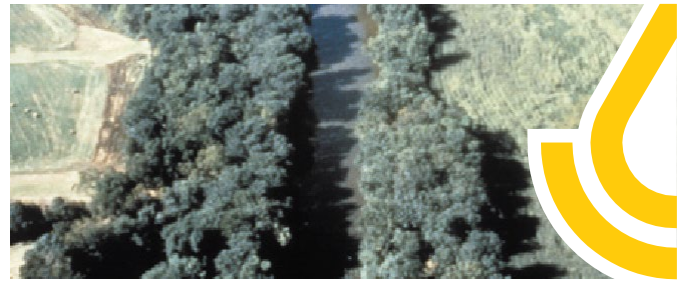


Riparian Forest Buffer

Wisconsin Guidance Document 391



DEFINITION

An area that consists predominately of combinations of trees and shrubs designed to mitigate the impacts of land use on a water feature. These areas are connections between aquatic and upland habitats for wildlife and can also serve as connections to other habitat areas along the water feature.

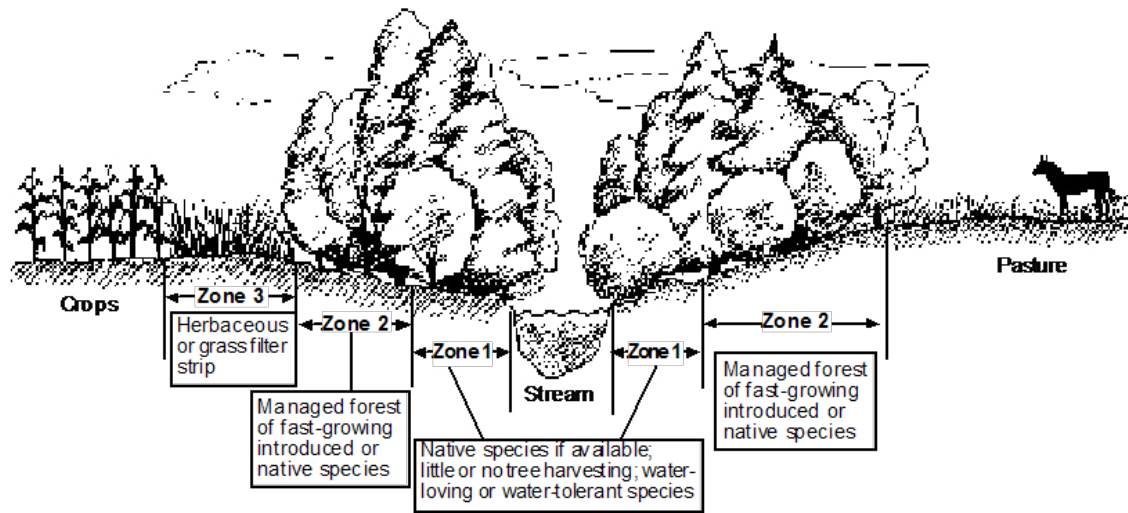
PURPOSE

- Provide shade to lower water temperatures and facilitate higher stream dissolved oxygen concentrations to improve habitat for aquatic organisms.
- Provide a source of detritus and large woody cover for aquatic organisms.
- Improve water quality by establishing permanent tree and herbaceous cover in floodplain areas subject to out-of-bank flow and/or scour erosion.
- Provide habitat and corridors for aquatic and terrestrial flora and fauna.
- Increase transpiration and infiltration, resulting in slower groundwater discharge to streams and reduced flood flows and to mitigate flood damage.
- Restore riparian plant communities.
- Improve water quality by reducing amounts of sediment, organic matter, nutrients, pesticides, and other pollutants in surface runoff and reducing the amounts of nutrients and other chemicals in shallow groundwater.
- Reduce pesticide drift entering the water body.
- Increase carbon storage in plant biomass and soils.

WHERE USED

Buffers are located along or around permanent or intermittent streams, lakes, ponds, wetlands, or seeps. Many of these areas feature year-round or seasonal moisture, which allows woody species to establish quickly. A new riparian forest buffer can rapidly benefit a variety of settings, such as cropland, rangeland, forest land, and urban areas.

Figure 1. Zones of Riparian Forest Buffer



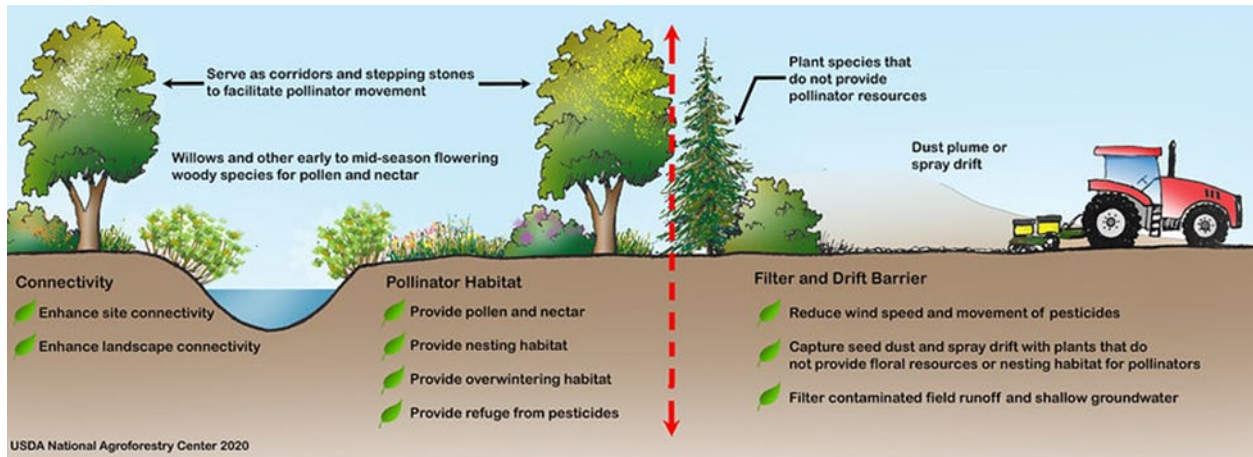
A riparian forest buffer includes a zone 1, the area closest to the stream or waterbody, and a zone 2, the area adjacent to and up gradient of zone 1. Trees and shrubs in zone 1 provide important wildlife habitat, litter fall for aquatic organisms, large wood that can fall into the stream or waterbody, and shading to lower water temperature. This zone helps stabilize streambanks and shorelines. It is important for trees and shrubs in this zone to be adapted to periodic flooding and/or seasonally wet soil. Trees and shrubs in zone 2 (along with zone 1) intercept sediment, nutrients, pesticides, and other pollutants in surface and subsurface water flows. Zone 2 can be managed to provide timber, wood fiber, and horticultural products. A third zone, zone 3, is established if periodic and excessive water flows, erosion, and sediment from upslope fields or tracts are anticipated. Zone 3 generally consists of herbaceous plants or grass and a diversion or terrace. This zone provides a “first line of defense” to assure proper functioning of zones 1 and 2.

RESOURCE MANAGEMENT SYSTEM

Riparian forest buffers are normally established concurrently with other practices as part of a resource management system. For example, adjoining streambanks or shorelines must be stabilized before or in conjunction with the establishment of the buffer (streambank and shoreline protection). To maintain proper functioning of a planting, excessive water flows and erosion must be controlled upslope of the riparian forest buffer (filter strip, critical area planting, residue management). New plantings must be protected from grazing during establishment.

WILDLIFE

Connecting a riparian forest buffer with existing perennial vegetation, such as woodlots and woody draws or other woody habitat (windbreak/shelterbelt), benefits wildlife, including fish and other aquatic organisms. Select tree and shrub species and a planting pattern that benefit the wildlife species of interest and enhance local landscape aesthetics. See Figure 2 for a layout that benefits pollinators.



PLANNING CONSIDERATIONS

See 612-Tree/Shrub Establishment-Planting Guide guidance document for general reference on planning a planting. 612-Tree/Shrub Establishment also has guidance documents for planting protection and ash replacement plantings. What follows is guidance specific to Riparian Forest Buffer plantings.

Zone 1: This zone is required to be at least 15 feet in width. Management should be limited to removal of invasive species or hazard trees. Economic activities should be limited in this zone, as the primary function is ecological. For this reason, only native species should be planted.

Soils in this area can often be waterlogged or seasonally flooded. This can be a difficult area to establish trees and shrubs. Areas that are waterlogged throughout the year should not be planted as the planting is likely to fail. Work around the edges of waterlogged areas or on mounds or other elevated areas within them. Mounds can also be created with site preparation using an excavator. Often cuttings of flooding tolerant species will work well in these situations. Willow species, eastern cottonwood, and balsam poplar are particularly well suited to the cutting planting method.

Tamarack is a good conifer choice around waterlogged soils. Black spruce (on acidic soils) and northern white-cedar (on calcareous soils) are good conifer choices around waterlogged soils as well and are best suited climatically to the northern parts of Wisconsin.

Areas that flood periodically with periods of drying in between have a wider range of planting options. In addition to the species already listed, swamp white oak, silver maple, bur oak, hackberry, red maple, northern red oak, and basswood may be appropriate depending on site and climate conditions. River birch and sycamore are also potential options and are best suited climatically to the southern part of Wisconsin.

American elm is suited to floodplains; however, it is susceptible to Dutch elm disease. Cultivars resistant to Dutch elm disease have been developed and include Jefferson (Hardiness Zone 4), New Harmony (Zone 4b), Valley Forge (Zone 4), JFS-Prince II Colonial Spirit® (Zone 4), Lewis and Clark Prairie Expedition® (Zone 3), Princeton (Zone 4), and St. Croix First Editions® St. Croix™ (Zone 3). These cultivars are typically available from commercial nurseries in more expensive sapling size trees. Note that resistance is not a guarantee a tree will survive the targeted disease, however it should perform better

USDA is an equal opportunity provider, employer, and lender.

Wisconsin Guidance Document 391, Riparian Forest Buffer • Page 3 of 6 • Last updated... June 28, 2021

than natural trees. These trees will be susceptible to other diseases of elm, such as elm yellows.

Several ash species are also well suited to floodplains; however, these species should not be planted at this time due to likely infestation by emerald ash borer. This recommendation will be revisited if a control option for emerald ash borer is found or resistant cultivars become available.

Stocking should be established at a minimum of 300 stems/acre, of which at least 200 stems/acre should be established as trees. Up to 100 stems/acre may be established as shrubs. It is advisable to plant more than the minimum to account for expected mortality. Plan for at least 25-30% mortality, and up to 50% mortality on difficult sites.

An exception to this stocking level is for forest riparian buffers planned adjacent to cold-water streams located in the Driftless Area. Trees should be planted at a minimum spacing of 18' – 20' in the first 50 feet adjacent to the cold-water stream to maintain grass/forb understory. Where prairie or oak savanna remnants occur on the site, a minimum spacing of 18' -20' may be maintained for the entire width of the riparian forest buffer to maintain these habitats.

Zone 2: This zone is required to be at least 20 feet in width. Forest management and agroforestry are encouraged in this zone. This zone can be used to meet a blend of economic and ecological objectives. Soils in this area can range from waterlogged to drier upland soils. Matching vegetation species to soil conditions is a key consideration in this zone.

This zone is where management for economic benefit is encouraged. Native species to consider for nut production include shagbark hickory and black walnut. Native species to consider for the floral industry include dogwoods and willows. Oak, black walnut, and sugar maple are native species generally valuable for timber production. Sugar maple can also be used for maple syrup production, although this will reduce timber value.

Make sure that species selected for planting are suited to the site and climate rather than focusing solely on economic considerations. Future climate conditions should be considered as well. Stocking will be dependent upon the objectives of the landowner for the zone. Finally, it is important to confirm that markets are available for planned economic production.

Zone 3: If required to buffer forested area from a crop field with a herbaceous/grass buffer, Conservation Practice Standard 393-Filter Strip should be used for planning.

Conservation Reserve Program (CRP) and Conservation Reserve Enhancement Program (CREP)

Considerations: The maximum width for CRP riparian forest buffers is 180 feet. The maximum width for most CREP riparian forest buffers is 150 feet. The Lake Superior CREP area has a maximum width of 200 feet for slopes that are 3% or less and a maximum width of 300 feet for slopes greater than 3%.

It is important to note that only native species can be planted for CRP and CREP. Non-native agroforestry species are not appropriate for CRP and CREP plantings. Stocking levels must meet minimums established by CRP or CREP guidance.

Site Preparation: Most sites will require some form of site preparation prior to planting to provide growing conditions suitable for tree survival and growth. The amount of site preparation needed will vary depending on existing condition of the planting site. Previously tilled cropland may not require much site preparation. An area that currently is established with aggressive grasses or invasive species will require intensive site preparation. In wet areas, mounding site preparation may increase planting success. This can be done with an excavator (backhoe) or by hand for small plantings. Mounds are typically 1-3 feet in diameter and 6-12 inches in height. When using mechanical equipment in wetland/riparian settings, it is important to work only when soil conditions are dry to avoid rutting and compaction (generally late summer). The mounds provide a better-drained and warmer planting spot which is beneficial for seedling establishment. Mounds mimic natural processes in wetland forests where trees are tipped over by wind, partially pulling the roots out and above the ground surface and resulting in a depression where the roots used to be. As the roots decompose and attached soil sloughs off, mounds are formed next to the depressions. These natural mounds should also preferentially be used as planting spots.

Conservation Practice Standard 490-Tree/Shrub Site Preparation should be used where significant site preparation is required.

Planting Protection: Areas with a high density of deer will require protection of planted species that deer find palatable. Rabbits and other rodents may also girdle trees in winter by eating the inner bark on the lower part of planted trees/shrubs. Tree shelters, individual tree cages, and perimeter fencing can be used to address deer and/or rodent damage. Shelters (and the trees within) may be susceptible to damage during flood events due to having a high resistance to flowing water. Flood risk must be weighed carefully with browse risk in these situations. Well-staked wire cages or perimeter fencing may be better options in flood-prone areas. More information can be found in Conservation Practice Standard 612-Tree/Shrub Establishment-Protection Guidance Document.

Competition Control During Establishment: To have a successful planting, competition from other vegetation must be controlled until the trees and shrubs have established and outgrown the competitive species. This is commonly done either by herbicide application or mulching/weed fabric. Herbicide application should be planned carefully to avoid impacts to water quality in the nearby water feature. Herbicides specifically formulated for use near or in water are recommended.

CONSIDERATIONS FOR AREAS OF EXISTING TREE/SHRUB COVER

Areas within the buffer that have established tree/shrub cover may already be functioning as riparian forest buffer. These areas should be excluded from the treatment area if they meet stocking guidelines for the forest type. To determine this, sample plots should be done. Install at least three sample plots and collect species, trees/acre, and DBH (Diameter at Breast Height - 4.5' above ground level) measurements. Use fixed area plots at a size that results in an average of 4 – 10 trees per plot (typical is a 1/20th acre fixed plot with a plot radius of 26.3' or 1/30th acre fixed plot with a plot radius of 21.5').

Average the plot data (DBH and trees/acre) and compare to the table below for bottomland hardwood forest type (if the existing forest type is not bottomland hardwoods, consult with NRCS state forester for recommendations).

- If the result falls within the stocking recommendations, no further action is required (although 314-Brush Management or 315-Herbaceous Weed Treatment may be needed for invasive plants). However, species composition should also be considered. Areas with significant stocking of ash species may fall below recommended stocking levels. A treatment to salvage ash and regenerate other species may be appropriate in this case.
- If stocking is higher than the maximum recommended, use 666-Forest Stand Improvement to implement a thinning.
- If stocking is below the minimum recommended, include in the Riparian Forest Buffer treatment and underplant the area to increase stocking. Carefully consider tree species' tolerance of shade in this case, and only choose trees that can thrive in the current light conditions.

Exceptions to this level of stocking are areas that are to be managed for oak savanna or Driftless Area cold-water stream management.

Table 1. Minimum and Maximum Stocking Levels by Average Diameter at Breast Height (DBH) for Bottomland Hardwood Forest Type

Average DBH (inches)	Range of Full Stocking (Trees/Acre)
6	202-475
10	112-202
14	71-112
18	49-71
22	36-49
26	27-36

Source: Meyers, C.C. 1989. Estimating bottomland hardwood growth and yield. In. Clark, F.B. tech. ed.; Hutchinson, J.G. ed. Central Hardwoods Notes. St. Paul, MN: USDA, Forest Service, North Central Forest Experiment Station. Note 5.05., accessed from the website North Central Region Bottomland Hardwood Management Guide: *A cooperative project of the USDA Forest Service and University of Minnesota.*

https://www.nrs.fs.fed.us/fmg/nfmg/bl_hardwood/silv/communities/intermediate.html#stockingchart. Accessed 4-19-2021.