

**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, 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. *See General Specifications for required plant densities for buffer plantings.*

Dominant vegetation will consist of existing, naturally regenerated, or planted trees and shrubs suited to the site and the intended purpose. *An adequate upstream or adjacent seed source must be present when using natural regeneration to establish a buffer.*

*Plantings will consist of two or more species with individual plants suited to the seasonal variation of soil moisture status of individual planting sites (see figure 1). Plant types and species shall be selected based on their compatibility in growth rates and shade tolerance. Select species from the Plant List, Table 1, located in General Specifications.*

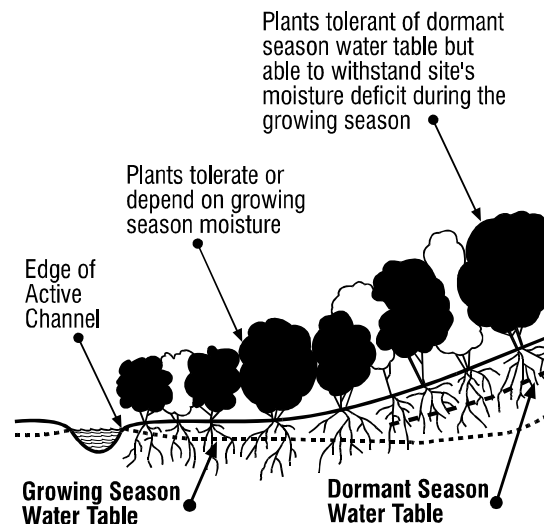


Figure 1. Plant adaptation to soil moisture.

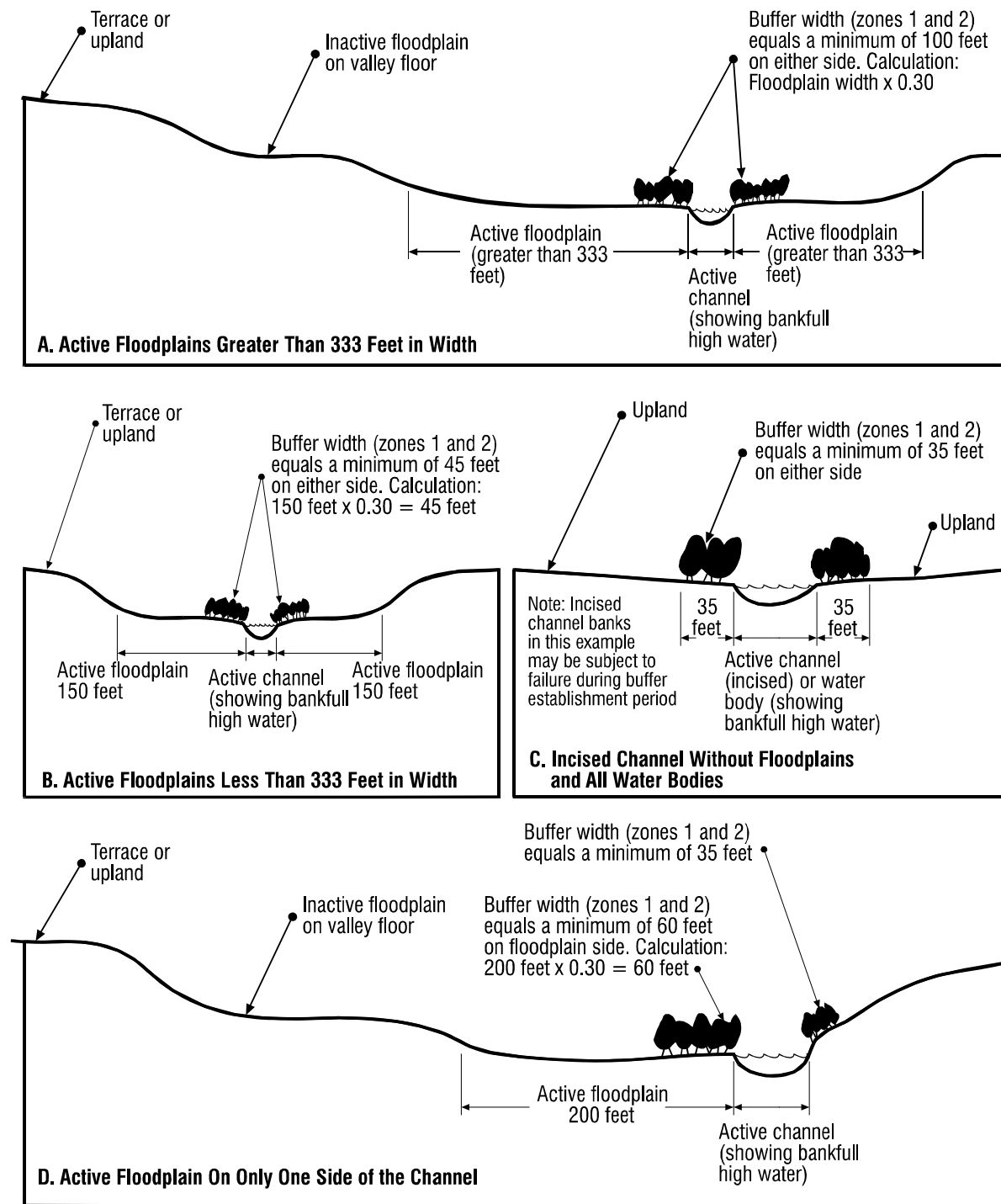


Figure 2. Examples of riparian forest buffer widths for water courses and water bodies.

All buffers will consist of a Zone 1 that begins at the normal water line, or at the top of the bank, and extends a minimum distance of 15 feet, measured horizontally on a line perpendicular to the water body.

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. *Felling and skidding of trees shall be directed away from the water course or water body. Skidding will be done in a manner to prevent creation of ephemeral channels perpendicular to the stream.*

Necessary site preparation and planting shall be done at a time and manner to insure survival and growth of selected species. *Refer to General Specifications for care, handling, and planting requirements for woody planting stock.*

Only viable, high-quality and adapted planting stock will be used. *Refer to General Specifications for size and quality requirements for woody planting stock.*

*The method of planting for new buffers shall include hand or machine planting techniques, be suited to achieving proper depths and placement of planting stock roots, and not impair the intended purpose and function of the buffer.*

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. *See General Specifications for detailed site preparation procedures. Supplemental moisture will be applied if and when necessary to assure early survival and establishment of selected species.*

Livestock shall be controlled or excluded as necessary to achieve and maintain the intended purpose. *On established buffers included within grazed areas, set utilization rates of key woody browse to allow woody vegetation to regrow sufficiently for its intended function. Impairment of buffer function by livestock overuse (trampling, compaction or over-utilization of woody plants) shall require immediate removal of livestock from the riparian area.*

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

**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.**

An additional strip or area of land, Zone 2, will begin at the edge and up-gradient of Zone 1 and extend a minimum distance of 20 feet, measured horizontally on a line perpendicular to the water body. The minimum combined width of Zones 1 and 2 will be 100 feet or 30 percent of the flood plain whichever is less, but not less than 35 feet. *Figure 2 (opposite page) illustrates examples of zone 1 and 2 widths for water courses and water bodies.*

Criteria for Zone 1 shall apply to Zone 2 except that removal of products such as timber, fiber, nuts, fruit and forbs is permitted and encouraged on a periodic and regular basis provided the intended purpose is not compromised by loss of vegetation or harvesting disturbance.

Zone 2 will be expanded 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 desired.

A Zone 3 shall be added to the riparian buffer when adjacent to cropland or other sparsely vegetated or highly erosive areas to filter sediment, address concentrated flow erosion, and maintain sheet flow. The Filter Strip standard (practice code 393) shall be used to design Zone 3. *See figure 3 next page. Stiff-stemmed grasses established at the up-gradient edge of zone 2 will accelerate deposition of sediment. See figure 4 next page.*

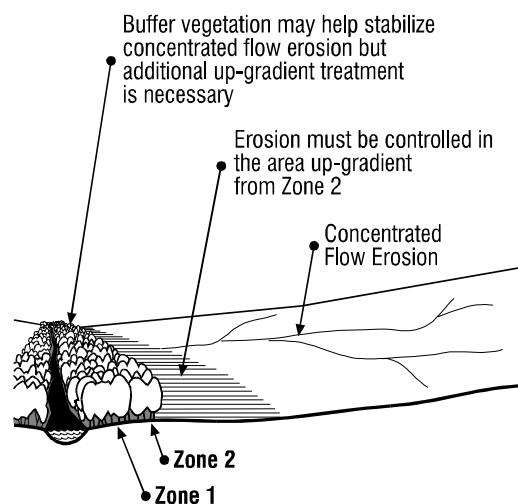


Figure 3. Control of concentrated flow erosion.

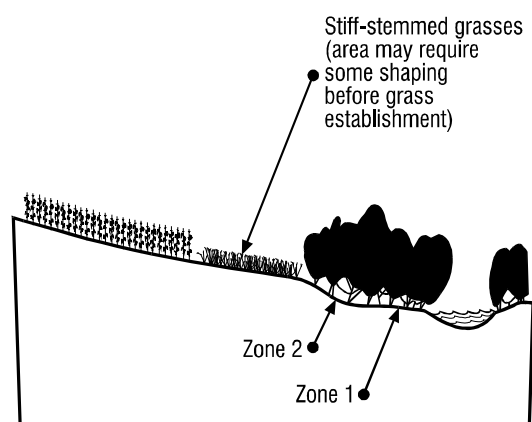


Figure 4. Sediment-trapping above zone 2.

**Additional Criteria to provide a source of detritus and large woody debris for aquatic and terrestrial organisms.**

Within zone 1 as 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 to create wildlife habitat and establish wildlife corridors.**

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. *The Buffer Width Guide for Selected Wildlife Species in General Specifications contains guide widths for key species.*

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

**Additional Criteria to create shade to lower water temperatures to improve habitat for aquatic organisms.**

A buffer for lowering warm-season water temperatures shall consist of at least zone 1 for water course reaches or water bodies less than or equal to 30 feet in width or water bodies greater than 30 feet wide but less than 1 acre. (Buffers for wider water courses or larger water bodies may be valuable but will have only site-specific effects.) Buffers shall be established or maintained at least on south and west sides of water courses and 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. See figure 5.

Buffer species shall include those species listed in the Plant List, Table 1, General Specifications, with sufficient height potential. Place drooping or wide-crowned trees and shrubs 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.

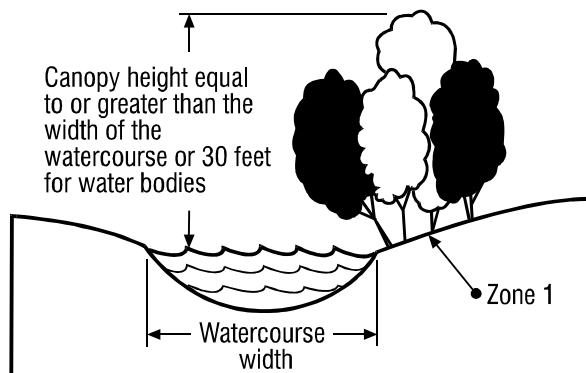


Figure 5. Canopy height for water temperature control.

## CONSIDERATIONS

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.

*Complex ownership patterns of riparian areas may require group planning for proper buffer design, function and management.*

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

*Joining of existing and new buffers increase the continuity of cover and will further moderate water temperatures. A mix of species with growth forms that are tall and wide-crowned or drooping will increase moderation effects. For water courses, buffers established on both sides will enhance multiple values.*

Favor tree and shrub species that are native, non-invasive, or have multiple values such as those suited for timber, biomass, nuts, fruit, browse, nesting, aesthetics and tolerance to locally used herbicides. *Consider species that resprout when establishing new rows nearest to water courses 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.*

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.

Plants that deplete ground water should be used with caution in water-deficit areas.

Allelopathic impacts of plants should be considered.

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

*Consider the positive and negative impacts beaver, muskrat, deer, rabbits and other local species may have on the successful management of the riparian and stream system. Temporary and local population control methods of these kinds of local species should be used cautiously and within state and local regulations.*

*Consider the type of human use (rural, suburban, urban) and the aesthetic, social and safety aspects of the area to determine the vegetation selection, arrangement and management. For example, avoiding shrubs that block views and pruning low tree branches near recreation trails allows for ease of patrolling.*

*Species selection criteria to improve aesthetics include seasonal foliage color, showy flowers and fruit, foliage texture, form and branching habit. The layout and design should be appropriate for the setting as determined by adjacent land uses. A landscape analysis can help determine specific aesthetic requirements.*

## 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.

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.

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

*Any removals of tree and shrub products shall be conducted in a manner that maintains the*

*intended purpose. Felling and skidding of trees shall be directed away from the water course or water body. Skidding will be done in a manner to prevent creation of ephemeral channels perpendicular to the stream.*

*For purposes of moderating water temperatures and providing detritus and large woody debris, riparian forest buffer management must maintain a minimum of 50 percent canopy cover. 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.*

*For providing habitat and corridors for wildlife, manage the buffer to favor food, shelter and nesting cover that would satisfy the habitat requirements of the indicator or target wildlife. Refer to Habitat Evaluation Procedures by the U.S. Fish and Wildlife Service or equivalent state document for the particular species.*

*For purposes of reducing excess pollutants in surface runoff and shallow groundwater (zone 1 and 2), or providing habitat and corridors for wildlife (zone 1 at a minimum), manage the dominant canopy to maintain maximum vigor of overstory and understory species.*

*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, or grazing of domestic animals) shall be implemented where available and feasible.*

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

## **REFERENCES (Examples)**

*American Fisheries Society, 1991. Influences of Forest and Rangeland Management on Salmonid Fishes and Their Habitats. Special Publication 19, Editor: William R. Meehan. Bethesda, MD.*

*California Department of Fish and Game, 1994. California Salmonid Stream Habitat Restoration Manual. Second Edition. Prepared by: Gary Flosi and Forrest L. Reynolds. Sacramento, CA.*

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*Oregon State University, Extension Service, 2000. Stream\*A\*Syst. EM 8761. Prepared by: G. Andrews and L. Townsend. Corvallis, OR.*

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

*State of Maryland, Department of Natural Resources, Public Lands, Forest Service, 1993. Soil Erosion and Sediment Guidelines for Forest Harvest Operations in Maryland. BMP Pocket Guide. Annapolis, MD.*

*U.S. Department of Agriculture, 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. Radnor, PA.*

*U.S. Department of Agriculture, Forest Service, Southern Region, 1992. Stream Habitat Improvement Handbook. Tech. Publ. R8-TP 16. Prepared by: Monte E. Seehorn, Atlanta, GA.*

*U.S. Department of Agriculture, Forest Service, Intermountain Research Station, 1989. Managing Grazing of Riparian Areas in the Intermountain Region. General Technical Report INT-263. Prepared by: Warren P. Clary and Bert F. Webster. Ogden, UT.*