



**Natural Resources Conservation Service**  
**CONSERVATION PRACTICE STANDARD**  
**RIPARIAN FOREST BUFFER**

**CODE 391**

**(ac)**

**DEFINITION**

An area predominantly trees and/or shrubs located adjacent to and up-gradient from watercourses or water bodies.

**PURPOSE**

This practice is used to accomplish one or more of the following purposes—

- Create shade to lower or maintain water temperatures to improve habitat for aquatic organisms
- Create or improve riparian habitat and provide a source of detritus and large woody debris
- 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
- Reduce pesticide drift entering the water body
- Restore riparian plant communities
- Increase carbon storage in plant biomass and soils

**CONDITIONS WHERE PRACTICE APPLIES**

Riparian forest buffers are applied on areas adjacent to permanent or intermittent streams, lakes, ponds, and wetlands. They are not applied to stabilize stream banks or shorelines.

**CRITERIA**

**General Criteria Applicable to All Purposes**

The riparian forest buffer shall be positioned appropriately and designed to achieve sufficient width, length, vertical structure/density and connectivity to accomplish the intended purpose(s).

Dominant vegetation will consist of existing, naturally regenerated, or seeded/planted trees and shrubs suited to the soil and hydrology of the site and the intended purpose(s).

The vegetation will extend a minimum width to achieve the purpose(s). See [Riparian Forest Buffer Design Procedures, \(391DP\)](#).

Measurement shall begin at and perpendicular to the normal water line, bank-full elevation, or the top of the bank as determined locally.

Overland flow through the riparian area will be maintained as sheet flow.

For sites to be regenerated or planted, excessive sheet-rill and concentrated-flow erosion will be controlled.

Excessive sheet-rill and concentrated-flow erosion will be controlled in the areas immediately adjacent and up-gradient of the buffer site.

Use tree and shrub species that are native and non-invasive. Substitution with improved and locally accepted cultivars or purpose-specific species is allowed. For plantings and seeding, only viable, high-quality and adapted plant materials will be used.

Favor tree and shrub species that have multiple values such as those suited for timber, nuts, fruit, florals, browse, nesting, and aesthetics.

Periodic removal of some forest products such as high value trees, medicinal herbs, nuts, and fruits is permitted 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 for achieving the intended purpose(s). See [Tree/Shrub Planting Procedures Guide, \(380TPP\)](#).

Livestock shall be controlled or excluded as necessary to achieve the intended purpose.

Refer to the standards [Prescribed Grazing \(528\)](#), and/or [Access Control \(472\)](#), as applicable.

Harmful plant and animal pests present on the site will be controlled or eliminated as necessary to achieve and maintain the intended purpose. If pesticides are used, refer to the standard [Pest Management \(595\)](#).

**Additional Criteria to 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**

The minimum width shall be measured horizontally on a line perpendicular to the water body beginning at the normal water line, bank-full elevation, or the top of the bank as determined locally.

The width will be extended in high nutrient, sediment, and animal waste application areas, where the contributing area is not adequately treated or where an additional level of protection is needed. A zone of herbaceous vegetation that meets the [Filter Strip \(393\)](#) standard must be added where the contributing area is not adequately treated, or where an additional level of protection is needed. Refer to [Herbaceous Vegetation Design Procedures \(550DP\)](#) for requirements for establishing herbaceous vegetation.

Existing, functional underground drains through the riparian area will pass pollutants directly to the outlet. To filter such pollutants, drains can be plugged, removed or replaced with perforated pipe/end plugs or water control structures (see Structure for Water Control - 587) to allow passage and filtration of drain water through the riparian forest root zone. Caution is advised that saturated conditions in the riparian and adjacent areas may limit existing land use and management.

**Additional Criteria to Create or Improve Riparian Habitat and Provide a Source of Detritus and Large Woody Debris**

The forested width will be extended to meet the minimum habitat requirements of the wildlife or aquatic species of concern.

Establish plant communities that address the target aquatic and terrestrial wildlife and pollinator needs and have multiple values such as habitat, nutrient uptake and shading. The establishment of diverse native woody and herbaceous species will enhance wildlife and pollinator values.

**Additional Criteria for Increasing Carbon Storage in Biomass and Soils**

Maximize width and length of the riparian forest buffer.

Select plants that have higher rates of carbon sequestration in soils and plant biomass and are adapted to the site to assure strong health and vigor. Plant the appropriate stocking rate for the site.

**Additional Criteria To Create Shade to Lower Water Temperatures to Improve Habitat For Aquatic Organisms**

When moderating water temperature for the targeted aquatic organism(s) especially cold water fisheries, tree species in Zone 1 will be selected to provide adequate shading during the summer months. If tree species in Zone 1 do not provide adequate shading, shade trees will also be a component of Zone 2. Refer to Riparian Forest Buffer Design Procedures (391DP) for zone descriptions; i.e., relative locations from the water body.

**Additional Criteria To Provide Habitat For 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 riparian plant communities that address the target wildlife needs and existing resources in the watershed.

Upland game birds and grassland songbirds that utilize woody cover are best suited to shrub only plantings that minimize detrimental impacts from raptors and provide optimum habitat. Refer to Riparian Forest Buffer Design Procedures (391DP), Table 3 for detailed width preferences for selected wildlife.

**CONSIDERATIONS**

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.

Using seed and/or seedlings collected or propagated from multiple sources can increase genetic diversity.

Consider selecting species with tolerance to herbicide leakage from adjoining fields.

Allelopathic impacts of plants should be considered.

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

For sites where continued function of drains is desired, woody root penetration may eventually plug the underground structure. In these cases, a setback of woody vegetation planted over the drain maintained in herbaceous cover or using rigid, non- perforated pipe will minimize woody root penetration.

Maximize widths, lengths, and connectivity of riparian forest buffers.

The species and plant communities that attain biomass more quickly will sequester carbon/ faster. The rate of carbon sequestration is enhanced as riparian plants mature and soil organic matter increases.

**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. Refer to Riparian Forest Buffer Design Procedures, (391DP), for plan design guidance. Refer to Tree Planting Procedures (NE 380TPP) for tree planting guidance. Use [NE CPA-15](#) and [NE CPA-15B](#) jobsheets to document tree/shrub planting plans.

## OPERATION AND MAINTENANCE

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

Any manipulation of species composition, stand structure and stocking by cutting or killing selected trees and understory vegetation shall sustain the intended purpose(s). Refer to the standard [Forest Stand Improvement \(666\)](#).

Control or exclusion of livestock and harmful wildlife shall continue. Refer to the standards [Prescribed Grazing \(528\)](#), and/or [Access Control \(472\)](#), as applicable.

Fertilizers, pesticides and other chemicals used to maintain buffer function shall not impact water quality.

## REFERENCES

Bentrop, Gary 2008. Conservation buffers: design guidelines for buffers, corridors, and greenways. Gen. Tech. Rep. SRS-109. Asheville, NC: Department of Agriculture, Forest Service, Southern Research Station.