

Planning Your Riparian Buffer: Design and Plant Selection

Amanda Fox, Graduate Student in Biological Systems Engineering;

Tom Franti, Extension Surface Water Management Specialist; Scott Josiah, Nebraska State Forester; and
Mike Kucera, State Resource Conservationist for the Natural Resources Conservation Service

Learn how to plan and design a riparian buffer and select appropriate tree and grass species. A companion NebGuide, *Installing Your Riparian Buffer: Tree and Grass Planting, Postplanting Care and Maintenance* (G1558), addresses buffer installation, planting trees and grasses, postplanting care and long-term maintenance.

Conservation buffers are planted for environmental, aesthetic, recreational, and economic reasons. Grass filter strips, grassed waterways, field borders, and field windbreaks are examples of conservation buffers. A conservation buffer also may be a streamside or riparian forest buffer and include trees, shrubs, and grasses. Riparian buffers are a *best management practice* to protect stream water quality, reduce streambank erosion, and provide wildlife habitat. Buffers also can provide income through payments from federal, state and local cost-share programs or through production and sale of specialty crops. This NebGuide provides instructions on riparian buffer planning, design and selection of tree and grass species appropriate for riparian buffers. It compliments the instructional video *Streamside Conservation: Installing and Maintaining Your Riparian Buffer*, available from University of Nebraska–Lincoln Extension. (To order the video, contact the University of Nebraska–Lincoln Educational Media, P.O. Box 830918, Lincoln, NE 68583-0918 or call 800-755-7765.)

Planning is the first step in buffer installation. First, identify your goals for the buffer, then select a design and plant materials to achieve your goals.

Goal Identification

Consider what you want to accomplish with your buffer. Do you want to protect surface water quality, enhance wildlife habitat, stabilize streambanks, and/or generate income? Buffers can be used to meet one or more of these goals.

Buffers protect surface water by intercepting runoff and

irrigation water flowing from crop fields. Vegetation in the buffer slows the water, increasing infiltration and allowing sediment deposition. This allows nutrients, chemicals, and other pollutants to be removed. Riparian forest buffers also stabilize streambanks and provide shaded areas for aquatic habitat. Plant roots anchor the stream bank and help prevent erosion.

Income can be generated through land rental and maintenance payments by enrolling the buffer in the Continuous Conservation Reserve Program (CCRP) or by selling specialty crops such as nuts, fruits, and woody florals grown in the buffer. Typically, specialty products grown in buffers under a CCRP contract cannot be harvested for sale during the contract period; however, these products can be harvested for personal use. Contact your local Natural Resources Conservation Service (NRCS) or Farm Service Agency (FSA) office for more information on regulations affecting the harvest and sale of specialty crops planted in buffers.

Selecting the Appropriate Buffer Design

Select a buffer design based on your goals. In the eastern United States, riparian forest buffers provide streambank stabilization, shade streams, and absorb nutrients from shallow groundwater. These buffers typically consist of three zones: trees near the stream, then shrubs, and then 30 feet or more of grasses adjacent to the cropland.

In the Great Plains producers as well as government officials, have been reluctant to have trees planted next to streams because fallen trunks and limbs may block streams, ditches and culverts. An alternative design, with shrubs and small trees planted next to the stream followed by taller trees and then grasses next to the cropland, may be more suitable in this region (*Figure 1*).

If your main goal is to provide wildlife habitat, design your buffer accordingly. Some birds, including game species such as pheasant and prairie grouse and non-game species such as songbirds, prefer open grassland to woody cover. On the other hand, deer and sharptail grouse prefer woody edges

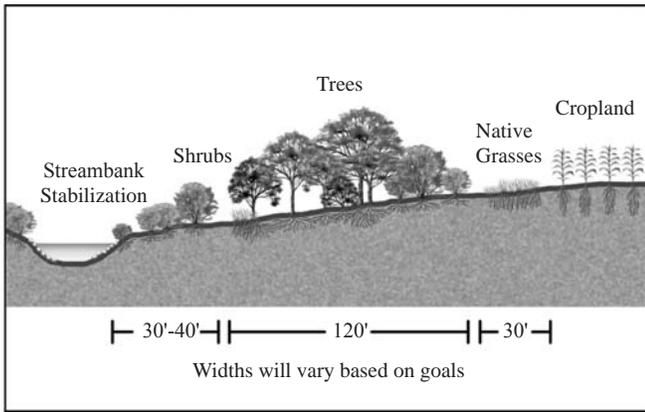


Figure 1. Cross section of an alternative buffer design.

(along narrow riparian forest buffers). Western meadowlark and mink prefer narrow (less than 35 feet wide) grass buffers. White-tailed deer, beaver, and red fox are content with just about any vegetation and width, whereas wild turkey and wood duck prefer forested buffers over 35 feet wide. For more information on wildlife needs refer to NRCS Conservation Practice Standard *Riparian Forest Buffer Code 391*.

A buffer also can be entirely grass (also called a grass filter or filter strip). Grass buffers are narrow strips of land between the crop and stream. The NRCS recommends a minimum width of 20-30 feet for grass buffers; however, widths may vary according to your goals, cropping history, crop field area, and the program in which your buffer is enrolled (*Table 1*). For more information, refer to NRCS Conservation Practice Standard *Filter Strip Code 393*.

Selecting Appropriate Plant Materials

Trees and Shrubs, Seedlings or Seeds?

Trees and shrubs can be planted as seeds or seedlings. Tree seeds can be purchased or collected free from trees in the fall. Seeds from native trees and shrubs may be best adapted to your area's climate and soil conditions. Direct planting seeds can be cheaper than planting seedlings and usually results in a denser stand of trees and shrubs. This stand will be more like a natural forest and better able to withstand wildlife damage, especially in early growth stages. Trees grown directly from seeds develop strong root systems that remain undisturbed

throughout establishment. Seeds also can be planted in the fall. Some species suitable for Nebraska and appropriate for direct seeding are noted in *Table II*. For more information on direct seeding trees and shrubs, refer to the University of Nebraska–Lincoln *NebGuide, Establishing Conservation Plantings of Nut Trees and Shrubs by Direct Seeding Methods (G1512)*.

Tree and shrub seedlings can be purchased as unrooted cuttings, bareroot plants, or in a container. Unrooted cuttings look like sticks and are cut from dormant tree branches during the winter (*Figure 2*). When planted, the underground portion forms roots and the above ground portion forms branches and leaves. Establishment of unrooted cuttings is more difficult than other seedlings and only a limited number of species, such as willows and some poplars, are suitable for this method in Nebraska. Bareroot seedlings are the most common type of seedlings used (*Figure 2*). They are grown from seed in a nursery until healthy root systems form. They are lifted without soil from the nursery beds and are transported for planting. Containerized seedlings are produced in containers. They may be shipped in the containers in which they were originally grown or removed from the containers at the nursery and packed in plastic bags (*Figure 2*). Although they are more expensive, their roots are better protected and they may be better suited for planting in dry and hard-to-establish sites.

Commonly used tree and shrub species are listed in *Table II*. Many tree and shrub species produce commercially valuable products such as decorative stems for the floral industry, fruit and nuts for the food industry, and other products for the pharmaceutical and herbal industries (*Table III*). Personnel at a local Extension office, Natural Resources Conservation Service, or Nebraska Forest Service office or commercial nurseries can help you select plants suited to your climate and soil type.

Grasses

The selection of appropriate grass species will depend on your goals. Densely planted, stiff-stemmed species should be selected to trap sediment and protect water quality. Other species may be used if wildlife habitat is a goal. Buffers planted under a CCRP contract must follow NRCS specifications for grass selection. To meet NRCS specifications, grass

Table I. NRCS conservation buffer and Continuous Conservation Reserve Program (CCRP) width guidelines.

	Previous Land Use	Minimum NRCS Width Requirements (feet)	CCRP Maximum Width (feet)	CCRP Grass Cover (feet)	CCRP Trees or Shrubs Cover (feet)
Grass Filter Strip	Cropland only	20-30 ¹	120	120	N.A.
Riparian Forest Buffer	Cropland	35	180	20-120 ²	35-180
Riparian Forest Buffer	Marginal pasture	35	180	20	35-180
Riparian Herbaceous Buffer	Marginal pasture only	20-50 ³	120	20-120 ³	Shrub clumps may be planted.

¹Greater minimum may be required if the ratio of minimum filter strip to drainage area is more than 1:30.

²Grass width is considered along the outside edge of the buffer only.

³50-foot minimum width required for wildlife purposes.

Table II. Commonly used shrub and tree species in riparian forest buffers ¹

	<i>Common Examples²</i>	<i>Desirable Characteristics</i>	<i>Best Planting Location</i>
Small Shrubs	Sand cherry	White flowers, black cherries	Statewide
	Peking cotoneaster	Berry-like fruit	Statewide
	Elderberry	Dark purple berries	All but Panhandle
	Sandbar willow	Flood tolerant, fast growing	Statewide
	Streamco willow	Flood tolerant, fast growing	Statewide
	Chokecherry	Edible fruit	Statewide
	Gray dogwood	High wildlife value	Statewide
	Redosier dogwood	Floral stems, winter color	Statewide
	Hansen rose	Flowers, fruit	Statewide
	Snowberry	High wildlife value	Statewide
Golden currant	Yellow flowers, purple fruit	Statewide	
Large Shrubs	Chokecherry	White flowers and cherries	Statewide
	American hazelnut	Hazelnuts	All but Panhandle
	Lilac	Flowers	Statewide
	Juneberry	Edible fruit	Statewide
	American plum	White flowers, fruit, fall color	Statewide
Caragena	Nitrogen fixing	Statewide	
Small Trees	Black cherry	Cherry wood, fruit	East
	Chickasaw plum	Drought tolerant	Statewide
	Amur maple	Drought tolerant, fall color	Statewide
Large Trees	Red mulberry	Edible fruit	Statewide
	Green ash	Yellow foliage in fall	Statewide
	Cottonwood	State tree, major wood supply	Statewide
	Hackberry	Tolerant to adverse weather	Statewide
	Black walnut	Wood, nuts	East
	Black willow	Flood tolerant	Statewide
	Silver maple	Flood tolerant	Statewide
Bur oak	Drought tolerant, acorns	Statewide	

¹Additional species are approved by NRCS for buffer plantings.

²Species listed in bold are well suited for direct seeding methods.

seed must be a mixture of at least three species adapted to the site. Warm season grass mixtures must contain at least 60 percent sod-forming stiff stem species such as big bluestem or switchgrass, and cool season grass mixtures must contain at least 40 percent sod-forming stiff stem species such as western wheatgrass or Virginia wild rye. Grass seed should be planted at a minimum rate of 40 pure live seeds (PLS) per square foot. Several common warm and cool season grass mixtures appropriate for Nebraska are presented in *Table IV*. Wildflowers, such as coneflower and blanket flower, may be added to grass mixtures for appearance and wildlife enhancement.

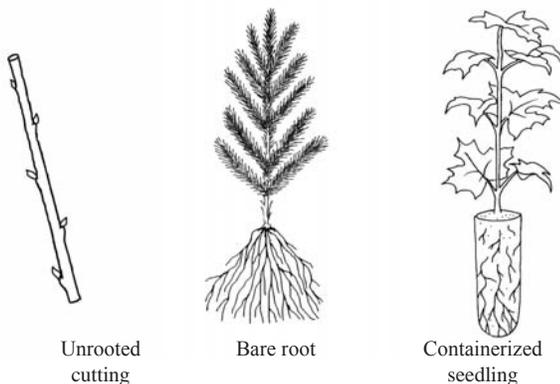


Figure 2. Types of seedlings.

Table III. Common specialty crop species.¹

	<i>Common Examples</i>	<i>Preferred Planting Location</i>
Nut Producing	Black walnut	East
	Chinese chestnut	Southeast
	Northern pecan	East
	Hybrid hazelnut	East
Woody Florals	Redstem dogwood	Statewide with irrigation
	Pussy willow	Statewide with irrigation
	Curly willow	Statewide with irrigation
	Forsythia	Statewide with irrigation
Fruit	Sand cherry	Statewide
	Elderberry	East
	Nanking cherry	All but Panhandle
	Corneliancherry	
	dogwood	East
	Chokecherry	East
	American plum	Statewide
Mulberry	Statewide	

¹When these species are used to produce a marketable product, planting location is limited to sites with superior growing conditions for maximum production. Planting locations are more restrictive than those listed in *Table II*.

Table IV. Common grass species used in grass buffers.¹

<i>Recommended Mixtures</i>	<i>Species in the Mixture</i>	<i>Percent of Mixture (%)</i>	<i>Seeding Rate² (PLS/ft²)</i>	<i>Upland Bird Wildlife Value</i>
Cool Season	Virginia wild rye	30	7.0	Nesting cover
	Canada wild rye	26	4.0	
	Western wheatgrass	44	7.0	
Warm Season	Big bluestem	40	4.2	Winter cover
	Switchgrass	35	1.6	
	Indiangrass	25	2.5	
Warm/Cool Season Mix	Switchgrass	60	2.7	Winter cover and nesting cover
	Big bluestem	20	2.1	
	Intermediate wheatgrass	20	4.0	
Warm Season	Big bluestem	30	3.2	Winter cover and nesting cover
	Switchgrass	25	1.1	
	Indiangrass	20	2.0	
	Sideoats grama	15	1.4	
	Little bluestem	10	0.7	
Warm/Cool Season Mix	Pubescent wheatgrass	30	5.2	Winter cover and nesting cover
	Western wheatgrass	30	4.8	
	Switchgrass	40	1.8	

¹Add legumes to mixtures to provide brooding cover benefits for upland game birds.

²PLS — pure live seeds.

Resources

For more information on installing and maintaining riparian buffers, contact: 1) your local University of Nebraska–Lincoln Extension office or visit the University’s *Conservation Buffer* Web site at www.conservationbuffers.unl.edu; 2) your local Natural Resources Conservation Service office or visit the Natural Resources Conservation Service Web site, *Buffer Strips: Common Sense Conservation* at www.nrcs.usda.gov/feature/buffers; or 3) the USDA Agroforestry Center or its *Riparian Forest Buffers* Web site at www.unl.edu/nac/riparian.html.

References

Establishing Conservation Plantings of Nut Trees and Shrubs by Direct Seeding Methods, University of Nebraska–Lincoln Extension NebGuide G1512, 2003.

Riparian Forest Buffer, Natural Resources Conservation Service Conservation Practice Standard CODE 391.

Filter Strip, Natural Resources Conservation Service Conservation Practice Standard CODE 393.

Funding

Partial funding for this publication was provided by an Education Grant from the Environmental Quality Incentives Program (EQIP) through the U.S. Department of Agriculture Natural Resources Conservation Service.

This publication has been peer-reviewed.

UNL Extension publications are available online at <http://extension.unl.edu/publications>.

Index: Water Resource Management

Water Quality

Issued February 2005

Extension is a Division of the Institute of Agriculture and Natural Resources at the University of Nebraska–Lincoln cooperating with the Counties and the United States Department of Agriculture.

University of Nebraska–Lincoln Extension educational programs abide with the nondiscrimination policies of the University of Nebraska–Lincoln and the United States Department of Agriculture.

© 2005, The Board of Regents of the University of Nebraska on behalf of the University of Nebraska–Lincoln Extension. All rights reserved.