RIPARIAN FOREST BUFFER DESIGN PROCEDURES

(391DP)

INTRODUCTION

Riparian areas are ecosystems that occur along water courses or at the fringe of water bodies. A riparian forest buffer is an area of predominately trees and/or shrubs located adjacent to and up-gradient from watercourses or water bodies (Figure 1).

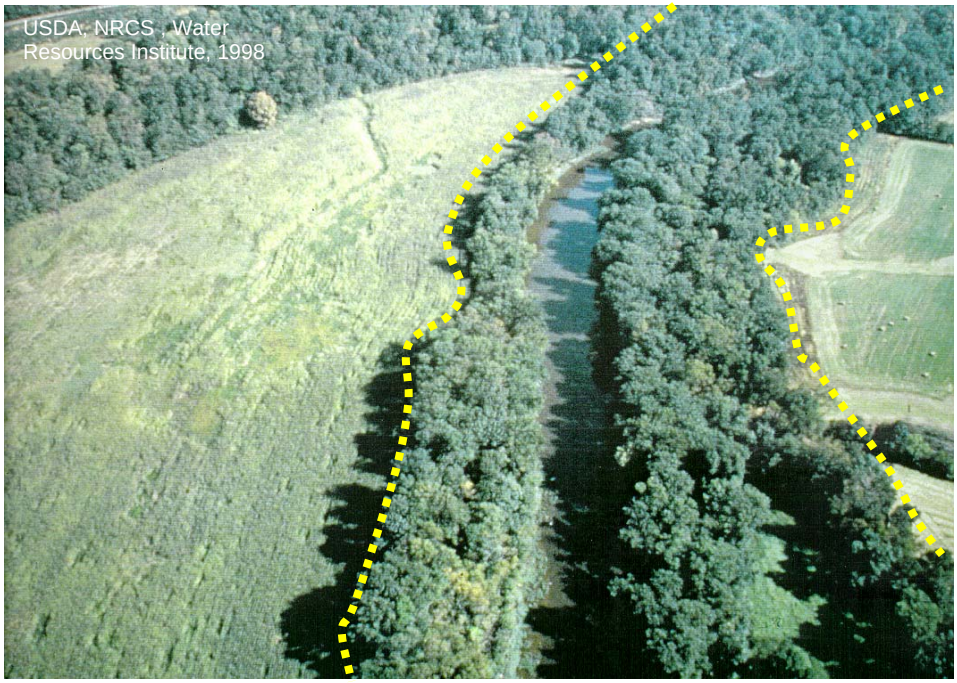

Figure 1. Example of a riparian forest buffer. Dotted yellow lines denote forest buffer area along a waterbody.

The following topics are covered in the riparian forest buffer design procedures:

- **Buffer size and location (p. 2),**
- **Site preparation, seeding rates, seed source requirements for buffers (p. 3),**
- **Woody and herbaceous vegetation species composition (p. 4),**
- **Habitat requirements for terrestrial and aquatic wildlife (p. 6),**
- **General operation and maintenance requirements (p. 8).**

SIZE AND LOCATION

All riparian forest buffers will have at least two zones. Zone 1 will be a minimum of 15 feet wide and will be measured horizontally on a line perpendicular to the water feature. Measurements will begin at the normal water line next to water bodies (lakes, ponds and wetlands) and from the bankfull elevation (1.5-2 year 24 hour storm event) next to water courses. In heavily incised stream channels, Zone 1 will be measured from the top of the incised streambank (Figure 2). Zone 1 will contain at least one row of trees and/or shrubs.

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. Zone 2 will also contain appropriate species of trees and/or shrubs.

The combined width of Zones 1 and 2 will be **at least** 35 feet at any point within the buffer (Figure 2). Refer to "habitat requirements for terrestrial and aquatic wildlife" to determine the width requirements for specific wildlife species.

In many instances, it is necessary to have the minimum combined width of Zones 1 and 2 extend 100 feet, or 30 percent of the flood plain, whichever is less. The active floodplain is defined as the flow width, including out of channel flow, that occurs after a 2-year, 24-hour storm event. Streams that are deeply incised will contain a 2-year, 24-hour storm event and the active floodplain is contained within their banks (refer to Figure 2 incised stream vs. non-incised stream).

Zone 3 shall be added directly up gradient of zone 2 when the riparian buffer is adjacent to erosive cropland, and other areas that are not adequately treated for water erosion. The purpose of Zone 3 is to filter sediment, sediment borne contaminants, address concentrated flow erosion, and maintain sheet flow through zones 1 and 2. The Filter Strip Standard (393) shall be used to design Zone 3.

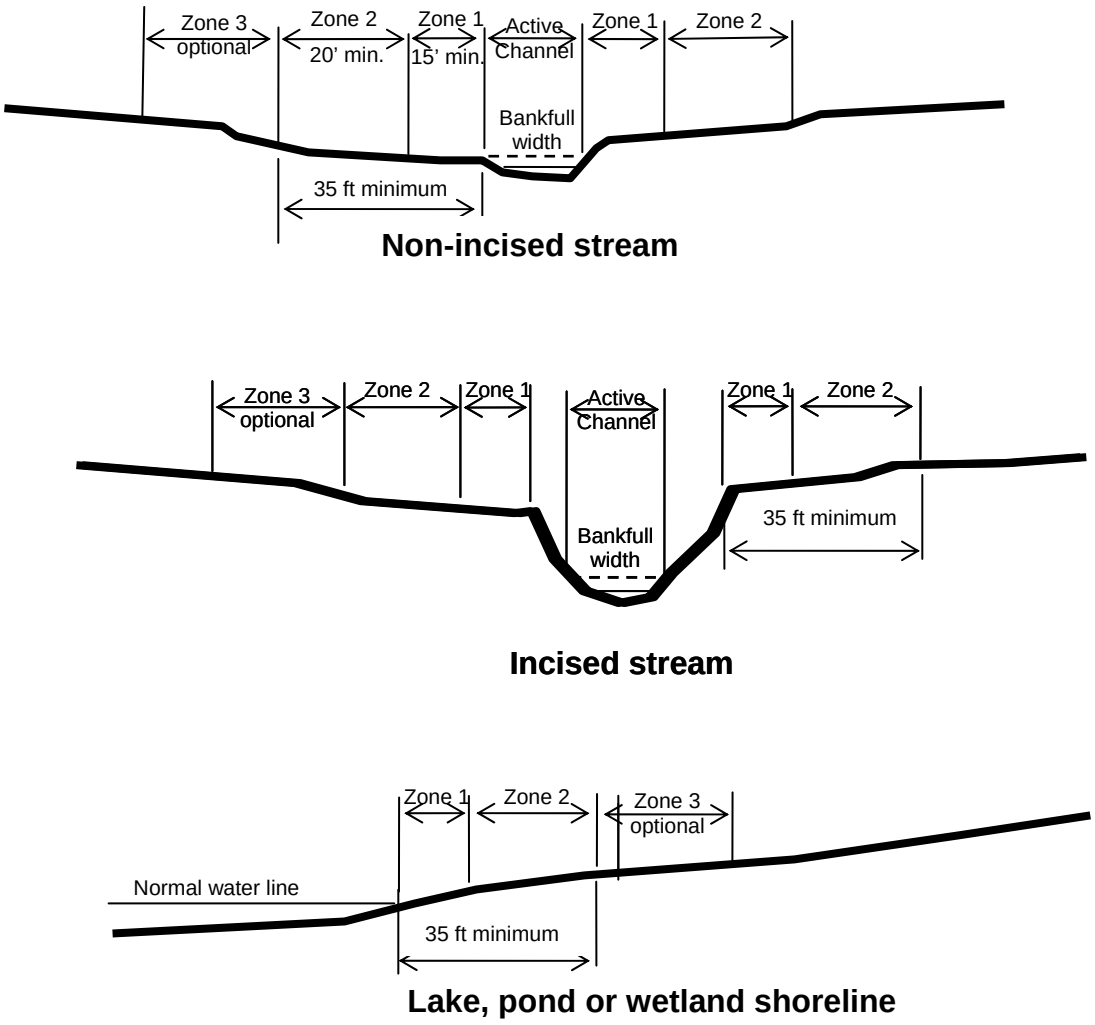

Figure 2. Illustration of forest buffer zones for a non-incised stream, incised stream, and lake, pond, or wetland shoreline. The minimum width of 35 feet provides area for planting more than one row of trees/shrubs deemed necessary to contribute to the intended purpose(s) of the buffer.

SITE PREPARATION, SEEDING RATES, SEED SOURCE REQUIREMENTS

Tree/Shrub Planting Procedures

Refer to Tree/Shrub Planting Procedures (380TPP) for planting procedures and requirements for tree/shrub plantings including: site preparation; planting stock requirements; planting dates; planting operations; control of competitive vegetation after planting; cover between rows; care and maintenance (including replanting); direct seeding methods; drip watering systems and fabric mulch installation. Use NE CPA-15 (Tree and Shrub Planting

Plan), or NE CPA-15B (Tree and Shrub Establishment-Direct Seeding) jobsheets to document forest buffer planting plans.

Initial Planting Density

Initial tree/shrub planting density for trees and shrubs (Table 1) will depend on their average height at 20 years of age, based on either the predetermined and documented heights, using "Conservation Tree & Shrub Suitability Groups", Section II, Windbreak Interpretations in the Field Office Technical Guide or the performance of the individual species (or comparable species) in nearby areas on similar sites.

Table 1. Initial Tree/Shrub Planting Density

Plant Types/Heights: (20 Year Height in Feet)	[2/] Plant-to-Plant Spacing (Feet)	No. of Plants/Stems (Per Acre)	
		Minimum	Maximum
[1/] Small shrubs (< 10 ft)	3-6	1,210	4,840
[1/] Large shrubs and small trees, including columnar trees (10 to 20 ft)	6-10	440	1,210
Large trees (> 20 ft)	10-15	200	440

[1/] Small shrubs and small trees planted as understory of large trees do not need to meet minimum planting density requirements.

[2/] It is preferable that plant-to-plant spacing is equal between and within rows when possible. If necessary for maintenance wider between-row spacing is allowed as long as the minimum number of saplings/plants/stems per acre is planted.

WOODY AND HERBACEOUS VEGETATION SPECIES COMPOSITION

Native species that are adapted to site conditions (i.e., soil type and duration of saturation and inundation) and provide diversity of cover and food for wildlife should be given priority (Table 2). Selected species are preferred that provide a deep, binding root mass to strengthen stream banks and improve soil health.

Table 2. Trees and Shrubs Tolerant of Saturated Soils

Deciduous Trees	**Shrubs**
American Sycamore	Buttonbush
Black Willow	Elderberry
Boxelder	False Indigo
Cottonwood	Gray Dogwood
Green Ash	Redosier Dogwood
Peachleaf Willow	Roughleaf Dogwood
Pin Oak	Sandbar Willow
Silver Maple	
Swamp White Oak	

Trees and shrubs listed in Table 2 are capable of withstanding saturated soils or areas of frequent flooding that occur in close proximity to many water courses and water bodies. Many other native trees and shrubs can be used on sites with moderate to well drained soils. For a complete list of tree and shrub species for all sites, refer to FOTG Section II, Windbreak Interpretations - Conservation Tree and Shrub Interpretations, Conservation Tree & Shrub Suitability Groups. Tables 1-10 provide guidance on adapted species for a specific site and Table 11 contains species attributes.

Removal of invasive woody (tree) species, including, but not limited to, Russian olive, Tamarisk (saltcedar), Siberian elm, and/or Honey locust, may be necessary to meet the objectives of this standard. Refer to Brush Management Design Procedures (314DP) and/or Forest Stand Improvement Design Procedures (666DP).

Conifers, such as ponderosa pine and Rocky Mountain juniper, can be utilized to a limited degree (< 10% composition), as appropriate on riparian areas in MLRAs 64 and 67 where they are adapted and meet the intended purpose. Otherwise, coniferous species are not well suited for use on Riparian Forest Buffers throughout the remainder of the state.

Herbaceous portions of the buffer should consist of a diverse mixture of grasses, forbs, and/or shrubs; monotypic stands of exotic grasses, including smooth brome, reed canarygrass, and Kentucky bluegrass, do not provide quality wildlife habitat. A significant amount of broadleaf plants, including native forbs and/or introduced legumes, should be present within the herbaceous cover. Refer to 380 TPP for herbaceous cover between tree/shrub rows.

Sites suited for predominantly herbaceous vegetation and occasional intermixed shrub blocks or savannah (scattered trees/shrubs) should be developed/managed using the Riparian Herbaceous Cover (390) standard. Sites that are/were naturally wooded with native tree species should be developed and managed as Riparian Forest Buffers (391).

The type of natural community determines whether to manage as a riparian forest buffer or as riparian herbaceous cover (Steinauer and Rolfsmeier, 2003). The following eight natural communities are critical habitat types that frequently occur adjacent to rivers and streams throughout Nebraska and should be developed or managed as riparian forest buffers (391):

- Eastern Cottonwood-Dogwood Riparian Woodland
- Eastern Cottonwood-Willow Riparian Woodland
- Eastern Riparian Forest
- Green Ash-Elm Canyon Bottom Woodland
- Lowland Bur Oak Forest
- Lowland Hackberry-Walnut Forest
- Paper Birch Springbranch Canyon Forest
- Western Riparian Woodland

The following twelve natural communities are critical habitat types that frequently occur adjacent to rivers and streams throughout Nebraska and should be developed or managed as riparian herbaceous cover (390):

- Eastern Cordgrass Wet Prairie
- Eastern Saline Marsh
- Eastern Saline Meadow
- Eastern Sedge Wet Meadow
- Missouri River Floodplain Terrace Grassland
- Northern Cordgrass Wet Prairie
- Northern Sedge Wet Meadow
- Western Alkaline March
- Western Alkaline Meadow
- Western Floodplain Terrace Grassland
- Western Streamside Wet Meadow
- Wet-mesic Tallgrass Prairie

Nebraska Biology Technical Note #65 – Terrestrial Natural Communities of Nebraska (Steinauer and Rolfsmeier, 2003), should be used as a reference. Each natural community description for these sites also contains detailed information related to woody and herbaceous plant species composition that can be used to develop planting recommendations or management options.

Additional guidance for selecting the appropriate buffer vegetation across Nebraska is found in Appendix A – Riparian Buffer Vegetation Recommendations.

HABITAT REQUIREMENTS FOR TERRESTRIAL AND AQUATIC WILDLIFE

The width of Zones 1 and 2 will be adjusted to meet the requirements of the targeted wildlife species (terrestrial or aquatic) within the parameters of what is appropriate for the associated plant community and/or ecotype. Refer to Table 3 for relative width preferences for selected wildlife species.

Table 3. Riparian Forest Buffer Width Preferences of Selected Wildlife Species

Badger	*
Black-footed Ferret	*
Black-tailed Jackrabbit	*
Canada Goose	*
Eskimo Curlew	*
Interior Least Tern	*
Piping Plover	*
Pronghorn Antelope	*
Rocky Mountain Bighorn	*
Sandhill Crane	*
Swift Fox	*
White-tailed Jackrabbit	*
Whooping Crane	*
American Burying Beetle	* - **N**
Blacknose Shiner	* - **N**
Finescale Dace	* - **N**
Massasauga	* - **N**
Mallard	* - **N**
Muskrat	* - **N**
Northern Redbelly Dace	* - **N**
Salt Creek Tiger Beetle	* - **N**
Topeka Shiner	* - **N**
Western Meadowlark	* - **N**
Blue-winged Teal	**N**
Eastern Bluebird	**N**
Gray Partridge	**N**
Greater Prairie Chicken	**N**
Mule Deer	**N**
Ring-necked Pheasant	**N**
Sharp-tailed Grouse	**N**

Mourning Dove	**N – W**
Northern Bobwhite Quail	**N – W**
Red Fox	**N – W**
Beaver	**N – V W**
Coyote	**N – V W**
Eastern Cottontail	**N – V W**
Great-horned Owl	**N – V W**
Lake Sturgeon	**N – V W**
Long-tailed Weasel	**N – V W**
Mink	**N – V W**
Raccoon	**N – V W**
Pallid Sturgeon	**N – V W**
Striped Skunk	**N – V W**
Sturgeon Chub	**N – V W**
Virginia Opossum	**N – V W**
White-tailed Deer	**N – V W**
Eastern Fox Squirrel	**W –V W**
Hairy Woodpecker	**W – V W**
Northern River Otter	**W – V W**
Red Bat	**W – V W**
Turkey Vulture	**W – V W**
Wild Turkey	**W – V W**
Wood Duck	**W – V W**
Bald Eagle	**V W**
Bobcat	**V W**
Eastern Woodrat	**V W**
Gray Fox	**V W**
Rocky Mountain Elk	**V W**
Southern Flying Squirrel	**V W**
Woodcock	**V W**

* = Woody Cover Does Not Benefit

N = Narrow (35 ft wide each side)

W = Wide (35-100 ft wide each side)

V W = Very Wide (>100 ft wide each side)

Shrubs are an important habitat component for many wildlife species. In order to maximize wildlife habitat values, at least two species of native shrubs should be used within Zones 1 and 2 and at least 25 percent of the area devoted to woody cover should be established to shrubs.

In order to meet minimum quality criteria for wildlife habitat, a score of 0.5 or greater is required on NE-CPA-43 (Riparian Habitat Evaluation Worksheet). For forested sites, refer to the NE-CPA-36 (Woodland Habitat Evaluation Worksheet) to address "species composition" on the Riparian Worksheet.

Buffers adjacent to water courses and water bodies where moderating water temperature is a concern (especially for cold water fisheries) should incorporate tree species in Zones 1 and 2 that will provide adequate shading during the summer months. For maximum benefit, a significant portion of the watercourse or water body will need to be shaded.

Shading estimates should account for effective tree heights (mature tree height plus the distance above the surface of the water body, where applicable). Refer to Tables 1-10 Conservation Tree & Shrub Suitability Groups in Section II Windbreak Interpretations of the FOTG to determine mature tree height. Shadow lengths will vary, depending on which side the buffer is located, the time of the day, and the month (trees on the south and west sides will provide the greatest impact to moderate water temperature). An approximation of shadow length is based on 50 percent of the effective tree height. For example, a mature tree 50 feet tall that is growing on a stream bank that is 10 feet above the normal flow line would have an effective tree height of 60 feet, providing an average shadow length of 30 feet.

GENERAL OPERATION AND MAINTENANCE REQUIREMENTS

Refer to "Care and Maintenance Section of the 380TPP Tree/Shrub Planting Procedures Guide for operation and maintenance requirements during the establishment phase of tree/shrub plantings, including replanting.

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.

Removal of products, such as timber, fiber, nuts, fruit, and forbs, in Zone 2 is permitted and encouraged on a periodic basis provided the intended purpose is not compromised by loss of vegetation or harvesting disturbance.

Refer to Filter Strip Standard (393) or Riparian Herbaceous Cover Standard (390) and Design Procedures (390DP) for recommendations on operation and maintenance as well as management within Zone 3.

Livestock grazing within Zones 1 and 2 is not compatible with proper buffer function and should not be conducted during the establishment of woody plants. Techniques, such as selective cutting, pruning, and/or understory planting, may be necessary once woody species are established.

Maintenance is needed on certain sites for control of unwanted vegetation (i.e., undesirable volunteer tree species, such as Siberian elm, Russian olive, red cedar, etc., and invasive, non-

native herbaceous species). Refer to Brush Management Standard (314) and Design Procedures (314DP).

A riparian functional assessment such as Stream Visual Assessment Protocol (SVAP) can be used to monitor the change in riparian health and direct future management needs.

REFERENCES

Steinauer, G, and S. Rolfsmeier. 2003. Terrestrial Natural Communities of Nebraska, Version III. NE Natural Heritage Program and NE Game and Parks Commission, Lincoln, NE; (note: also issued as NE NRCS Biology Tech. Note 65).