USDA Natural Resources Conservation Service

Ecological site R058DY020SD
Loamy Overflow

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General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

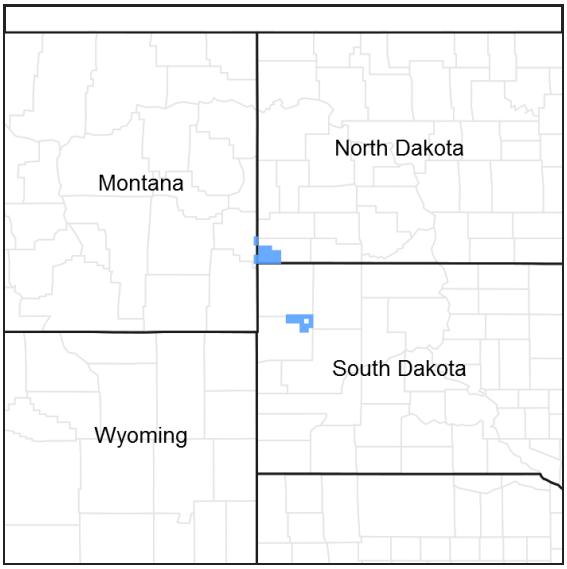


Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

MLRA notes

Major Land Resource Area (MLRA): 058D–Northern Rolling High Plains, Eastern Part

The Northern Rolling High Plains, Eastern Part (MLRA 58D) is shared between South Dakota (65 percent), Montana (21 percent), and North Dakota (14 percent). The MLRA is approximately 2,755 square miles. The small towns of Buffalo and Camp Crook, South Dakota, and Marmarth, North Dakota, are all within the boundary of this MLRA, and Baker, Montana, is on the northern most edge. Portions of the Little Missouri National Grassland and Custer National Forest are also in the MLRA. Portions of the Little Missouri River and the headwaters of major tributaries that eventually form the Grand and Moreau Rivers in South Dakota are also in this area.

The Northern Rolling High Plains, Eastern Part consists of Cretaceous marine and continental sediments of shale, siltstone, and sandstone. The continental and marine Hell Creek Formation is under approximately 85 percent of the MLRA, and the Fox Hills Sandstone forms the southern boundary of the MLRA. Tertiary deposits are in scattered areas throughout the MLRA. These deposits consist of the Paleocene Ludlow and Tongue River Formations, the Oligocene White River Group, and the Miocene Arikaree Group. These Tertiary deposits are resistant and positioned above the Cretaceous beds. Ponderosa pine growing in areas of these Tertiary formations further distinguishes these formations from the other formations in the MLRA. Pleistocene and Holocene river sand and gravel deposits are also on the valley floors and on the terraces along the larger rivers in the area. A large Quaternary eolian deposit is directly south of the town of Buffalo.

The average elevation of MLRA 58D ranges from 2,300 feet to 4,000 feet, increasing gradually from east to west. Harding Peak is the highest point at 4,019 feet. In places, flat-topped, steep-sided buttes rise sharply above the gently rolling plains below.

The dominant soil orders in this MLRA are Alfisols, Entisols, Inceptisols, and Mollisols. The soils in the area dominantly have a frigid soil temperature regime, an ustic soil moisture regime that borders on aridic, and mixed mineralogy. They are shallow to very deep, generally well drained, and loamy or clayey.

Annual precipitation is 14 to 17 inches and can fluctuate widely from year to year. Most rainfall occurs early in the growing season. Some high-intensity thunderstorms occur mid to late summer. The native vegetation in this MLRA consists primarily of grasses and forbs with a small component of trees and shrubs along streams. Ponderosa pine grow on the upper slopes and on the top of some of the higher buttes. Open grasslands are characterized by western wheatgrass, green needlegrass, blue grama, and buffalograss. Wyoming big sagebrush grows on clayey soils in the western part of the MLRA.

More than four-fifths of the MLRA is privately owned ranches running cattle, sheep, or both. Less than 5 percent of the area is federally owned. The major resource concerns are water quality, wind erosion, and water erosion (USDA, NRCS. 2006. Ag Handbook 296).

Classification relationships

USDA
Land Resource Region G—Western Great Plains Range and Irrigated Region:
Major Land Resource Area (MLRA) 58D—Northern Rolling High Plains, Eastern Part.

US Environmental Protection Agency (EPA)
Level IV Ecoregions of the Conterminous United States:
Northwestern Great Plains—43:
Forested Buttes—43d.
Sagebrush Steppe—43e.

USDA Forest Service
Ecological Subregions: Sections and Subsections of Conterminous United States:
Great Plains - Palouse Dry Steppe Province—331:
Missouri Plateau Section—331M.
Sagebrush Steppe Subsection—334Mi.

Ecological site concept

The Loamy Overflow ecological site occurs throughout MLRA 58D. It is located on Strahler Stream Orders 2 or greater. This site is a run-in site and receive additional moisture through overflow during flooding and high-water events, and to a minor extent, runoff from adjacent sites. The slopes range is from 0 to 3 percent. Soils are deep (greater than 20 inches in depth). The soil surface layer is 10 to 15 inches in depth with texture of silt loam and loam. The texture of the subsurface layer’s ranges from fine sand to silty clay loam.

The vegetation will gradually shift from almost exclusively herbaceous species in the upper reaches of a drainage to a mix of species including; grasses, forbs, shrubs and tree, in the lower reaches. Vegetation in the Reference State (1.0) consists primarily of warm- and cool-season tall and mid- grasses. Big bluestem is the dominant warm-season grass, while western wheatgrass and needlegrasses are the dominant cool-season grasses. Forbs are common and very diverse. Patches of western snowberry, American plum, chokecherry, silver sagebrush, and buffaloberry are almost always present. Trees species can exist throughout the site but are more likely to occur in the lower reaches. Major tree species include plains cottonwood, green ash, and American elm. This site is susceptible to the invasion of non-native trees, including Russian olive and saltcedar. When disturbed, this site is very susceptible to invasion of non-native cool-season grasses, Canada thistle, hound’s tongue, and other weedy forbs.

Associated sites

R058DY009SD	**Sandy** The Sandy ecological site is be found on landscaped above or upslope of the Loamy Overflow ecological site.
R058DY010SD	**Loamy** The Loamy ecological site is found on landscaped above or upslope of the Loamy Overflow ecological site.
R058DY022SD	**Loamy Terrace** The Loamy Terrace ecological site is be found adjacent to or up-slope of the Loamy Overflow ecological site.

Similar sites

R058DY022SD	**Loamy Terrace** The Loamy Terrace ecological site will have less big bluestem; and less vegetative production than the Loamy Overflow ecological site.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Andropogon gerardii* (2) *Pascopyrum smithii*

Physiographic features

The Loamy Overflow ecological site occurs on nearly level lowlands and drainageways that receive additional water from overflow of streams or runoff from adjacent slopes.

Table 2. Representative physiographic features

Landforms	(1) Flood plain (2) Stream terrace
Runoff class	Low to medium
Flooding duration	Brief (2 to 7 days)
Flooding frequency	Occasional to frequent
Ponding duration	Brief (2 to 7 days)
Ponding frequency	None
Elevation	701–1,219 m
Slope	0–3%
Water table depth	203 cm
Aspect	Aspect is not a significant factor

Climatic features

The climate in MLRA 58D is typical of the drier portions of the Northern Great Plains where sagebrush steppes to the west yield to grassland to the east. Average annual precipitation ranges from 14 to 17 inches with most falling in the early growing season. Some high intensity, convective thunderstorms occur in the summer. Precipitation in winter occurs as snow. Temperatures show a wide range between summer and winter and between daily maximums and minimums. This wide range is due to the high elevation and dry air, which permit rapid incoming and outgoing radiation. Outbreaks of cold air from Canada in winter move rapidly from northwest to southeast and account for extreme minimum temperatures. Extreme storms may occur during the winter but have the most severe effect on ranching operations during late winter and in spring.

The normal average annual temperature is about 44 °F. January is the coldest month with average temperatures ranging from about 12 °F (Marmarth, North Dakota) to about 20 °F (Baker, Montana). July is the warmest month with temperatures averaging from about 70 °F (Marmarth, North Dakota) to about 76 °F (Baker, Montana). The range of normal average monthly temperatures between the coldest and warmest months is about 55 °F. Wind speeds are estimated to average about 11 miles per hour (mph) annually, ranging from about 13 mph during the spring to about 10 mph during the summer. Daytime winds are generally stronger than nighttime winds. Strong storms may bring brief periods of high winds with gusts of more than 50 mph.

Growth of cool-season plants begins in early to mid-March, slowing or ceasing in late June. Warm-season plants begin growth about mid-May and continue to early or mid-September. Cool-season plants may green-up in September and October if adequate soil moisture is present.

Table 3. Representative climatic features

Frost-free period (characteristic range)	97-111 days
Freeze-free period (characteristic range)	121-129 days
Precipitation total (characteristic range)	381-432 mm
Frost-free period (actual range)	93-115 days
Freeze-free period (actual range)	120-132 days
Precipitation total (actual range)	356-432 mm
Frost-free period (average)	104 days
Freeze-free period (average)	125 days
Precipitation total (average)	406 mm

Climate stations used

- (1) BAKER 1 E [USC00240412], Baker, MT
- (2) LADNER 9SW [USC00394671], Camp Crook, SD
- (3) CAMP CROOK [USC00391294], Camp Crook, SD
- (4) BUFFALO ASOS [USW00094037], Buffalo, SD
- (5) BUFFALO 13 ESE [USW00094081], Reva, SD
- (6) REDIG 11 NE [USC00397062], Buffalo, SD
- (7) HOOVER [USC00393945], Newell, SD

Influencing water features

This Loamy Overflow ecological site is located adjacent to intermittent and perennial streams and receives occasional flooding.

Stream Type: B6, C6 (Rosgen System)

Soil features

Soils that represent the Loamy Overflow ecological site have silt loam and loam surface textures that are 10 to 15 inches thick. Slopes range from 0 to 3 percent. Soils are deep and formed in alluvium derived from sedimentary rock. The texture of the subsurface layer’s ranges from fine sand to silty clay loam. The soils in this site are well drained and have a slow infiltration rate. Soils are stratified and are nonrestrictive to water movement and root penetration.

This site should show no evidence of rills, wind-scoured areas, or pedestalled plants. Water flow paths are broken, irregular in appearance, or discontinuous. The soil surface is stable and intact.

Major Soil correlated to the Loamy Overflow ecological site onclude, Glendive, Havre, Korchea, and Straw.

The Havre and Korchea series are also correlated to the Loamy Terrace (R058DY022SD) ecological site when found on a stream terrace with rare or no flooding.

These soils are susceptible mainly to water erosion typically as a result of flooding events. Erosion may occur with a loss of vegetative cover. Loss of 50 percent or more of the surface layer of the soils on this site can result in a shift in species composition and production.

More information can be found in the various soil survey reports. Contact the local USDA Service Center for soil survey reports that include more detail specific to your area of interest, or use the internet to access USDA's Web Soil Survey.

Table 4. Representative soil features

Parent material	(1) Alluvium–sandstone and siltstone
Surface texture	(1) Silt loam (2) Loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Slow
Soil depth	203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0–15%
Available water capacity (0-101.6cm)	17.78 cm
Calcium carbonate equivalent (0-101.6cm)	0–15%
Electrical conductivity (0-101.6cm)	0–4 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–2
Soil reaction (1:1 water) (0-101.6cm)	6.1–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–5%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

The Loamy Overflow ecological site developed under the Northern Great Plains climatic conditions; light to severe grazing by bison and other large herbivores; sporadic, natural or human-caused wildfire (often of light intensities); occasional flooding; and other biotic and abiotic factors that typically influence soil and site development. Changes occur in the plant communities due to short-term weather variations, effects of native and exotic plant and animal species, and management actions. Although the following plant community descriptions are typical of the transitions between communities, severe disturbances, such as periods of well below average precipitation and the introduction of non-native cool-season grasses, can cause significant shifts in plant communities and species composition.

Downcutting of the drainageway or stream channel will eventually leave the overflow site on a higher and drier landscape position. In this case the site will be described as the Loamy Terrace ecological site (R058DY022SD).

Continuous season-long grazing (during the typical growing season of May through October) or repeated seasonal grazing (e.g., every spring, every summer) without adequate recovery periods following each grazing occurrence causes this site to depart from the Big Bluestem-Western Wheatgrass-Needlegrass/Shrubs/Scattered Trees Plant

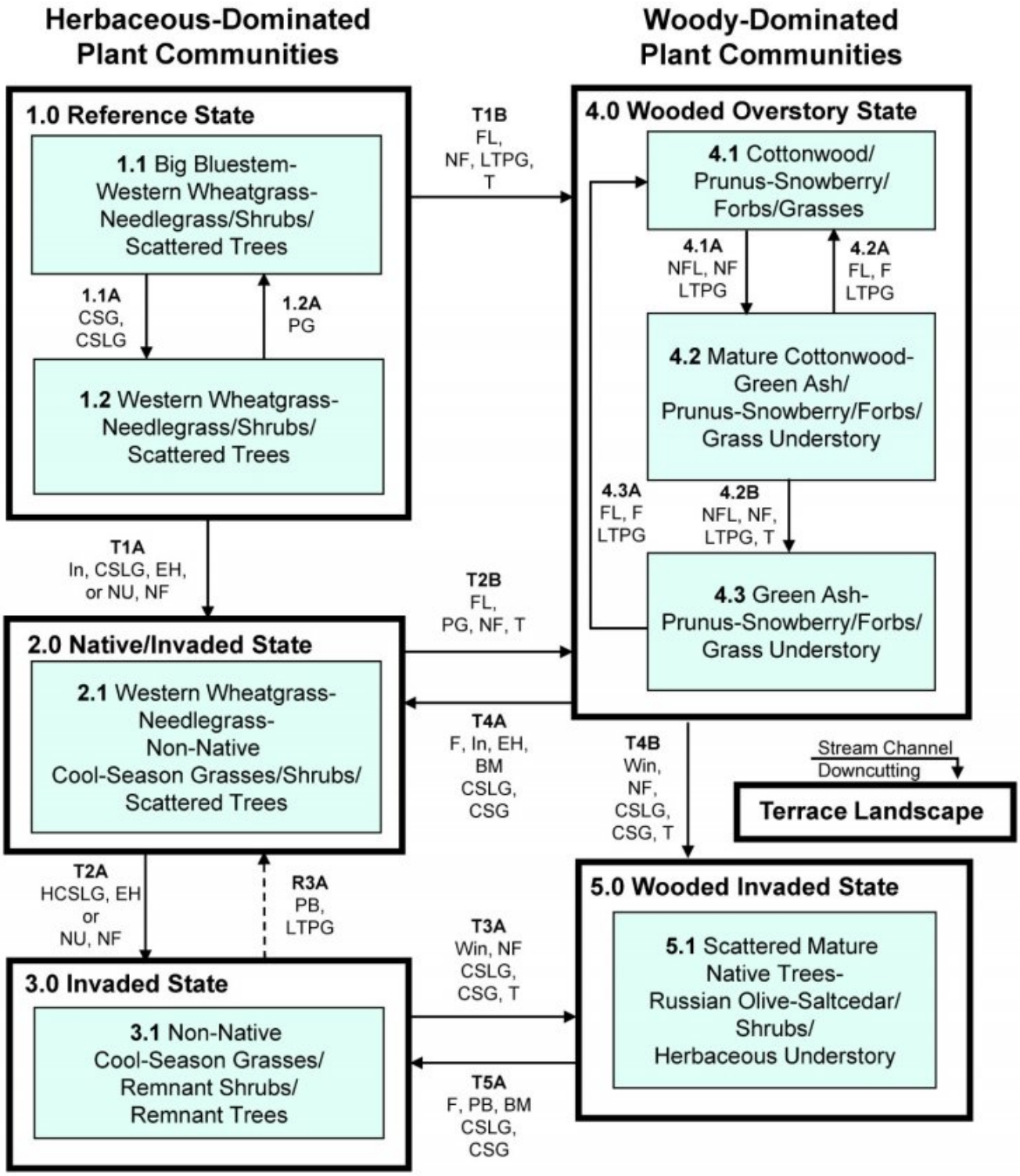
Community (1.1). Western wheatgrass increases initially and will eventually decrease with continuous grazing. Grasses such as big bluestem, switchgrass, and prairie cordgrass will decrease in frequency and production. Introduced species such as Kentucky bluegrass, smooth brome, and cheatgrass invade the site as a result of inadequate recovery periods between grazing events and overstocking. Where trees dominate the site, woody regeneration will decline, and grasses and forbs will become dominant in the understory. It is thought that the Reference State (1.0) is an herbaceous-dominated site located on higher landscape positions where flooding events are infrequent. Where the Loamy Overflow site occupies lower landscape positions adjacent to streams, the plant community will typically be dominated by a mixed hardwood overstory. Major drivers of the Loamy Overflow ecological site are flooding, no-flooding, fire, no-fire, grazing, haying, non-use, invasion of non-native woody plants and non-native cool-season grasses, and land-use conversion.

Interpretations are primarily based on the Big Bluestem-Western Wheatgrass-Needlegrass/Shrubs/Scattered Trees Plant Community (1.1). It has been determined by study of rangeland relic areas, areas protected from excessive disturbance, and areas under long-term rotational grazing regimes. Trends in plant community dynamics ranging from heavily grazed to lightly grazed areas, seasonal use pastures, and historical accounts also have been used. Plant communities, states, transitional pathways, and thresholds have been determined through similar studies and experience.

The following state-and-transition diagram illustrates the common plant communities on the site and the transition pathways between communities. The ecological processes are discussed in more detail in the plant community descriptions following the diagram.

State and transition model

Loamy Overflow R058DY020NE 1/31/19



BM – Brush management
CSG – Continuous seasonal grazing
CSLG – Continuous season-long grazing
EH – Excessive haying
F – Fire
FL – Flooding
HCSLG – Heavy, continuous season-long grazing
In – Invasion of non-native cool-season grasses.

LTPG – Long-term prescribed grazing
NF – No fire
NFL – No flooding
NU – Non use
PB – Prescribed burning
PG – Prescribed grazing
T – Time
Win – Invasion of non-native woody species
- - → Transition may not be fast and/or feasible.

Diagram Legend: Loamy Overflow - R058DY020SD

T1A	1.0 to 2.0	Continuous season-long grazing; excessive haying; invasion and establishment of non-native cool-season grasses will cause this transition. Extended periods of non-use and no fire can also cause this transition.
T1B	1.0 to 4.0	Flooding and no fire, followed by long-term prescribed grazing including proper stocking, change in season of use, and grazing deferment which allows time for woody seedling establishment.
T2A	2.0 to 3.0	Heavy, continuous season-long grazing; or excessive haying will cause this transition. Extended periods of non-use and no fire can also cause this transition.
T2B	2.0 to 4.0	Flooding; no fire; followed by prescribed grazing that included proper stocking, change in season of use, and deferment which allows time for woody seedling establishment.
T3A	3.0 to 5.0	Invasion of non-native woody species; no fire; continuous season-long grazing; or continuous seasonal grazing; and time.
T4A	4.0 to 2.0	Fire; brush management; invasion of non-native, cool-season grasses; excessive haying; continuous season-long grazing, or continuous seasonal grazing.
T4B	4.0 to 5.0	Invasion of non-native woody species; no fire; continuous season-long grazing; or continuous seasonal grazing; and time.
T5A	5.0 to 3.0	Fire; prescribed burning; mechanical or chemical brush management; continuous season-long grazing; or continuous seasonal grazing.

R3A	3.0 to 2.0	Long-term prescribed grazing with proper stocking rates, change in season of use, and time for adequate recovery, or possibly prescribed burning followed by long-term prescribed grazing. This transition may not be fast or feasible.

1.1A	1.1 to 1.2	Continuous seasonal grazing; or continuous season-long grazing.
1.2A	1.2 to 1.1	Prescribed grazing with proper stocking, change in season of use, and adequate time for plant recovery following grazing events.
4.1A	4.1 to 4.2	No flooding; no fire; long-term prescribed grazing that included proper stocking, change in season of use, and deferment which provides opportunity for woody regeneration and time.
4.2A	4.2 to 4.1	Flooding; fire; long-term prescribed grazing that included proper stocking, change in season of use, and deferment which provides opportunity for woody regeneration.
4.2B	4.2 to 4.3	No flooding; no fire; long-term prescribed grazing that included proper stocking, change in season of use, and time.
4.3A	4.3 to 4.1	Flooding; fire; long-term prescribed grazing that included proper stocking, change in season of use, and deferment which provides opportunity for woody regeneration.

State 1
The Reference State

The Reference State (1.0) represents what is believed to show the natural range of variability that dominated the dynamics of the ecological site prior to European settlement. The vegetation in the Reference State (1.0) is dominated by warm- and cool-season grasses, various shrub and tree species that are scattered across the site. In pre-European times, the primary disturbance mechanisms included periodic fire, flooding, and grazing by large herding ungulates. Timing of fires and grazing coupled with weather events dictated the dynamics that occurred within the natural range of variability. Today, a similar state can be found on areas that are properly managed with grazing and sometimes on areas receiving occasional short periods of rest.

Dominant plant species

- cottonwood (*Populus*), tree
- green ash (*Fraxinus pennsylvanica*), tree
- American elm (*Ulmus americana*), tree
- western snowberry (*Symphoricarpos occidentalis*), shrub
- silver buffaloberry (*Shepherdia argentea*), shrub
- silver sagebrush (*Artemisia cana*), shrub
- leadplant (*Amorpha canescens*), shrub
- rose (*Rosa*), shrub
- big bluestem (*Andropogon gerardii*), grass
- western wheatgrass (*Pascopyrum smithii*), grass
- green needlegrass (*Nassella viridula*), grass

- switchgrass (*Panicum virgatum*), grass
- prairie cordgrass (*Spartina pectinata*), grass
- Canada wildrye (*Elymus canadensis*), grass
- needle and thread (*Hesperostipa comata ssp. comata*), grass
- prairie Junegrass (*Koeleria macrantha*), grass
- blue grama (*Bouteloua gracilis*), grass
- American licorice (*Glycyrrhiza lepidota*), other herbaceous
- American vetch (*Vicia americana*), other herbaceous
- aster (*Aster*), other herbaceous
- goldenrod (*Solidago*), other herbaceous

Community 1.1
Big Bluestem-Western Wheatgrass-Needlegrass/Shrubs/Scattered Trees

Interpretations are based primarily on the Big Bluestem-Western Wheatgrass-Needlegrass/Shrubs/Scattered Trees Plant Community. This is also considered to be the Reference Plant Community (1.1). This site evolved with grazing by large herbivores and occasional prairie fires. This plant community can be found on areas with a history of proper grazing management, including adequate recovery periods between grazing events. The potential vegetation will consist of approximately 80 percent grasses or grass-like plants, 10 percent forbs, and 10 percent shrubs and trees. The plant community is dominated by both warm- and cool-season grasses. Major grasses include big bluestem, western wheatgrasses, and green needlegrass. Other grasses and grass-likes include switchgrass, prairie cordgrass, Canada wildrye, needle and thread, prairie Junegrass, and blue grama. Forbs consist of American licorice, American vetch, aster species, and goldenrod. Woody species included in the plant community are western snowberry, silver buffaloberry, silver sagebrush, leadplant, and rose. Scattered plains cottonwood, green ash, and American elm also may occur. The potential for tree regeneration or establishment is relatively low without flooding events. This plant community is well adapted to the Northern Great Plains climatic conditions. Individual species can vary greatly in production depending on growing conditions (timing and amount of precipitation and temperature). Community dynamics, nutrient cycle, water cycle and energy flow are functioning at the site's potential. Plant litter is properly distributed with some movement off-site and natural plant mortality is low. The diversity in plant species allows for high tolerance to drought. Run-off from adjacent sites and moderate or high available water capacity provides a favorable soil-water-plant relationship.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1917	2652	3435
Shrub/Vine	151	267	420
Forb	62	188	336
Tree	–	31	67
Total	**2130**	**3138**	**4258**

Figure 9. Plant community growth curve (percent production by month). SD5803, Northern Rolling High Plains, cool-season/warm-season co-dominant.. Cool-season, warm-season co-dominant, uplands..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	10	20	28	21	10	5	3	0	0

Community 1.2
Western Wheatgrass-Needlegrass/Shrubs/Scattered Trees

This plant community can slowly develop from the adverse effects of continuous seasonal grazing or continuous season-long grazing without adequate recovery periods between each grazing event during the growing season. Recognition of this plant community will enable the land user to implement key management decisions before a significant ecological threshold is crossed. The potential vegetation is made up of approximately 80 percent grasses and grass-like species, 10 percent forbs, and 10 percent shrubs and trees. Western wheatgrass, needle and thread

and green needlegrass are the dominant species. Forb species include cudweed sagewort, white prairie aster, goldenrod, scurfpea, and western yarrow. The dominant shrubs include western snowberry, rose, plum, and silver sagebrush. Plains cottonwood, green ash, and possibly American elm will be found scattered across the site. Compared to the Big Bluestem-Western Wheatgrass-Needlegrass/Shrubs/Scattered Trees Plant Community (1.1), cool-season species including western wheatgrass and needlegrass have increased in composition, and the tall warm-season grasses have declined. Vegetative production has also declined. This plant community is relatively stable and resistant to change. The dominant herbaceous species are very adapted to grazing; however, the mid-grass species and the more palatable forbs will decrease. The reduction of litter and short plant heights result in higher soil temperatures, poor water infiltration rates, increased runoff, and high evapotranspiration rates. This plant community can occur throughout the site, on spot grazed areas, and around water sources where season-long grazing patterns occur.

Table 6. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1110	2010	2892
Shrub/Vine	118	247	392
Forb	118	185	252
Tree	–	25	50
Total	**1346**	**2467**	**3586**

Figure 11. Plant community growth curve (percent production by month). SD5802, Northern Rolling High Plains, cool-season dominant, warm-season subdominant. Cool-season dominant, warm-season subdominant..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	10	23	34	15	6	5	4	0	0

Pathway 1.1A
Community 1.1 to 1.2

Continuous season-long grazing, or continuous seasonal grazing (early spring or late winter) will lead to the Reference Plant Community (1.1) to the Western Wheatgrass-Needlegrass/Shrubs/Scattered Trees Plant Community (1.2).

Pathway 1.2A
Community 1.2 to 1.1

Prescribed grazing with proper stocking rate, change in season of use, and adequate time for plant recovery; will convert the Western Wheatgrass-Needlegrass/Shrubs/Scattered Trees Plant Community (1.2) to the Big Bluestem-Western Wheatgrass-Needlegrass/Shrubs/Scattered Trees Plant Community (1.1).

Conservation practices

Prescribed Grazing

State 2
Native/Invaded State

The Native/Invaded State is very similar to the Reference State (1.0). It is still dominated by native warm- and cool-season grasses, but invasive non-native cool-season grasses are now present. These non-native cool-season grasses can comprise up to 30 percent of total annual air-dry production. The primary disturbance mechanisms for this State include grazing by domestic livestock, infrequent fires, flooding and haying operation. Timing and intensity of grazing events coupled with weather dictate the dynamics that occur within this State. The warm-season native grass can decline and an increase in introduced sod-grasses will occur. Many times, the Native/Invaded State appears as a mosaic of community phases caused primarily by continuous season-long grazing. The

Native/Invaded State is dominated by cool- and warm-season grasses. It can be found on areas that are properly managed with grazing and prescribed burning, and sometimes on areas that receive occasional short periods of rest. Warm-season species can decline and a corresponding increase in cool-season grasses will occur.

Dominant plant species

- cottonwood (*Populus*), tree
- green ash (*Fraxinus pennsylvanica*), tree
- American elm (*Ulmus americana*), tree
- western snowberry (*Symphoricarpos occidentalis*), shrub
- plum (*Prunus*), shrub
- silver sagebrush (*Artemisia cana*), shrub
- rose (*Rosa*), shrub
- western wheatgrass (*Pascopyrum smithii*), grass
- needle and thread (*Hesperostipa comata ssp. comata*), grass
- Kentucky bluegrass (*Poa pratensis*), grass
- smooth brome (*Bromus inermis*), grass
- prairie cordgrass (*Spartina pectinata*), grass
- big bluestem (*Andropogon gerardii*), grass
- white sagebrush (*Artemisia ludoviciana*), other herbaceous
- goldenrod (*Solidago*), other herbaceous
- scurfpea (*Psoralidium*), other herbaceous
- common yarrow (*Achillea millefolium*), other herbaceous

Community 2.1
Western Wheatgrass-Needlegrass-Non-Native Cool-Season Grasses/Shrubs/Scattered Trees

This plant community phase has shifted to cool-season rhizomatous wheatgrasses and needlegrasses. The vegetation is about 80 percent grasses and grass-like plants, 10 percent forbs, and 10 percent shrubs and trees. Dominant grasses include western wheatgrass, needle and thread, Kentucky bluegrass, and smooth brome. Prairie cordgrass and big bluestem will still occur on minor amounts. Major forbs include cudweed sagewort, goldenrods, scurfpea, and western yarrow. Western snowberry, plum, silver sagebrush, and rose are the dominant shrubs. Scattered cottonwood, green ash, and possibly American elm trees will be present in minor amounts. Energy capture by this plant community phase has shifted from late spring and summer to early spring through early summer. This plant community is moderately resistant to change. The herbaceous species present are well adapted to grazing; however, species composition can be altered through long-term overgrazing or excessive haying. If the herbaceous component is intact, it tends to be resilient if the disturbance is not long-term.

Table 7. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1154	1695	2230
Forb	95	151	207
Shrub/Vine	95	151	207
Tree	–	20	45
Total	**1344**	**2017**	**2689**

Figure 13. Plant community growth curve (percent production by month). SD5801, Northern Rolling High Plains, cool-season dominant.. Cool-season dominant, uplands..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	4	12	25	36	10	5	4	4	0	0

State 3
Invaded State

This State is the result of invasion and dominance of introduced species. The Invaded State (3.0) is characterized by the dominance of Kentucky bluegrass and smooth brome, and an increasing thatch layer that effectively blocks introduction of other plants into the system. Plant litter accumulation tends to favor the more shade-tolerant, introduced grass species. The nutrient cycle is also impaired, and the result is typically a higher level of nitrogen, which also favors the introduced species. Increasing plant litter decreases the amount of sunlight reaching plant crowns, thereby shifting competitive advantage to shade-tolerant introduced grass species. Studies indicate that soil biological activity is altered, and this shift apparently exploits the soil microclimate and encourages growth of the introduced grass species. Once the threshold is crossed, a change in grazing management alone cannot cause a reduction in the invasive grass dominance. Preliminary studies would tend to indicate this threshold may exist when Kentucky bluegrass exceeds 30 percent and native grasses represent less than 40 percent of the plant community composition. Plant communities dominated by Kentucky bluegrass have significantly less cover and diversity of native grasses and forb species (Toledo, D., et al., 2014).

Dominant plant species

- cottonwood (*Populus*), tree
- green ash (*Fraxinus pennsylvanica*), tree
- American elm (*Ulmus americana*), tree
- western snowberry (*Symphoricarpos occidentalis*), shrub
- plum (*Prunus*), shrub
- silver sagebrush (*Artemisia cana*), shrub
- rose (*Rosa*), shrub
- smooth brome (*Bromus inermis*), grass
- Kentucky bluegrass (*Poa pratensis*), grass

Community 3.1
Non-Native Cool-Season Grasses/Remnant Shrubs/Remnant Trees

Plant Community (3.1) is a result of heavy, continuous grazing; excessive haying; or extended periods of non-use and no fire. It is characterized by a dominance of Kentucky bluegrass and smooth brome. The dominance is at times so complete that other species are difficult to find on the site. A thick duff layer also accumulates at or above the soil surface through non-use. Nutrient cycling is greatly reduced, and native plants have great difficulty becoming established. When dominated by smooth brome, infiltration is moderately reduced, and runoff is moderate. Production can be equal to or higher than the interpretive plant community. However, when dominated by Kentucky bluegrass, infiltration can be greatly reduced, and high levels of runoff. Production in this case will likely be significantly less. In either case, the period that palatability is high is relatively short, as these cool-season species mature rapidly. Energy capture is also reduced. Remnant shrubs and trees may occupy this plant community, but regeneration is unlikely.

Table 8. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1003	1533	2057
Forb	84	135	185
Shrub/Vine	34	108	185
Tree	–	18	39
Total	**1121**	**1794**	**2466**

Figure 15. Plant community growth curve (percent production by month). SD5801, Northern Rolling High Plains, cool-season dominant.. Cool-season dominant, uplands..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	4	12	25	36	10	5	4	4	0	0

State 4

Wooded Overstory State

The Wooded Overstory State is the result of the establishment of a tree overstory and shrub mid-story canopy. This State is more common on the lower reaches of the watershed. The dynamics of the Wooded Overstory State (4.0) are largely due to flooding and natural successional changes, starting with cottonwood and shrub establishment, and eventually the development of a green ash and American elm plant community. The successional process can restart following another flooding event. Water control structures which limit flooding, livestock grazing, heavy wildlife browse, fire, the introduction of non-native, cool-season grasses, and encroachment of Russian olive can alter the dynamics of this site, resulting in old remnant stands of trees with little, if any regeneration.

Dominant plant species

- cottonwood (*Populus*), tree
- plum (*Prunus*), tree
- western snowberry (*Symphoricarpos occidentalis*), shrub
- plum (*Prunus*), shrub
- chokecherry (*Prunus virginiana*), shrub
- silver buffaloberry (*Shepherdia argentea*), shrub
- silver sagebrush (*Artemisia cana*), shrub
- currant (*Ribes*), shrub
- boxelder (*Acer negundo*), shrub

Community 4.1
Cottonwood/Prunus-Snowberry/Forbs/Grasses

This plant community typically occurs after a flooding event. Flooding reduces herbaceous competition through scouring of the soil surface, which provides a site for regeneration and establishment of cottonwood and shrubs. Prescribed grazing, which prevents targeted grazing of cottonwood seedlings, is necessary for this plant community to establish. Trees will range from seedlings to saplings, and the herbaceous understory will remain productive as a result of the filtered canopy of the deciduous trees. Understory shrubs, primarily plum, chokecherry, and snowberry will likely establish. However, other species, including silver buffaloberry, silver sagebrush, and currants can occur and make up a significance percentage of the shrub layer.

Community 4.2
Mature Cottonwood-Green Ash-Boxelder/Prunus-Snowberry/Forbs/Grass Understory

This plant community develops over time with prescribed grazing and no flooding or fire. Mature cottonwood trees and woody shrubs provide a suitable microclimate for establishment of other deciduous trees. Green ash are typically the first trees to establish, but other species such as American elm and possibly box elder will establish as well. Regeneration of woody species will normally be evident (i.e., seedlings and saplings should be present). The herbaceous plant community will remain relatively productive, but will be reduced somewhat from the Reference Plant Community (1.1). This is due mainly to the competition from the woody shrub understory.

Community 4.3
Green Ash/Prunus-Snowberry/Forbs/Grass Understory

This plant community develops over time, with prescribed grazing and no flooding. Mature cottonwood trees will likely remain in lesser numbers, but the dominant trees will normally consist of green ash and American elm. At times there will be a mix of all three species; however, some areas will be dominated by one or two of these species. Woody shrubs will remain in the understory, but typically in lesser amounts than in the previous two plant communities. While somewhat reduced, the herbaceous understory will remain relatively productive. The trees will mostly be in the mature stage, but regeneration will normally be evident (i.e., seedlings and saplings should be present).

Pathway 4.1A
Community 4.1 to 4.2

No flooding, no fire, and long-term prescribed grazing that manages the herbaceous understory, but is not

detrimental to woody regeneration, will allow plant community (4.1) to develop into the Mature Cottonwood-Immature Green Ash-Boxelder/Prunus-Snowberry/Forbs/Grass Understory Plant Community (4.2). Existing saplings must be large enough to avoid damage by livestock and wildlife for this pathway to occur.

Conservation practices

Prescribed Grazing

Pathway 4.2A
Community 4.2 to 4.1

Flooding, and possibly fire, which opens-up the herbaceous understory and allows for woody regeneration, followed by long-term prescribed grazing that manages for woody regeneration and establishment will shift plant community (4.2) back to the Cottonwood/Prunus-Snowberry/Forbs/Grasses Plant Community (4.1).

Conservation practices

Prescribed Grazing

Pathway 4.2B
Community 4.2 to 4.3

No flooding, no fire, and long-term prescribed grazing that manages the herbaceous understory but is not detrimental to woody regeneration, and time will transition plant community (4.2) to the Green Ash/Prunus-Snowberry/Forbs/Grass Understory Plant Community (4.3).

Conservation practices

Prescribed Grazing

Pathway 4.3A
Community 4.3 to 4.1

Flooding, and possibly fire, which opens up the herbaceous understory and allows for woody regeneration, followed by long-term prescribed grazing that manages for woody regeneration and establishment will shift plant community (4.3) back to the Cottonwood/Prunus-Snowberry/Forbs/Grasses Plant Community (4.1).

Conservation practices

Prescribed Grazing

State 5
Woody Invaded State

The Woody Invaded State developed as a result of continuous season-long grazing, or continuous seasonal grazing and no fire combined with the invasion and establishment of Russian olive, and possible saltcedar on the Loamy Overflow ecological site. With time, the cottonwood, and ash trees that survive become mature, with little or no regeneration. This is due mainly to grazing of seedlings and saplings. Wildlife browse can also contribute to the loss of native tree and shrub regeneration. Grazing that limits regeneration also results in a reduction of the desirable native herbaceous species, often resulting in a dominance of species such as bluegrass and smooth brome, and forbs such as western ragweed, Canada thistle, burdock, and other invasive species.

Dominant plant species

- cottonwood (*Populus*), tree
- green ash (*Fraxinus pennsylvanica*), tree
- Russian olive (*Elaeagnus angustifolia*), tree
- saltcedar (*Tamarix ramosissima*), shrub

- Kentucky bluegrass (*Poa pratensis*), grass
- smooth brome (*Bromus inermis*), grass
- Canada thistle (*Cirsium arvense*), other herbaceous
- burdock (*Arctium*), other herbaceous
- hound's tongue (*Cynoglossum*), other herbaceous

Community 5.1
Scattered Mature Native Trees-Russian Olive-Saltcedar/Shrubs/Forbs/Bluegrass

This plant community developed due to the lack of natural occurring flooding events, native woody regeneration, and continuous season-long grazing without adequate recovery periods. Older mature trees remain, including cottonwood and green ash. The trees are scattered, and the site may have a “park-like” appearance with few trees and reduced understory. If grazed during the winter, the increased durations of livestock loitering can result in manure accumulations and soil compaction which will reduce the vigor of the native understory plant community. Kentucky bluegrass and smooth brome continue to persist as dominant grass species at reduced production rates. The presence of non-desirable forb species such as Canada thistle, burdock, and hound’s tongue can be prolific and difficult to control. When invaded by Russian olive and/or saltcedar these species will increase dramatically over time and will eventually dominate the site.

Transition T1A
State 1 to 2

Continuous season-long grazing; excessive haying; or non-use and no fire, and the invasion of non-native cool-season grasses will transition the Reference Plant Community (1.1) to the Native/Invaded State (2.0).

Transition T1B
State 1 to 4

Flooding, followed by long-term prescribed grazing, and no fire are necessary to shift the Re4ference State (1.0) to the Cottonwood/Prunus-Snowberry/Forbs/Grasses Plant Community (4.1). Flooding reduces herbaceous competition through scouring of the soil surface and provides a site for regeneration to occur. Once a flooding event occurs during the proper time, a long-term period of prescribed grazing is necessary to establish and maintain a woody plant community. Grazing during the mid-summer growing season typically has an adverse effect on woody regeneration. The Woody Overstory State (4.0) is more likely to occur and persist on the mid- to lower reaches of a drainage.

Conservation practices

Prescribed Grazing

Transition T2A
State 2 to 3

Heavy, continuous grazing, and excessive haying will cause a transition from the Native/Invaded State (2.0) to the Invaded State (3.0). Extended periods of non-use and no fire will also result in the expansion of non-native cool-season grasses on this site. The ecological threshold can be identified by the percentage of non-native cool-season species in the plant community. Preliminary studies would tend to indicate this threshold may exist when Kentucky bluegrass exceeds 30 percent of the plant community composition and native grasses represent less than 40 percent (Toledo, D., et al., 2014). Smooth brome is assumed to follow a similar ecological threshold but is not documented scientifically.

Transition T2B
State 2 to 4

Flooding and no fire, followed by prescribed grazing including proper stocking, change in season of use, and adequate time for recovery will likely transition the Native/Invaded State (2.0) to the Woody Overstory State (4.0). Timed grazing is very important and must be followed for many years for tree saplings to attain a height at which

livestock will not damage or kill the trees. Wildlife browse can also be a concern if the management objective is to improve the overstory canopy. The Wooded Overstory State (4.0) is more likely to occur on the mid- to lower reaches of a drainageway.

Conservation practices

Prescribed Grazing

Restoration pathway R3A
State 3 to 2

Long-term prescribed grazing (moderate stocking levels coupled with adequate recovery periods, or other grazing systems intended to treat specific species dominance, or periodic light to moderate stocking levels, possibly including periodic rest) may lead the Invaded State (3.0) over a threshold to the Native/Invaded State (2.0). Prescribed burning may also be needed to suppress cool-season invasive grasses. This will likely take a long period of time, possibly up to ten years or more, and recovery may not be attainable. Success depends upon whether native reproductive propagules remain intact on the site.

Conservation practices

Prescribed Burning
Prescribed Grazing

Transition T3A
State 3 to 5

Invasion of non-native trees; no fire for extended periods of time; continuous season-long grazing, or continuous seasonal grazing and time will cause a transition from the Invaded State (3.0) to the Wooded Invaded State (5.0). Canopy cover increases as trees increase in size, which alters microclimate and reduces fine fuel amounts, resulting in reduced fire intensity and frequency.

Transition T4A
State 4 to 2

Fire or brush management; the invasion of non-native, cool-season grasses; excessive haying; continuous season-long grazing, or continuous seasonal grazing resulting in little woody regeneration, and time will transition the Wooded Overstory State (4.0) to the Native/Invaded State (2.0).

Conservation practices

Brush Management

Transition T4B
State 4 to 5

Invasion of non-native trees, coupled with no fire and continuous season-long grazing, or continuous seasonal grazing, and time will transition this State (4.0) to the Wooded Invaded State (5.0).

Transition T5A
State 5 to 3

Fire, brush management to remove Russian olive and saltcedar, continuous season-long grazing, or continuous seasonal grazing will transition the Woody Invaded State (5.0) to the Invaded State (3.0).

Conservation practices

Brush Management

Additional community tables

Table 9. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Tall Warm-Season Grasses**			785–1098	
	big bluestem	ANGE	*Andropogon gerardii*	628–1098	–
	switchgrass	PAVI2	*Panicum virgatum*	0–157	–
	prairie cordgrass	SPPE	*Spartina pectinata*	31–157	–
	prairie sandreed	CALO	*Calamovilfa longifolia*	0–157	–
2	**Rhizomatous Wheatgrass**			471–942	
	western wheatgrass	PASM	*Pascopyrum smithii*	471–942	–
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	0–314	–
3	**Cool-Season Bunchgass**			314–785	
	green needlegrass	NAVI4	*Nassella viridula*	157–628	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	157–314	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–157	–
	Canada wildrye	ELCA4	*Elymus canadensis*	0–94	–
4	**Short Warm-Season Grasses**			31–157	
	blue grama	BOGR2	*Bouteloua gracilis*	31–157	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–31	–
5	**Other Native Grasses**			31–157	
	little bluestem	SCSC	*Schizachyrium scoparium*	0–157	–
	Grass, perennial	2GP	*Grass, perennial*	0–157	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	31–94	–
	composite dropseed	SPCOC2	*Sporobolus compositus var. compositus*	0–63	–
6	**Grass-Likes**			31–157	
	sedge	CAREX	*Carex*	31–157	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–94	–
7	**Non-Native Cool-Season Grasses**			–	
Forb					
8	**Forbs**			63–314	
	Forb, native	2FN	*Forb, native*	31–157	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	31–94	–
	goldenrod	SOLID	*Solidago*	31–94	–
	Maximilian sunflower	HEMA2	*Helianthus maximiliani*	31–94	–
	scurfpea	PSORA2	*Psoralidium*	31–63	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	31–63	–
	white prairie aster	SYFA	*Symphyotrichum falcatum*	31–63	–
	showy milkweed	ASSP	*Asclepias speciosa*	0–31	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	0–31	–

	Canadian anemone	ANCA8	*Anemone canadensis*	0–31	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–31	–
	purple prairie clover	DAPU5	*Dalea purpurea*	0–31	–
	American licorice	GLLE3	*Glycyrrhiza lepidota*	0–31	–
	American vetch	VIAM	*Vicia americana*	0–31	–
	blue-eyed grass	SISYR	*Sisyrinchium*	0–31	–
	cinquefoil	POTEN	*Potentilla*	0–31	–
Shrub/Vine					
9	**Shrubs**			157–377	
	western snowberry	SYOC	*Symphoricarpos occidentalis*	31–157	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–157	–
	American plum	PRAM	*Prunus americana*	31–94	–
	rose	ROSA5	*Rosa*	31–94	–
	silver buffaloberry	SHAR	*Shepherdia argentea*	0–94	–
	chokecherry	PRVI	*Prunus virginiana*	0–63	–
	currant	RIBES	*Ribes*	0–63	–
	Saskatoon serviceberry	AMAL2	*Amelanchier alnifolia*	0–31	–
	silver sagebrush	ARCA13	*Artemisia cana*	0–31	–
Tree					
10	**Trees**			0–63	
	American elm	ULAM	*Ulmus americana*	0–63	–
	green ash	FRPE	*Fraxinus pennsylvanica*	0–63	–
	plains cottonwood	PODEM	*Populus deltoides ssp. monilifera*	0–63	–
	Tree	2TREE	*Tree*	0–63	–
	boxelder	ACNE2	*Acer negundo*	0–31	–

Table 10. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Tall Warm-Season Grasses**			123–247	
	big bluestem	ANGE	*Andropogon gerardii*	123–247	–
	prairie sandreed	CALO	*Calamovilfa longifolia*	0–123	–
	prairie cordgrass	SPPE	*Spartina pectinata*	0–123	–
	switchgrass	PAVI2	*Panicum virgatum*	0–74	–
2	**Rhizomatous Wheatgrass**			370–740	
	western wheatgrass	PASM	*Pascopyrum smithii*	247–616	–
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	0–247	–
3	**Cool-Season Bunchgrass**			123–493	
	green needlegrass	NAVI4	*Nassella viridula*	49–247	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	49–247	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–74	–
	Canada wildrye	ELCA4	*Elymus canadensis*	0–25	–
4	**Short Warm-Season Grasses**			49–247	

4	**Short Warm-Season Grasses**			49–247	
	blue grama	BOGR2	*Bouteloua gracilis*	49–247	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–123	–
5	**Other Native Grasses**			25–123	
	Grass, perennial	2GP	*Grass, perennial*	0–123	–
	little bluestem	SCSC	*Schizachyrium scoparium*	0–74	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	25–74	–
	composite dropseed	SPCOC2	*Sporobolus compositus var. compositus*	0–49	–
6	**Grass-Likes**			49–123	
	sedge	CAREX	*Carex*	49–123	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–74	–
7	**Non-Native Cool-Season Grasses**			–	
Forb					
8	**Forbs**			123–247	
	Forb, native	2FN	*Forb, native*	25–123	–
	Forb, introduced	2FI	*Forb, introduced*	0–74	–
	scurfpea	PSORA2	*Psoralidium*	25–74	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	25–74	–
	white prairie aster	SYFA	*Symphyotrichum falcatum*	25–74	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	25–74	–
	goldenrod	SOLID	*Solidago*	25–74	–
	American licorice	GLLE3	*Glycyrrhiza lepidota*	0–49	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	0–49	–
	showy milkweed	ASSP	*Asclepias speciosa*	0–25	–
	American vetch	VIAM	*Vicia americana*	0–25	–
	cinquefoil	POTEN	*Potentilla*	0–25	–
	Maximilian sunflower	HEMA2	*Helianthus maximiliani*	0–25	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–25	–
	purple prairie clover	DAPU5	*Dalea purpurea*	0–25	–
Shrub/Vine					
9	**Shrubs**			123–370	
	western snowberry	SYOC	*Symphoricarpos occidentalis*	49–247	–
	rose	ROSA5	*Rosa*	25–123	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–123	–
	American plum	PRAM	*Prunus americana*	25–99	–
	silver buffaloberry	SHAR	*Shepherdia argentea*	0–74	–
	silver sagebrush	ARCA13	*Artemisia cana*	0–74	–
	chokecherry	PRVI	*Prunus virginiana*	0–49	–
	currant	RIBES	*Ribes*	0–49	–
	Saskatoon serviceberry	AMAL2	*Amelanchier alnifolia*	0–49	–
Tree					
10	**Trees**			0–49	

	American elm	ULAM	*Ulmus americana*	0–49	–
	green ash	FRPE	*Fraxinus pennsylvanica*	0–49	–
	plains cottonwood	PODEM	*Populus deltoides ssp. monilifera*	0–49	–
	Tree	2TREE	*Tree*	0–49	–
	boxelder	ACNE2	*Acer negundo*	0–25	–

Table 11. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Tall Warm-Season Grasses**			40–202	
	prairie cordgrass	SPPE	*Spartina pectinata*	20–202	–
	big bluestem	ANGE	*Andropogon gerardii*	20–101	–
	prairie sandreed	CALO	*Calamovilfa longifolia*	0–40	–
2	**Rhizomatous Wheatgrass**			202–404	
	western wheatgrass	PASM	*Pascopyrum smithii*	202–404	–
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	20–40	–
3	**Cool-Season Bunchgrass**			101–404	
	green needlegrass	NAVI4	*Nassella viridula*	101–303	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	101–202	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–40	–
4	**Short Warm-Season Grasses**			40–202	
	blue grama	BOGR2	*Bouteloua gracilis*	40–202	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–40	–
5	**Other Native Grasses**			20–101	
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–101	–
	Grass, perennial	2GP	*Grass, perennial*	0–61	–
	composite dropseed	SPCOC2	*Sporobolus compositus var. compositus*	20–40	–
	little bluestem	SCSC	*Schizachyrium scoparium*	0–40	–
6	**Grass-Likes**			40–161	
	sedge	CAREX	*Carex*	40–161	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–61	–
7	**Non-Native Cool-Season Grasses**			202–404	
	Kentucky bluegrass	POPR	*Poa pratensis*	101–404	–
	smooth brome	BRIN2	*Bromus inermis*	0–202	–
	cheatgrass	BRTE	*Bromus tectorum*	40–202	–
	field brome	BRAR5	*Bromus arvensis*	0–101	–
Forb					
8	**Forbs**			101–202	
	Forb, native	2FN	*Forb, native*	20–101	–
	Forb, introduced	2FI	*Forb, introduced*	20–101	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	20–101	–
	goldenrod	SOLID	*Solidago*	20–81	–

	goldenrod	SOLID	*Solidago*	20–61	
	scurfpea	PSORA2	*Psoralidium*	20–61	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	20–61	–
	white prairie aster	SYFA	*Symphyotrichum falcatum*	20–61	–
	American licorice	GLLE3	*Glycyrrhiza lepidota*	0–61	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	0–40	–
	showy milkweed	ASSP	*Asclepias speciosa*	0–20	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–20	–
	purple prairie clover	DAPU5	*Dalea purpurea*	0–20	–
	cinquefoil	POTEN	*Potentilla*	0–20	–
Shrub/Vine					
9	**Shrubs**			101–202	
	western snowberry	SYOC	*Symphoricarpos occidentalis*	20–101	–
	American plum	PRAM	*Prunus americana*	20–81	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–61	–
	silver sagebrush	ARCA13	*Artemisia cana*	0–61	–
	rose	ROSA5	*Rosa*	20–61	–
	silver buffaloberry	SHAR	*Shepherdia argentea*	0–40	–
	chokecherry	PRVI	*Prunus virginiana*	0–40	–
	currant	RIBES	*Ribes*	0–20	–
	Saskatoon serviceberry	AMAL2	*Amelanchier alnifolia*	0–20	–
Tree					
10	**Trees**			0–40	
	American elm	ULAM	*Ulmus americana*	0–40	–
	green ash	FRPE	*Fraxinus pennsylvanica*	0–40	–
	plains cottonwood	PODEM	*Populus deltoides ssp. monilifera*	0–40	–
	Russian olive	ELAN	*Elaeagnus angustifolia*	0–40	–
	Tree	2TREE	*Tree*	0–40	–
	boxelder	ACNE2	*Acer negundo*	0–20	–

Table 12. Community 3.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Tall Warm-Season Grasses**			0–36	
	prairie cordgrass	SPPE	*Spartina pectinata*	0–90	–
	big bluestem	ANGE	*Andropogon gerardii*	0–36	–
	prairie sandreed	CALO	*Calamovilfa longifolia*	0–18	–
	switchgrass	PAVI2	*Panicum virgatum*	–	–
2	**Rhizomatous Wheatgrass**			36–269	
	western wheatgrass	PASM	*Pascopyrum smithii*	36–269	–
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	0–90	–
3	**Cool-Season Bunchgrass**			0–269	
	green needlegrass	NAVI4	*Nassella viridula*	0–179	–

	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–179	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–36	–
4	**Short Warm-Season Grasses**			36–179	
	blue grama	BOGR2	*Bouteloua gracilis*	36–179	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–90	–
5	**Other Native Grasses**			0–72	
	Grass, perennial	2GP	*Grass, perennial*	0–54	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–36	–
	composite dropseed	SPCOC2	*Sporobolus compositus var. compositus*	18–36	–
6	**Grass-Likes**			36–179	
	sedge	CAREX	*Carex*	36–179	–
	Grass-like (not a true grass)	2GL	*Grass-like (not a true grass)*	0–54	–
7	**Non-Native Cool-Season Grasses**			359–717	
	Kentucky bluegrass	POPR	*Poa pratensis*	359–717	–
	smooth brome	BRIN2	*Bromus inermis*	0–179	–
	cheatgrass	BRTE	*Bromus tectorum*	36–179	–
	field brome	BRAR5	*Bromus arvensis*	0–179	–
Forb					
8	**Forbs**			90–179	
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	18–90	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	18–90	–
	goldenrod	SOLID	*Solidago*	18–90	–
	Forb, native	2FN	*Forb, native*	18–90	–
	Forb, introduced	2FI	*Forb, introduced*	18–90	–
	scurfpea	PSORA2	*Psoralidium*	0–54	–
	white prairie aster	SYFA	*Symphyotrichum falcatum*	18–36	–
	American licorice	GLLE3	*Glycyrrhiza lepidota*	0–36	–
	showy milkweed	ASSP	*Asclepias speciosa*	0–18	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	0–18	–
Shrub/Vine					
9	**Shrubs**			36–179	
	western snowberry	SYOC	*Symphoricarpos occidentalis*	18–90	–
	rose	ROSA5	*Rosa*	18–54	–
	silver sagebrush	ARCA13	*Artemisia cana*	0–54	–
	American plum	PRAM	*Prunus americana*	0–36	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–36	–
	chokecherry	PRVI	*Prunus virginiana*	0–18	–
Tree					
10	**Trees**			0–36	
	plains cottonwood	PODEM	*Populus deltoides ssp. monilifera*	0–36	–
	Russian olive	ELAN	*Elaeagnus angustifolia*	0–36	–
	Tree	2TREE	*Tree*	0–36	–

	boxelder	ACNE2	*Acer negundo*	0–18	–
	green ash	FRPE	*Fraxinus pennsylvanica*	0–18	–

Animal community

Wildlife Interpretations
MLRA 58D lies within the drier portion of the northern mixed-grass prairie ecosystem where sagebrush steppes to the west yield to grassland steppes to the east. Prior to European settlement, this area consisted of diverse grass- and shrubland habitats interspersed with varying densities of depressional instream wetlands and woody riparian corridors. These habitats provided critical life cycle components for many users. Many species of grassland birds, small mammals, reptiles, amphibians, and herds of roaming bison, elk, and pronghorn were among the inhabitants adapted to this semi-arid region. Roaming herbivores, as well as several small mammal and insect species, were the primary consumers linking the grassland resources to predators such as the gray wolf, mountain lion, and grizzly bear, and smaller carnivores such as the coyote, bobcat, fox, and raptors. The prairie dog was once abundant; however, the species remains a keystone species within its range. The black-footed ferret, burrowing owl, ferruginous hawk, mountain plover, and swift fox were associated with prairie dog complexes.

Historically, the northern mixed-grass prairie was a disturbance-driven ecosystem with fire, herbivory, and climate functioning as the primary disturbance factors either singly or in combination. Following European settlement, livestock grazing, cropland conversion, elimination of fire, energy development, and other anthropogenic factors influenced species composition and abundance. Introduced and invasive species further impacted plant and animal communities. The bison was a historical keystone species but had been extirpated in this area as a free-ranging herbivore. The loss of the bison and reduction of prairie dog populations and fire as ecological drivers greatly influenced the character of the remaining native plant communities and altered wildlife habitats. Human development has reduced habitat quality for area-sensitive species.

Within MLRA 58D, the Loamy Overflow ecological site provides upland grassland cover with an associated forb, shrub, and tree component. It was typically part of an expansive grassland landscape that included combinations of Shallow Loamy, Shallow Clayey, Thin Loamy, Thin Claypan, Sandy, Sandy Claypan, Loamy, Sandy Terrace and Clayey ecological sites.

This ecological site can support a riparian plant community and remains essentially intact. The floodplain plant community may be composed of mature cottonwood and various age classes of elm, green ash, and boxelder; with a shrub component of wild plum, western snowberry, silver buffaloberry, wild rose, etc. The presence or absence of this tree/shrub component is an important factor influencing wildlife species composition.

Occasional to frequent flooding deposits silt on the site which may allow for potential sprouting of plains cottonwood. This site is subject to invasion of grass species such as annual bromegrasses and Kentucky bluegrass. Woody species such as Eastern red cedar, Rocky Mountain juniper, Tamarisk, and Russian olive may invade this site.

The Loamy Overflow ecological site provides important habitat for grassland, woodland, and shrub nesting birds, small rodents, bats, mammalian predators, and a variety of reptiles, amphibians, and insects. Within MLRA 58D, this site provides the suitable habitat for numerous riparian associated species. This site provides foraging and brood rearing habitat for upland game birds such as greater sage-grouse and sharptailed grouse. However, due to the presence of invasive grass and/or woody species ground nesting birds' reproduction is reduced.

Big Bluestem-Western Wheatgrass-Needlegrass/Shrubs/Scattered Trees (1.1): The predominance of grasses plus high diversity of forbs and shrubs in this community favors grazers and mixed-feeders, such as white-tailed deer. Plant communities associated with woody habitat provide habitat for songbirds such as brown thrasher, redheaded woodpecker, warbling vireo, yellow warbler, gray catbird, Say's phoebe, loggerhead shrike, Lazuli bunting, yellow breasted chat, and black-headed grosbeak; and raptors such as red-tailed hawk, Swainson's hawk, American kestrel, and great-horned owl. Insects, such as pollinators, play a large role in maintaining the forb community and provide a forage base for birds and other species. Diverse prey populations are available for grassland raptors and mammalian predators, especially bobcat.

The diversity of grasses, forbs, and shrubs provide high nutrition levels for small and large herbivores including voles, mice, thirteen-lined ground squirrel, Eastern cottontail rabbit, white-tailed jackrabbit, and deer. This ecological

site provides excellent fawning habitat for white-tailed deer. The relatively high stature of this plant community provides suitable thermal, protective, and escape cover for small and large mammals. This plant community provides habitat for various amphibian and reptile species such as frogs, toads, salamanders, bull and garter snakes. Introduced bird species such as European starling, ring-necked pheasant, and gray partridge will use this site.

Native/Invaded State (2.0): Resulting from continuous seasonal grazing, non-use, or reduction in fire frequency, shrubs and western wheatgrass will dominate. Shrub diversity and density has increased. The tree component remains largely unchanged. Livestock damage to trees is often noticeable. The increase in the shrub component results in increased habitat for yellow warbler, gray catbird, loggerhead shrike, Bell's vireo, brown thrasher, Lazuli bunting, and yellow breasted chat. When present, the tall tree component continues to provide habitat for red-tailed hawk, American kestrel, redheaded woodpecker, warbling vireo, black-headed grosbeak, and Say's phoebe. This plant community provides habitat for various amphibian and reptile species such as frogs, toads, salamanders, bull, and garter snakes.

Invaded State (3.0): These plant communities develops under continuous season-long grazing of western wheatgrass. The dominant vegetation includes Kentucky bluegrass, smooth brome, and annual grasses, forbs, invaders, and early successional biennial and perennial species. Plant species from adjacent ecological sites may become minor components of this plant community. The community is susceptible to invasion of other non-native species due to soil disturbances and relatively high percent of bare ground. Soil erosion is potentially high, impacting offsite aquatic habitats through increased runoff, nutrient, and sediment loads. Reduced surface cover, low plant density, low plant vigor, loss of root biomass, and soil compaction, all contribute to decreased wildlife abundance and diversity. Since secondary succession is highly variable plant and wildlife species will vary. These plant communities provide habitat for generalist or early successional species.

Wooded State (4.0): Multiple successional changes can occur on lower reaches of drainages when trees establish on the site. However, this wildlife interpretation will only include a discussion of the "Lower and Upper Woody Draw" in general. Long-term prescribed grazing, continuous season-long grazing, continuous seasonal grazing, heavy wildlife browsing, fire, flooding (and no flooding), and time all influence plant community succession. Grass species may decline dramatically, and species composition can shift due to woody competition and disturbances.

Woody vegetation provides excellent nesting cover, escape cover, and den sites for a variety of species. Species such as white-footed mice, bushy-tailed woodrat, porcupine, sharp-tailed grouse, black-billed magpie, Townsend's solitaire, dark-eyed junco, brown thrasher, lark sparrow, and white-crowned sparrow will also increase. Species such as meadow voles, spotted ground squirrel, northern grasshopper mice, and western harvest mice will not utilize this site. Grassland-nesting songbirds will be significantly reduced. Raptors such as the long-eared owl will increase.

This site provides habitat for other songbirds such as yellow warbler, orange-crowned warbler, yellow-rumped warbler, Wilson's warbler, gray catbird, Say's phoebe, loggerhead shrike, Lazuli bunting, yellow-breasted chat, wrens, and chickadees. Other raptors such as red-tailed hawk, Swainson's hawk, American kestrel, and great-horned owl may continue to use this site. Insects continue to provide a significant forage base for birds and various bats, especially species such as the Western small-footed Myotis, the fringe-tailed Myotis and the Townsend's big-eared bat. Diverse prey populations are available for grassland raptors and mammalian predators, especially bobcat. Other mammalian predators utilizing this plant community include the coyote, mink, long-tailed and least weasels, red fox, and spotted and striped skunks.

Grazing Interpretations
The following list suggests annual, initial stocking rates for average growing conditions. These estimates are conservative and should be used only as guidelines in the initial stages of conservation planning. Commonly, the current plant composition does not entirely match any particular plant community (as described in this ecological site description). Therefore, a resource inventory is necessary to document plant composition and production. More accurate estimates of carrying capacity should eventually be calculated using the following stocking rate information along with animal preference data and actual stocking records, particularly when grazers other than cattle are involved. In consultation with the land manager, a more intensive grazing management program that results in improved harvest efficiencies and increased carrying capacity may be developed.

The following suggested initial stocking rates are based on 912 lb/acre (air-dry weight) per animal-unit-month (AUM)

with a 25 percent harvest efficiency of preferred and desirable forage species (refer to USDA-NRCS, National Range and Pasture Handbook). An AUM is defined as the equivalent amount of forage required by a 1,000-pound cow, with or without calf, for one month.

Plant Community: Big Bluestem-Western Wheatgrass-Needlegrass/Shrubs/Scattered Trees (1.1)
Average Production (lb/acre, air-dry): 2,800*
Stocking Rate (AUM/acre): 0.77*

Plant Community: Western Wheatgrass-Needlegrass/Shrubs/Scattered Trees (1.2)
Average Production (lb/acre, air-dry): 2,200*
Stocking Rate (AUM/acre): 0.60*

Plant Community: Western Wheatgrass-Needlegrass-Non-Native Cool-Season Grasses/Shrubs/Scattered Trees (2.1)
Average Production (lb/acre, air-dry): 1,800*
Stocking Rate (AUM/acre): 0.49*

Plant Community: Non-Native Cool-Season Grasses/Remnant Shrubs/Remnant Trees (3.1)
Average Production (lb/acre, air-dry): 1,600*
Stocking Rate (AUM/acre): 0.44*

Plant Community: All other plant communities identified in this document have variable annual production values and require onsite sampling to determine initial stocking rates.

*Total annual production and stocking rates are highly variable and require onsite sampling.

Total onsite annual production may contain vegetation deemed undesirable or untargeted by the grazing animal. Therefore, AUM values may need reducing to reflect only preferred or desirable forage species.

Grazing by domestic livestock is one of the major income-producing industries in the area. Rangeland in this area may provide yearlong forage for livestock. During the dormant period, the forage for livestock likely has insufficient protein to meet livestock requirements. Added protein allows ruminants to better utilize the energy stored in grazed plant materials. A forage quality test (either directly or through fecal sampling) should be used to determine the level of supplementation needed.

Hydrological functions

Water is the principal factor limiting forage production on this site. This site is dominated by soils in hydrologic group B. Infiltration and runoff potential for this site varies from moderate to high depending on soil hydrologic group, slope, and ground cover. In many cases, areas with greater than 75 percent ground cover have the greatest potential for high infiltration and lower runoff. An example of an exception would be where shortgrasses form a strong sod and dominate the site. Normally areas where ground cover is less than 50 percent have the greatest potential to have reduced infiltration and higher runoff. Refer to the USDA-NRCS National Engineering Handbook, Part 630, for hydrologic soil groups, runoff quantities, and hydrologic curves.

Recreational uses

This site provides opportunities for hunting upland game species. The wide variety of plants that bloom from spring until fall have aesthetic value that appeals to visitors.

Wood products

No appreciable wood products are typically present on this site.

Other products

Harvesting the seeds of native plants can provide additional income on this site.

Other information

Revision Notes: “Previously Approved” Provisional
This provisional ecological site description (ESD) has passed quality control (QC) and quality assurance (QA) to ensure it meets the 2014 NESH standards for a “Provisional” ecological site description.

This ecological site description (ESD) is an updated “Previously Approved” ESD that represented a first-generation tier of documentation that met all requirements as an “Approved” ESD as laid out in the 1997 National Range and Pasture Handbook (NRPH). The requirements for approved status changed with the release of the 2014 National Ecological Site Handbook (NESH). The previously approved document fully described the reference state and community phases in the state-and-transition model. All other alternative states were at least described in narrative form. The “Previously Approved” ESD has been field-tested for a minimum of five years and is a proven functional document for conservation planning. The “Previously Approved” ESD may not contain all tabular and narrative entries as required in the current “Approved” level of documentation, but it is expected this ESD will continue refinement toward the current “Approved” status.

Site Development and Testing Plan
Future work, as described in an official project plan, is necessary to validate the information in this provisional ecological site description. The plan will include field activities for low-, medium-, and high-intensity sampling, soil correlations, and analysis of the data. Annual field reviews should be done by soil scientists and vegetation specialists. Final field review, peer review, quality control, and quality assurance reviews are required to produce the final document.

Inventory data references

Information presented here has been derived from NRCS clipping data and other inventory data. Field observations from range-trained personnel were also used. Those involved in developing this site description include: Ryan Beer, Range Management Specialist (RMS), NRCS; Chuck Berdan, Biologist, Bureau of Land Management (BLM); Stan Boltz, RMS, NRCS; Dave Dewald, Wildlife BIO, NRCS; Mitch Faulkner, RMS, NRCS; Jody Forman, RMS, NRCS; Dennis Froemke, RMS, NRCS; Tom Juntti, BIO, United States Forest Service (USFS); Cheryl Nielsen, RMS, NRCS; Jeff Printz, RMS, NRCS; Mike Stirling, RMS, NRCS; Dan Svingen, BIO, USFS; Darrell Vanderbusch, Soil Scientist, NRCS; Cindy Zachmeier, BIO, NRCS; and Tim Zachmeier, BIO, BLM.

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Approval

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Acknowledgments

This ecological site description was updated by Rick L. Peterson on January 31, 2020.

The ESDs were available for QC review by Mark Hayek, Emily Helms, Ryan Beer, and Mitch Faulkner.

All ecological sites were then reviewed and approved at the Provisional Level by David Kraft, Regional ESS, Salina, KS in September 2020.

Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	Stan Boltz, Ryan Beer, Mitch Iverson, Thad Berrett, Cheryl Nielsen
Contact for lead author	stanley.boltz@sd.usda.gov, 605-352-1236
Date	05/06/2010
Approved by	Stan Boltz
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** None.

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2. **Presence of water flow patterns:** Typically none or barely visible. Evidence of water flow may be present after high overland flow events or flooding from adjacent streams, but vegetation normally remains intact.

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3. **Number and height of erosional pedestals or terracettes:** None.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 0 to 5 percent is typical.

5. **Number of gullies and erosion associated with gullies:** None typical, however limited headcutting may form after high runoff or flooding events. Existing gullies should be stabilized with good vegetative cover.

6. **Extent of wind scoured, blowouts and/or depositional areas:** None typical, but limited deposition may occur after major runoff or flooding events.

7. **Amount of litter movement (describe size and distance expected to travel):** Litter of small and medium size classes will move after average to high rainfall events. Litter does not travel far, typically being trapped in small bunches by the extensive vegetative cover. Litter movement may be fairly extensive after major runoff or flooding events.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Soil aggregate stability ratings should typically be 5 to 6, normally 6. Surface organic matter adheres to the soil surface. Soil surface fragments will typically retain structure indefinitely when dipped in distilled water.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** A-horizon should be 5 to 20 inches thick with mollic (dark) colors when moist. Structure typically is medium to fine granular in the upper A-horizon.

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Combination of shallow and deep rooted species (mid & tall rhizomatous and tufted perennial cool- and warm-season grasses) with fine and coarse roots positively influences infiltration.

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None – when dry, B horizons can be hard and appear to be compacted, but no platy structure will be present.

12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

    Dominant: Tall warm-season rhizomatous >

    Sub-dominant: Mid cool-season rhizomatous > Mid/tall cool-season bunchgrasses > Shrubs >

    Other: Forbs > Mid/short warm-season bunchgrasses = Grass-likes > Trees

    Additional:

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Very little evidence of decadence or mortality. Bunch grasses have strong, healthy centers and shrubs are vigorous.

14. **Average percent litter cover (%) and depth (in):**

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** Production ranges from 1,900-3,800 lbs./acre (air-dry weight). Reference value production is 2,800 lbs./acre (air-dry weight).

16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:** State and local noxious weeds, Kentucky bluegrass, snowberry, and smooth bromegrass.

17. **Perennial plant reproductive capability:** All species exhibit high vigor relative to climatic conditions. Do not rate based solely on seed production. Perennial grasses should have vigorous rhizomes or tillers.