

**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 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 or water courses, lakes, ponds, wetlands, and areas with ground water recharge that are capable of supporting woody vegetation.

CRITERIA

General Criteria Applicable To All Purposes

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

Dominant vegetation will consist of existing, naturally regenerated, or planted trees and shrubs suited to the site and the intended purpose.

Occasional removal of some tree and shrub products such as high value trees is permitted in zone 1 provided the intended purpose is not compromised by the loss of vegetation or harvesting disturbance.

Necessary site preparation and planting shall be done at a time and manner to insure survival and growth of selected species.

Only viable, high-quality and adapted planting stock will be used.

Site preparation shall be sufficient for establishment and growth of selected species and is done in a manner that does not compromise the intended purpose.

Livestock shall be excluded from riparian buffers to ensure the intended purpose is met.

Harmful pests present on the site will be controlled or eliminated as necessary to achieve and maintain the intended purpose.

For optimal carbon storage, select plant species that are adapted to the site to assure strong health and vigor and plant the full stocking rate for the site.

Comply with applicable federal, state and local laws and regulations during the installation,

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

**NRCS, KY
February 2005**

operation (including harvesting activities) and maintenance of this practice.

Zone Width Criteria

Zone 1 begins at the normal water line, or at the top of the bank, and extends up gradient until it reaches the edge of zone 2. Both zones 1 and 2 are required for all riparian buffers. Zone 3, if included, begins at the upstream edge of Zone 2. The width of the buffer is measured horizontally on a line running perpendicular to the water body.

Zone 3 may be eliminated when the immediate upstream contributing watershed area is managed as permanent hay, pasture, or woodland with sediment retention potential. Riparian buffers established below cropland or other areas that contribute significant sediment loads must contain zone 3. Zone 3 shall be 20 feet in width when included.

To address odd areas and field edges, the minimum buffer width shall be maintained for at least 80% of the buffers length in a field.

Zone Widths

Stream Order ^{1/}	Zone 1	Zone 2	Zone 3	Total All Zones
First	15'	35' to 145' with Zone 3	20'	50'-180'
Second		35' to 165' without Zone 3		
Third				
Fourth and Larger	15'	85' to 145' with Zone 3 85' to 165' without Zone 3	20'	100'-180'
Ohio and Miss. River Main Stem ^{2/}	15'	265' with Zone 3 285' without Zone 3	20'	300'

1/ Stream 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 two streams of equal order join. For example, it takes 2 second order streams joining to make a third order stream. For the purposes of this standard, stream order determinations will be made using the Strahler method as mapped in the National Hydrology Dataset (NHD).

2/ To ensure water quality protection, minimum total buffer width on the Ohio and Mississippi river main stems is 300'. Buffers on these rivers may be adjusted to less than 300 feet but only when the landscape or land ownership patterns won't allow installation of a 300' buffer. However, buffer widths including all zones will not be less than 100' regardless of the circumstances.

Use the criteria for first, second, and third order streams, to determine buffer width requirements around wetlands, lakes, ponds, sinkholes, and ditches with seasonal or permanent flow.

Vegetation Criteria

Necessary site preparation and planting shall be done at a time and manner to insure survival and growth of selected species. Only viable, high quality and adapted planting stock will be used. Seedlings shall not be less than 3/8" in caliper at 1" above the root collar. Refer to NRCS Technical Standard Forest Site Preparation (490) for site preparation information. Refer to the NRCS Technical Standard Tree/Shrub Establishment (612) for woody plant material care, handling, and planting requirements.

Where hydrologic conditions allow, at least 80% of the species planted in Zones 1 and 2 shall consist of at least three hard mast tree species equally distributed by number. Rows may contain the same species but shall not exceed a maximum of one consecutive row of the same species. To achieve optimum interspersion, plant at least 2 species per row alternating species within the row.

See Table 1 for recommended tree and shrub species for riparian buffer plantings. Species selected should be compatible with each other. Species selection should also be made based on site characteristics and species preference. Table 1 contains information useful in selecting

suitable species such as Regional Wetland Indicator Status.

Planting rates for trees or trees and shrubs should be between 605 seedlings per acre (approximately 6' x 12' spacing) and 681 seedlings per acre (approximately 8' x 8' spacing). Consider using the 12' row width for equipment access if post planting management activities are planned. Use the 8' x 8' spacing when it is anticipated that the planting will not receive mechanized post planting treatments.

Zone 3, when included, will be established to or maintained in permanent grass/legume/forb cover. The species selected shall have stiff upright stems. This zone will provide the primary sediment retention function for the buffer. Plantings in Zone 3 should contain at least one grass and one legume or forb. Table 2 lists species and seeding rates for Zone 3. Seeding and seedbed preparation for grass, legume, and forb plantings should be according to the NRCS Conservation Cover (327) practice standard.

Natural Regeneration can be used to address small odd areas that are less than 1/2 acre in size that are inaccessible to spray equipment. Areas shall not be grazed or mowed in order to facilitate natural regeneration.

Additional Criteria To Provide Habitat For Aquatic Organisms And Terrestrial Wildlife

Width of Zone 1 and/or Zone 2 will be expanded to meet the minimum requirements of the wildlife or aquatic species and associated communities of concern.

Establish plant communities that address the target wildlife needs and existing resources in the watershed.

To improve habitat for interior bird species and other wildlife that need larger areas of forest land, the width of zone 2 may be extended to where the total riparian buffer width is 300 feet. Note: Program cost-share and rental payments may be limited to smaller widths due to program rules.

Use tree and shrub species that have high wildlife benefit in zone 1 and 2. See Table 1 for wildlife merit of tree and shrub species. Zone three, when included, should be established to native grass to provide optimum wildlife benefits.

Additional Criteria to Stabilize Streambanks

Select or maintain species in zone 1 that have medium/rapid growth characteristics. Encourage high plant densities with close spacing of 8 x 8.

Correct problems with severely leaning trees that might contribute to potential unstable banks. When correcting these problems, tree root wads should remain in the streambank if a leaning tree is removed.

Planting of trees in the area next to a stream will help stabilize the streambank in the future. If the streambank is unstable during the planning of the riparian zone, it should be treated using the STREAMBANK AND SHORELINE PROTECTION STANDARD (580).

Additional Criteria to Prevent Flooding Damage and Scour Erosion by Slowing Flood Waters, Flattening Flood Peaks, and Trapping Large Debris and Water-borne Sediments

For river systems, to address scour erosion, slow flood water, and trap debris and sediment, the width of zone 2 may be extended to where the total buffer width is 300 feet. Note: Program cost-share and rental payments may be limited to smaller widths due to program rules. Select species that exhibit good survival in areas that are inundated for long periods. Refer to Table 1 for species flooding tolerances.

Additional Criteria to Address Riparian Buffer Installation Under Power Lines

Zones 1 and 2 may be established to all shrubs instead of tree species when they will be located in an area encumbered by power line easement. These areas may also be allowed to naturally regenerate.

It is up to the landowner to develop an agreement with the utility easement holder to prevent spraying of the established area. If the riparian buffer is established under a program and the area is sprayed by the easement holder thereby killing the established cover, program rules may require that the participant reestablish the required vegetation.

Shrubs shall be planted according the vegetation criteria above.

Additional Criteria For Establishing Riparian Buffers in the Conservation Reserve Enhancement Program (CREP)

This criteria only applies to areas where a CREP has been approved.

Zone Width Requirements

Minimum zone widths are according to the table in the Zone Width Criteria section above.

For Green River tributaries, Zone 3 may be extended to the point where the entire buffer width is a maximum of 300' from the top of the bank.

For the Green River main stem, Zone 3 may be extended to the point where the entire buffer width is a maximum of 1,000' from the top of the bank.

Vegetation Requirements

Zones 1 and 2 must be established to trees or a mixture of trees and shrubs.

Zone 3 can be planted to all native grass, all trees, or a mixture of trees and shrubs or a mixture of shrubs and native grass.

Tree plantings shall include at least three hard mast species equally distributed by number that comprise >80% of the stand. One of the hard mast species must be from the red oak family and one must be from the white oak family.

Planting rates for trees or trees and shrubs should be between 605 seedlings per acre (approximately 6' x 12' spacing) and 681 seedlings per acre (approximately 8' x 8' spacing).

Native grass plantings shall include a minimum of at least 2 native grasses and 1 pound of at least 4 native forbs. See Table 3 for native grass and forb seeding rates.

Zone 3 is required when the upstream land use is cropland or other land use that can contribute a high sediment load. Zone 3 is optional when pasture, hayland or woodland is the upstream land use.

Kentucky's CREP allows for increased widths to improve water quality and wildlife habitat.

Riparian Buffers can be planned across areas in which reverse drainage or break in slope occurs for the purposes of improving wildlife habitat, increasing infiltration rates within the watershed, and historic riparian restoration in the watershed.

CONSIDERATIONS

When working with Kentucky's "Special Use Waters", work with landowners to increase buffer widths above the minimum to protect these resources. Kentucky's "Special Use Waters" include Cold Water Aquatic Habitat, Outstanding State Resource Waters, Exceptional Waters, Federal Wild River Areas, Federal Scenic River Areas, Outstanding National Resource Waters, and Reference Reach Waters. Definitions, detailed information, and locations of these special use waters can be viewed at http://nrepcapps.ky.gov/special_waters/specialwaters.htm. If there are any questions about the special use waters, please contact the Division of Water, Water Quality Certification Section at (502) 564-3410.

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

Consider marking the buffer boundary to prevent encroachment by cropping equipment.

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

Favor tree and shrub species that are native and non-invasive that have multiple values such as those suited for timber, biomass, nuts, fruit, browse, nesting, aesthetics and tolerance to locally used herbicides.

Tree and shrub species, which may be alternate hosts to undesirable pests, should be avoided. Species diversity should be considered to avoid loss of function due to species-specific pests.

Allelopathic impacts of plants should be considered.

The location, layout and density of the buffer should complement natural features, and mimic natural riparian forests.

PLANS AND SPECIFICATIONS

Specifications for applying this practice shall be prepared for each site and recorded using approved specification sheets, job sheets, technical notes, and narrative statements in the conservation plan, or other acceptable documentation.

OPERATION AND MAINTENANCE

The following actions shall be carried out to insure that this practice functions as intended throughout its expected life.

The riparian forest buffer will be inspected periodically and protected from adverse impacts such as excessive vehicular and pedestrian traffic, pest infestations, pesticides, livestock or wildlife damage and fire.

A 60% survival rate after three years is considered satisfactory if trees are well distributed over the planted area. The planted areas will be evaluated to determine whether to replant failed spots or if natural regeneration will meet the objectives of the landowner.

As applicable, control of concentrated flow erosion and sediment deposition shall be controlled by an adjacent filter strip.

Any use of fertilizers, pesticides and other chemicals to assure buffer function shall not compromise the intended purpose.

Evaluation of Existing Riparian Forest Buffer

The following criteria is used to determine if an area exhibits the minimum functions of a riparian buffer. This criteria is developed based on the water quality functions of a riparian buffer and therefore will not optimize all riparian functions. A more detailed evaluation method will be required to determine if specific riparian functions are optimized. In this case, contact the NRCS conservationist with specialty in the riparian function in question.

To ensure that an area functions as a riparian buffer, several factors must be present. These factors are: 1) a tree and/or shrub canopy must be present that contributes enough leaf and woody material to develop a forest type soil with a duff layer; 2) herbaceous layer dominated by shade tolerant vegetation indicative of forest land that contains less than 20% forage type herbaceous species. These characteristics must extend for at least 50 feet for first, second,

and third order streams and 100 feet for fourth order and larger streams and be adjacent to the stream or water body for the area to be considered a riparian buffer.

The resource planner should determine if the area is functioning as a riparian buffer by observing the current condition as well as the planned condition.

Example: An area of adequate width may have enough tree canopy to form a duff layer and provide adequate shade to select for woodland herbaceous species. However, if due to grazing, there is a thin herbaceous vegetative layer, no duff layer and/or eroding stream bank, this area would not meet the criteria for a riparian buffer. Although, if the area is planned for livestock exclusion, the area would in the future exhibit the characteristics and functions of a riparian buffer and could be planned as a riparian buffer provide the required width is met.

REFERENCES

Wenger, Seth. 1999. A Review of the Scientific Literature on the Riparian Buffer Width, Extent and Vegetation. Office of Public Service and Outreach, Institute of Ecology, University of Georgia.

Table 1. Native tree and shrub species eligible for riparian buffers in Kentucky. Species selection should be based on site characteristics and planting objectives. Other species may be used provided they are native and are recommended by KDF or KDFWR.

Species (Common/Scientific)	Red Or White Oak Family	Wildlife Merit	Growth Rate	Height at 20 Years	Mature Height (feet)	Regional Indicator Status	Shade Tolerance
Baldcypress <i>Taxodium distichum</i>	-	M	Rapid	45	130	OBL	Intermediate
Dogwood, Red-osier <i>Cornus sericea</i>	-	H	Moderate	5	5	FACW+	Intermediate
Dogwood, Silky <i>Cornus amomum</i>	-	H	Moderate	7	7	FACW	Intermediate
Hawthorn, <i>Crataegus</i> (Native KY Species)	-	H	Moderate	25	25	FAC	Intermediate
Hickory, Shellbark <i>Carya laciniosa</i> *	-	H	Moderate	35	130	FAC	Tolerant
Holly, Deciduous <i>Ilex decidua</i>	-	M	Moderate	33	33	FACW	Tolerant
Oak, Black <i>Quercus velutina</i> *	Red	H	Moderate	25	90	FACU	Intermediate
Oak, Bur <i>Quercus macrocarpa</i> *	White	H	Slow	25	100	FACU-	Intermediate
Oak, Cherrybark <i>Quercus pagodafolia</i> *	Red	H	Moderate	60	110	FACW	Intermediate
Oak, Chinkapin <i>Quercus muehlenbergii</i> *	White	H	Moderate	30	80	FAC	Intolerant
Oak, Northern Red <i>Quercus rubra</i> *	Red	H	Moderate	36	100	FACU-	Intermediate
Oak, Nuttall <i>Quercus nuttallii</i> *	Red	H	Moderate	40	120	FACW	Intolerant
Oak, Overcup <i>Quercus lyrata</i> *	White	H	Moderate	30	80	OBL	Intermediate
Oak, Pin <i>Quercus palustris</i> *	Red	H	Rapid	40	100	FACW	Intolerant
Oak, Shumard <i>Quercus shumardii</i> *	Red	H	Moderate	40	110	FAC+	Intolerant
Oak, Southern Red <i>Quercus falcata</i> *	Red	H	Slow	35	100	FACU-	Intermediate
Oak, Swamp Chestnut <i>Quercus</i> *	White	H	Moderate	35	100	FACW	Intolerant
Oak, Swamp White <i>Quercus bicolor</i> *	White	H	Rapid	30	100	FACW+	Intermediate
Oak, Water <i>Quercus nigra</i> *	Red	H	Rapid	30	90	FAC	Intolerant
Oak, White <i>Quercus alba</i> *	White	H	Slow	25	100	FACU-	Intermediate
Oak, Willow <i>Quercus phellos</i> *	Red	H	Rapid	60	100	FAC+	Intolerant
Pawpaw <i>Asimina triloba</i>	-	H	Slow	30	35	FACU	Tolerant
Pecan <i>Carya illinoensis</i> *	-	H	Slow	35	140	FACU	Intolerant
Persimmon <i>Diospyros virginiana</i>	-	H	Moderate	25	50	FAC-	Tolerant
Plum, Wild <i>Prunus</i> sp.	-	H	Moderate	24	24	FACU-	Intolerant
Redbud, Eastern <i>Cercis canadensis</i>	-	M	Slow	16	16	FACU-	Tolerant
Spicebush <i>Lindera benzoin</i>	-	M	Slow	12	12	FACW-	Intermediate
Viburnum, (Native KY Species)	-	H	Slow	6	6	FACW-	Tolerant
Walnut, Black <i>Juglans nigra</i> *	-	H	Rapid	35	90	FACU	Intolerant
Yellow Poplar <i>Liriodendron tulipifera</i>	-	M	Rapid	50	120	FACU	Intolerant

* - Hard Mast Species; H = high; M = medium; L = low

NRCS, KY

February 2005

Table 2. Zone 3 Species and Seeding Rates. Plantings in Zone 3 should contain at least one grass and one legume or forb. Mixtures of introduced grasses must include a minimum of ten pounds PLS (pure live seed) grass/acre. Mixtures of native grasses must include a minimum of five lbs. PLS grass/acre.

Species	Wildlife Rating ^{1/}	Single Grass Species Seeding Rate (Minimum Pounds/Acre)	Multiple Grass Species Seeding Rate (Minimum Pounds/Acre)
<u>Introduced Grasses</u>			
KY Bluegrass	F	15	10
Orchardgrass	G	15	10
Red Top	G	5	1
Timothy	G	10	5
<u>Native Grasses</u>			
Big Bluestem	E	5	Minimum 0.5 to 1.0 Maximum
Eastern Gama Grass	E	5	3
Indiangrass	E	5	Minimum 0.5 to 1.0 Maximum
Little Bluestem	E	5	1
Side Oats Grama	E	NA	1
Switchgrass	G	5	Minimum 0.5 to 1.0 Maximum
Virginia Wild Rye	E	5	1
<u>Introduced Legumes</u>			
		Legume Seeding Rate For Single Legume Species (lbs.)	Legume Seeding Rate For Multiple Legume Species (lbs.)
Alsike Clover	G	2	1
Birdsfoot Trefoil	F	3	1.5
Ladino	F	1	0.5
Kobe Lespedeza	G	3	1.5
Korean Lespedeza	G	3	1.5
Red Clover	F	3	2
White Clover	F	1	0.5
<u>Native Forbs</u>			
		(see the NRCS 645 Standard For Eligible Forb Species)	
Single Species	E	1 pound/Acre	
Multiple Species ^{2/}	E	At least 1 pound of at least 4 species/Acre	

1/ - Wildlife ratings are: E – Excellent, G – Good, and F – Fair.

2/ - See Table 4 for forb seeding rates when multiple forb species are being established.

Table 3. Zone 3 Species and Seeding Rates (CREP Only). A minimum of at least 2 native grasses and 1 pound of at least 4 native forb species is required. All native grass mixtures must include a minimum of 5 pounds grass PLS per acre. This minimum seeding rate may be increased by 25% when site conditions warrant. Forbs should be recommended as the component species for native grass plantings. However, if a participant insists on using legumes, the legume seeding rates should be according to the NRCS Conservation Cover (327) practices standard.

<u>Species</u>	<u>Minimum Seeding Rate For Each Species</u>
Native Grasses	
Big Bluestem	Minimum 0.5 lb. to 1.0 lb. Maximum
Eastern Gama Grass	3
Indian Grass	Minimum 0.5 lb. to 1.0 lb. Maximum
Little Bluestem	1
Switchgrass	Minimum 0.5 lb. to 1.0 lb. Maximum
Side Oats Grama	1
Virginia Wild Rye	1
Native Forbs	
Mixture ^{1/}	At least 1 pound of at least 4 species/Acre

1/ - See Table 4 for forb seeding rates.

Table 4. Zone 3 forb seeding rates based on 4 species at 1 lb/acre total. Species included below are easy to establish, economical, and readily available.

Mix Number	Common Name	Scientific Name	Seeding Rate per Acre
1	Partridge Pea Blackeyed Susan Greyheaded Coneflower Bergamot	Cassia fasciculata Rudbeckia hirta Ratibida pinnata Monarda fistulosa	10.0 ounces/acre 2.0 ounces/acre 3.0 ounces/acre 1.0 ounces/acre
2	Blackeyed Susan Greyheaded Coneflower Purple Coneflower Bergamot	Rudbeckia hirta Ratibida pinnata Echinacea purpurea Monarda fistulosa	2.0 ounces/acre 2.0 ounces/acre 10.0 ounces/acre 2.0 ounces/acre
3	Partridge Pea Blackeyed Susan False Sunflower Roundheaded Lespedeza	Cassia fasciculata Rudbeckia hirta Heliopsis helianthoides Lespedeza capitata	6.0 ounces/acre 1.0 ounces/acre 5.0 ounces/acre 4.0 ounces/acre
4	Partridge Pea Blackeyed Susan Illinois Bundleflower Purple Coneflower	Cassia fasciculata Rudbeckia hirta Desmanthus illinoensis Echinacea purpurea	6.0 ounces/acre 1.0 ounces/acre 3.0 ounces/acre 6.0 ounces/acre