Natural Resources Conservation Service

CONSERVATION PRACTICE STANDARD

RIPARIAN FOREST BUFFER

CODE 391

(ac)

DEFINITION

An area of predominantly trees and/or shrubs located adjacent to and up-gradient from water courses 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, pesticides, and other pollutants in surface runoff and reduce excess nutrients and other chemicals in shallow groundwater flow
- Reduce pesticide drift entering the water body
- Restore riparian plant communities
- Increase carbon storage in plant biomass and soils

CONDITIONS WHERE PRACTICE APPLIES

This practice may be applied adjacent to perennial or intermittent streams and ditches, lakes, ponds, and wetlands. For protection and stabilization of streambanks and shorelines, refer to the Maryland conservation practice standard for Streambank and Shoreline Protection (580).

When herbaceous areas are designed parallel to the riparian forest buffer, plan them as separate practices. Such practices include Filter Strip (393) and Field Border (386).

CRITERIA

General Criteria Applicable to All Purposes

The riparian forest buffer shall be located appropriately and designed to achieve sufficient width, length, vertical structure/density, and connectivity to meet the intended purpose(s) of the practice, conditions of the site, and the objectives of the land user. Dominant vegetation shall consist of existing, naturally regenerated, or planted trees and/or shrubs.

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 and on one side of the water body.

Maintain overland flow through the riparian area as sheet flow to the extent feasible.

Control excessive sheet-rill and concentrated flow erosion in the areas immediately adjacent to and upgradient of the buffer site.

Select 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, highquality and adapted plant materials will be used. All plantings shall consist of a mixture of two or more species to achieve greater diversity.

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

Natural regeneration may be used to establish a buffer, if the following conditions are met:

- There is an adequate natural seed source of desired species in adjacent areas;
- Site conditions are favorable for establishing the desired number and distribution of seedlings within a specified time period; and,
- Noxious or invasive species are not likely to jeopardize the stand.

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

For additional requirements concerning species selection, planting dates, rates, methods, and care in handling and planting of the seed or planting stock, refer to the applicable sections of the Maryland Conservation Planting Guide.

Control or exclude livestock as needed to establish and maintain the buffer. Refer to the Maryland conservation practice standards for Access Control (472), Fence (382), and Stream Crossing (578).

Control plant and animal pest species to the extent feasible to achieve and maintain the intended purpose of the practice. Control noxious weeds as required by state law. If pesticides are used, refer to the Maryland conservation practice standard for Pest Management (595).

After the buffer is established, periodic removal of some forest products such as high value trees, medicinal herbs, nuts, and fruits may be permitted, provided the intended purpose is not compromised by the loss of vegetation or harvesting disturbance.

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

Establish plant communities that address the target terrestrial and aquatic wildlife and pollinator needs and have multiple values such as food, cover, shelter, nutrient uptake, and shading. The establishment of diverse native woody species will enhance wildlife and pollinator values. Refer to the applicable section of the Maryland Conservation Planting Guide for additional information concerning the habitat values of selected tree and shrub species.

Select an appropriate buffer width for wildlife habitat based on the individual wildlife species or groups of species desired (see Table 1, below). Widths in Table 1 include the sum of buffer widths on one or both sides of water courses or water bodies, and may extend beyond riparian boundaries. When both sides are buffered, each side shall be at least 35 feet wide, measured horizontally on a line perpendicular to the water body, beginning at the top of bank or wetland edge.

Table 1. Minimum buffer widths for wildlife habitat.

Purpose	Minimum Buffer Width in Feet
Bald eagle nesting, cavity nesting ducks, heron rookery	600
Beaver, dabbling ducks, mink, salmonids	300
Forest interior dwelling species (FIDS)	300

Purpose	Minimum Buffer Width in Feet
Neotropical migrants	300
Deer	200
Reptiles and amphibians*	100
Fish	100
Wildlife travel corridors	100

** Many reptiles and amphibians require that the buffer extends into terrestrial habitats (i.e., uplands) to support their full life cycle, including nesting and egg-laying.*

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 Groundwater Flow

The minimum width shall be at least 35 feet measured horizontally on a line perpendicular to and on one side of 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 beyond the minimum width to include important resource features such as wetlands, steep slopes, areas that are occasionally or seasonally flooded, or critical habitats.

Increase the buffer width 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.

Untreated concentrated flow from areas where manure, fertilizer or pesticides are applied shall not bypass the buffer. Address concentrated flow with supporting practices or treatments at the edge of the buffer (e.g., grass filter strips, saturated buffers), along the concentrated flow path (e.g., grassed waterways, bioreactors), or within the buffer (e.g., shallow excavated pools, water control structures).

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 programs may dictate criteria in addition to, or more restrictive than, those specified in this standard.

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 conservation practice standard for Streambank and Shoreline Protection (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 up-gradient of a planned woody buffer when ephemeral, concentrated flow, or sheet and rill erosion and sedimentation are a concern. 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.

On large streams and rivers, consider increasing the buffer width to at least 30 percent of the geomorphic floodplain width or 100 feet, whichever is less (but not less than 35 feet wide).

Consider using a mix of species with growth forms that are tall and wide-crowned or drooping in order to increase the shading effect. Protecting the south or southwest side of the watercourse will provide the greatest temperature control. Buffers established on both sides of watercourses will provide multiple values.

Consider species that re-sprout when establishing species nearest to watercourses or 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.

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

When considering natural regeneration vs. planting, a number of regeneration factors should be evaluated before determining that natural regeneration is appropriate for a site. These factors include, but are not limited to, the presence of sufficient seed trees, prevailing wind direction and other seed dispersal factors, seedbed requirements, potential for seed germination, and 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.

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 use of wider buffers to reduce the long-term impacts of invasive species.

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.

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.

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 to allow passage and filtration of drain water through the riparian root zone. Caution is advised that saturated conditions in the riparian and adjacent areas may limit existing land use and management.

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

Identify and evaluate any constraints such as economic feasibility, management options, and regulatory and cost-share program requirements.

PLANS AND SPECIFICATIONS

Plans and specifications for this practice shall be prepared in accordance with the previously listed criteria. Refer to the applicable sections of the Maryland Conservation Planting Guide for specifications concerning species selection, planting dates, rates, methods, and care in handling and planting of the seed or planting stock. Plans and specifications shall contain sufficient detail to ensure successful implementation of this practice and may be recorded in narrative form, on Implementation Requirements (IR) sheets, or other approved forms.

Follow the establishment recommendations provided in the Maryland fact sheets for tree and shrub plantings, and complete the 391 IR sheet or provide a planting plan prepared by a professional forester.

The following items shall be addressed, as appropriate:

- Purpose of riparian forest buffer;
- Length, width and spacing of the planting;
- Method of site preparation;
- Species selected for establishment, seeding/planting rates, and planting dates;
- Type of plant materials to be used (i.e. bare-root seedlings, containerized, balled and burlapped);
- The number of plant materials of each species to be used;
- Rate and type of soil amendments to be applied (if any);
- Method(s) used to protect plantings from animal damage (e.g., fencing, repellents, shelters, etc.) or for weed control. When using shelters, specify the number and species to be protected.

Supporting Data and Documentation

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

- Location of the practice on the conservation plan map;
- Assistance notes. The notes shall include dates of site visits, name or initials of the person who made the visit, specifics as to alternatives discussed, decisions made, and by whom;
- Completed IR sheet, or Practice Certification sheet along with a Maryland Department of Natural Resources, Forest Service planting plan or other specifications and management plans.

OPERATION AND MAINTENANCE

An Operation and Maintenance (O&M) plan shall be prepared and is the responsibility of the client to implement. The O&M plan shall be reviewed with and provided to the client.

At a minimum, the following components shall be addressed in the O&M plan, as applicable:

- Inspect the trees and shrubs at least annually during the first and second years. If survival is less than expected, replant as needed to achieve the intended purpose of the practice. If native trees and/or shrubs (other than what was planted) become established, and this cover meets the intended purpose of the practice and the client's objectives, the cover should be considered adequate;
- If tree shelters are used, remove them before they impede the growth of the trunk. Removal should not occur until the seedling has adequate girth to support itself (usually 3 to 5 years after planting), or until the seedling has attained sufficient height to survive deer browse. Remove bird netting from shelters when tree growth reaches the top of the shelter;
- Check for insects and diseases and if an incidence threatens stand survival, take corrective action to keep the pest under control;
- Control undesirable plants by pulling, mowing, or spraying with a selective herbicide. Control noxious weeds as required by state law;
- Protect trees and shrubs from wildfire and damage from livestock and wildlife to the extent feasible;
- Trees and shrubs should not be fertilized in the first year, because the plants will develop too much top growth compared to the roots. If nutrients will be applied later, refer to the conservation practice standard for Nutrient Management (590);
- Describe the acceptable uses (e.g., occasional removal of some tree and shrub products, etc.) and time of year or frequency of use restrictions, if any. *Pay particular attention to regulatory and program requirements as they relate to acceptable vs. restricted uses and other management restrictions. An approved sediment and erosion control plan is required when timber harvesting*

disturbs over 5,000 sq. ft. In the Chesapeake Bay Critical Area, a Timber Harvest Plan is also required.

REFERENCES

Bentrup, 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.

Brown, R.G., Brown, M.L. 1972. *Woody Plants of Maryland*. Baltimore, MD.

Dirr, Michael A. 2009. *Manual of Woody Landscape Plants. Their Identification, Ornamental Characteristics, Culture, Propagation and Uses.* 6th Edition, Stipes Publishing LLC, 1325 pages.

Keller, C.M.E.; Robbins, C.S.; Hatfield, J.S. 1993. *Avian Communities in Riparian Forests of Different Widths in Maryland and Delaware.* Wetlands V.13(2):137-144.

Martin, A.C.; Zim, H.S.; Nelson, A.L. 1961. *American Wildlife & Plants: A Guide to Wildlife Food Habitats*. New York, NY. Dover Publications.

Maryland Dept. of Natural Resources, 2005. *Riparian Forest Buffer Design and Maintenance*. Compiled by Anne Hairston-Strang, Annapolis, Md.

Mayer, P.M., S.K. Reynolds, M.D. McCutchen, and T.J. Canfield, October, 2005. *Riparian Buffer Width, Vegetative Cover, and Nitrogen Removal Effectiveness*: A Review of Current Science and Regulations. EPA/600/R-05/118, U.S. Environmental Protection Agency, Cincinnati, OH.

Nutrient Subcommittee of Chesapeake Bay Program, 1995. *Water Quality Functions of Riparian Buffer Systems in the Chesapeake Bay Watershed.* EPA 903-R-95-004.

Palone, R.S. and A.H. Todd (editors), 1997. *Chesapeake Bay Riparian Handbook: A Guide for Establishing and Maintaining Riparian Forest Buffers.* USDA Forest Service, NA-TP-02-97, Radnor, PA.

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

USDA, Forest Service, Northeastern Area State and Private Forestry, 1991. *Riparian Forest Buffers — Function and Design for Protection and Enhancement of Water Resources*. NA-PR-07-91. Prepared by. David J. Welsch Atlanta, GA.

USDA, Forest Service, Southern Region, 1992. *Stream Habitat Improvement Handbook*. Tech. Publ. R8TP 16. Prepared by: Monte E Seehorn Radnor, PA.

USDA, Natural Resources Conservation Service. *Conservation Practice Standards.* Maryland Field Office Technical Guide, Section IV.

USDA, Natural Resources Conservation Service. *Stream Corridor Restoration: Principles, Processes, and Practices*. National Engineering Handbook, Part 653.

USDA, Natural Resources Conservation Service. Streambank and Shoreline Protection. Engineering Field Handbook, Chapter 16.

USDA, Natural Resources Conservation Service, Soil Bioengineering for Upland Slope Protection and Erosion Reduction. Engineering Field Handbook, Chapter 18.

U.S. Fish and Wildlife Service, Chesapeake Bay Field Office, with the Natural Science Center and Adkins Arboretum, 1995. Native Plants for Wildlife Habitat. Annapolis, MD.