NATURAL RESOURCES CONSERVATION SERVICE

RESTORATION AND MANAGEMENT OF RARE OR DECLING HABITATS

PRAIRIE DESIGN PROCEDURES

(643DPa)

Restoration and Management of Rare or Declining Habitats shall be planned and applied in accordance with the 643 standard detailed in Section IV of the Field Office Technical Guide (FOTG). This document describes the definition, purpose, and conditions where Restoration and Management of Rare or Declining Habitats applies, as well as criteria, considerations, and operation and maintenance for developing site-specific plans for this practice.

1. **Refer to *Herbaceous Vegetation Design Procedures (550 DP)***
   Located at FOTG, Section IV, A. Conservation Practices, Range Planting (550) for guidance on installing this practice which covers the following subject:

SUBJECT	SECTION
• Grass Seeding Specifications	1
• Soil Fertility and pH (at seeding time)	2
• Existing Cover Conditions	3
• Seedbed Preparation	4
• Summer Annual Cover crops	5
• Companion Crops	6
• Mulching	7
• Species/Variety Selection	8
• Seeding Dates	9
• Seed Requirements	10
• Seeding Rates	11
• Pure Live Seed Calculations	12
• Seeding Depth	13
• Seeding Equipment	14
• Drill Calibration	15
• Management & Protection During Establishment	16
• Guidelines for Stand Evaluation	17

2. **Determining the Required Extent of Restoration**
   a. Restoration is used where site conditions require that a majority of desired plant species must be seeded or planted. This typically occurs where the existing land use is cropland or where the perennial vegetation is completely dominated by undesirable and/or non-native plants and must be eradicated prior to seeding/planting appropriate species.

   b. Renovation, by contrast, is used on sites where many of the desired plant species already occur but specific techniques used will suppress the undesired and/or non-native species.

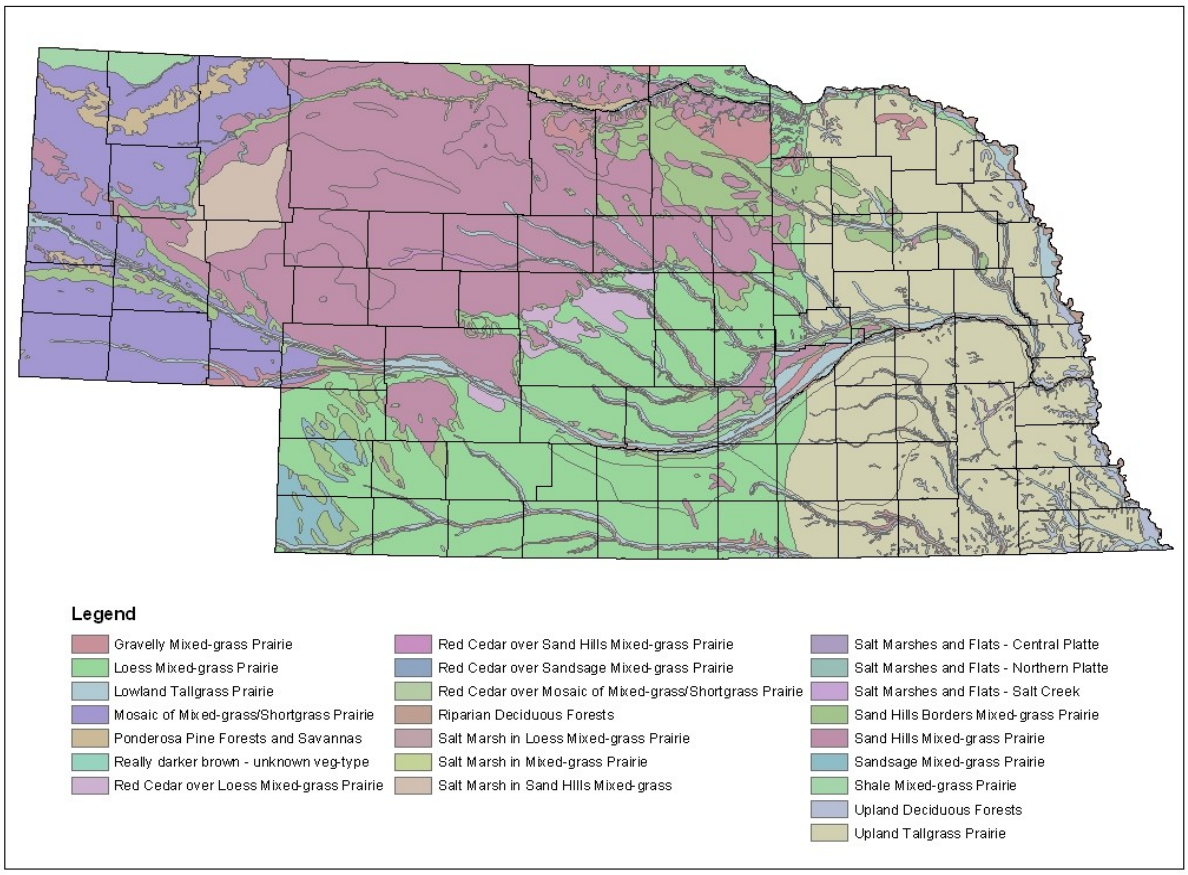
c. Management may be the only action necessary for native plant communities which are largely intact and functioning near desired levels.

3. Determining the Appropriate Plant Community

Information related to the native plant communities for Nebraska is found in the following sources:

a. The map shown in Figure 1 is a variation of Native Vegetation of Nebraska by Robert B. Kaul and Steven B. Rolfsmeier and published by University of Nebraska – Lincoln, Conservation and Survey Division (June 1993). The original source contains text descriptions of the plant community, including dominant species, within the key.

Figure 1 – Native Vegetation Map of Nebraska



b. The publication, Terrestrial Natural Communities of Nebraska – Version III, written by Gerry Steinauer and Steve Rolfsmeier (Biology Technical Note #65) contains details about the range and site (environmental description) for each natural community.

c. Intact native plant communities in close proximity (less than 10 miles) to the restoration/renovation site that have similar soils, slope, aspect, etc.

d. Historic soil surveys often contain references to plant species or vegetative communities which occupy certain soil types, range sites and condition classes.

e. Site specific information can be determined by using a combination of soil type and precipitation levels to identify major prairie types. The map of Nebraska shown in **Appendix A** (at the end of this document) was developed using Range Sites (assigned by soil type) and Vegetative Zones to approximate the locations of six major prairie types within the state.

4. Species and Variety Selection

Individual grasses, forbs, grass-like plants (i.e. sedges), and shrubs (where applicable) used to comprise the species within the mixture must be adapted to the site being restored/renovated and be representative of the historic plant community being restored. Sources of information noted below can be used to supplement data related to the appropriate composition of a seed mix.

a. Ecological Site Descriptions, found in Section II, FOTG, Tables 1-9 of the Range Planting Specification (550 S), and Table 2 of the Herbaceous Vegetation Design Procedure (550 DP) provide information on the composition of native grassland communities and relative abundance and adaptation of native grasses and forbs by Ecological Site and/or Major Land Resource Area (MLRA). Restrictions on minimum and maximum seeding rates by species may not be applicable for prairie restoration purposes due to increased species diversity requirements.

b. Terrestrial Natural Communities of Nebraska – Version III, June 30, 2003 by Gerry Steinauer and Steve Rolfsmeier (Biology Technical Note # 65) which contains a "vegetation description" for each community including abundant and noteworthy species.

c. A Guide to Prairie and Wetland Restoration in Eastern Nebraska published by Prairie Plains Resource Institute and Nebraska Game and Parks Commission (Biology Technical Note #55) which contains species listed by habitat and prairie type as well as seed collection period.

d. The Flora of Nebraska by Robert B. Kaul, David Sutherland, and Steven Rolfsmeier and published by School of Natural Resources, University of Nebraska – Lincoln in 2006 which contains a distribution map of plant species by county.

5. Seeding Rates

a. Seeding Rates for the Purpose of Prairie Restoration (Standard Option)

- This option is to be used for most prairie restorations and is intended to provide a balanced ratio of grasses and forbs to allow species diversity to be maintained.
- The minimum seeding rate is 20 PLS/sq. ft. total of all species (grasses and forbs).
- Native forbs will comprise a minimum of 25% of the seeding. For example, 15 PLS/Ft^2 of grass and 5 PLS/Ft^2 of forbs would be an acceptable ratio.
- When using a range interseeder for renovations, use a minimum total of 10 PLS/sq ft. See Range Planting Specification (550 S) for additional information.

b. Seeding Rates for Prairie Restoration with a Wildlife Habitat Objective (Wildlife Option)

- This option is to be used for prairie restorations where early successional habitat for wildlife is an objective. Rate of establishment will be reduced and increased levels of bare ground and forbs composition will be persist to benefit select wildlife.
- The minimum seeding rate is 10 PLS/sq. ft. total of all species (grasses and forbs) and grasses must comprise a minimum of 5 PLS/sq. ft. in the mix.
- Native forbs will comprise a minimum of 33% of the seeding and cannot exceed 66% of the seeding. For example, 5 PLS/Ft^2 of grass and 5 PLS/Ft^2 of forbs is a suitable ratio.

c. Seeding Rates for Prairie Restoration with a Grazing Objective (Range Planting Option)

- This option is to be used for prairie restorations where forage for livestock grazing is an objective. Rate of establishment and forage quality will be similar to other range plantings but with a higher forbs composition and greater species diversity.
- The minimum seeding rate is 20 PLS/sq. ft. for all grasses.
- Native forbs will be added in addition to the grasses and will comprise a minimum of 20% of the seeding. For example, 20 PLS/Ft^2 of grass and 5 PLS/Ft^2 of forbs is a suitable ratio.

6. Species Diversity Requirements

a. All prairie restorations and renovations must provide a minimum of 20 species of grasses and forbs (as well as shrubs, such as sand sagebrush, where applicable based on the targeted plant community). The mixture will be comprised of a minimum of 8 grasses and 7 forbs or shrubs with additional species of any type added to reach 20 species. Species diversity must occur throughout the site.

- Exceptions to the 20 species minimum only apply to the plant communities listed below. For these areas, the minimum species diversity is 15 species made up of a mixture of a minimum of 7 grasses and 5 forbs/shrubs with additional species of any type added to reach 15 species. Species diversity must occur throughout the site.

1. Mosaic of Mixed-grass and Shortgrass Prairie
2. Sandsage Mixed-grass Prairie
3. Other localized prairie types found in Vegetative Zone 1 in western Nebraska

b. Any restoration seeding mixture designed to be "high diversity" must exceed 50 total species of suitable grasses, forbs, and/or shrubs.

7. Seeding Equipment

a. Basic guidance is located within Section 14 of the Herbaceous Vegetation Design Procedure (550 DP). Broadcast seeding is only recommended for local ecotype seedings where seed was harvested or collected from native prairie sites and the mix cannot be properly seeded with a drill due to excess inert matter. All of the following requirements must be met for broadcast seedings:

- Seed quality requirements as listed in eFOTG, Section II, Pasture and Hayland Interpretations must be met. (i.e. testing for purity/germination)
- Seeding rate (described above) is increased by a minimum of 50%.
- Substantial bare ground (> 50%) exists to allow seed to soil contact.
- Seed application is followed by either multiple freeze-thaw and/or snowfall events OR a light harrow or roller packer operation to incorporate the seed.
- Site is not prone to excessive erosion by wind or water prior to establishment.

8. Plans and Specifications

a. Use NE-CPA-8 Job Sheet for Grass Seedings to document practice designs, certification, and other requirements as noted in Herbaceous Vegetation Design Procedures, (550 DP).

b. Renovations are often complex and variable due to multiple factors impacting the current condition and the numerous techniques which may be used to enhance the site. Consultation with an experienced resource professional is necessary to develop the renovation plan.

9. Management and Protection During Establishment

a. Weed control methods must be selective to avoid impacts to desired plants. Forbs, both seeded and non-noxious, volunteer weeds, are an important component of the prairie restoration and provide habitat values that are beneficial to many wildlife species. Spot treatment of target weeds is necessary to preserve the integrity of the prairie restoration.

b. Prescribed burns and light grazing events for a short duration (less than 2 weeks) may be incorporated after one full growing season is completed in order to manipulate cover levels and species diversity within the stand.

10. Established Stand Management

a. Management activities should be intended to maintain or improve species diversity, prevent establishment or spread of non-native plants, set back or accelerate succession to influence the grass to forbs ratio within the stand, and periodically remove excessive litter to increase plant vigor.

b. Management practices that mimic natural disturbances (grazing, burning, and rest) are preferred. It is beneficial to incorporate these practices into ongoing management and of prairie habitats. The "patch

burn-graze" technique is a possible method to use them in combination. Refer to Prescribed Grazing (528) and Prescribed Burning (338) for additional information.

c. Other techniques may also be necessary to meet the objectives of the restoration/renovation (i.e. herbicide treatments). Haying or mowing is an acceptable practice when used periodically and in combination with other techniques. Timing of haying operations should be altered from year to year. The primary nesting period (May 1 to July 15) should be avoided unless the timing is critical to the success of a management activity designed to maintain the native plant community.

11. Support References

Herbaceous Vegetation Design Procedures (550 DP)

Range Planting (550S) Specification

Grass Seedings Job Sheet, NE-CPA-8

Seed Mix Calculator

Ecological Site Descriptions can be located at (eFOTG Section II, A. Statewide Soil and Site Information; 1. Rangeland, Grazed Forestland, Native Pastureland Interpretations)

EXAMPLES 1 – 6: PRAIRE RESTORATION SEED MIXTURES

These prairie restoration seed mixtures are provided as **examples** for the Standard Option and the Wildlife Option. Adaptation of these examples is encouraged and will often be necessary to accommodate considerations such as site conditions, project objectives, cost restrictions, and seed availability.

Each of the six major prairie types in Nebraska is addressed below:

1) Loess Mixed-grass Prairie
2) Upland Tallgrass Prairie
3) Lowland Tallgrass Prairie
4) Sandhills Mixed-grass Prairie
5) Sand Sage Mixed-grass Prairie
6) Mosaic of Mixed-grass and Shortgrass Prairie

Example 1 **LOESS MIXED-GRASS PRAIRIE**	***Standard Option***		***Wildlife Option***	
Grass Species	**#PLS**	**% of Grass**	**#PLS**	**% of Grass**
Big bluestem	**0.70**	17.6	**0.25**	18.7
Blue grama	**0.10**	10.8	**0.05**	16.1
Indiangrass	**0.30**	8.0	**0.10**	7.9
Little bluestem	**0.80**	27.4	**0.20**	20.4
Prairie Junegrass	**0.01**	3.5	**0.01**	10.5
Sideoats grama	**0.50**	14.6	**0.15**	13.0
Switchgrass	**0.05**	3.0	**0.02**	3.5
Western wheatgrass	**0.90**	15.1	**0.20**	9.9
Forb Species	**#PLS**	**% of Forbs**	**#PLS**	**% of Forbs**
Blackeyed Susan	**0.01**	6.6	**0.01**	6.6
Blanketflower	**0.02**	1.4	**0.02**	1.4
Cudweed sagewort	**0.005**	10.2	**0.005**	10.2
Dotted gayfeather	**0.05**	3.2	**0.05**	3.2
False boneset	**0.03**	7.0	**0.03**	7.0
Fringed sagewort	**0.005**	9.1	**0.005**	9.1
Hoary vervain	**0.01**	2.4	**0.01**	2.4
Leadplant	**0.15**	8.4	**0.15**	8.4
Maximilian sunflower	**0.02**	1.4	**0.02**	1.4
Purple prairieclover	**0.05**	6.3	**0.05**	6.3
Roundhead lespedeza	**0.05**	3.4	**0.05**	3.4
Showy partridgepea	**0.10**	2.3	**0.10**	2.3
Stiff goldenrod	**0.01**	5.9	**0.01**	5.9
Upright coneflower	**0.02**	6.7	**0.02**	6.7
Western yarrow	**0.01**	10.5	**0.01**	10.5
White or Heath aster	**0.01**	10.0	**0.01**	10.0
White prairieclover	**0.03**	5.2	**0.03**	5.2

Example 2 **UPLAND TALLGRASS PRAIRIE**	***Standard Option***		***Wildlife Option***	
Grass Species	**#PLS**	**% of Grass**	**#PLS**	**% of Grass**
Big bluestem	**0.70**	17.4	**0.25**	18.6
Canada wildrye	**0.50**	8.7	**0.20**	10.4
Indiangrass	**0.40**	10.6	**0.15**	11.9
Little bluestem	**0.70**	23.8	**0.20**	20.4
Prairie Junegrass	**0.03**	10.5	**0.01**	10.5
Sideoats grama	**0.40**	11.5	**0.15**	13.0
Switchgrass	**0.10**	5.9	**0.03**	5.3
Western wheatgrass	**0.70**	11.6	**0.20**	9.9
Forb Species	**#PLS**	**% of Forbs**	**#PLS**	**% of Forbs**
Blackeyed Susan	**0.01**	6.6	**0.01**	6.6
Black Sampson	**0.05**	2.6	**0.05**	2.6
Canada milkvetch	**0.05**	5.9	**0.05**	5.9
Compass plant	**0.10**	0.5	**0.10**	0.5
Cudweed sagewort	**0.005**	10.3	**0.005**	10.3
Dotted gayfeather	**0.02**	1.3	**0.02**	1.3
False sunflower	**0.10**	2.7	**0.10**	2.7
Illinois bundleflower	**0.20**	5.5	**0.20**	5.5
Leadplant	**0.09**	5.1	**0.09**	5.1
Maximilian sunflower	**0.07**	4.8	**0.07**	4.8
Purple prairieclover	**0.08**	10.1	**0.08**	10.1
Rough gayfeather	**0.05**	5.0	**0.05**	5.0
Roundhead lespedeza	**0.05**	3.5	**0.05**	3.5
Showy partridgepea	**0.20**	4.6	**0.20**	4.6
Upright coneflower	**0.02**	6.8	**0.02**	6.8
Western yarrow	**0.01**	10.6	**0.01**	10.6
White prairieclover	**0.08**	14.1	**0.08**	14.1

Example 3 **LOWLAND TALLGRASS PRAIRIE**	***Standard Option***		***Wildlife Option***	
Grass Species	**#PLS**	**% of Grass**	**#PLS**	**% of Grass**
Big bluestem	**1.00**	25.0	**0.30**	22.5
Canada wildrye	**0.60**	10.5	**0.20**	10.5
Indiangrass	**0.50**	13.3	**0.20**	15.9
Little bluestem	**0.40**	13.6	**0.10**	10.2
Sideoats grama	**0.20**	5.8	**0.10**	8.7
Switchgrass	**0.20**	11.8	**0.06**	10.6
Virginia wildrye	**0.90**	10.0	**0.20**	6.6
Western wheatgrass	**0.60**	10.0	**0.30**	15.0
Forb Species	**#PLS**	**% of Forbs**	**#PLS**	**% of Forbs**
Blackeyed Susan	**0.01**	6.7	**0.01**	6.7
Boneset	**0.01**	11.8	**0.01**	11.8
Canada milkvetch	**0.07**	8.2	**0.07**	8.2
Canada or Showy tick-trefoil	**0.10**	4.0	**0.10**	4.0
Cup plant	**0.05**	0.5	**0.05**	0.5
Grayhead coneflower	**0.02**	5.7	**0.02**	5.7
Illinois bundleflower	**0.25**	6.9	**0.25**	6.9
Joe Pye weed	**0.01**	6.2	**0.01**	6.2
New England aster	**0.01**	6.0	**0.01**	6.0
Ohio spiderwort	**0.03**	2.0	**0.03**	2.0
Plains coreopsis	**0.01**	7.6	**0.01**	7.6
Purple prairieclover	**0.05**	6.3	**0.05**	6.3
Showy partridgepea	**0.25**	5.7	**0.25**	5.7
Swamp milkweed	**0.03**	1.0	**0.03**	1.0
Thickspike gayfeather	**0.10**	5.1	**0.10**	5.1
White prairieclover	**0.03**	5.3	**0.03**	5.3
Wild bergamot	**0.02**	11.0	**0.02**	11.0

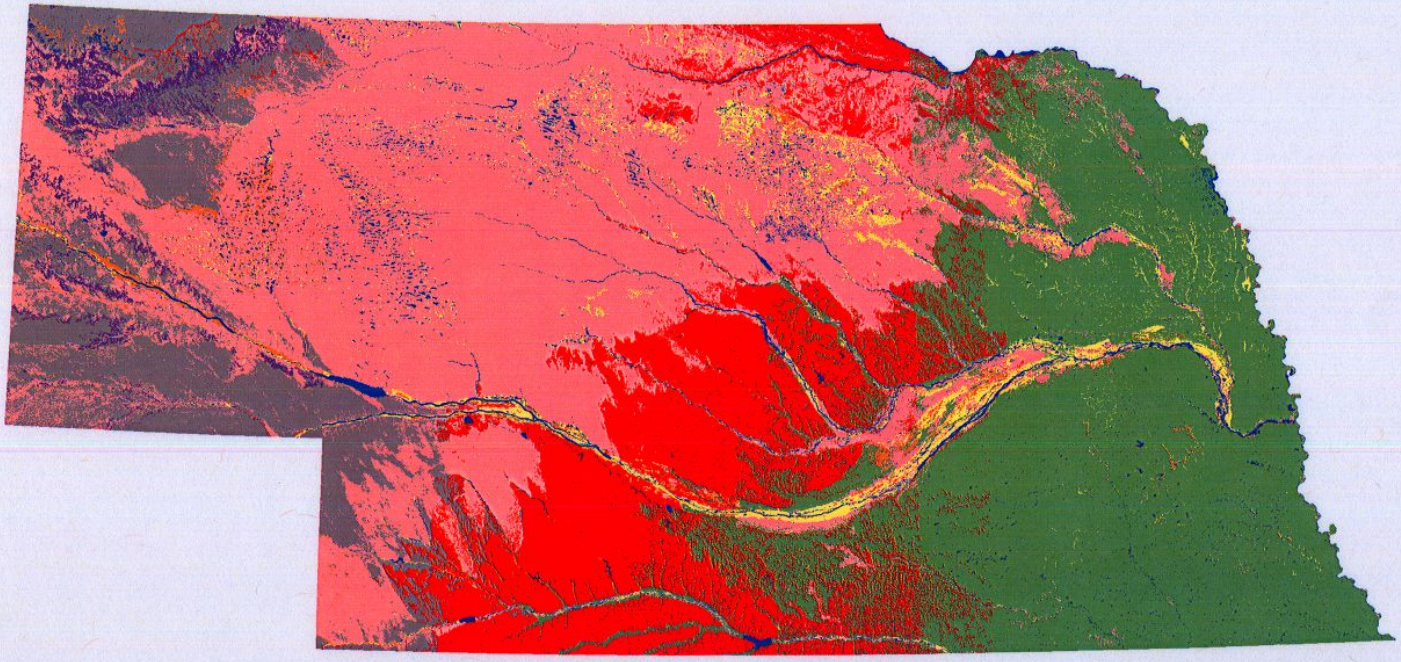
Example 4 **SANDHILLS MIXED-GRASS PRAIRIE**	***Standard Option***		***Wildlife Option***	
Grass Species	**#PLS**	**% of Grass**	**#PLS**	**% of Grass**
Blue grama	**0.10**	10.9	**0.05**	11.6
Indiangrass	**0.40**	10.7	**0.15**	8.6
Little bluestem	**0.50**	17.2	**0.20**	14.6
Needle-and-thread grass	**0.50**	8.8	**0.20**	7.5
Prairie Junegrass	**0.01**	3.5	**0.01**	7.5
Prairie sandreed	**0.40**	16.7	**0.20**	17.8
Sand bluestem	**1.00**	17.3	**0.40**	14.7
Sand lovegrass	**0.02**	4.0	**0.01**	4.2
Switchgrass	**0.10**	5.9	**0.05**	6.3
Western wheatgrass	**0.30**	5.0	**0.20**	7.2
Forb Species	**#PLS**	**% of Forbs**	**#PLS**	**% of Forbs**
Common evening primrose	**0.01**	6.5	**0.01**	6.5
Cudweed sagewort	**0.005**	10.2	**0.005**	10.2
False-boneset	**0.02**	4.6	**0.02**	4.6
Fringed sagewort	**0.005**	9.0	**0.005**	9.0
Hoary vervain	**0.03**	7.3	**0.03**	7.3
Leadplant	**0.05**	2.8	**0.05**	2.8
Plains gayfeather	**0.01**	0.6	**0.01**	0.6
Purple prairieclover	**0.07**	8.7	**0.07**	8.7
Rocky Mountain bee plant	**0.05**	1.4	**0.05**	1.4
Roundhead lespedeza	**0.02**	1.4	**0.02**	1.4
Shell-leaf penstemon	**0.05**	6.2	**0.05**	6.2
Stiff goldenrod	**0.01**	5.9	**0.01**	5.9
Upright coneflower	**0.05**	16.7	**0.05**	16.7
White or Heath aster	**0.01**	10.0	**0.01**	10.0
White prairieclover	**0.05**	8.7	**0.05**	8.7
Arkansas rose (optional)	**0.10**	-	**0.05**	-

Example 5 **SAND SAGE MIXED-GRASS PRAIRIE**	***Standard Option***		***Wildlife Option***	
Grass Species	**#PLS**	**% of Grass**	**#PLS**	**% of Grass**
Blue grama	**0.10**	10.8	**0.05**	11.5
Indiangrass	**0.30**	7.9	**0.15**	8.5
Little bluestem	**0.10**	3.4	**0.05**	3.7
Needle-and-thread grass	**0.60**	10.5	**0.30**	11.2
Prairie sandreed	**0.50**	20.7	**0.25**	22.2
Sand bluestem	**1.30**	22.3	**0.50**	18.4
Sand lovegrass	**0.03**	5.9	**0.02**	8.4
Switchgrass	**0.20**	11.8	**0.07**	8.9
Western wheatgrass	**0.40**	6.7	**0.20**	7.2
Forb/Shrub Species	**#PLS**	**% of Forbs**	**#PLS**	**% of Forbs**
Common evening primrose	**0.01**	6.0	**0.01**	6.0
Cudweed sagewort	**0.005**	9.3	**0.005**	9.3
Dotted gayfeather	**0.01**	0.6	**0.01**	0.6
Fringed sagewort	**0.005**	8.3	**0.005**	8.3
Leadplant	**0.05**	2.5	**0.05**	2.5
Purple prairieclover	**0.09**	10.3	**0.09**	10.3
Rocky Mountain bee plant	**0.10**	2.6	**0.10**	2.6
Slimleaf scurfpea	**0.01**	0.1	**0.01**	0.1
Upright coneflower	**0.05**	15.3	**0.05**	15.3
Western yarrow	**0.02**	19.1	**0.02**	19.1
Sand sagebrush	**0.02**	25.9	**0.02**	25.9

Example 6 **MOSAIC MIXED / SHORTGRASS PRAIRIE**	***Standard Option***		***Wildlife Option***	
Grass Species	**#PLS**	**% of Grass**	**#PLS**	**% of Grass**
Blue grama	**0.15**	16.2	**0.07**	16.2
Buffalograss	**0.90**	7.7	**0.50**	9.1
Green needlegrass	**0.60**	16.5	**0.20**	11.8
Little bluestem	**0.40**	13.7	**0.25**	18.4
Needle-and-thread grass	**0.20**	3.5	**0.10**	3.7
Prairie sandreed	**0.15**	6.2	**0.07**	6.3
Sideoats grama	**0.50**	14.5	**0.15**	9.4
Western wheatgrass	**1.30**	21.7	**0.70**	25.1
Forb Species	**#PLS**	**% of Forbs**	**#PLS**	**% of Forbs**
American vetch	**0.10**	1.1	**0.10**	1.1
Cudweed sagewort	**0.005**	10.3	**0.005**	10.3
Dotted gayfeather	**0.01**	0.6	**0.01**	0.6
Fringed sagewort	**0.005**	9.2	**0.005**	9.2
Purple prairieclover	**0.10**	12.6	**0.10**	12.6
Slimleaf scurfpea	**0.01**	0.1	**0.01**	0.1
Stiff goldenrod	**0.01**	6.0	**0.01**	6.0
Upright coneflower	**0.05**	16.9	**0.05**	16.9
Western yarrow	**0.02**	21.1	**0.02**	21.1
White prairieclover	**0.06**	10.6	**0.06**	10.6
Winterfat	**0.20**	11.5	**0.20**	11.5

Appendix A: Nebraska Prairie Types (Based on Range Sites)

This map was developed using Range Sites (assigned by soil type) and Vegetative Zones to approximate the locations of major prairie types within the state. This information is intended to provide generalized guidance for restoration plan development. Accuracy is dependent upon multiple factors including differences in soil map unit design from county to county and the natural gradation (rather than abrupt change) of prairie types in transition zones caused by soils and precipitation. In addition, many minor prairie types, as described within Terrestrial Natural Communities of Nebraska, are contained within the major prairie types depicted on the map.



- Mosaic of Mixed-grass & Shortgrass Prairie
- Sandhills Mixed-grass Prairie
- Sand Sage Mixed-grass Prairie
- Loess Mixed-grass Prairie
- Upland Tallgrass Prairie
- Steep Slopes/Wooded
- Water/Miscellaneous
- Saline
- Lowland Tallgrass Prairie

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NRCS Natural Resources Conservation Service