

USDA
NATURAL RESOURCES
CONSERVATION SERVICE
MARYLAND CONSERVATION
PRACTICE STANDARD
RIPARIAN FOREST BUFFER
CODE 391
(Reported by Acre)

DEFINITION

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

PURPOSES

This practice may be applied for one or more of the following purposes:

1. To reduce excess amounts of sediment, organic material, nutrients, pesticides and other pollutants in surface runoff and reduce excess nutrients and other chemicals in shallow ground water flow;
2. To create or improve riparian habitat and provide a source of detritus and large woody debris for fish and other aquatic organisms;
3. To create shade to lower or maintain water temperatures to improve habitat for aquatic organisms;
4. Reduce pesticide drift entering the water body;
5. Restore riparian plant communities;
6. Increase carbon storage in plant biomass and soils.

**CONDITIONS WHERE PRACTICE
APPLIES**

This practice may be applied on stable areas

adjacent to permanent or intermittent streams, lakes, ponds, wetlands and areas with ground water recharge. (For areas with unstable banks, refer to the Maryland conservation practice standard for Streambank and Shoreline Protection, Code 580.)

CONSIDERATIONS

Assess the severity of bank erosion and its influence on existing or potential riparian trees and shrubs. Watershed-level treatment or bank stabilization activities may be needed before establishing a riparian forest buffer. (Refer to the Maryland conservation practice standard for Streambank and Shoreline Protection, Code 580, and to Chapter 18 of the Engineering Field Handbook.) Complex ownership patterns of riparian areas may require group planning for proper buffer design, function and management.

Consider the need for a vegetated filter strip when ephemeral, concentrated flow or sheet and rill erosion and sedimentation is a concern up-gradient of a planned woody buffer. Consider the use of structural practices when vegetative measures alone will not provide sufficient erosion control.

Consider connecting existing and new buffers to increase the continuity of cover and further moderate water temperatures, improve habitat and enhance water quality functions.

Consider using a mix of species with growth forms that are tall and wide-crowned or drooping in order to increase the shading effect. For water courses, buffers established on both sides will enhance multiple values.

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 re-sprout when establishing new rows nearest to water courses or water bodies. For detritus and large woody debris, use species that will meet the specific requirements of fish and other aquatic organisms for food, habitat, migration and spawning.

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact the [Natural Resources Conservation Service - Maryland](#) or visit the [electronic Field Office Technical Guide \(eFOTG\)](#).

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

The location, layout and density of the buffer should complement natural features in riparian areas. Avoid layouts and locations that would concentrate flood flows or return flows. Low, flexible-stemmed shrubs will minimize obstruction of local flood flows.

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

Allelopathic impacts of plants should be considered.

Consider that for sites where continued function of drains is desired, woody root penetration may eventually plug the underground structure.

CRITERIA

Criteria Applicable to All Purposes

The location, layout, and density of the riparian forest buffer shall be selected to accomplish the intended purpose of the practice, conditions of the site, and the objectives of the land user. Dominant vegetation will consist of existing, naturally regenerated, or planted trees and/or shrubs suited to the soil and hydrology of the site and the intended purpose(s).

The riparian forest buffer shall consist of an area that begins at the top of the bank and extends a minimum distance of 35 feet measured horizontally on a line perpendicular to the water body. The minimum width may be wider than 35 feet to achieve the desired purpose.

Overland flow through the riparian area shall be maintained as sheet flow as much as practical.

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

Use tree and shrub species that are native, or are introduced and are non-invasive. Use of native species is required for the first 15 feet. Non-native, non-invasive species may be planted beyond the first 15 feet, although the use of native species is encouraged throughout the buffer. All plantings shall consist of a mixture of two or more species to achieve greater diversity.

Species selected for planting shall be suited to the seasonal variation of soil moisture on the planting site. Plant types and species shall be selected based on their compatibility in growth rates, shade tolerance, and other characteristics.

Natural regeneration may be used to establish a buffer, if the following conditions are met: (1) there is an adequate natural seed source of desired species in adjacent areas; (2) site conditions are favorable for establishing the desired number and distribution of seedlings within a specified time period; and, (3) noxious or invasive species are not likely to jeopardize the stand.

A number of regeneration factors must be evaluated before determining that natural regeneration is appropriate for a site. These factors include, but are not limited to:

1. The quality and spacing of seed trees;
2. Seed tree height;
3. Seed dispersal characteristics;
4. Prevailing wind direction;
5. Frequency of seed crop production;
6. Time of year for seed fall;
7. Seedbed requirements;
8. Seed viability and dormancy factors;
9. Potential for seed germination;
10. Seedling growth rates; and,
11. Shade-tolerant vs. intolerant species.

Planting is usually preferred over natural regeneration because it is easier to control the

mix and distribution of species and it takes less time for woody plants to become established and reach maturity.

Site preparation for planting or natural regeneration shall be done at a time and manner to insure survival and growth of selected species.

Livestock shall 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. (Refer to the Maryland conservation practice standards for Fence, Code 382, and Stream Crossing, Code 578.)

Plant and animal pests present on the site shall be controlled to the extent feasible to achieve and maintain the intended purpose of the buffer.

Additional Criteria for Water Quality

To reduce excess amounts of sediment, organic material, nutrients, pesticides and other pollutants in surface runoff and reduce excess nutrients and other chemicals in shallow ground water flow.

The minimum width shall be at least 35 feet measured horizontally on a line perpendicular to the water body, beginning at the top of bank or wetland edge. In order to adequately address water quality, the buffer width may need to be expanded to include important resource features such as wetlands, steep slopes, areas that are occasionally or seasonally flooded, or critical habitats.

The width will be extended in high nutrient, sediment and animal waste application areas, where the contributing area is not adequately treated or an additional level of protection is needed.

In areas where an excess amount of sediment is a concern, a herbaceous filter strip must be planted at least 24 feet wide and up-gradient of the tree planting. Refer to the Maryland conservation practice standard for Filter Strip, Code 393, for design criteria to be used for the herbaceous planting. Structural measures such as level spreaders, diversions, and grassed waterways

shall be used when erosion cannot be controlled by vegetative practices alone.

Existing, functional underground drains and open ditches through the riparian area will pass pollutants, directly to the outlet. To filter such pollutants, drains or ditches can be plugged, removed or replaced with perforated pipe/end plugs 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 for Riparian Habitat

To provide wildlife habitat, including travel corridors for wildlife, and to provide a source of detritus and large woody debris for fish and other aquatic organisms.

Wildlife Habitat - Select trees and shrubs that provide food, cover, and shelter for the desired wildlife species. Refer to the conservation practice standard for Conservation Cover (Tables 3 and 4), and the Maryland Wildlife Biology and Management Handbook for more information.

Select buffer widths for wildlife habitat based on the individual wildlife species or groups of species desired. Widths in the following table include the sum of buffer widths on one or both sides of water courses or water bodies and may extend beyond riparian boundaries. (In such cases, refer to the Maryland conservation practice standard for Tree/Shrub Establishment, Code 612, for establishment of upland forests.)

Wildlife Species	Minimum Buffer Width in Feet
Bald eagle nesting, cavity nesting ducks, heron rookery	600
Neotropical migrants	300
Beaver, dabbling ducks, mink, salmonids	300
Deer	200
Frog, salamander	100

Table 1. Minimum buffer widths for wildlife habitat.

Woody Debris - Within the first 15 feet at 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.

Additional Criteria for Water Temperature

To create shade to moderate water temperatures to improve habitat for fish and other aquatic organisms.

A buffer for controlling warm-season water temperatures shall be established or maintained on south and west sides of water courses and water bodies, insofar as practical. 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. *Note:* Buffers for water courses wider than 30 feet may be valuable but will only have site-specific effects.

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

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.

Note: Specific cost-sharing programs or other funding sources may dictate criteria in addition to, or more restrictive than, those specified in this standard.

PLANS AND SPECIFICATIONS

Plans and specifications for establishment of riparian forest buffers shall be prepared in accordance with the previously listed criteria. Plans and specifications shall contain sufficient detail concerning site preparation and establishment to ensure successful installation of the practice.

Tree and/or shrub species shall be specified and established in accordance with the Maryland conservation practice standard for Conservation Cover, Code 327. Tree/shrub establishment goals shall be based on the primary purpose of the buffer, using the planting rates as shown in Table 5, Code 327. Grasses and forbs, if needed for a herbaceous filter strip component of the forest buffer, shall be specified and established in accordance with the Maryland conservation practice standard for Filter Strip, Code 393.

In addition, follow the establishment recommendations provided in the Maryland Job Sheets for tree and shrub plantings, warm season grass plantings, and cool season grass plantings. The completed job sheet(s) can serve as the planting plan for the buffer.

OPERATION AND MAINTENANCE

Job Sheet(s) or site specific management plans shall be developed and provided to the client to assure performance of the practice as intended. At a minimum, the following components shall be addressed:

Frequency of Inspections

At a minimum, require annual inspections of the riparian buffer during the establishment period, which is normally 2 - 3 years.

Vegetation in the Riparian Buffer

Describe what inspections are required to determine whether the desired vegetation is present in suitable quantity, quality, and distribution to achieve the purposes of the buffer.

Describe the extent of management needed to maintain vegetation in the desired species composition or age class (if applicable), or no management required (e.g., natural area).

Continue to replace dead trees or shrubs and control undesirable vegetative competition until the buffer is, or will progress to, a fully functional condition.

As applicable, continue to control concentrated flow or mass soil movement up-gradient of the forest buffer to maintain buffer function.

For purposes of moderating water temperatures and providing detritus and large woody debris, maintain a minimum of 50 percent canopy cover in the riparian forest buffer. To achieve benefits provided by large woody debris, natural mortality of trees and large shrubs may need to be supplemented by periodically falling and placing selected stems or large limbs within water courses and water bodies to reach original design specifications.

To provide habitat and corridors for wildlife, manage the buffer to favor food, shelter and nesting cover that will satisfy the habitat requirements of the desired wildlife species. Refer to Maryland Wildlife Biology and Management Handbook for more information.

For purposes of reducing excess pollutants in surface runoff and shallow groundwater, or providing habitat and corridors for wildlife, manage the dominant canopy to maintain maximum vigor of overstory and understory species.

Nuisance Plants and Animals

Describe the extent to which plant and animal pest species, including noxious weeds, will need to be controlled.

Weeds should be controlled for 2 - 3 years after planting. 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), shall be implemented where available and feasible.

The use of tree shelters for seedling protection is encouraged if browsing from deer is likely. Refer to the Maryland Maryland Job Sheets for

tree and shrub plantings for specific information concerning the use and removal of tree shelters.

Acceptable Uses

Describe the acceptable uses (e.g., grazing, hunting, nature preserve, etc.) and time of year/frequency of use restrictions, if any.

Limit disturbance within the first 15 feet to occasional removal of some tree and shrub products such as high value trees. Regular removal of tree and shrub products such as timber, nuts and fruit may be permitted outside of this area if the intended purpose is not compromised by the loss of vegetation or harvesting disturbance. Any removals of tree and shrub products shall be conducted in a manner that maintains the intended purpose and is consistent with state and local law.

An approved sediment and erosion control plan is required when harvesting disturbs over 5,000 sq. ft. In the Chesapeake Bay Critical Area, a Timber Harvest Plan is also required.

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

SUPPORTING DATA AND DOCUMENTATION

The following is a list of the minimum data and documentation to be recorded in the case file:

1. Purpose of riparian forest buffer;
2. Field location and plan map;
3. Size of planting;
 - a. Width of floodplain (ft);
 - b. Width of planting (ft);
 - c. Length of stream (ft);
 - d. Acres of riparian forest buffer.
4. Planting details;
 - a. Date planted;
 - b. Species planted;
 - c. Spacing of planting.
5. Operation and maintenance plan.

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