



## Managing pastures for water quality

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# Understanding Riparian Areas

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“Riparian” from the Latin term riparius, literally means at the water’s edge, or pertaining to the banks of a river, stream, or pond. Riparian areas, comprising about 18% of the total land mass of Wisconsin, have distinctive soil characteristics and sustain unique plant communities that thrive under high water tables. Of Wisconsin’s riparian areas, approximately 73% are considered to have “natural” riparian cover (forests or grasslands), while 26% have been converted for agricultural uses and 1% have been developed for urban use (Westphal and Ostry, 2006). Uplands are the areas within a watershed that are above and outside the riparian zone of a water body.

**WATERSHED** – An area of land divided from adjacent areas by topographic features that determine where precipitation is stored within the soil and is released downslope to other locations via streams and rivers draining the area.

## What is a riparian area?

**R**iparian areas are the narrow green zone of land adjacent to streams, rivers, lakes and other water bodies. They are identified by the presence of unique plant communities, soils and topography that are shaped by the availability and actions of water as compared to adjacent upland areas within any given **watershed**.

Definitions of italicized words can be found in sidebar boxes and are referenced from Chew, 1991; Waskom and Neibauer, 2004.

### Did You Know?

Wisconsin lakes, rivers and streams are public resources, owned in common by all. The public has greater rights in waters that are considered “navigable” which is generally defined as having enough water to float a canoe or small recreational craft on a regularly reoccurring basis. A stream does not need to be regularly used for recreational or other general purposes, but is considered a public waterway based on its capacity to be navigable and public. Most projects on the banks or within 500 feet of a public waterway require a permit from the Department of Natural Resources (Magyera, 2007). Some examples of activities affected by proximity to a public waterway are:

- fishing and hunting access
- site planning and development
- irrigating farm fields and extracting water for livestock use
- home and land improvements (buildings and construction, landscaping, driveways, installation of shoreline erosion control)



Chapter 30.10 of Wisconsin State Statutes provides the “Declarations of Navigability”, and states that “no dam, bridge or other obstruction shall be made in or over” navigable waters without the permission of the state (Kent and Dudiak, 2001).

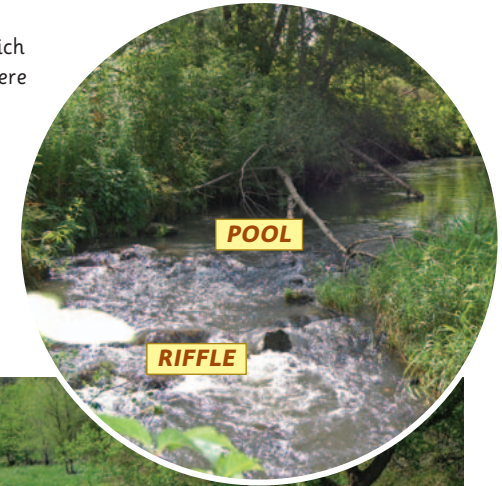
## How do riparian areas work?

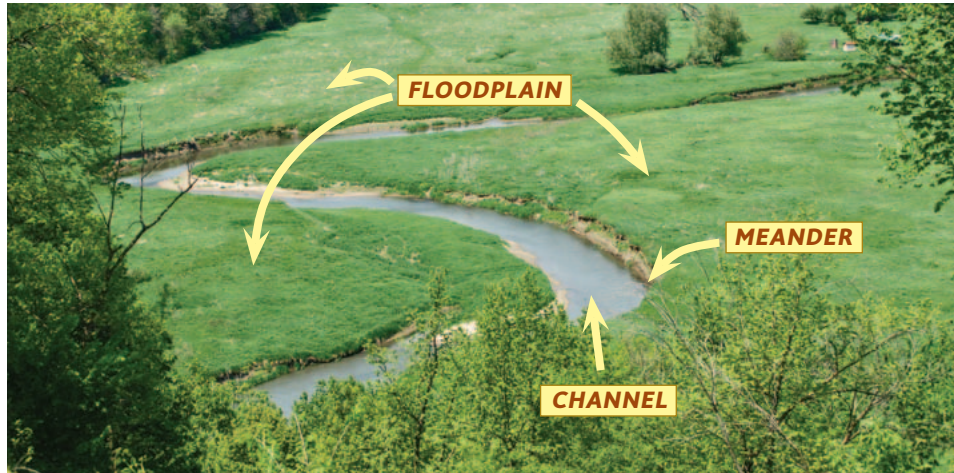
Physically, water has mass, so it responds to gravity by flowing downhill at some velocity. As water moves over the landscape, its kinetic energy erodes soil, rocks and other geologic materials (**sediment or load**) and carries it downstream. The amount of water flowing, gradient of the slope, and landscape barriers along the way affect water's ability to move the load it carries.

To balance the load carried with the energy available, water will leave some of its load in the **streambed** and pick up other materials, forming curves in the stream channel as water flows through it. To balance water's mass, velocity, slope of descent and the load it carries, water erodes parts of the channel to form the outside of the curves and deposits materials on the inside, forming the meanders of streams and rivers. Within the channel, pools and riffles also develop as water alternately slows down, and then speeds up in response to changes in the landscape.

Sediment, debris and other materials carried by the water are dropped as its energy suddenly decreases when the water spreads across the land.

Pool refers to the points at which a stream is relatively deep, where stream energy is dissipated by an increased volume of water and the surface is essentially level. In contrast, the riffle is a point at which the stream is relatively energetic due to constriction or steep gradient.





The bed where a natural flow of water runs and/or the deeper part of streams and rivers is called the channel. Floodplain refers to the areas adjacent to rivers or streams that are submerged by maximum flow, usually during snowmelt or after major storms. Floodplain soils are primarily composed of the sediment deposited by the flowing water from such events. The areas along the stream length where it loops back and forth across the floodplain are called meanders.

Normally, water will be confined to its channel, but during high-water events such as heavy rains and snow melt, riparian areas cannot balance the sudden increases in water's mass. At this time, **erosion** occurs to help slow the water's velocity as the increased mass moves downhill.

The natural meanders along the channel are important to assist in slowing the water's velocity and decreasing the potential for excessive damage to the riparian system. Where the volume of water exceeds the banks of its channel, a floodplain is formed.

**EROSION** – The process by which soil and land surfaces are worn down or washed away by the action of water, wind, ice or landslides.

**SEDIMENT (LOAD)** – The non-water portion of stream flow, consisting of dissolved materials, suspended particles, and larger objects (bed-load) such as cobbles and boulders. The suspended load includes silt, sand and other non-dissolved particles of sediment that are transported without being deposited as the stream flows. The larger bed load materials intermittently move along the streambed by sliding, rolling or bouncing.

**STREAMBED** – The boundary between surface water and groundwater or impermeable rock, composed of surface bedrock or sediments deposited by flowing water.

Other ecological characteristics along riparian areas such as geologic materials and vegetation are also important to riparian area function. For example, rocky areas are more resistant to erosion by water than sandy areas as the stream moves along its course. Dense grassy vegetation and deep-rooted trees or shrubs provide more protection of the landscape from erosion than bare banks. Riparian areas can be classified for their resilience to high-water events according to these and other characteristics, which also provide clues to appropriate management of human activities within and along their boundaries.

## Why do we need healthy riparian areas?

Riparian areas have several unique functions that provide significant benefits to the surrounding ecosystem, including clean water, wildlife habitat and forage for grazing livestock. In order to provide these many benefits, riparian areas must be managed to enhance their natural functions. As managers, our first goal is to understand how riparian areas function, and then determine how our management can help support rather than impede those natural processes.

Let's look briefly at the many benefits that healthy riparian areas provide.

► **Riparian areas serve to slow, capture and store water for later release.**

During high precipitation events and when winter snows begin to melt, excess **surface water** or **runoff** begins to flow across the landscape, creating a potential for erosion. As the water reaches the nearest riparian area, it is added to existing stream flow.

Functioning like a sponge, the riparian area supports water **infiltration** and **percolation**, storing and recharging **groundwater**.



When too much water arrives in the riparian area at one time, the excess water overflows the stream or river's banks and covers the riparian floodplain. At this point, the water's energy begins to slow, reducing the potential for flood damage.

This stored groundwater is eventually released back into rivers, streams and lakes to maintain surface flows and is also used as a source of drinking water.



► **Riparian areas protect or improve water quality.**

As water moves through a riparian area, the contaminants, nutrients and sediments it carries are filtered out, protecting surface water quality. Some of the geologic materials that water carries settle out as water slows going through the riparian area, allowing banks and shorelines to be maintained or built. Better soil conditions enhance the plant diversity within the area. In turn, more riparian plants capture more nutrients during the filtering process, also improving water quality.

► **Riparian areas provide wildlife habitat.**

Vegetation in riparian areas provides a source of food and shelter for a diverse variety of wildlife species, including birds, mammals, reptiles and amphibians. Riparian areas also connect other habitats, serving as corridors for wildlife movement.

Surface water quality is protected when healthy vegetation filters out nutrients and sediment from runoff as it flows into the stream.



Wildlife use riparian areas for food, shelter and travel corridors.

**GROUNDWATER** – Water that has infiltrated below the earth’s surface through porous or highly fractured rock formations and held there by impervious rock layers.

**INFILTRATION** – The process of surface water crossing through the earth’s surface and entering the soil.

**PERCOLATION** – The continued downward movement of water through the soil profile into groundwater.

**RUNOFF** – The precipitation or snow-melt that does not infiltrate and instead travels downhill overland until entering a defined channel. Also known as overland flow or surface runoff, it has the potential to erode soil and transport sediments, nutrients and/or pathogens into water bodies.

**SURFACE WATER** – The water held on the surface of the earth in lakes, ponds, rivers, streams, etc.

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► **Riparian areas provide livestock forage.**

Abundant moisture in riparian areas provides a consistent supply of vegetation throughout the grazing season. This can be especially important in providing potential livestock forage during

dry periods when upland pasture growth slows. Rotational grazing management is needed to ensure that riparian pastures are not overgrazed.



With management, grazing livestock can utilize riparian vegetation as a source of forage.



## Did You Know?

In Wisconsin, half of the land areas designated as riparian are associated with wetlands, but wetland acreage is disappearing at a rapid pace. In the early 1800s, Wisconsin had nearly 10 million acres of wetlands. However, in the past century about 5 million wetland acres have been ditched, diked and drained for uses such as agriculture, roads, housing and shopping centers (Wisconsin Wetlands Association, [www.wisconsinwetlands.org](http://www.wisconsinwetlands.org)). Wetlands serve many of the same vital functions as other riparian areas, including flood control, wildlife habitat, shoreline stabilization, groundwater recharge and discharge, and natural scenic beauty.



A wetland is an area of land that is regularly wet or flooded, such as a marsh, swamp, slough or scrape.

## How can riparian areas be protected?

**R**iparian areas are always changing, but how they change and how rapidly change occurs, depends on our activities and management. For example, development in or near riparian areas will greatly increase the potential for surface water runoff, and could cause loss of bank stability and vegetative cover. Soil disturbances due to unrestricted grazing along streams may result in an increase of invasive or weedy plant species. In both



- ✓ Stabilize stream banks using vegetation, rocks and other materials to prevent bank degradation and sediment delivery into the stream.

of these examples, a loss in riparian function results in fewer ecological benefits to wildlife and less water quality protection.

As a landowner, your management activities can impact the health and function of not only your riparian system, but the downstream watershed. The photos in this section show stewardship practices you can utilize to protect riparian areas and surface water quality.



Sauk County Land Conservation Department photo

- ✓ Improve or repair the stream corridor through sloping and grading of banks, addition of fish habitat structures and reshaping the channel.



✓ **Maintain a permanent strip of vegetation as a buffer between the stream bank and adjacent cropland or pastures to trap sediment and nutrients.**



**Inset: When a buffer is lacking, soil and nutrients from cropland enters nearby streams causing significant water quality impairments.**



✓ **Carefully manage livestock grazing in riparian areas to ensure that adequate plant cover remains and bank trampling is minimized.**



**Inset: Unmanaged grazing often leads to streambank trampling, lack of vegetation and nutrient and sediment delivery to the stream.**



✓ Manage adjacent uplands to decrease soil erosion and increase water infiltration.

✓ Avoid or minimize damage from construction projects, forestry management activities, and urban development.

✓ Preserve adjacent wetlands and/or floodplain areas to increase riparian water storage capacity.



✓ Prevent damage during personal recreational use of riparian areas.

## Did You Know?

Wisconsin's rules to control runoff from farms and other sources went into effect October 1, 2002 to help protect Wisconsin's lakes, streams and groundwater resources. Wisconsin Department of Natural Resources (DNR) rule NR 151 sets performance standards and prohibitions for farms. It also sets urban performance standards to control construction site erosion, runoff from streets and roads, and manage fertilizer use on large turf areas. Wisconsin Department of Agriculture, Trade & Consumer Protection (DATCP) rule ATCP 50 identifies conservation practices that farmers must follow to meet performance standards and outlines the requirements for nutrient management plans.

The Wisconsin Farmland Preservation Program incorporated Statewide Agricultural Performance Standards from both the NR 151 and ATCP 50 administrative rules into its compliance requirement in 2004 to protect and preserve Wisconsin's water resources. The following standards and prohibitions of NR 151 and ATCP 50 must be followed by all farms regardless of size in order to be in compliance with the Farmland Preservation Program and state laws.

- **Runoff from fields and buildings must be diverted away from feedlots, manure storage areas, and barnyards located within sensitive areas.\***
- **All livestock operations must prevent direct runoff into streams and rivers from feedlots or manure storage sites.**
- **Livestock access to streams and rivers must be limited to maintain adequate sod or self sustaining vegetative cover. This does not apply to properly designed, installed, and maintained livestock/farm equipment crossings.**
- **Soil erosion must be controlled so that all cropped fields meet the tolerable\*\* soil erosion limits.**
- **Nutrients (fertilizers and manure) must be applied to agricultural fields in accordance with a nutrient management plan, requiring:**
  - » **no winter spreading near surface waters or steep slopes**
  - » **no spreading near wells, sinkholes and other conduits to groundwater**
  - » **limit fall nutrient applications on fields that are susceptible to nitrogen leaching**
  - » **limit nutrient applications to what is needed to grow a healthy crop**
- **All manure storage structures must be built, managed, repaired and closed in accordance with accepted standards to prevent contamination of surface and groundwater resources and prevent manure storage overflows.**
- **Manure must be stacked away from sensitive areas.**

\* Areas within 300 feet of a stream, 1,000 feet of a lake, areas susceptible to groundwater contamination or areas up-gradient from private wells.

\*\* A tolerable soil erosion rate ("T") has been defined by soil scientists for all types of Wisconsin soils according to standardized USDA soil erosion guidelines.

**Find these additional resources online:**

- The NR 151 complete Runoff Management rules – <http://dnr.wi.gov/runoff>
- DATCP Working Lands Initiative information – [http://datcp.wi.gov/Environment/Working\\_Lands\\_Initiative](http://datcp.wi.gov/Environment/Working_Lands_Initiative)
- Wisconsin’s Runoff Rules: What Farmers Need to Know – <http://dnr.wi.gov/runoff/pdf/ag/farmersneed.pdf>
- The WI DATCP factsheet, Water Quality Protection: Features of the “590” Nutrient Management Standard – <http://datcp.wi.gov/uploads/Farms/pdf/WaterQualityProtectionFeaturesOf590.pdf>

Your local USDA Natural Resources Conservation Service, County Land Conservation Department and UW Extension Offices are all excellent sources of information to help you learn more about managing riparian areas. Cost share programs may also be available for conservation and habitat improvements.

<b>Agency/ Contact</b>	<b>Your County Land and Water Conservation Department</b>	<b>WI Department of Natural Resources (DNR)</b> <a href="http://www.dnr.state.wi.us">http://www.dnr.state.wi.us</a>	<b>WI Dept. of Agriculture, Trade and Consumer Protection (DATCP)</b> <a href="http://datcp.state.wi.us/index.jsp">http://datcp.state.wi.us/index.jsp</a>	<b>USDA Natural Resources Conservation Service (NRCS)</b> <a href="http://www.wi.nrcs.usda.gov">www.wi.nrcs.usda.gov</a>	<b>Your County UW-Extension Office</b> <a href="http://www.uwex.edu/ces">http://www.uwex.edu/ces</a>
<b>Type of Assistance</b>	Information, technical assistance and cost-sharing opportunities for: <ul style="list-style-type: none"> <li>• Nutrient management planning</li> <li>• Managed grazing plans</li> <li>• Stream crossings and other improvements</li> </ul>	Information and publications on: <ul style="list-style-type: none"> <li>• Wisconsin’s natural resources rules and regulations</li> </ul>	Information and publications on: <ul style="list-style-type: none"> <li>• Wisconsin’s agricultural rules and regulations</li> </ul>	Technical assistance and cost-sharing opportunities for: <ul style="list-style-type: none"> <li>• Nutrient management planning</li> <li>• Managed grazing plans</li> <li>• Stream crossings and other stream improvements, manure storage, water diversions and other conservation practices</li> </ul>	Information and publications on: <ul style="list-style-type: none"> <li>• Pasture management and managed grazing systems</li> <li>• Livestock production and management</li> <li>• Nutrient and manure management planning</li> <li>• Farmer grazing networks in your area</li> <li>• Storm water management for urban and construction areas</li> </ul>

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## For further reading:

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## UWEX Publications GWO057

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This material is based upon work supported by the Cooperative State Research, Education, and Extension Service, U.S. Department of Agriculture under Award No. 2009-45045-05632. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the view of the U.S. Department of Agriculture.

Funding for this factsheet was also provided by the Wisconsin Grazing Lands Conservation Initiative (GLCI) through grant #618-2, "Managing Riparian Pastures to Protect Water Quality".

Photos by Peggy Compton except where otherwise noted. Graphic design by Jeffrey J. Strobel, UW-Extension Environmental Resources Center.

