

**NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD**

RIPARIAN FOREST BUFFER

(Acre)
CODE 391

DEFINITION

An area of predominantly trees and/or shrubs located adjacent to and upgradient from watercourses or water bodies.

PURPOSES

- Create shade to lower water temperatures to improve habitat for aquatic organisms.
- Provide a source of detritus and large woody debris for aquatic and terrestrial organisms.
- Create wildlife habitat and establish wildlife corridors.
- Reduce excess amounts of sediment, organic material, nutrients and pesticides in surface runoff and reduce excess nutrients and other chemicals in shallow ground water flow.
- Provide a harvestable crop of timber, fiber, forage, fruit, or other crops consistent with other intended purposes.
- Provide protection against scour erosion within the floodplain.
- Restore natural riparian plant communities.
- Moderate winter temperatures to reduce freezing of aquatic over-wintering habitats.
- To increase carbon storage.

CONDITIONS WHERE PRACTICE APPLIES

On stable areas adjacent to permanent or intermittent streams, lakes, ponds, wetlands and areas with ground water recharge. Where existing perennial vegetation is already established directly adjacent to the water body,

the riparian forest buffer will apply to the landward side of the existing vegetation within the maximum buffer width allowable.

CRITERIA

GENERAL CRITERIA APPLICABLE TO ALL PURPOSES

The location, layout, width, length and woody plant density of the riparian forest buffer will accomplish the intended purpose and function.

Where subsurface drains (tile lines) cross a tree/shrub planting, and where these drains will remain functional, sealed conduit will be installed through the planting and extend a minimum for 100 feet from rows of large trees (capable of reaching heights greater than 60 feet) and 75 feet from all other trees and shrubs. Trees and shrubs will not be planted within 50 feet of either side of functional subsurface drains.

Riparian Forest Buffers will be most effective when used as a component of a conservation management system that includes additional practices such as nutrient management, pest management, residue management, erosion, runoff and sediment control practices.

Zone 1

Zone 1 will begin at the normal high water line, or at the upper edge of the active channel or shore, and extend a minimum distance of 25 feet, measured horizontally on a line perpendicular to the water course or water body (see figure 1).

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact the Natural Resources Conservation Service.

Dominant vegetation will consist of existing, planted or seeded trees and shrubs suited to the site and the intended purpose. Plant two or more species suited to the site. Select species from Table 1, Plant List for Riparian Forest Buffers, or from Conservation Tree/Shrub Suitability Groups located in Section II of the Illinois Field Office Technical Guide. Favor heavy-seeded species that are marked with an asterisk in Table 1.

Where equipment access is necessary to maintain channel beds and banks on low gradient, shallow drainageways, a strip no more than 40 feet wide adjacent to the stream may be maintained in low shrubs. Maintenance equipment may be operated over the top of shrubs with little, if any, lasting damage to the woody plants. If possible restrict access to one side only, preferably the north or east bank. Wider channels may require equipment access on both sides. See Plans and Specifications for recommended low-growing, flexible shrub species to plant on access corridors. Note that equipment access corridors comprised of low shrubs will reduce or eliminate the function of the buffer for lowering water temperature and providing large woody debris.

Occasional removal of some tree and shrub products such as high value trees is permitted provided the intended purpose is not compromised by the loss of vegetation or harvesting disturbance. Trees to be harvested should be marked by a forester to avoid "highgrading" the stand. Felling and skidding of trees shall be directed away from the water course or water body. Skidding will be done in a manner to prevent creation of ephemeral channels perpendicular to the stream.

Natural regeneration should only be used on sites that are not suited to any kind of tree planting (see "Use of Root Pruned Potted Stock for Difficult Sites", General Specification 391) or direct seeding. The tree planting plan developed for establishing the buffer will include justification for use of natural regeneration. See practice standard TREE/SHRUB ESTABLISHMENT (612) for more information on natural regeneration and tree planting.

Site preparation and planting or seeding for establishing new buffers shall be done at a time and in a manner to insure survival and growth of selected species. Refer to practice standards FOREST SITE PREPARATION (490) and TREE/SHRUB ESTABLISHMENT (612) for more information on site preparation, tree planting or direct seeding.

Livestock will be controlled or excluded as necessary to achieve and maintain the intended purpose. Water course crossings and livestock watering shall be located and sized to minimize impact to buffer vegetation and function.

Zone 2

An additional strip or area of land, zone 2, will begin at the edge and landward of zone 1 and extend a minimum distance of 25 feet, measured horizontally on a line perpendicular to the water course, for first and second order streams and 75 feet for third order and larger streams (see figure 1). Stream order can be determined using a USGS 7.5 minute quad map: first order streams are permanently flowing streams at the uppermost level of a watershed. Two first order streams join to form a second order stream, two second order streams join to form a third order stream, etc.

Criteria for zone 1 shall apply to zone 2 except that removal of tree and shrub products such as timber, nuts and fruit is permitted on a periodic and regular basis provided the intended purpose is not compromised by loss of vegetation or harvesting disturbance.

Maximum combined width of zones 1 and 2 is defined by the 100-year floodplain (see figure 2). The 100-year floodplain can be determined from Federal Emergency Management Agency (FEMA) maps. Additional assistance may be obtained from the Illinois Water Survey. On small streams with floodplains less than 50 feet wide the maximum width is 50 feet. For lakes, ponds, wetlands and areas of ground water recharge the maximum combined width of zones 1 and 2 is 300 feet.

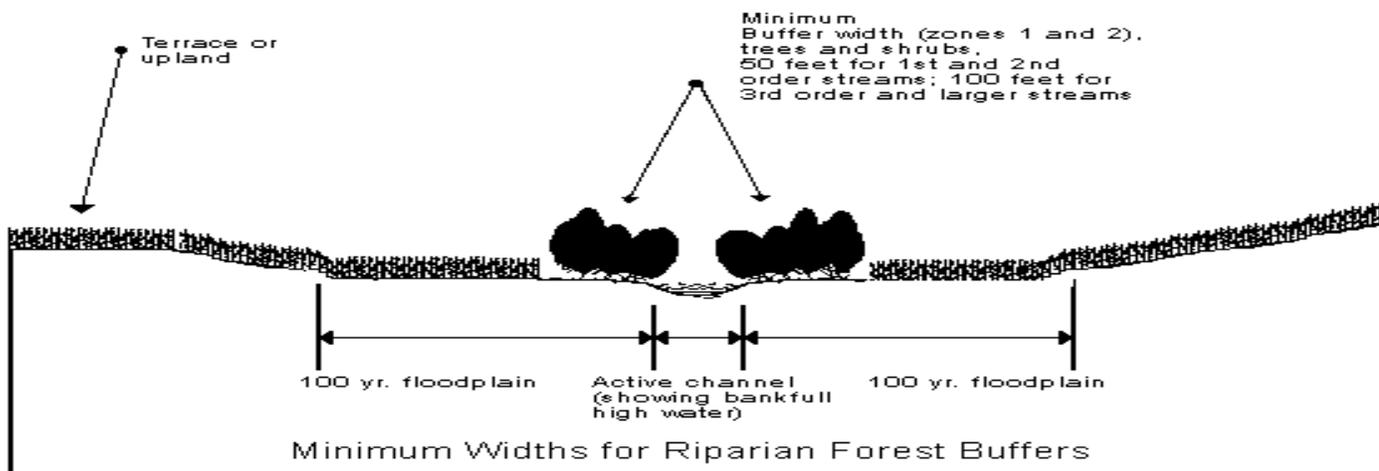


Figure 1. Minimum Widths for Riparian Forest Buffers.

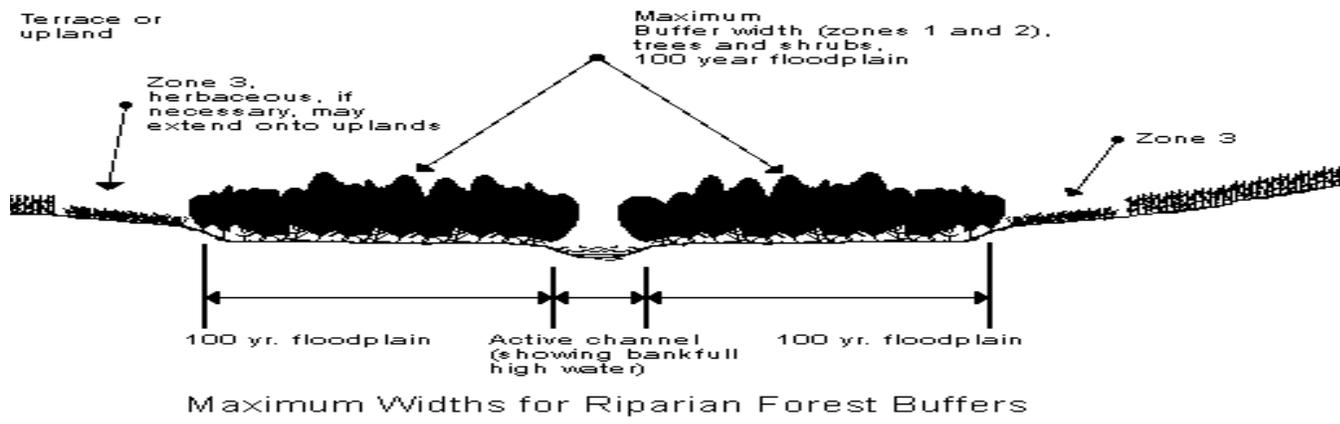


Figure 2. Maximum Widths for Riparian Forest Buffers.

Concentrated flow erosion, excessive sheet and rill erosion or mass soil movement will be controlled in the up-gradient area immediately adjacent to zone 2 prior to establishment of the riparian forest buffer.

ADDITIONAL CRITERIA FOR IMPROVING WATER QUALITY BY REDUCING AMOUNTS OF SEDIMENT, ORGANIC MATTER, NUTRIENTS, PESTICIDES, AND OTHER POLLUTANTS IN SURFACE RUNOFF AND SHALLOW GROUND WATER.

Zone 3

Where ephemeral, concentrated flow or sheet and rill erosion and/or sedimentation are concerns in the area up-gradient of zone 2, an optional Zone 3 will be established (see figure 2). Zone 3 is a vegetated strip consisting of grasses or grasses and forbs. Stiff-stemmed grasses established at the up-gradient edge of zone 2 will accelerate deposition of sediment. Criteria from practice standard FILTER STRIP (393), will be used in designing Zone 3. Minimum and maximum widths of zone 3 will conform with specifications found in practice standard FILTER STRIP (393).

Zone 3 may be included in the 100 year flood plain or it may begin at the boundary of the 100-year floodplain and extend onto adjacent uplands.

When concentrated flow or excessive sheet and rill erosion and sedimentation cannot be controlled vegetatively, consider structural or mechanical treatments.

Manage the dominant tree canopy to maintain maximum vigor of overstory and understory species. Periodic thinning and/or prescribed burning may be necessary to allow adequate light to reach the forest floor to maintain a good cover of grasses and forbs. Forest canopy cover may reach 100% during the first 10-15 years but should be thinned to approximately 80% to maintain vigor and influence species composition of both the understory and overstory.

ADDITIONAL CRITERIA FOR IMPROVING WATER QUALITY AND PROVIDING PROTECTION AGAINST SCOUR EROSION BY ESTABLISHING PERMANENT WOODY AND HERBACEOUS COVER ON FLOODPLAIN AREAS SUBJECT TO OUT OF BANK FLOW AND/OR SCOUR EROSION.

Widths of Zones 1 and 2 will be increased to include areas of overland flow and/or scour erosion, up to the width of the 100-year floodplain. Evidence of these conditions includes scour, residue or debris deposits, which may be observed either during a site visit or aerial photography.

ADDITIONAL CRITERIA TO PROVIDE HABITAT AND CORRIDORS FOR WILDLIFE.

The following widths are the sum of the combined width of Zone 1 and Zone 2 on one or both sides of water courses or water bodies. These are minimum widths required for the wildlife species or combinations of species listed:

Species:	Minimum width, in feet
Bald eagle, cavity nesting ducks, heron rookery, sandhill crane	600
Common loon, pileated woodpecker	450
Beaver, dabbling ducks, mink, and to achieve full diversity and largest numbers of various bird species	300
Gray squirrel fox squirrel	240
Deer	200
Lesser scaup, harlequin duck	165
Frog, salamander	100

ADDITIONAL CRITERIA TO CREATE SHADE TO LOWER WATER TEMPERATURES TO IMPROVE HABITAT FOR AQUATIC ORGANISMS.

The tallest tree species adapted to the site (see Table 1) shall be established or maintained on south and west sides of water courses and water bodies. The buffer canopy shall be established to achieve at least 50 percent crown cover with average canopy heights equal to or greater than the width of the water course or 30 feet for water bodies. See Figure 5.

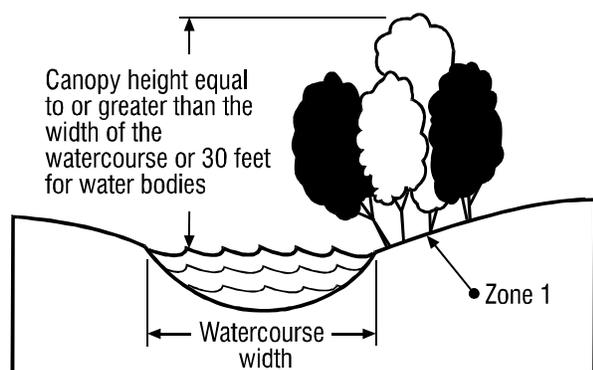


Figure 3. Canopy height for water temperature control.

Buffer species shall include those species listed in Table 1 with sufficient height potential. Place drooping or wide-crowned trees and shrubs nearest the water course or body. Shoreline or channel relief (e.g., deeply incised channels) and topographic shading will be taken into account in selecting species.

ADDITIONAL CRITERIA TO PROVIDE A SOURCE OF DETRITUS AND LARGE WOODY DEBRIS FOR AQUATIC AND TERRESTRIAL ORGANISMS.

Within Zone 1 as a minimum, establish, favor or manage species capable of producing stems and limbs of sufficient size to provide an eventual source of large woody debris for in-stream habitat for fish and other aquatic organisms. See Table 1 for recommended species.

CONSIDERATIONS

The severity of bank erosion and its influence on existing or potential riparian trees and shrubs should be assessed. Watershed-level treatment or bank stability activities may be needed before establishing a riparian forest buffer.

Where possible, drainage tiles should be brought to the surface or a tee installed upslope from the buffer. This will allow tile drainage to flow through the buffer, maximizing the filter function of the buffer.

Complex ownership patterns of riparian areas may require group planning for proper buffer design, function and management.

Favor tree and shrub species that are native and have multiple values such as those suited for timber, biomass, nuts, fruit, browse, nesting, aesthetics and tolerance to locally used herbicides. Consider species that resprout to facilitate prompt regeneration after harvest or any impact. If black walnut is to be planted refer to [Guide to Selection of Soil Suitable for Growing Black Walnut in Illinois](#) in REFERENCES.

Avoid tree and shrub species which may be alternate hosts to pests. Species diversity should be considered to avoid loss of function due to species-specific pests.

Consider the positive and negative impacts beaver, muskrat, deer, rabbits and other local species may have on the successful management of the riparian and stream system.

Temporary and local population control methods of these kinds of local species should be used cautiously and within state and local regulations.

PLANS AND SPECIFICATIONS

Specifications for this practice shall be prepared for each site. Specifications shall be recorded using approved specifications sheets, job sheets, narrative statements in the conservation plan, or other acceptable documentation. Requirements for operation and maintenance of

the practice shall be incorporated into site specifications.

PLANTING DENSITIES, CARE, HANDLING, SIZE AND PLANTING REQUIREMENTS FOR WOODY PLANTING STOCK

Refer to practice standard TREE/SHRUB ESTABLISHMENT (612) for specifications regarding plant to plant spacing and requirements for planting stock and seeding.

PREPARATION OF PLANTING SITES

Refer to practice standard FOREST SITE PREPARATION (490) for specifications on preparing planting or seeding sites.

PLANT LIST

Table 1 lists woody plant species (trees and shrubs) commonly associated with and suited to riparian areas. Key attributes are listed for each plant to assist with the design process for establishing new buffers. For additional species recommendations, based on soils, see Conservation Tree/Shrub Suitability Groups, Section II of the Illinois field Office Technical Guide.

Where equipment access corridors are necessary adjacent to stream channels, recommended low shrub species include but are not limited to: red-osier dogwood (Cornus stolonifera), gray dogwood (C. racemosa), buttonbush (Cephalanthus occidentalis), arrow-wood (Viburnum recognitum), swamp privet (Forestiera acuminata), and winterberry (Ilex verticillata).

OPERATION AND MAINTENANCE

The following actions shall be carried out to insure that this practice functions as intended throughout its expected life. These actions include normal repetitive activities in the application and use of the practice (operation), and repair and upkeep of the practice (maintenance).

The riparian forest buffer will be inspected periodically, protected and restored as needed, to maintain the intended purpose from adverse impacts such as excessive vehicular and pedestrian traffic, pest infestations, pesticide use on adjacent lands, livestock damage and fire.

Replacement of dead trees or shrubs and control of undesirable vegetative competition will be continued until the buffer is, or will progress to, a fully functional condition.

As applicable, control of concentrated flow erosion or mass soil movement shall be continued in the up-gradient area immediately adjacent to zone 2 to maintain buffer function.

For providing habitat and corridors for wildlife, manage the buffer to favor food, shelter and nesting cover that would satisfy the habitat requirements of the indicator or target wildlife.

Any use of fertilizers, mechanical treatments, prescribed burning, pesticides and other chemicals to assure buffer function shall not compromise the intended purpose. Biological control of undesirable plant species and pests (e.g., using predator or parasitic species, or grazing of domestic animals) shall be implemented where available and feasible.

Additional operation and maintenance requirements shall be developed on a site-specific basis to assure performance of the practice as intended.

REFERENCES

Chesapeake Bay Riparian Handbook: A Guide for Establishing and Maintaining Riparian Forest Buffers. NA-TP-02-97, USDA-Forest Service, S&PF, Radnor, PA.
<http://www.chesapeakebay.net/pubs/su bcommittee/nsc/forest/handbook.htm>

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Schultz, R.C., J.P. Colletti, T.M. Isenhardt, W.W. Simpkins, C.W. Mize, and M.L. Thompson. 1995. Design and Placement of a Multi-species Riparian Buffer Strip. Agroforestry Systems 29:201-225.

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Understanding the Science Behind Riparian Forest Buffers: The Effects on Plant and Animal Communities. Klapproth, J.C. and J.E. Johnson, 2000. VA CES Pub. No. 420-152. <http://www.ext.vt.edu/pubs/forestry/420-152/420-152.html>

Table 1. Plant List for Riparian Forest Buffers

Species (Common/Scientific)	pH Range	Flooding Tolerance	Large Debris	Shade Value	Wildlife Merit	Height (feet)	IL Plant Suitability Zone	
arrow-wood	Viburnum recognitum	5.1-6.5	H	L	L	H	8	All
ash, green	Fraxinus pennsylvanica	6.1-7.5	M	M	H	M	60	All
white	Fraxinus americana	6.1-7.5	L	M	H	M	70	All
baldcypress	Taxodium distichum	6.1-6.5	VH	M	M	M	80	II, III
birch, river	Betula nigra	4.0-6.5	M	H	M	M	50	All
buttonbush	Cephalanthus occidentalis	6.1-6.5	VH	L	L	L	10	All
cottonwood	Populus deltoides	6.6-7.5	H	H	M	H	90	All
dogwood, gray	Cornus racemosa	6.1-8.5	H	L	L	H	8	All
red-osier	Cornus stolonifera	6.1-8.5	H	L	L	H	12	All
hackberry	Celtis occidentalis	6.6-8.5	M-L	M	M	M	60	All
*hickory, shellbark	Carya laciniosa		M	M	H	H	70	All
water	Carya aquatica		VH	M	M	H	70	III
holly, swamp	Ilex decidua	4.0-8.5	VH	L	L	M	16	All
winterberry	Ilex verticillata	4.5-8.0	VH	L	L	M	20	II, III
locust, honey	Gleditsia triacanthos	6.1-7.5	H	H	M	L	70	All
*water	Gleditsia aquatica		VH	M	M	L	60	III
maple, boxelder	Acer nagundo	5.1-7.5	M	H	M	M	40	All
silver	Acer saccharinum	5.5-7.5	M	H	H	M	80	All
red	Acer rubrum	4.5-6.5	M	M	H	M	70	All
*oak, bur	Quercus macrocarpa	4.0-8.5	H	M	H	H	80	All
pin	Quercus palustris	5.5-6.5	M-L	H	M	H	75	All
willow	Quercus phellos		M	M	H	H	70	III
shingle	Quercus imbricaria		M	M	M	H	65	All
overcup	Quercus lyrata		VH	M	H	H	70	II, III
swamp white	Quercus bicolor	6.6-7.5	M-H	M	H	H	70	All
cherrybark	Quercus pagodafolia		M	M	H	H	75	III
swamp chestnut	Quercus michauxii		M-H	M	H	H	75	III
shumard	Quercus shumardii		M-L	M	H	H	80	II, III
*pawpaw	Asimina triloba		M	L	L	H	25	All
*pecan	Carya illinoensis	6.6-7.5	M	M	H	H	80	All
*persimmon	Diospyros virginiana	6.1-6.5	M	M	M	H	50	II, III
privet, swamp	Forestiera acuminata		VH	L	L	L	14	All
sugarberry	Celtis laevigata		M-L	M	M	H	80	II, III
sweetgum	Liquidambar styraciflua		M	H	H	H	90	III
sycamore	Platanus occidentalis	6.6-8.5	H	H	M	H	90	All
water tupelo	Nyssa aquatica		VH	H	H	H	90	III
*walnut, black	Juglans nigra	6.6-8.5	M-L	M	M	H	80	All
willow, black	Salix nigra	6.6-7.5	H	H	L	M	60	All
sandbar	Salix exigua (interior)		VH	L	L	L	6	All
peachleaf	Salix amygdaloides	6.6-7.5	H	L	L	L	30	All
pussey	Salix discolor	6.6-7.5	H	L	L	L	20	I

*Heavy seeded species preferred for seeding and planting to increase species diversity.

VH = very high; H = high; M = medium; L = low

pH Range: from Hightshoe, G.L., 1988, Native Trees, Shrubs and Vines for Urban and Rural America

Flooding Tolerance. General capacity of the plant to withstand standing water. VH = able to survive deep, prolonged flooding for more than one year; H = able to survive deep flooding for one growing season, with mortality occurring if flooding is repeated the following year; M = able to survive flooding or saturated soils for 30 consecutive days during the growing season; L = unable to survive more than a few days of flooding during the growing season without mortality.

Large Debris. Potential for the plant to produce debris larger than ten inches in diameter before senescence. H = large debris likely within life span of the plant; M = large debris possible within life span of the plant; L = large debris unlikely within life span of the plant.

Shade Value. The density or fullness of shade provided by an individual plant's crown in full leaf out condition. H = large crown providing full shade; M = partially open or medium sized crown that provides patchy or incomplete shade; L = very open or small crown that provides minimal shade.

Wildlife Merit. The potential for the plant to provide useful cavity sites and/or quality fruit production for wildlife. H = excellent large cavity potential and/or high quality fleshy fruit or nut production; M = moderate cavity potential or fruit production; L = low cavity potential and dry, non-nut fruit production.

Height. Potential height at physical maturity.

Illinois Plant Suitability Zones. See Illinois NRCS Field Office Technical Guide, Section II - Climatic Data.