# Riparian Areas

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# The Value of Riparian Areas

## A Transition from Aquatic to Terrestrial Ecosystems

A **riparian area** is the area of land and water forming a transition from aquatic to terrestrial ecosystems along streams, lakes and open water wetlands. See Figure RMZ-1.

Riparian areas are among the most important and diverse parts of forest ecosystems. They support high soil moisture and a diversity of associated vegetation and wildlife, and they perform important ecological functions that link aquatic and terrestrial ecosystems:

- ❒ Riparian areas maintain streambank, channel and shoreline stability, stream temperature and water quality.

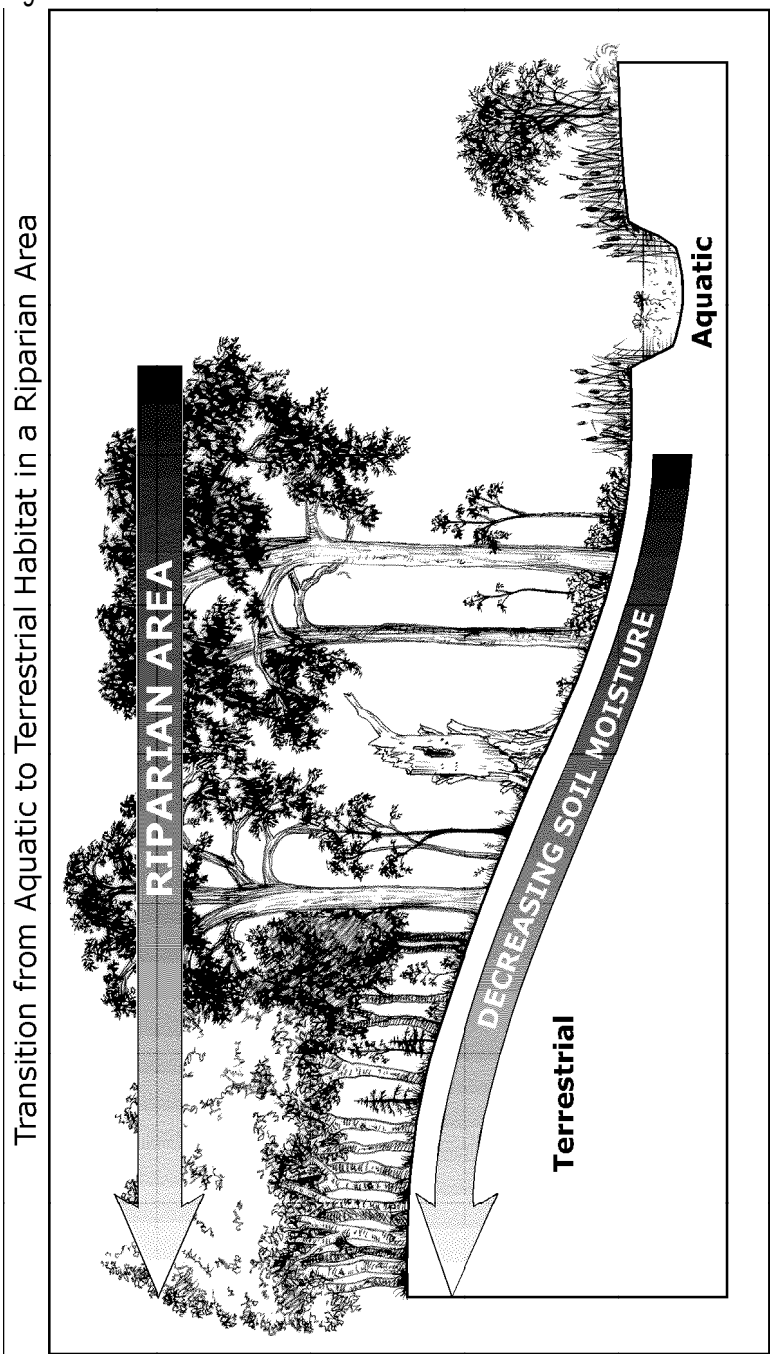
- ❒ Riparian areas provide water storage and conservation, nutrient and food input to the aquatic system, instream structure of coarse woody debris, and a moderated microclimate.

- ❒ Riparian areas also provide important habitat for many species of fish, mammals, birds, reptiles, amphibians and insects.

- ❒ Riparian areas are also important for recreation, tourism, forest products, hunting, fishing, biological diversity and other human values they provide.

To protect the functions and values of riparian areas, riparian guidelines recommend specific **riparian management zones (RMZs)** for streams, lakes and open water wetlands. These RMZs are applied in the portion of the riparian area where site conditions and landowner objectives are used to determine management activities that address riparian resource needs.

*Figure RMZ-1*


Transition from Aquatic to Terrestrial Habitat in a Riparian Area
RIPARIAN AREA
DECREASING SOIL MOISTURE
Aquatic
Terrestrial

## Protecting Riparian Functions and Values

The purpose of these voluntary guidelines is to protect riparian functions and values by minimizing the potential adverse impacts of forest management. These functions and values include:

- ❒ Timber production
- ❒ Moderation of riparian microclimates caused by canopy shade (including water temperature and soil temperature)
- ❒ Bank, channel and shoreline stability
- ❒ Recruitment of coarse woody debris
- ❒ Habitat diversity
- ❒ Biotic and microhabitat diversity
- ❒ Resiliency to natural catastrophes

Impacts that may occur during forest management activities can affect the functions associated with riparian areas. Some of the issues and concerns associated with conducting forest management activities within forested riparian areas have been summarized (Laursen 1996).

For example, timber removal may increase water and sediment yields, leading to stream channel destabilization and loss of aquatic habitat. It may also decrease woody instream cover, destabilize streambanks, reduce shading, increase water temperatures, reduce inputs of fine litter to the water body, and reduce the diversity of plants and animals in the area. Also, road crossings may add sediment and cause bank failures.

From a landscape perspective, managing a greater proportion of the riparian area for uneven-age mixed stands of longer-lived species suitable to the site can help protect riparian functions and values.

Forested riparian areas perform important ecological functions that link aquatic and terrestrial ecosystems. They are also highly valued by humans because of the wide array of products and services they provide. These beneficial functions and values include the following:

- ❒ Maintaining soil, channel and streambank stability, stream temperature and water quality
- ❒ Providing water storage and conservation
- ❒ Providing nutrient and food input to the aquatic system
- ❒ Providing instream structure of coarse woody debris
- ❒ Providing a moderated microclimate
- ❒ Providing diverse and productive habitat for aquatic and terrestrial wildlife, habitat continuity and travel corridors for wildlife, and support of unique habitats and communities
- ❒ Providing for recreation, tourism, forest products, hunting, fishing, biological diversity and other human values

## The Importance of Riparian Areas

Retaining vegetation, including trees, within riparian areas is key to maintaining functional linkages between the terrestrial and aquatic ecosystems, including the following:

❒ Retaining nutrients and sediment and maintaining water quality: Riparian vegetation plays a very important role in retaining nutrients, sediment and organic matter. Intact riparian vegetation also acts as a very effective filter to maintain or improve water quality.

Within the riparian area, the vegetation traps suspended material and slows the water velocity, allowing sediment to settle out. It also slows downslope movement of leaves and branches, providing time for their decomposition and the recapture of nutrients before they reach the water body. Plants that are near the water's edge absorb nutrients directly from the water.

❒ **Wildlife habitat:** Riparian areas have high plant diversity, both horizontally and vertically from the water's edge, which contributes to the high diversity of plants and animals that live in these areas. Frequently the most species-rich habitats to be found in a landscape, riparian areas provide critical corridors linking favored wildlife habitats.

The species that are of most concern in riparian areas are "obligate" species, which require both the water and surrounding forests as habitat. In Minnesota, obligate riparian species include 32 reptile/amphibian species, 20 bird species and 15 mammal species. Numerous plant and invertebrate species (such as salamanders) are also strongly associated with these habitats. Those species are found only in these areas or spend critical portions of their life cycle there.

❒ **Inputs of coarse woody debris and fine litter:** Coarse woody debris helps to create and maintain pools, reduces stream velocities, forms eddies where food organisms are concentrated, supplies protection from predators, provides shelter during winter runoff, and traps and stores small debris from the forest. It also traps smaller debris, which then traps fine debris, sediment and organic matter and can lead to natural levee formation.

The fine litter formed by the breakdown of decomposing plants, leaves and animals serves as the energy base for the aquatic food chain. Future sources of decay-resistant coarse woody debris can be maintained by actively managing for large-diameter conifers.

❒ **Maintaining moderate temperatures through shading:** Small increases in air and water temperatures may lead to changes in the composition and growth of fish, aquatic insect and riparian species. Riparian vegetation, particularly the vegetation overhanging or shading the water's surface, regulates water temperature. Shading away from the water's edge helps to minimize the warming of overland surface water flows before they reach the water body.

❒ **Bank, channel and shoreline stabilization:** Roots and rhizomes of riparian vegetation stabilize and reinforce the banks and shorelines of streams, lakes and open water wetlands. Roots proliferate into fresh sediment deposits, helping to stabilize them. In addition, root systems allow the formation of overhanging banks, which provide excellent habitat for aquatic organisms.

Riparian areas were important to society's prehistoric ancestors and are no less so to modern society, if for somewhat different reasons. Because hunting and gathering cultures of the past used riparian areas extensively as places to live and obtain food, cultural resources are often located there.

Today, the water's edge is recognized as an important resource for a variety of reasons, including spiritual values, aesthetics, wood products and recreation.

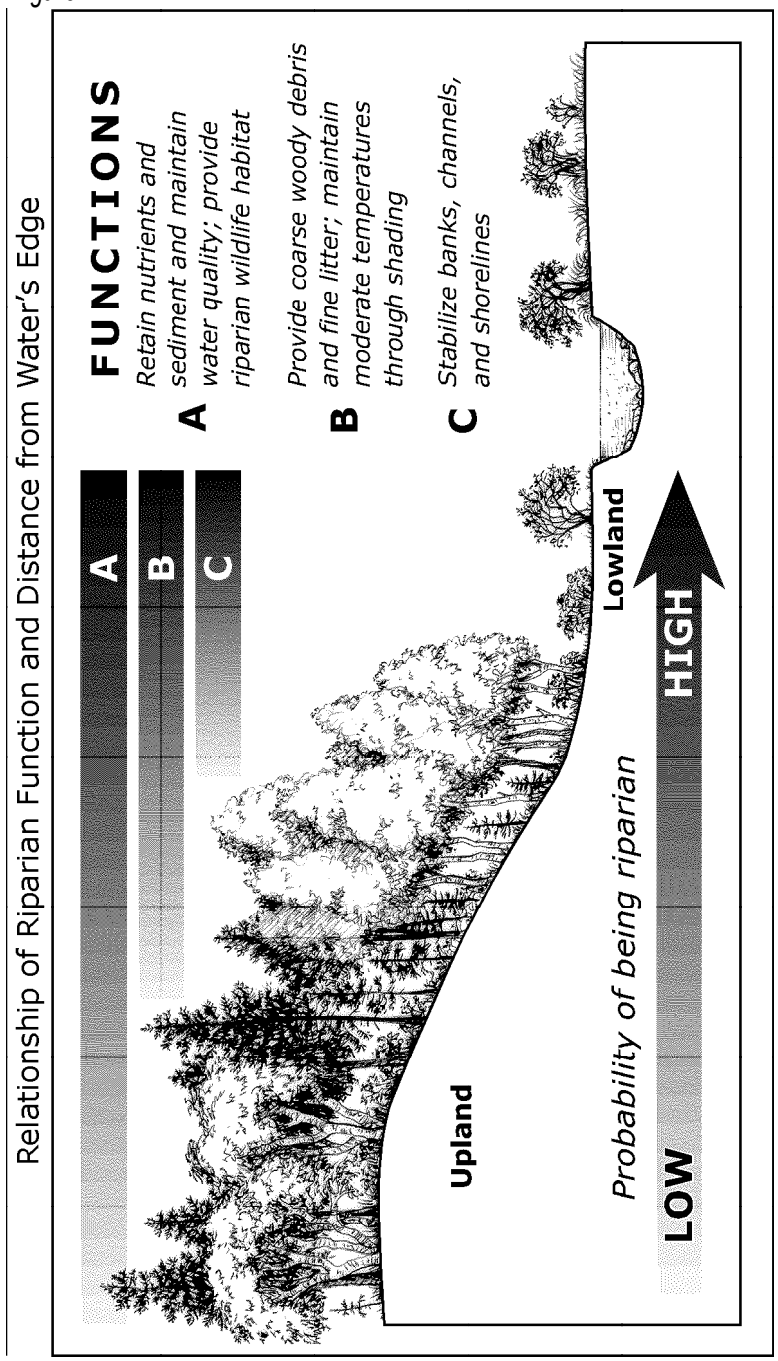
## Variability of Riparian Functions

The functional importance of riparian areas varies in type and degree due to their variability in hydrological, topographical and vegetational condition. For example, the riparian area of a lowland black spruce or black ash forest is very different from that of an upland aspen or northern hardwood forest. Similarly, the riparian area associated with a wide swampy floodplain is very different from the riparian area of a stream that has a steep bank adjacent to it.

For this reason, it is difficult to arrive at definitive numerical widths to define the riparian management zone (RMZ), as each riparian area is unique and the management zone chosen will vary in width depending on site conditions and landowner objectives.

It may also be difficult to know where some riparian functional linkages cease to exist, such as the movement of soil in water to a stream or the extent of terrestrial wildlife habitat. Not all riparian functions are equally important at all distances from the water. The probability of a forest serving a riparian function decreases as the distance from the water's edge increases. At some distance from the water's edge, the likelihood of a location having any riparian function at all is very low. See Figure RMZ-2.

*Figure RMZ-2*


Relationship of Riparian Function and Distance from Water's Edge
FUNCTIONS
A Retain nutrients and sediment and maintain water quality; provide riparian wildlife habitat
B Provide coarse woody debris and fine litter; maintain moderate temperatures through shading
C Stabilize banks, channels, and shorelines
A
B
C
Upland
Lowland
Probability of being riparian
LOW
HIGH

# The Riparian Management Zone: Minimizing Adverse Impacts on Riparian Areas

**Riparian management zones (RMZs) are areas of special concern** along streams, lakes and open water wetlands. They are intended to retain relatively continuous forest cover for the protection and maintenance of aquatic and wildlife habitat, aesthetics, recreation and forest products. Within the RMZ, management activities should be modified through RMZ guidelines to minimize potential adverse impacts.

For example, it is important to keep slash out of intermittent streams where flash flooding will move the excess debris downstream. Additionally, an RMZ should be designed to minimize blowdown of residual trees. This requires consideration of site characteristics (such as exposure to wind, species and soil moisture) as well as the width and residual basal area.

The leave tree recommendation for even-age management—"Following harvest, concentrate leave trees adjacent to the RMZ in clumps, strips or islands, varying in size with a minimum size of 1/4 acre per clump and occupying a minimum of 5% of the area adjacent to the RMZ"— is a strategy to address blowdown of residual trees within RMZs. Refer to Table GG-5 and Figure GG-15 in *General Guidelines: Managing Riparian Areas* for more information on relationships between varying residual basal area in the RMZ and landowner objectives and RMZ functions.

**The recommended minimum RMZ widths** in *General Guidelines* Tables GG-2 through GG-6 provide general guidance for most water quality, aquatic and wildlife habitat protection, and aesthetic objectives.

Landowner interest in increasing the functional effectiveness of riparian areas or considering larger landscape implications of their management actions may result in wider RMZs than those recommended in the guidelines. Consultation with a natural resource professional may help in making these decisions.

## The Need for Monitoring and Research

There is a need to intensively monitor and to carry out research to determine the effectiveness of riparian management zone guidelines and their ability to accomplish their intended objectives.

While the guidelines are based on the best available scientific information and compromise, most of the research studies that form the basis for discussion were conducted in other regions of the country. Considerable research in Minnesota is needed on riparian areas due to the lack of data specific to landforms, water bodies and forest cover types found within the state.

The types of site-specific research that would be beneficial for Minnesota's conditions include assessments of the following:

❒ How leaving varying amounts of residual basal area after timber harvesting within riparian forests may affect such factors as the composition, growth and productivity of the residual forest and biological diversity.

❒ How leaving large dead trees on the ground after timber harvesting within riparian forests may affect such factors as the composition, growth and productivity of the residual forest and biological diversity.

❒ How varying levels of riparian forest reserves (including residual basal area, crown closure and width of the riparian management zone) may, over time, affect such factors as bank stability; reduction in overland flow of sediment; ability to remove chemicals (including nitrogen and phosphorus) from overland flow; maintenance of moderate water temperatures through shading; provision of coarse woody debris; and the production of fine litter.

# Other Considerations

❒ Guidelines for skid trails established as part of water quality and wetland guidelines are appropriate for use when operating within the RMZ. See *Timber Harvesting: Skidding and Skid Trails,* and *Timber Harvesting: Water Quality and Wetlands.*

❒ The term "shade strip" (as referenced in *Protecting Water Quality and Wetlands in Forest Management*) is not used in this integrated guidebook. Instead, the term "riparian management zone (RMZ)" should address all of the functions and values (including water temperature) that were formerly associated with shade strips.

❒ Leaving some super-canopy trees and other long-lived species in the RMZ should be a consideration. If possible, choose trees from the "Excellent" category of Table GG-7: Leave Tree Preferences for Longevity, Windfirmness and Cavity Potential in *General Guidelines: Retaining Leave Trees.*

This approach will provide habitat for riparian species that require large super-canopy trees (trees above the existing mature canopy) for hunting perches and nesting sites. (The "excellent" species recommended are white pine, oaks, elms, ashes, sugar maple, yellow birch and basswood.)

# Selected Resources for Additional Information

*At the Water's Edge: The Science of Riparian Forestry.* Conference Proceedings. 1996. S. B. Laursen (ed.). Minnesota Extension Service, St. Paul, Minnesota. 160 pages.

*Biodiversity: A Background Paper for a Generic Environmental Impact Statement on Timber Harvesting and Forest Management in Minnesota.* 1992. Jaakko Pöyry Consulting, Inc., Tarrytown, New York. 109 pages.

*Final Generic Environmental Impact Statement Study on Timber Harvesting and Forest Management in Minnesota*. 1994. Jaakko Pöyry Consulting, Inc., Tarrytown, New York.

*Forest Wildlife: A Background Paper for a Generic Environmental Impact Statement on Timber Harvesting and Forest Management in Minnesota*. 1992. Jaakko Pöyry Consulting, Inc., Tarrytown, New York. 283 pages.

*Maintaining Productivity and Forest Resources Base: A Background Paper for a Generic Environmental Impact Statement on Timber Harvesting and Forest Management in Minnesota*. 1992. Jaakko Pöyry Consulting, Inc., Tarrytown, New York. 302 pages.

*Northeast Region Plan; Forest, Fish and Wildlife Management Program Appendix: Biodiversity Guidelines*. 1994. Minnesota Department of Natural Resources, Division of Forestry, St. Paul, Minnesota. 40 pages.

*Protecting Water Quality and Wetlands in Forest Management: Best Management Practices in Minnesota*. 1995. St. Paul, Minnesota. 140 pages.

*Riparian Vegetation Effectiveness*. National Council of the Paper Industry for Air and Stream Improvement, Inc., Research Triangle Park, North Carolina. 26 pages. (Unpublished)

*Visual Quality Best Management Practices for Forest Management in Minnesota*. 1994. St. Paul, Minnesota. 78 pages.