

NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

Riparian Forest Buffer

(Acres)

Code 391

DEFINITION

An area of predominantly trees and/or shrubs located adjacent to and up-gradient 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 areas adjacent to permanent or intermittent streams, lakes, ponds, wetlands and areas with

ground water recharge that are capable of supporting woody vegetation.

CRITERIA

General Criteria Applicable to All Purposes

- Plans and application of riparian forest buffer shall comply with all applicable federal, state, and local laws and regulations.
- Dominant vegetation shall consist of existing, planted or seeded trees and shrubs adapted to the site and the intended purpose.
- The species, type of plant material, location, layout and density of the planting shall accomplish the intended purpose and function.
- Native plant species shall be used whenever possible. Known non-native invasive species shall not be used.
- Removal of trees for timber products shall not compromise the intended purpose of the buffer.
- Livestock shall be controlled or excluded as necessary to achieve and maintain the intended purpose.
- Riparian buffers shall be designed to meet the minimum buffer width as designated in Table 1.
- Woody plants shall be established without compromising the integrity of:
 1. Property Lines
 2. Fences
 3. Utilities

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

- 4. Roads
- 5. Legal Drains
- 6. Other Easement Areas or Right of Ways
- Where subsurface drains (tile lines) cross through a tree/shrub planting, and where these drains will remain functional, non-perforated tile shall be installed through the planting and extend a minimum of 50 feet on either side of the planting, or trees/shrubs shall not be planted within 50 feet on either side of the perforated tile line.

• **Buffer Configuration**

All buffers shall consist of at least two zones, Zone 1 and Zone 2. In addition, Zone 3 shall be required if needed to control erosion up-gradient of Zone 2.

Zone 1 – Streamside Forest

Shall begin at the normal water line, or at the top upper edge of the active channel or shore, extend a minimum distance of 25 feet measured horizontally on a line perpendicular to the water body. Tree removal is minimized in this zone to allow trees to grow to maturity. Mature trees are needed to lower water temperatures and to provide a source of detritus for fish and other aquatic organisms. Occasional removal of trees for forest products is permitted provided that the intent of the buffer is not compromised. Felling and skidding of trees shall be directed away from the water course or water body. Skidding shall be done in a manner that minimizes soil erosion.

Exception for legal drains (only with written permission): Zone 1 can begin 30 feet from the top of bank to provide an access strip for equipment ingress and egress.

The access strip is allowable if the primary purpose of the buffer is attainable with the presence of the access strip. The access strip shall be maintained in herbaceous plants.

- Written permission shall be obtained for all easements.

Zone 2 – Managed Forest

Shall begin immediately from Zone 1 and extend a minimum distance listed in Table 1. Minimum Zone Widths.

Criteria for Zone 1 applies except that removal of trees for forest products is permitted on a periodic and regular basis provided the intended purpose is not compromised.

Table 1. Minimum Zone Widths (in feet)

Stream Order ¹	Zone 1	Zone 2	Total
1,2	25	25	50
3 and larger	25	75	100
Others ²	25	25	50

¹Stream order is a description of a drainage pattern. It is a measure of the position of a stream in the hierarchy of tributaries. First order streams are those which have no tributaries. Stream order increases when 2 streams of equal order join. For example, it takes 2 second order streams joining to make a third order stream.

²Includes open ditches and streams that have surface flow for less than 6 months out of the year. Also includes buffers around wetlands, lakes, and ponds.

Zone 3 – Stiff-Stemmed Grasses

Where ephemeral, concentrated flow or sheet and rill erosion is a concern in the area up-gradient of Zone 2, install a vegetated filter strip of grasses and/or forbs. When Zone 3 is used it shall be applied in accordance with FOTG (391) *Filter Strip* with a minimum width of 20 feet.

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• **Plant Establishment**

Tree and/or shrub plantings shall follow site preparation/weed control for establishment, planting dates, planting and storage guidelines as detailed in FOTG (612) *Tree/Shrub Establishment*.

The planting of a riparian buffer shall establish a minimum of 300 trees/acre using one of the planting and/or establishment methods as detailed in FOTG (612) *Tree/Shrub Establishment*.

If seedlings are planted a minimum of 436 trees/acre shall be planted using a 10' X 10' spacing or equivalent.

Criteria to Create Shade to Lower Water Temperatures to Improve Habitat for Aquatic Organisms

Buffer species shall be capable of achieving desired height and crown density required for shade production. The buffer canopy shall be established to achieve at least 50% crown cover with an average projected canopy shade length equal to or greater than the planned width of the water body that needs shade protection. Use

Table 2, Shadow Length Table as a tree height guide with Table 3, on pages 4-5 to select suitable species.

Place trees and shrubs with high shade values 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.

Table 2. Shadow Length Table¹

Tree Height (ft.)	June	July	August
40	23	25	32
50	29	31	40
60	35	38	48
70	41	44	56
80	47	50	64
90	52	57	72

¹Shadow length at 10 AM and 2 PM, from the ASHRE Handbook, 1972

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Table 3. - Plant List for Riparian Buffers (see page 5 for definitions of abbreviations used in this table)

Common Name/ Scientific Name	Indiana Suitability	Flood Tolerance	Large Debris	Soil Drainage	Shade Value	Mature Height	Wildlife		
							Food	Cavity Nesting	Bat Roost
Ash, Green <i>Fraxinus pennsylvanica</i>	All	H	M	VPD-WD	H	60	M	M	M
Ash, White <i>Fraxinus americana</i>	All	M	M	MWD-WD	H	70	M	M	M
Baldcypress <i>Taxodium distichum</i>	So. IN ¹	VH	M	VPD-WD	M	80	M	M	M
Birch, River <i>Betula nigra</i>	All	M	H	VPD-WD	M	50	M	M	M
Blackgum <i>Nyssa sylvatica</i>	All	M	M	PD-WD	H	60	H	M	M
Buttonbush <i>Cephalanthus occidentalis</i>	All	VH	L	VPD-SPD	L	5	H	L	L
Cherry, Black <i>Prunus serotina</i>	All	L	M	MWD-WD	L	70	H	L	M
Chokeberry, Black <i>Aronia melanocarpa</i>	All	L	L	SPD-WD	L	10	H	L	L
Cottonwood <i>Populus deltoides</i>	All	H	H	PD-ED	M	90	L	H	M
Cranberry, Highbush <i>Viburnum trilobum</i>	All	L	L	VPD-WD	L	9	H	L	L
Dogwood, Red-Osier <i>Cornus stolonifera</i>	All	H	L	VPD-WD	L	10	H	L	L
Dogwood, Silky <i>Cornus amomum</i>	All	H	L	VPD-WD	L	10	H	L	L
Elderberry <i>Sambucus canadensis</i>	All	H	L	VPD-WD	L	9	H	L	L
Hickory, Shellbark <i>Carya laciniosa</i>	All	M	M	VPD-WD	H	70	H	M	H
Hackberry <i>Celtis occidentalis</i>	All	M	M	SPD-WD	M	50	M	M	M
Maple, Red <i>Acer rubrum</i>	All	H	H	VPD-WD	H	70	M	H	M
Maple, Silver <i>Acer saccharinum</i>	All	H	H	VPD-WD	H	80	M	H	M
Oak, Bur <i>Quercus macrocarps</i>	All	H	M	PD-ED	H	80	H	H	M
Oak, Cherrybark <i>Quercus pagodafolia</i>	So. IN ¹	M	M	SPD-WD	H	75	H	H	M
Oak, Pin <i>Quercus palustris</i>	All	H	H	VPD-WD	M	75	H	H	M

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Common Name/ Scientific Name	Indiana Suitability	Flood Tolerance	Large Debris	Soil Drainage	Shade Value	Mature Height	Wildlife		
							Food	Cavity Nesting	Bat Roost
Oak, Overcup <i>Quercus lyrata</i>	So. IN ¹	VH	M	VPD-WD	M	70	H	H	M
Oak, Red <i>Quercus rubra</i>	All	L	H	MWD-WD	H	80	H	H	M
Oak, Swamp Chestnut <i>Quercus michauxii</i>	So. IN ¹	M	H	SPD-WD	H	70	H	H	M
Oak, Swamp White <i>Quercus bicolor</i>	All	M	M	VPD-WD	H	70	H	H	M
Oak, White <i>Quercus alba</i>	All	L	H	MWD-WD	H	90	H	H	M
Pawpaw <i>Asimina triloba</i>	All	L	L	SPD-WD	L	20	M	L	L
Pecan <i>Carya illinoensis</i>	So. IN ¹	H	M	SPD-WD	H	120	H	H	M
Persimmon <i>Diospyros virginiana</i>	All	M	M	MWD-WD	M	50	H	M	M
Sweetgum <i>Liquidambar styraciflua</i>	So. IN ¹	M	M	PD-WD	M	85	L	M	M
Sycamore <i>Platanus occidentalis</i>	All	H	H	PD-WD	H	90	L	H	M
Tuliptree (Yellow Poplar) <i>Liriodendron tulipifera</i>	All	L	M	PD-WD	M	90	M	M	M
Walnut, Black <i>Juglans nigra</i>	All	M	M	MWD-WD	M	80	H	M	M
Willow, Black <i>Salix nigra</i>	All	VH	L	VPD-WD	L	60	L	M	M
Willow, Peachleaf <i>Salix amygdaloides</i>	All	VH	L	VPD-WD	L	30	L	L	L
Willow, Pussy <i>Salix discolor</i>	All	VH	L	VPD-WD	L	20	L	L	L
Willow, Sandbar <i>Salix interior</i>	All	VH	L	VPD-WD	L	10	L	L	L

¹Counties south of U.S. 40

Letter Definitions

H	High
M	Medium
L	Low

Soil Drainage Class

VPD	Very Poorly Drained
PD	Poorly Drained
SPD	Somewhat Poorly Drained
MWD	Moderately Well Drained
WD	Well Drained

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Criteria to Provide a Source of Detritus and Large Woody Debris for Aquatic and Terrestrial Organisms

Within Zone 1, establish, favor or manage species capable of producing stems and limbs of sufficient size to provide an eventual source of large woody debris (>10 inches in diameter) for in-stream habitat for fish and other aquatic organisms.

Refer to Table 3 on page 4 and 5 for species recommendations.

Criteria to Create Riparian Habitat and to Establish Corridors for Wildlife

The riparian forest buffer shall be planned for the target wildlife species. Woody plants shall be selected from Table 3, and/or from FOTG (645) *Upland Wildlife Habitat Management* and/or from FOTG (644) *Wetland Wildlife Habitat Management*. Refer to Table 4. for the minimum buffer widths for applicable wildlife species.

Table 4. Buffer Widths (minimum) for Selected Species

Species	Minimum Width, feet
Bald eagles, herons, egrets and cranes	600
Pileated woodpeckers, barred owls	450
Beaver, mink, waterfowl	300
Gray and fox squirrels	300
Deer	200
Amphibians and aquatic reptiles	50

Criteria to Reduce Sediment, Nutrients, Pesticides in Surface Runoff and to Provide Protection Against Scour Erosion within the Floodplain.

- To reduce sediment outflow the design width of Zone 2 shall be increased to include areas of debris and/or sediment deposits not to exceed the width of the 100 year flood plain. When Zone 2 cannot be increased Zone 3 shall be established to a minimum width of 20 feet.
- Manage the dominant tree canopy to maintain the vigor of the overstory and understory species. Periodic thinning may be required to allow adequate light to reach the forest floor to maintain a good cover of herbaceous plant species.
- The design width of Zone 2 shall be increased to include areas of overland flow, scour erosion, and overland flow channels up to the width of the 100 year floodplain

Criteria to Provide a Harvestable Crop of Timber and to Increase Carbon Storage

The riparian buffer shall be established and managed for timber products without compromising the buffers ability to support other planned criteria.

To promote rapid canopy closure and to produce a forest containing well-formed trees a minimum of 544 trees/acre shall be planted (8' X 10' spacing or equivalent) or established using direct seeding methods.

All timber harvesting activities shall be in compliance with the “Indiana Logging and Forestry Best Management Practices - BMP Field Guide”

CONSIDERATIONS

Consider the landowners objectives for riparian forest buffer, so that the planned objective for the planting is achievable.

Bare root seedlings should be considered as the standard method to establish trees and shrubs.

Planting bare root seedlings has proven to be the most economical and successful method to

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establish trees and shrubs. However, other methods to establish trees and shrubs may be applicable in some circumstances.

Seed sources for direct seeding and woody planting stock should be locally adapted and come from no more than 200 miles north or south of the planting site.

Consider selecting species from Conservation Tree/Shrub Suitability Groups (CTSG), species to plant, Section II (FOTG). Trees to plant from CTSG's can be viewed at the NRCS Indiana web site.

Monocultures and off site species are discouraged for riparian forest buffers.

Consider using a support stake when planting container trees and balled and burlapped stock.

Consider planting a mixture of species (5-10 species) adapted to the site (including shrubs) to improve plant diversity.

Seek technical assistance from a professional forester for reforestation or other conservation tree planting projects.

To improve plant growth, consider 2 additional years of chemical weed control after plants are established. Weed control should be performed using narrow bands (2'-3' wide) on each side of a plant row unless the entire site is treated.

Fine hardwood species should be mixed with other tree species and shrubs to promote diversity.

Sites that are frequently flooded or ponded for long or very long duration may be difficult and impractical for tree/shrub establishment.

Consider using natural regeneration on these sites to establish woody plants and allow the site to revegetate to herbaceous and/or woody plant cover.

Consider that natural regeneration is often likely to occur, but not guaranteed on sites that have a seed source from a forested floodplain system where seeds are deposited in sufficient quantity to establish woody vegetation. On these sites, natural regeneration of light seeded species (e.g. green ash, silver maple, cottonwood, etc.) may establish large numbers of tree seedlings.

Consider selecting species from FOTG Wildlife Upland Habitat Management (645) and/or FOTG Wetland Wildlife Habitat Management (644) to enhance wildlife benefits.

Shrub species may be direct seeded to provide wildlife habitat. Refer to Direct Seeding of Shrubs, IN-NRCS, Forestry Technical Note No. 16.

When planning this practice, consider how it can enhance and/or protect air quality.

PLANS AND SPECIFICATIONS

Plans and specifications for tree/shrub establishment will be prepared for each site in accordance with the criteria for this practice. The plan will include planting dates, site preparation, weed control, plant spacing, species, type of stock used, and planting and storage guidelines.

OPERATION AND MAINTENANCE

Check survivability of planted species after 3 years to insure that at least 300 desirable stems/acre of woody plants are established. If less than 300 stems/acre are established additional planting will be completed if it is determined that additional natural regeneration will not be sufficient to colonize the site within an acceptable time frame (usually 5 years).

Control weed competition during establishment (3 years). Competing weeds, brush, and vines can adversely affect survival, form and rate of tree growth. Additional years of weed control may be needed in some instances e.g. to control johnsongrass, quackgrass, or other hard to control weed species.

Use the following or combination of methods as needed to control weed competition (see Table 1 for specific treatments, FOTG (612) *Tree/Shrub Establishment*):

- shallow cultivation
- mowing
- spraying approved herbicides
- cutting woody plants and applying approved pesticides

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Correlatively prune hardwood species, as needed depending on species and growth form desired. Refer to FOTG (660) *Tree Shrub Pruning*.

Protect the planting from fire. Plan access roads and firelanes prior to planting. See Indiana Field Office Technical Guide, Section IV for *Access Road* (560) and *Firebreak* (394).

Fence if necessary to protect the planting from excessive livestock browsing and trampling damage, refer to FOTG Standards, Use Exclusion (472) and Fence (382).

Protect from disease, rodents, deer, and insects using approved pesticides, hunting, fencing, or other appropriate methods. Additional information can be viewed from the “Illinois Direct Seeding Handbook”, Wildlife Damage Management.

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