

**NATURAL RESOURCES CONSERVATION SERVICE
CONSTRUCTION SPECIFICATIONS**

**RESTORATION AND MANAGEMENT OF RARE OR DECLINING
HABITATS**

1. General Specifications

Procedures, technical details, and other information listed below provide additional guidance for carrying out selected components of the main practice and supplements the requirements and considerations.

2. Prairie Habitat Restoration

Habitat restoration can range from actively seeding and planting an area, to passively allowing restoration through appropriate management and natural succession. Management practices such as weed and pest control, inter-seeding, artificial disturbances that mimic natural disturbance, prescribed burning, prescribed grazing, or use access control should be used to accelerate the succession process.

Restoration methods are likely to:

- Establish an herbaceous plant community that closely resembles the native community to the extent technically and fiscally practical.
- In most cases, establish desired herbaceous plant communities within four years by utilizing management methods that will speed the natural succession process.
- Use management methods that mimic natural disturbances in order to maintain the desired plant community for the long-term.

3. Species

Plant species and their distribution and abundance should mimic the natural plant community as closely as possible.

When developing a seed mixture for a given ecological site, refer to the electronic Field Office Technical Guide (eFOTG), Section II, Ecological Site Descriptions (ESDs), for estimates of native plant composition. Species may be selected based on technically authoritative sources such as research findings, historic records from natural history writings, and/or native species found on adjacent sites that have been maintained as historic prairies. It is preferable to utilize native seed from similar/local sites if possible and if the material is commercially available.

4. Prairie Habitat Types

Geographic area and minimum species composition for establishment of prairie habitat types are as follows:

- **Tallgrass prairie:** Tallgrass prairies will be planted to a minimum of five native grass species and ten native forb/legume species. Seeding rates and mixtures are shown in Table S-2. *Geographic area:* Jewell, Mitchell, Lincoln, Ellsworth, Rice, Reno, Kingman, Barber, and all counties to the east thereof in Kansas.
- **Mixed grass prairie:** Mixed grass prairies will be planted to a minimum of five native grass species and a mixture of ten native forbs and/or legumes equaling 1.0 Pure Live Seed (PLS) pound per acre. Seeding rates and mixtures are shown in Table S-2a. *Geographic area:* Norton, Phillips, Smith, Graham, Rooks, Osborne, Trego, Ellis, Russell, Ness, Rush, Barton, Hodgeman, and Pawnee counties in Kansas.

- **Sand prairie:** Sand prairies will be planted to a minimum of five native grass species and five forb/legume species. One percent of the acreage will be planted to sand plum. Seeding rates and mixtures are shown in Table S-3. *Geographic area:* Barton, Edwards, Harvey, Kiowa, Kingman, Pawnee, Pratt, Reno, Rice, and Stafford counties in Kansas applied on the following ecological sites: Choppy Sands, Sands, Sandy, Sandy Lowland, Sandy Terrace, and sub-irrigated with a sandy surface texture.
- **Shortgrass prairie:** Shortgrass prairies will be planted to a minimum of five native grass species and four native forb/legume species. Seeding rates and mixtures are shown in Table S-4. *Geographic area:* Cheyenne, Decatur, Finney, Gove, Grant, Gray, Greeley, Hamilton, Haskell, Kearny, Lane, Logan, Meade, Morton, Rawlins, Scott, Seward, Sherman, Sheridan, Stanton, Stevens, Thomas, Wallace, and Wichita counties. This area is within Major Land Resource Area (MLRA) 72 and includes the predominant soil series of Campus, Colby, Elkader, Keith, Kuma, Mansic, Mansker, Richfield, and Ulysses.
- **Sandsage prairie:** Sandsage prairies will be planted to a minimum of five native grass species, four forb/legume species, and 0.10 PLS pound per acre sandsage. Seeding rates and mixtures are shown in Table S-5. *Geographic area:* Clark, Comanche, Edwards, Finney, Ford, Gray, Grant, Hamilton, Haskell, Kearny, Kiowa, Lane, Meade, Morton, Scott, Seward, Stanton, and Stevens counties in Kansas on the following ecological sites: Choppy Sands, Sands, Sandy, Sandy Lowland, Sandy Terrace, and sub-irrigated range sites with sandy surface texture.

5. Seeding

- **Methods:** Refer to Conservation Practice Standard 550, Range Planting, for cover crop, seedbed preparation, planting rates, depth of planting, seeding dates, seed origin, and other planting requirements. When possible and commercially available, native ecotypes should be utilized in place of certified varieties. Forb/legume species must be adapted to the site. Use eFOTG, Section II, ESDs, as a reference to determine forb/legume species adaptability.

No-till drills utilized for planting native grasses and forbs should include depth bands (½-inch), or other depth control mechanism, notched coulters ahead of double-disk openers, packer wheels, seedbox with auger-like agitator, and oversized seed tubes to accommodate fluffy grass seed, and a separate seedbox for forb and small grass seed. Standard grass drills have the same requirements, except notched coulters are not necessary. Ideal depth for planting native forbs is slightly less than that for native grasses, and care must be taken not to plant native forb seed too deep; however, seed-soil contact is very important.

- **Fertility:** Refer to Conservation Practice Standard 550, Range Planting, for lime and fertilizer requirements for native grass species.

Most native legumes are pH sensitive. If the pH is highly acidic (below 5.0), lime should be applied according to a current soil test recommendation. When soil phosphorus test levels are low (below 15 ppm Bray P-1 and below 10 ppm Sodium Bicarbonate) apply approximately 10 lbs P₂O₅/ac when placed with seed and 20 lbs/ac when broadcast. Soil samples for phosphorus should be taken to a depth of 3 inches, and soil samples for pH should be taken to a depth of 8 inches. If the site is naturally low or high in pH, select native species adapted to these conditions.

- **Weed Control:** Noxious weeds will be controlled by spot treatment, spraying with labeled herbicides (herbicides must not compromise the desired plant composition). A wick applicator may be used for applying a non-selective translocated herbicide. An analysis of potential weed competition will be made prior to seeding in order to recommend appropriate weed control strategy.

All chemicals used must be registered, handled, and applied in accordance with product label directions. For application guidelines refer to eFOTG, Section I, Chemical Weed Control for Field Crops, Pastures, Rangeland, and Non-cropland; the Kansas State University (KSU) Agricultural Experiment Station; and the Cooperative Extension Service.

Weedy grasses such as foxtail, barnyard grass, sandbur, annual bromes, crabgrass, or other annual grasses should not be mowed or shredded unless severe shading occurs. Shredding may cause these annual grasses to stool out causing more competition to seeded grasses. When necessary,

mowing or shredding must be completed such that more leaves are cut from weedy grasses than from seeded grasses and discontinued in late July to early August. Pre-emergent herbicides may be appropriate for some warm season grass and forb seedings (refer to the product label).

6. Operation and Maintenance

During the seeding year, it may be difficult to determine whether a prairie restoration is successful. When the seeding has more than 0.25 seeded plants per square foot, it can be considered successful. It may take two to four years before the seeding is fully successful.

All native herbaceous plant communities in Kansas evolved under the influence of two basic disturbance processes: fire and herbivory.

Grazing by livestock must not occur for at least two successive growing seasons or until the seeded plants are well established. Grazing must be limited and timed to achieve the desired effects on the native plant community.

Prescribed burning must be conducted and timed to achieve the desired effects on the native plant community. Refer to Conservation Practice Standard 338, Prescribed Burning.

7. Riparian Habitat Restoration

Habitat restoration can range from actively seeding and/or planting an area, to passively allowing restoration through appropriate management and natural regeneration. Refer to Conservation Practice Standard 391, Riparian Forest Buffer. To determine if the site is suited for natural regeneration as a means of establishment, refer to Kansas Forestry Technical Note KS-9 or Conservation Practice Standard 391, Riparian Forest Buffer.

8. Species

Sites to be planted or seeded to declining riparian habitat must be planted to adapted native trees and shrubs. Species must be listed in Table S-6 for Riparian Forests, and be adapted to the site according to eFOTG, Section II, Soils Data Mart, and Windbreak and Environmental Plantings Report.

Tree and shrub species that require cool, moist, and shaded conditions to establish should not be planted on cropland sites. Only native species that will establish on open cropland sites will be used. For guidance refer to Table S-6, and the eFOTG, Section II, Soils Data Mart, and Windbreak and Environmental Planting Report.

9. Riparian Habitat Types

Geographic area and minimum species composition for establishment of riparian habitat types are as follows:

Riparian forests: Frequently flooded riparian sites will be planted to a minimum of four tree species and two shrub species. Infrequently flooded riparian sites will be planted to a minimum of five tree species and two shrub species. Refer to Table S-6 for species.

Large streams and rivers: Riparian areas adjacent to large streams and rivers will be restored to native vegetation to help provide streambank stabilization, water quality benefits, landscape corridors, biodiversity, and wildlife habitat. Riparian types found in Kansas include riparian forests, riparian woodland, riparian shrub land, and riparian meadows.

10. Planting

Species composition will be based on the riparian type and shall be adjusted based on the number of species utilized and species adapted to the site according to the eFOTG, Section II, Soils Data Mart, Windbreak and Environmental Plantings Report, and species composition requirements in Table S-6. Plant storage, handling, site preparation, and planting, including direct seeding, will be done according to Kansas Forestry Technical Note KS-9. Plant-to-plant spacing will be based on requirements in Table S-6. Species of shrubs and trees shall be mixed within rows to closely resemble the native plant community to the extent technically and fiscally practical.

11. Operation and Maintenance

Weeds and vegetation threatening stand establishment will be controlled by tillage, mowing, cutting and/or spraying with labeled selective herbicides, or spot spraying with non-selective herbicides. Care must be taken so herbicides do not damage trees and shrubs. Guidelines for controlling competitive vegetation are in Kansas Forestry Technical Note KS-9.

Insects and diseases will be monitored and controlled when an infestation threatens stand survival.

Protection from damage by wildlife, including rodents, may be necessary. Individual tree protection devices (tubes or other devices), animal repellents, and/or fencing may be used.

Livestock will be excluded from tree/shrub plantings.

Replant all tree and shrub seedlings or re-seed all seeded areas where establishment has failed during the first three years after the original planting. When replanting is necessary, planting will be made with the same native species, unless that species was found to be poorly adapted. If there are still significant void areas after the first two years, hand planting will be completed as necessary to fill void areas.

Long-term maintenance shall include periodic checks of the planting. Pruning and removal of broken branches and other maintenance will be completed as necessary.

12. Low Maintenance Native Grass and Forb Seedings for Riparian Forests, Woodlands, or Shrub Lands

Low maintenance native grass seedings shall be used between tree rows when needed to control erosion until desired forest, woodland, or shrub land cover is established. Seedings shall be made before or concurrent with tree plantings. All mixtures must include native grass species. An additional 1.0 PLS/ac of non-competitive native forbs may be added to all grass mixtures. .

Native grass species selected will be non-competitive with trees, will address soil erosion, are adapted to the site, and adapted to mowing or other management. Refer to Kansas Forestry Technical Note KS-9 for information pertaining to native grass cover. An example mixture follows:

Low Maintenance Mixture

Species/Mix	PLS lbs/acre
Canada wildrye	6.0
Little bluestem	0.6
Sideoats grama	1.5
Buffalograss	0.5
Showy partridgepea	0.9
Illinois bundleflower	0.1

13. References

Stubbendieck, James et al. 1992. *North American Range Plants*, 4th. ed. Lincoln, NE: University of Nebraska Press.

Stephens, H.A. 1973. *Woody Plants of the North Central Plains*, 1st. ed. Lawrence, KS: The University Press of Kansas.

Hightshoe, Gary L. 1988. *Native Trees, Shrubs, and Vines for Urban and Rural America*, 1st. ed. New York, NY: Van Nostrand Reinhold.

United States Department of Agriculture. 1990. *Silvics of North America Volume 2, Hardwoods*. Forest Service, U.S. Department of Agriculture Handbook 654, 887 pp., illus.

Table S-2. Tallgrass Prairie (Seeding Rates and Mixtures)

Species (minimum of five grass species, grass species mix must total 100%, plus 1 PLS pound of forb/legume mix)	PLS Pounds Per Acre	% of Grass Mixture
Big bluestem	6.0	15-35
Little bluestem	4.0	15-30
Indiangrass	6.0	10-25
Switchgrass	3.0	5-20
Sideoats grama	6.0	0-20
Blue grama	2.0	0-15
Buffalograss	5.0	0-10
Western wheatgrass	10.0	0-15
Forb/legume species (minimum of ten from the list below) *	1.0	Add 1 PLS pound/acre

*Forb species selected must be adapted to the site. Refer to the eFOTG, Section II, ESDs, for additional guidance for species selection.

Commercially Available Native Forbs

Arkansas rose (<i>Rosa arkansan</i>)	Missouri primrose (<i>Oenothera missouriensis</i>)
Blackeyed Susan (<i>Rudbeckia hirta</i>)	New England aster (<i>Aster novae angliae</i>)
Blanketflower (<i>Gaillardia aristata</i>)	Pale purple coneflower (<i>Echinacea pallida</i>)
Butterfly milkweed (<i>Asclepias tuberosa</i>)	Pitcher sage (<i>Salvia azurea</i>)
Canada milkvetch (<i>Astragalus canadensis</i>)	Plains coreopsis (<i>Coreopsis tinctoria</i>)
Clasping coneflower (<i>Rudbeckia amplexicaulis</i>)	Prairie aster (<i>Aster patens</i>)
Cudweed sagewort (<i>Artemisia ludoviciana</i>)	Purple coneflower/Blacksampson (<i>Echinacea angustifolia</i>)
Dotted gayfeather (<i>Liatris punctata</i>)	Purple coneflower (<i>Echinacea purpurea</i>)
Englemann's daisy (<i>Engelmannia pinnatifida</i>)	Purple prairieclover (<i>Dalea purpurea</i>)
False sunflower/Smooth oxeye (<i>Heliopsis helianthoides</i>)	Roundhead lespedeza (<i>Lespedeza capitata</i>)
Fringed sagewort (<i>Artemisia frigida</i>)	Scarlet globemallow (<i>Sphaeralcea coccinea</i>)
Grayhead coneflower (<i>Ratibida pinnata</i>)	Shell leaf penstemon/large beardtongue (<i>Penstemon grandiflorus</i>)
Hairy goldaster (<i>Chrysopsis villosa</i>)	Showy partridgepea (<i>Cassia chamaecrista</i>)
Illinois bundleflower (<i>Desmanthus illinoensis</i>)	Stiff goldenrod (<i>Solidago rigida</i>)
Indian blanket (<i>Gaillardia pulchella</i>)	Stiff sunflower (<i>Helianthus rigidus</i>)
Lance-leaf coreopsis (<i>Coreopsis lanceolata</i>)	Swamp milkweed (<i>Asclepias incarnata</i>)
Leadplant (<i>Amorpha canescens</i>)	Thickspike gayfeather (<i>Liatris pycnostachya</i>)
Maximilian sunflower (<i>Helianthus maximiliani</i>)	Upright coneflower (<i>Ratibida columnifera</i>)
Missouri goldenrod (<i>Solidago missouriensis</i>)	White aster (<i>Aster ericoides</i>)
	White prairieclover (<i>Petalostemum</i> or <i>Dalea candidum</i>)
	Wild bergamot (<i>Monarda fistulosa</i>)

Table S-2a. Mixed Grass Prairie (Seeding Rates and Mixtures)

Species (minimum of five grass species, grass species mix must total 100%, plus 1 PLS pound of forb/legume mix)	PLS Pounds Per Acre	% of Grass Mixture
Big bluestem	6.0	20-30
Little bluestem	4.0	10-20
Indiangrass	6.0	0-10
Switchgrass	3.0	10-20
Sideoats grama	6.0	0-20
Blue grama	2.0	10-20
Buffalograss	5.0	0-10
Western wheatgrass	10.0	10-15
Forb/legume species (minimum of ten from the list below) *	1.0	Add 1 PLS pound/acre

*Forb species selected must be adapted to the site. Refer to the eFOTG, Section II, ESDs, for additional guidance on species selection.

Commercially Available Native Forbs

Arkansas rose (<i>Rosa arkansan</i>)	Missouri goldenrod (<i>Solidago missouriensis</i>)
Blackeyed Susan (<i>Rudbeckia hirta</i>)	Pitcher sage (<i>Salvia azurea</i>)
Blanketflower (<i>Gaillardia aristata</i>)	Plains coreopsis (<i>Coreopsis tinctoria</i>)
Butterfly milkweed (<i>Asclepias tuberosa</i>)	Purple coneflower/Blacksampson (<i>Echinacea angustifolia</i>)
Clasping coneflower (<i>Rudbeckia amplexicaulis</i>)	Purple prairieclover (<i>Dalea purpurea</i>)
Cudweed sagewort (<i>Artemisia ludoviciana</i>)	Roundhead lespedeza (<i>Lespedeza capitata</i>)
Dotted gayfeather (<i>Liatris punctata</i>)	Scarlet globemallow (<i>Sphaeralcea coccinea</i>)
Englemann's daisy (<i>Engelmannia pinnatifida</i>)	Shell leaf penstemon/large beardtongue (<i>Penstemon grandiflorus</i>)
False sunflower/Smooth oxeye (<i>Heliopsis helianthoides</i>)	Showy partridgepea (<i>Cassia chamaecrista</i>)
Fringed sagewort (<i>Artemisia frigida</i>)	Stiff goldenrod (<i>Solidago rigida</i>)
Grayhead coneflower (<i>Ratibida pinnata</i>)	Stiff sunflower (<i>Helianthus rigidus</i>)
Hairy goldaster (<i>Chrysopsis villosa</i>)	Swamp milkweed (<i>Asclepias incarnata</i>)
Illinois bundleflower (<i>Desmanthus illinoensis</i>)	Upright coneflower (<i>Ratibida columnifera</i>)
Indian blanket (<i>Gaillardia pulchella</i>)	White aster (<i>Aster ericoides</i>)
Leadplant (<i>Amorpha canescens</i>)	White prairieclover (<i>Petalostemum</i> or <i>Dalea candidum</i>)
Maximilian sunflower (<i>Helianthus maximiliani</i>)	

Table S-3. Sand Prairie (Seeding Rates and Mixtures)

Species (minimum of five grass species, grass species mix must total 100%, plus 1 PLS pound of forb/legume mix)	PLS Pounds Per Acre	% of Grass Mixture
Big bluestem or Sand bluestem	6.0	10-20
Little bluestem	4.0	10-20
Indiangrass	6.0	10-20
Switchgrass	3.0	10-20
Sand lovegrass	2.0	0-20
Sideoats grama	6.0	0-10
Blue grama	2.0	0-15
Prairie sandreed	4.0	0-10
Giant sandreed	4.0	0-10
Forb/legume species (minimum of five from the list below) *	1.0	Add 1 PLS pound/acre
Shrubs (i.e., sandplum, golden currant)	1% of acreage	1% of area to be seeded

*Forb species selected must be adapted to the site. Refer to the eFOTG, Section II, ESDs, for additional guidance on species selection.

Commercially Available Native Forbs

Catsclaw sensitivebriar (*Schrankia nuttallii*)
 Compassplant (*Silphium laciniatum*)
 Dotted gayfeather (*Liatris punctata*)
 Illinois bundleflower (*Desmanthus illinoensis*)
 Manyflower scurpea (*Psoralea tenuiflora*
var. floribunda)
 Maximilian sunflower (*Helianthus*
maximiliannii)
 Pale purple coneflower (*Echinacea pallida*)
 Pitcher sage (*Salvia azurea*)

Prairie sunflower (*Helianthus petiolaris*)
 Purple coneflower (*Echinacea angustifolia*)
 Purple prairieclover (*Dalea purpurea*)
 Roundhead lespedeza (*Lespedeza capitata*)
 Showy partridgepea (*Cassia chamaecrista*)
 Silktop dalea (*Dalea aurea*)
 Slimflower scurfpea (*Psoralea tenuiflora*)
 Texas croton (*Croton texensis*)
 Upright coneflower (*Ratibida columnifera*)
 Virginia tephrosia (*Tephrosia virginiana*)

Table S-4. Shortgrass Prairie (Seeding Rates and Mixtures)

Species (minimum of five grass species, grass species mix must total 100%, plus 1 PLS pound of forb/legume mix)	PLS Pounds Per Acre	% of Grass Mixture
Blue grama	2.0	30% required
Buffalograss	5.0	15% required
Switchgrass	3.0	10-20
Little bluestem	4.0	0-20
Big bluestem	6.0	0-15
Sideoats grama	6.0	10-30
Western wheatgrass	10.0	0-15
Forb/legume species (minimum of four from the list below) *	1.0	Add 1 PLS pound/acre

*Forb species selected must be adapted to the site. Refer to eFOTG, Section II, ESDs for additional guidance on species selection.

Commercially Available Native Forbs

Blacksampson (*Echinacea angustifolia*)
 Dotted gayfeather (*Liatris punctata*)
 Englemann's daisy (*Engelmannia pinnatifida*)
 Illinois bundleflower (*Desmanthus illinoensis*)
 Leadplant (*Amorpha canescens*)

Maximilian sunflower (*Helianthus maximilian*)
 Purple prairieclover (*Dalea purpurea*)
 Pitcher sage (*Salvia azurea*)
 Upright coneflower (*Ratibida columnifera*)

Table S-5. Sandsage Prairie (Seeding Rates and Mixtures)

Species (minimum of five grass species, grass species mix must total 100%, plus 1 PLS pound of forb/legume mix)	PLS Pounds Per Acre	% of Grass Mixture
Big bluestem or Sand bluestem	6.0	10-20
Little bluestem	4.0	10-20
Indiangrass	6.0	10-20
Switchgrass	3.0	10-20
Sand lovegrass	2.0	0-20
Sideoats grama	6.0	0-10
Blue grama	2.0	0-15
Prairie sandreed	4.0	0-10
Giant sandreed	4.0	0-10
Forb species (minimum of four from the list below) *	1.0	Add 1 PLS pound/acre
Sand sagebrush	0.10	0.10 PLS pound/acre

*Forb species selected must be adapted to the site. Refer the eFOTG, Section II, ESDs, for additional guidance on species selection.

Commercially Available Native Forbs

Dotted gayfeather (*Liatrix punctata*)
 Englemann's daisy (*Engelmannia pinnatifida*)
 Illinois bundleflower (*Desmanthus illioensis*)
 Indian blanket (*Gaillardia pulchella*)
 Maximillian sunflower (*Helianthus maximilian*)

Pitcher sage (*Salvia azurea*)
 Purple prairieclover (*Dalea purpurea*)
 Showy partridgepea (*Cassia chamaecrista*)
 Upright coneflower (*Ratibida columnifera*)

Table S-6. Riparian Forest, Woodland, or Shrub Land Species Mixture *

Species	Minimum Stand Composition in %	Plant Spacing Feet (ft.)
INFREQUENTLY FLOODED SITES		
TREES		10-20 ft
American elm (<i>Ulmus americana</i>)	0-10	
Basswood, American linden (<i>Tilia americana</i>)	0-10	
Black walnut (<i>Juglans nigra</i>)	0-30	
Boxelder (<i>Acer negundo</i>)	0-10	
Bur oak (<i>Quercus macrocarpa</i>)	10-30	
Green ash (<i>Fraxinus pennsylvanica</i>)	10-20	
Hackberry (<i>Celtis occidentalis</i>)	5-10	
Kentucky coffeetree (<i>Gymnocladus dioica</i>)	0-10	
Red elm (<i>Ulmus rubra</i>)	0-10	
Red oak (<i>Quercus rubra</i>)	0-10	
Silver maple (<i>Acer saccharinum</i>)	0-10	
SHRUBS		4-8 ft
Buttonbush (<i>Cephalanthus occidentalis</i>)	0-5	
Wild gooseberry (<i>Ribes missouriensis</i>)	5-10	
American hazelnut (<i>Corylus americana</i>)	0-5	
Rough-leaved dogwood (<i>Cornus drummondii</i>)	0-10	
Golden currant (<i>Ribes odoratum</i>)	0-10	
Wild plum (<i>Prunus americana</i>)	5-10	
Choke cherry (<i>Prunus virginiana</i>)	0-10	
Aromatic sumac (<i>Rhus aromatica</i>)	5-10	
FREQUENTLY FLOODED SITES		
TREES		10-20 ft
Black willow (<i>Salix nigra</i>) or Peach-leaf willow (<i>Salix amygdaloides</i>)	0-20	
Boxelder (<i>Acer negundo</i>)	0-15	
Cottonwood (<i>Populus deltoides</i>)	10-30	
Green ash (<i>Fraxinus pennsylvanica</i>)	10-30	
Silver maple (<i>Acer saccharinum</i>)	5-15	

*Refer to the eFOTG, Section II, Soils Data Mart, and Windbreak and Environmental Plantings Report for guidance on species adaptability to soils and additional species that are not listed above.