be used relatively inexpensively to exclude livestock from streams. Encouraging animals to drink or cross at managed points will reduce random trampling of streambanks and decrease the risk of animal injury.

Two of three streams studied responded favorably to streambank fencing, bank stabilization, and the installation of rock-lined animal crossings (Wohl and Carline, 1996). In general, abundance and diversity of macroinvertebrates was highest in the third ungrazed stream, which also supported the highest abundance of brown trout. But it was found that total dissolved solids decreased by 50% and macroinvertebrate density increased by at least 70% in the two grazed streams.

Riparian Buffer Strips

Replacement of natural riparian vegetation with cropland or pasture typically results in stream eutrophication (excessive growth of aquatic plants due to excess nutrients), temperature extremes, water quality declines, channel instability, excessive erosion, and undesirable shifts in

Photo courtesy of USDA Natural Resources Conservation Service. Nose water pump to protect stream from trampling.

Photo courtesy of USDA Natural Resources Conservation Service. Riparian buffer strips protect stream water quality.

the aquatic life. Establishment of riparian buffer strips of either woody or grassy vegetation can help amend many of these problems, although poor agricultural practices elsewhere in the watershed may overwhelm the beneficial function of buffers.

The width and length of buffers determine their effectiveness. Buffers as narrow as 12 to 20 feet can stabilize streambanks and filter upland runoff, but minimum widths of 30 to 60 feet are better. Buffers of 600 to 1,200 feet in length will substantially reduce bank erosion, but minimum lengths of 0.5 to 2 miles may be needed to maintain healthy stream biological communities (Lyons, 1999).

Benefits of Buffers

Buffers offer many benefits to streams, depending on their design and location. Some of the benefits of buffers include:

- Protect air and water quality.
- Reduce soil erosion caused by wind and rain.
- Stabilize the banks of streams, rivers, and lakes.
- Trap water-borne sediment that pollutes streams, rivers, and lakes (can reduce up to 80% of sediment).
- Trap manure, fertilizer, pesticides, and other contaminants that pollute surface water (reduce 40% of phosphorous and significant levels of nitrate).
- Trap bacteria and other pathogens that cause water-borne diseases in people, livestock, and wildlife (up to 60% of pathogens removed in runoff).
- Provide habitat for fish and wildlife.
- Cool streams and rivers, creating good conditions for cold-water species.
- Help prevent flooding.
- Increase outdoor recreational opportunities (hunting, fishing, hiking).
- Make the landscape more beautiful and properties more valuable (Landowner Resource Center, Ontario, Canada, 2000).

Controlled Grazing Strategies

The majority of the research literature shows that totally excluding livestock from streams is the most acceptable best management practice to follow. In reality, this practice is seldom followed because of the high cost of fencing streams and riparian areas that are grazed by livestock. In some livestock grazing areas, the riparian zone has been grazed for decades without excluding livestock. Most of the natural buffers in these riparian zones have been converted to grass and legume pastures.

Low or moderate grazing in riparian areas have grazing effects that are much less significant than heavy or unmanaged grazing (Trimble and Mendel, 1995). Several grazing strategies have been employed to reduce the effects of grazing on riparian systems. Many researchers agree with Myers and Swanson (1995), who indicate that deferred rotation grazing led to improvement of aquatic and riparian habitats, but that complete rest produced the most improvement.

Photo courtesy of Jim Hoorman. Management intensive grazing (MIG) has reduced streambank erosion in this Ohio stream, letting the riparian vegetation recover from over grazing. This area has become a separate pasture and is only grazed when conditions are optimal.

Management intensive grazing (MIG) is a grazing system designed to maximize both forage yield and quality. Livestock at a high stocking density are rotated frequently through a series of paddocks. In the Midwest, MIG has been adopted by a large number of dairy and beef farmers. Rotational grazing and MIG are similar concepts and the terms are used interchangeably.

A controversy has developed because traditional best management practices, based on the experiences in the arid western United States, recommend that cows be excluded from the riparian zone. Exclusion of cows from the riparian zone is often unpopular with rotational grazers, because it is expensive and takes land out of production. However, managed rotational grazing effectively reduces the time cows spend in riparian areas and has been demonstrated to reduce the impact in and along streams in relation to continuous grazing (Cox, 1998).

Farmers use managed grazing practices to improve pasture productivity, increase livestock growth, and protect riparian areas (Lyons et al., 2000; Clark, 1998). Managed grazing encompasses a range of strategies but the most critical component is management, not uncontrolled grazing. If grazers actively manage livestock and limit the critical times that livestock are allowed to graze riparian areas, many detrimental effects can be minimized or eliminated.

Research studies show that managed grazing can simultaneously enhance farm productivity, decrease input expenses, and protect the environmental conditions on the farm (Macon, 2002; Herrick et al., 2002; Paine et al., 1999; Berton, 1998). Even governmental agencies and

environmentalists, who implicate continuous grazing as a primary cause of riparian degradation, now join with farmers in promoting managed rotational grazing as a way to protect riparian areas (Lyons et al., 2000; Mosely et al., 1998; Leonard et al., 1997; Elmore, 1992).

General Guidelines for Grazing Riparian Areas

The first criteria is to protect the riparian area. Livestock should be totally excluded from streams when streambanks are steep and eroding, when livestock will cause damage to sensitive native plant species, will damage wildlife habitat, or will cause damage to adjacent forest or woodland species in or along the riparian area.

If livestock are going to be allowed to graze the riparian area, the effects of rotational grazing in the riparian area can be reduced if the following conditions are met:

The riparian area has to be suitable to graze. Riparian areas that have species that are predominately grass and legume pasture species may be grazed lightly.

Livestock are managed and grazed so that minimal damage is done to the riparian area. Livestock are only allowed in the riparian zone for short periods of time (less than a week) and only when conditions are dry so that the streambank does not erode. Livestock are not allowed to excessively lounge or defecate in the stream. The riparian area is given adequate time to recover before grazing is resumed. See The Effects of Grazing Management on Riparian Areas, LS-3-05 for more information on grazing riparian areas.

Grazing riparian areas is not recommended when streambanks are eroding, or when conditions are too wet to graze. Grazing is not recommended when the native species is not predominately grass or legumes. Grazing is not recommended during peak fish and aquatic organism spawning periods.

Photo courtesy of USDA Natural Resources Conservation Service. Fencing and livestock exclusion used to protect water quality.

Riparian Grazing Strategies

Other critical components of riparian grazing include (Leonard et al., 1997; Clary and Webster, 1989; Bellows, 2003):

- Combining managed upland grazing practices with good riparian grazing management. Plant palatable forage species on adjacent upland areas.
- Installing alternative watering systems and controlling grazing to minimize deposition of manure in or near streams.
- Place feed supplements such as mineral, salt, grain, hay, or molasses in upland areas away from riparian areas.
- Adapting grazing management practices to local conditions and to the species being grazed. See OSU Extension fact sheet on "The Effects of Grazing Management on Riparian Areas," LS-3-05.
- Employ long-term rest from grazing riparian areas that are highly degraded.
- Employ short-term or seasonal rest to protect wet streambanks and riparian vegetation that is emerging, regenerating, or setting seed.
- Maintain streambank structure and function by maintaining a healthy cover of riparian vegetation. To discourage livestock from congregating in sensitive riparian areas, place brush, rocks, boulders, fence, and/or living hedges along streambanks where sensitive riparian areas are located.
- Provide alternative shade in upland areas to encourage livestock to congregate away from sensitive riparian areas.
- Be flexible in your grazing management and document mistakes so that you can learn from them and avoid repeating them.

Guidelines for well-managed riparian grazing systems have to be specific to each stream. The effectiveness of a given system depends on how well it fits both the ecological condition of the grazing area and the management requirements of the livestock enterprise (Elmore, 1992). Too often a grazing system developed for a specific application has been used elsewhere without adequate consideration of local site conditions.

Barriers to Implementing Riparian Measures

Riparian area management continues to receive attention from many groups in Ohio. One issue has been that each governmental agency seems to have a different idea of just what should be done in a riparian area and how wide the treated area should be. Consequently, landowners may be confused by conflicting recommendations.

Landowners, particularly those in heavily farmed areas in Ohio where riparian buffers are most needed, are reluctant to plant trees along streams. This is so in spite of generous incentive payments and stems from

the fact that farmers are reluctant to re-establish trees in areas where they have spent so many years trying to clear streambanks. The landowner concerns need to be addressed if riparian measures are to be implemented on an expanded scale.

If landowners with good management skills were allowed to use MIG to graze livestock along streams, healthy riparian areas may be established. Landowners who continuously graze livestock in riparian zones should be encouraged to adopt MIG and rotational grazing principles. Adoption of MIG and rotational grazing with good management reduces negative impacts to riparian vegetation and negative impacts to water quality caused by continuous grazing.

Overall Conclusions

Overgrazing or unmanaged grazing can:

- Reduce vegetative cover and infiltration.
- Compact the soil, increase runoff, increase erosion, and increase nutrient and sediment yield.
- Increase erosion of the streambank and contributes to sediment contamination of streams.
- Vegetation removal leads to higher stream water temperature.
- Manure either in the uplands or into water bodies can lead to elevated levels of nutrients and pathogens.
- Fish and aquatic invertebrates are sensitive to sediment input, water temperature, and eutrophication (excess algae and plant growth due to excess nutrients). Low or moderate grazing has less significant effects than continuous grazing or overgrazing.
- Note caution voiced by Larsen et al. (1998)—current literature contains many studies that are not experimental with replicated treatments and statistically valid results.
- Very little research has been conducted and published for grazing practices in the Midwest (Mulla and Addiscott, 1999).

For more information on the effects of livestock grazing riparian areas see the following fact sheets in the Livestock and Streams series:

- Understanding the Benefits of Healthy Riparian Areas, LS-1-05
- Negative Effects of Livestock Grazing Riparian Areas, LS-2-05
- The Effects of Grazing Management on Riparian Areas, LS-3-05
- Pathogenic Effects from Livestock Grazing Riparian Areas, LS-5-05

For more information on Riparian Buffer Best Management Practices consult the Natural Resource Conservation Service.

- *Standard 395: Stream Habitat Improvement and Management outlines ways to restore, improve, or maintain chemical and biological functions of a stream.*
- *Standard 382: Fencing outlines how to construct a barrier to livestock or wildlife to protect a stream.*
- *Standard 528: Design and Layout of Rotational Stocking System outlines how to inventory your grazing assets and start rotational grazing.*
- *Standard 561: Heavy Use Area Protection outlines how to develop stream water ramps and systems.*
- *Standard 578: Stream Crossings outlines how to stabilize an area for livestock and traffic to cross a stream.*
- *Standard 644: Wetland Wildlife Habitat Management outlines how to develop or maintain habitat for wetland wildlife.*
- *Standard 717: Livestock Shade Structures has plans for portable or permanent structures for livestock shade.*

References

Bartlett, B. Watering Systems for Grazing Livestock, Great Lakes Basin Grazing Network and Michigan State University Extension. p. 9.

Bellows, B. C. June 2003. Managed grazing in riparian areas. Livestock Systems Guide, Appropriate Technology Transfer for Rural Areas. At www.attra.ncat.org.

Berton, V. 1998. Ten Years of SARE. Sustainable Agriculture Research and Education Program, CSREES, U.S. Department of Agriculture. Washington, DC. p. 82-83.

Clark, E. A. 1998. Landscape variables affecting livestock impacts on water quality in the humid temperate zone. Can. J. of Plant Sci. Vol. 78. p. 181-190.

Clary, W. P., and B. F. Webster. 1989. Managing grazing of riparian areas in the Intermountain Region. General Technical Report INT-263. U.S. Department of Agriculture, Forest Service, Intermountain Research Station, Ogden, UT. p. 11.

Cox, C. B. 1998. Fish and invertebrate communities in the Whitewater River Watershed: A GIS based examination of land use effects. M.S. Thesis. Univ. of Minnesota, St. Paul.

Elmore, W. 1992. Riparian responses to grazing practices. In: R. J. Naiman (ed.) Watershed management: Balancing sustainability and environmental change, Springer-Verlag. New York. p. 442-457.

Godwin, D. C., and J. R. Miner. 1996. Potential of offstream livestock watering to reduce water quality impacts. Bioresour. Technol. 58:285-290.

Herrick, J. E., J. R. Brown, A. J. Tugel. P. L. Shaver, and K. M. Havstad. 2002. Applications of soil quality to monitoring and management: Paradigms from rangeland ecology. Agronomy Journal. V. 94. p. 3-11.

Larsen, R. E., W. C. Krueger, M. R. George, M. R. Barrington, J. C. Buckhouse, and D. E. Johnson. 1998.

Viewpoint—livestock influences on riparian zones and fish habitat—literature classification. J. Range Manage. 51:661-664.

Landowner Resource Center, 2000. Buffers protect the environment. Extension Notes, Ontario Canada. ISSN 1198-3744. www.Irconline.com/Extension_notes_English/pdf/bffrs.pdf.

Leonard, S., G. Kinch, V. Elsbernd, M. Borman, and S. Swanson. 1997. Riparian area management: Grazing management for riparian-wetland areas. Technical Reference 1737-14. U.S. Department of Interior, Bureau of Land Management, National Applied Resource Sciences Center, Denver, CO. p. 63.

Lyons, J. 1999. Riparian vegetation influences on prairie streams. NRCS Management and Restoration of Midwestern Riparian Systems Workshop Report. Chicago, Illinois.

Lyons, J., B. M. Weigel, L. K. Paine, and D. J. Undersander. 2000. Influence of intensive rotational grazing on bank erosion, fish habitat quality, and fish communities in southwestern Wisconsin trout streams. J. of Soil and Water Conservation. V. 56, No. 3. p. 271-276.

Macon, D. 2002. Grazing for change: Range and watershed management success stories in California. California Cattleman's Association, Sacramento, CA. p. 36.

Mosely, M., R. D. Marmel, R. Blackwell, and T. Bidwell. 1998. Grazing and riparian area management. In: M.S. Cooper (ed.) Riparian area management handbook. Oklahoma Cooperative Extension Service, Division of Agricultural Services and Natural Resources, Oklahoma State University and the Oklahoma Conservation Commission. p. 47-53.

Myers, T. J., and S. Swanson. 1995. Impact of deferred rotation grazing on stream characteristics in central Nevada: A case study. North Am. J. Fisheries Manage. 15:428-439.

Mulla, D. J., and T. M. Addiscott. 1999. Validation approaches for field-, basin-, and regional-scale water quality models. Assessment of non-point source pollution in the vadose zone. Geophysical Monograph 108 ed. American Geophysical Union, Washington, DC.

Paine, L. K., D. Undersander, and M. D. Casler. 1999. Pasture growth, production, and quality under rotational and continuous grazing management. J. of Prod. Agri. V. 12, p. 569-577.

Sheffield, R. E., S. Mostaghimi, D. H. Vaughan, E. R. Collins, Jr., and V. G. Allen. 1997. Off-stream water sources for grazing cattle as a stream bank stabilization and water quality BMP. Trans. ASAE. 40:595-604.

Trimble, S. W., and A. C. Mendel. 1995. The cow as a geomorphic agent—A critical review. Geomorphology. 13:233-253.

Undersander, D., and B. Pillsbury. 1999. Grazing streamside pastures. University of Wisconsin Extension, Madison, WI. p. 16.

Wohl, N. E., and R. F. Carline. 1996. Relations among riparian grazing, sediment loads, macroinvertebrates, and fishes in three central Pennsylvania streams. Can. J. Fisheries Aquatic Sci. 53(suppl. 1):260-266.

Acknowledgments

The following persons reviewed the original material: Dr. Lloyd Owens, Soil Scientist, USDA-ARS; Dr. Steve Loerch, Professor of Animal Sciences, The Ohio State University; and Robert Hendershott, Grassland Specialist, USDA-NRCS. The authors thank Kim Wintringham (Technical Editor, Section of Communications and Technology) for editorial and graphic production.