

Agroforestry Notes

USDA Forest Service, Rocky Mountain Station • USDA Natural Resources Conservation Service

AF Note 5

January, 1997

A Riparian Buffer Design for Cropland

Mike Dosskey, National Agroforestry Center; Dick Schultz and Tom Isenhardt, Iowa State University, Department of Forestry

Purpose

- Present a general, multi-purpose, riparian buffer design suitable for most cropland situations
- Provide some guidelines for adjusting this general design to better fit site-specific conditions or landowner needs

General Design

In order to ease the task of developing a new design for each buffer application, we present a general width and vegetation design which we think can be used in most cropland situations with acceptable results. This multi-purpose design can be used “as is” or adjusted to better suit specific landowner needs or site conditions.

Description

A general, multi-purpose, riparian buffer design consists of a 50 ft-wide strip of grass, shrubs, and trees between the normal bank-full water level and cropland. Trees spaced 6-10 ft apart occupy the first 20 ft nearest the stream, shrubs spaced 3-6 ft apart dominate the next 10 ft, and grass extends 20 ft further out to the edge of the crop field. This design can be thought of as consisting of 2 rows of trees, 2 rows of shrubs, and 20 ft of grass. Planting trees and shrubs in well-spaced rows make maintenance activities, such as mowing or mulching, easier to do. This design requires 6 acres per mile of bank (12 acres per mile of stream if installed on **both** sides of the stream).

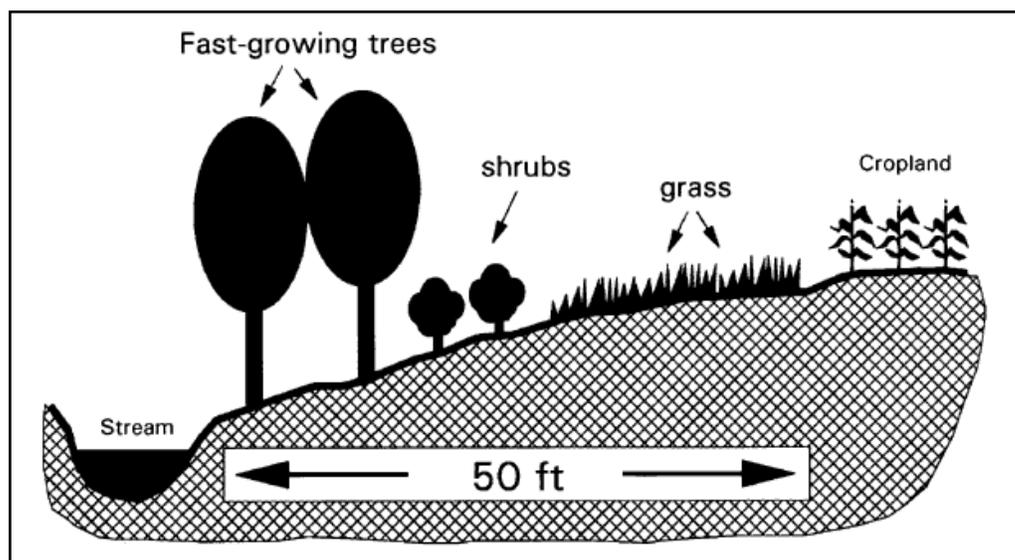


Figure 1 — A general, multi-purpose, riparian buffer design for cropland



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Effectiveness

This buffer design provides good levels and balance of most buffer benefits. Trees and shrubs near the waterway stabilize the bank, improve and protect the aquatic environment, and protect cropland from flood erosion and debris damage. Grass disperses and slows the flow of runoff from adjacent crop fields which promotes settling of sediment and infiltration of nutrients and pesticides, while vigorously growing vegetation and soil microbes take up nutrients and some pesticides. Perennial vegetation provides wildlife habitat and visual diversity to a cropland landscape.

This design may provide only limited control of dissolved nutrients and pesticides in cropland runoff; and be ineffective for stabilizing serious streambank erosion. For wildlife habitat, installation of this buffer design along both sides of a small stream provides an effective width of 100 ft.

Adjustments

The general design described above provides a useful starting point for developing more efficient buffer designs. Several situations are presented below for which the general design should be adjusted.

Adjustments for reducing buffer costs

- **Situation:** Landowner is unwilling to commit enough land, money, or installation and management effort to support the full recommended buffer width.
Adjustment: Narrower buffer. The landowner should expect less overall benefit from a narrower buffer, particularly for nutrient and pesticide runoff control and for wildlife habitat. In general, however, a narrow buffer provides more benefits than no buffer at all. Narrower buffers require more careful selection of vegetation types in order to maximize benefits.
- **Situation:** Landowner wants to qualify for cost-share and/or tax-incentive programs.
Adjustment: As needed. Federal, state, and privately supported incentive programs for conservation, forestry, or alternative products will vary in their requirements for vegetation type, minimum width, and management. Often, such programs require a greater land area than is provided by a 50-ft buffer width.

Adjustment for increasing overall buffer benefit

- **Situation:** Landowner wants greater overall level of benefit.
Adjustment: Wider buffer. This applies mainly to nutrient and pesticide runoff control and wildlife habitat. Be aware that there may be decreasing added benefit for each additional unit of width, such as is commonly observed for sediment filtration. Acceptable width for aesthetic benefits, such as visual diversity, is entirely a matter of the landowner's opinion.

Adjustments for site conditions where some benefits are not needed

- **Situation:** Ephemeral streams have negligible aquatic resources.
Adjustment: Trees and shrubs are not needed for providing shade, shelter, and plant litter.
- **Situation:** Stream or lake is a warm-water fishery.
Adjustment: Trees and shrubs are not needed for providing shade and temperature control, unless there remains a need to control algae blooms. Trees and shrubs may still be required for providing debris for shelter and food.

Adjustments for emphasizing one benefit (high-priority) over others (lower priority)

- **Situation:** Emphasize bank stabilization.
Adjustment: Greater proportion of the buffer width in shrubs and trees. On smaller

streams and lakes, a narrower buffer may be sufficient. Where active erosion is occurring, flood-tolerant woody plants, such as willows, may be planted at the water's edge. Severe bank erosion may require intensive engineering (see Special Situations below).

- **Situation:** Emphasize filtering sediment from agricultural runoff.
Adjustment: Narrower buffer with the greatest proportion of width in grass. Dense, stiff grasses may perform better than bunchgrasses and short, flexible grasses.
- **Situation:** Emphasize nutrient and pesticide runoff control, particularly of soluble forms.
Adjustment: Wider buffer and greater proportion in fast-growing grasses and trees. Deep-rooted grasses may perform better than shallow-rooted grasses.
- **Situation:** Emphasize habitat for larger forest animals.
Adjustment: Wider overall, with a greater proportion of width in shrubs and trees. More variety of plant species provides habitat for a greater diversity of animals.
- **Situation:** Avoid tree windthrow which can damage stream banks and add excessive amounts of large debris to the waterway.
Adjustment: Substitute shrubs for trees, or reverse tree and shrub positions in the buffer design, i.e., shrubs near bank, trees in the middle. Use deep-rooted, wind-firm tree and shrub species. This adjustment may be useful on wide, steep streambanks.
- **Situation:** Maximize marketable products from the buffer.
Adjustment: Greater proportion of buffer width planted with desired perennial crop plants, such as hay grasses, fiber and high-value timber trees, nut and berry crop trees and shrubs. Plant spacing should be adjusted to obtain optimum production. For example, use closer spacing for fiber tree crops, and wider spacing for timber production.
- **Situation:** Emphasize cropland protection from flood damage.
Adjustment: Greater proportion of width in sturdy, flood-tolerant trees and shrubs. Larger streams and rivers may require greater overall buffer width.

Special situations

- **Situation:** Need to halt severe or rapid streambank erosion.
Adjustment: Intensive “bioengineering” or “hard” engineering techniques may be necessary to stabilize the bank, and be backed up with a buffer strip primarily of trees and shrubs. This situation is more common on deeply-incised, unstable streams. Although well-established, mature trees and shrubs may help prevent serious bank erosion from occurring, it is very difficult to re-establish trees and shrubs once serious erosion becomes active.
- **Situation:** Landowner wants trees in a buffer to act as a windbreak.
Adjustment: Greater proportion of buffer width in more-closely spaced trees. Effectiveness will depend on buffer and cropland orientation relative to prevailing wind direction.

Additional Information

“Stewards of Our Streams: Buffer Strip Design, Establishment, and Maintenance.” Iowa State University Extension Bulletin Pm-1626b/April 1996.

“Design and Placement of a Multi-Species Riparian Buffer Strip.” R.C. Schultz, J.P. Colletti, T.M. Isenhardt, W.W. Simpkins, C.W. Mize, and M.L. Thompson. *Agroforestry Systems*, Vol. 29, p. 201-226. 1995.

Authors

Michael G. Dosskey, Riparian Ecologist/Soil Scientist, National Agroforestry Center and University of Nebraska, Department of Forestry, Fisheries and Wildlife, 101 Plant Industry Bldg., Lincoln, Nebraska 68583-0814. Phone 402-472-8472; fax 402-472-2964; e-mail mdosskey@unlinfo.unl.edu

Richard C. Schultz, Forest Ecologist/Hydrologist, Iowa State University, Department of Forestry, 251 Bessey Hall, Ames, Iowa 50011-1021. Phone 515-294-7602; fax 515-294-2995; e-mail rschultz@iastate.edu

Thomas M. Isenhardt, Aquatic Ecologist, Iowa State University, Department of Forestry, 251 Bessey Hall, Ames, Iowa 50011-1021. Phone 515-294-1458; fax 515-294-2995; e-mail isenhardt@iastate.edu

Acknowledgments

The authors thank the following agencies and programs for their support: • US Environmental Protection Agency (EPA) under the Federal Nonpoint Source Management Program • Agriculture in Concert with the Environment program, jointly funded by the USDA Cooperative State Research, Education and Extension Service, and the EPA • USDA Forest Service - Northeast Area State & Private Forestry • Iowa Department of Natural Resources • Nebraska Department of Environmental Quality • Leopold Center for Sustainable Agriculture, Iowa State University

For more information contact: USDA National Agroforestry Center, 1945 No. 38th Street, Lincoln, Nebraska 68583-0822. Phone: 402-437-5178. <http://nac.unl.edu>

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