USDA Natural Resources Conservation Service

Ecological site R064XY002NE
Wet Subirrigated

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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.

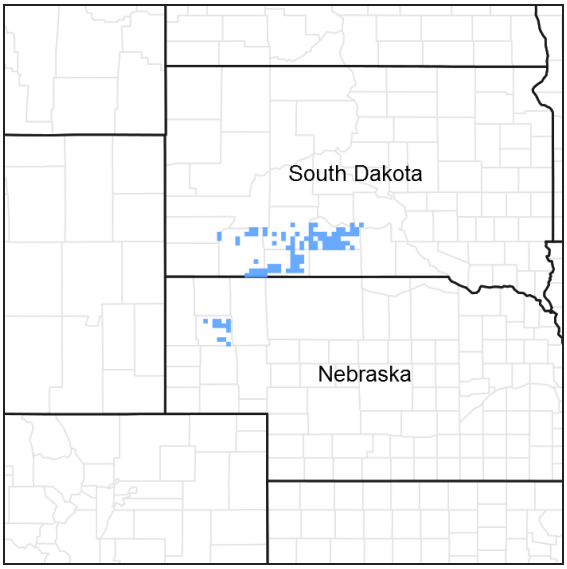

Figure 1. Mapped extent

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): 064X–Mixed Sandy and Silty Tableland and Badlands

The Mixed Sandy and Silty Tableland and Badlands (MLRA 64) is shared almost equally between South Dakota (42 percent) and Nebraska (41 percent). A small portion is in Wyoming (17 percent). The MLRA consists of 11,895 square miles. The towns of Kadoka and Pine Ridge, South Dakota; Chadron and Alliance, Nebraska; and Lusk, Wyoming, are all within the boundaries of this MLRA.

The following areas of special interest are in this MLRA: Agate Fossil Beds National Monument, Chadron State Park, Fort Robinson State Park, and the Pine Ridge Indian Reservation; parts of the Oglala and Buffalo Gap National Grasslands, which are in the Nebraska National Forest; and nearly all of Badlands National Park. The Badlands are internationally renowned for their Oligocene vertebrate fossils.

The northern section of the MLRA consists of old plateaus and terraces that have been deeply eroded by wind, water, and time. The southern section consists of nearly level to broad intervalley remnants of smooth fluvial plains. These two sections are separated by the Pine Ridge escarpment. Elevations gradually increase from 2,950 to 5,073 feet from east to west. The main drainageway through Badlands National Park is the White River. The headwaters of both the White and Niobrara Rivers are in MLRA 64. The Pine Ridge escarpment is at the northernmost extent of the Ogallala Aquifer.

Tertiary continental sediments consisting of sandstone, siltstone, and claystone underlie most of the area. Many of the bedrock units in the southern third of the MLRA are covered by loess. Soils range from shallow to very deep and from generally well drained to excessively drained. They are loamy or sandy. The Badlands consist of stream-laid layers of silt, clay, and sand mixed with layers of volcanic ash.

Average annual precipitation for the area ranges from 14 to 20 inches. Most of the rainfall occurs as frontal storms in the spring and early summer. This area supports a mixture of short-, mid-, and tall-statured warm- and cool-season grasses. On the Pine Ridge Escarpment, these plants grow in association with ponderosa pine, Rocky Mountain juniper, western snowberry, skunkbush sumac, common chokecherry, and rose. Wyoming big sagebrush grows in minor amounts in the drier, far western portion of the MLRA; however, small remnant stands can be found in the eastern portion of the Oglala National Grassland in Nebraska.

Sixty percent of the MLRA is grassland, 11 percent of which is under Federal management. Twenty-two percent of the area is used as cropland, and 4 percent is forested. Major resource concerns include wind erosion, water erosion, and surface water quality (USDA-NRCS, 2006, Ag Handbook 296).

For development of ecological sites, MLRA 64 is divided into two precipitation zones (PZ): 14 to 17 inches per year and 17 to 20 inches per year. The wetter zone extends from the western end of the Pine Ridge Escarpment near Lusk, Wyoming, eastward along the escarpment through Nebraska and into the Big Badlands area of South Dakota. The drier zone extends from Wyoming eastward to Alliance and Oshkosh, Nebraska, south of the Pine Ridge Escarpment. MLRA 64 stops at the western edge of the Nebraska Sand Hills (MLRA 65).

A unique geologic area known as the Hartville Uplift is in the far southwest corner of the 14 to 17 inch precipitation zone. The Hartville Uplift is an elongated, north-northwest-oriented, broad domal arch of Laramide age (70-50 million years ago). It extends approximately 45 miles between Guernsey and Lusk, Wyoming, and is 15 miles wide at its widest point. Erosion has exposed a core of granite and Precambrian metasedimentary and metavolcanic rocks (Steele et al., 2018). In addition to the ecological sites in the 14 to 17 inch precipitation zone of MLRA 64, three unique ecological site descriptions were developed to describe the soils and plant community dynamics in the Hartville Uplift.

Classification relationships

USDA Land Resource Region G—Western Great Plains Range and Irrigated Region:
Major Land Resource Area (MLRA) 64—Mixed Sandy and Silty Tableland and Badlands

U.S. Environmental Protection Agency (EPA)
Level IV Ecoregions of the Conterminous United States:
High Plains—25:
Pine Ridge Escarpment—25a.
Flat to Rolling Plains—25d.
Pine Bluffs and Hills—25f.
Sandy and Silty Tablelands—25g.
Northwestern Great Plains—43:
White River Badlands—43h.
Keya Paha Tablelands—43i.

USDA Forest Service
Ecological Subregions: Sections and Subsections of Conterminous United States:
Great Plains and Palouse Dry Steppe Province—331:
Western Great Plains Section—331F:
Subsections:
Shale Scablands—331Fb.
White River Badlands—331Fh.
Pine Ridge Escarpment—331Fj.
High Plains—331Fk.
Hartville Uplift—331Fm.
Western Nebraska Sandy and Silty Tablelands—331Fn.
Keye Paha Tablelands—331Ft.

Powder River Basin Section—331G:
Subsection: Powder River Basin—331Ge.

Ecological site concept

The Wet Subirrigated ecological site is found throughout MLRA 64 but is of minor extent. It is a run-in site on nearly level to gently sloping flood plains and interdunal swales. Slopes range from 0 to 2 percent. The soils are very deep and formed in eolian sands and sandy alluvium. The surface layer is fine sand or loam 5 to 10 inches in thickness. Soils are poorly drained and have moderate permeability. The texture of the subsurface layer ranges from very fine sandy loam to silt loam. A seasonal water table occurs within 3.5 feet of the surface.

Vegetation in the Reference State (1.0) is dominated by tall- and mid-stature warm-season grasses and forbs, but the plant community can shift to cool-season grasses and sedges in areas where the water table is stable at a higher level.

Associated sites

R064XY022NE	**Wet Land** The Wet Land ecological site is adjacent to the Wet Subirrigated ecological site but has permanent or seasonal flooding.
R064XY024NE	**Subirrigated** The Subirrigated ecological site is adjacent to the Wet Subirrigated ecological site on flood plains.

Similar sites

R064XY024NE	**Subirrigated** The Subirrigated ecological site is in landscape positions similar to those of the Wet Subirrigated site. The Subirrigated plant community has more little bluestem and less prairie cordgrass than the Wet Subirrigated ecological site.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Andropogon gerardii* (2) *Spartina pectinata*

Physiographic features

The Subirrigated ecological site is found on nearly level to gently sloping flood plains and interdunal swales. A water table generally occurs within reach of plants for the majority of the growing season.

Table 2. Representative physiographic features

Landforms	(1) Flood plain (2) Interdune
Runoff class	Negligible to low
Flooding duration	Very brief (4 to 48 hours) to brief (2 to 7 days)
Flooding frequency	Rare to frequent
Ponding frequency	None
Elevation	2,900–5,000 ft
Slope	0–2%
Water table depth	0–18 in
Aspect	Aspect is not a significant factor

Climatic features

MLRA 64 has a continental climate consisting of cold winters and hot summers, low humidity, light rainfall, and ample sunshine. Extremes in temperature are common in some years. The climate results from MLRA 64 being near the geographic center of North America. There are few natural barriers on the Northern Great Plains. Air masses move freely across the plains and account for rapid changes in temperature.

Average annual precipitation ranges from 14 to 20 inches per year. The normal average annual temperature is about 47 °F. January is the coldest month with average temperatures ranging from about 21 °F (Wood, SD) to about 25 °F (Hemingford, NE). July is the warmest month with average temperatures ranging from about 70 °F (Keeline 3 W, WY: 1953–1986) to about 76 °F (Wood, SD). The range of normal average monthly temperatures between the coldest and warmest months is about 55 °F. This large annual range attests to the continental nature of the climate of this area. Wind speeds average about 11 miles per hour annually, ranging from about 13 miles per hour during the spring to about 10 miles per hour during the summer. Daytime winds are generally stronger than nighttime winds. Occasionally, strong storms bring brief periods of high winds with gusts to more than 50 miles per hour.

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)	92-120 days
Freeze-free period (characteristic range)	119-139 days
Precipitation total (characteristic range)	16-19 in
Frost-free period (actual range)	87-122 days
Freeze-free period (actual range)	110-149 days
Precipitation total (actual range)	15-20 in
Frost-free period (average)	107 days
Freeze-free period (average)	130 days
Precipitation total (average)	17 in

Climate stations used

- (1) GLENDO 6NE [USC00483936], Glendo, WY
- (2) HARRISON 20 SSE [USW00094077], Harrison, NE
- (3) ALLIANCE 1WNW [USC00250130], Alliance, NE
- (4) HARRISON [USC00253615], Harrison, NE
- (5) HEMINGFORD [USC00253755], Hemingford, NE
- (6) INTERIOR 3 NE [USC00394184], Interior, SD
- (7) MARTIN [USC00395281], Martin, SD
- (8) WOOD [USC00399442], Wood, SD
- (9) LUSK 2 SW [USC00485830], Lusk, WY
- (10) TORRINGTON 29N [USC00488997], Jay Em, WY
- (11) CHADRON 3NE [USC00251578], Chadron, NE

Influencing water features

The Wet Subirrigated ecological site has a combination of physical and hydrological features that provides season-long ground water within 3.5 feet of the surface and allows relatively free movement of water and air in the upper part of the soil. The site is subject to rare or frequent flooding.

Wetland description

Wetland Description: (Cowardin et al., 1979)
System: Palustrine
Subsystem: NA
Class: Emergent Wetland
Subclass: Persistent

Soil features

Soils in this site have a fine sand to loam textured surface layers with slopes of 0 to 2 percent. The soils are poorly drained and formed in eolian sands and sandy alluvium. The surface layer is 5 to 10 inches thick. The subsurface texture ranges from very fine sandy loam to silt loam.

Soils Correlated to the Wet Subirrigated Site: Lamo variant, Loup, and Orwet

Rills and gullies are not typically present. Water flow patterns are barely distinguishable if at all present. Litter typically falls in place, and signs of movement are not common. Chemical and physical crusts are rare to non-existent.

More information regarding the soil is available in soil survey reports. Contact the local USDA Service Center for details specific to your area of interest, or go online to access the USDA Web Soil Survey.

Table 4. Representative soil features

Parent material	(1) Eolian sands–sandstone and siltstone (2) Alluvium–sandstone and siltstone
Surface texture	(1) Loam (2) Fine sand
Family particle size	(1) Loamy
Drainage class	Poorly drained
Permeability class	Moderate
Soil depth	80 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	6–8 in
Calcium carbonate equivalent (0-40in)	0–10%
Electrical conductivity (0-40in)	0–2 mmhos/cm
Sodium adsorption ratio (0-40in)	0–6
Soil reaction (1:1 water) (0-40in)	6.6–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–5%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

The Wet Subirrigated ecological site developed under 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); 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.

Grazing, forage management, and fluctuating water table depths can result in plant communities shifting from being dominated by warm-season plants to being dominated by cool-season plants. These drivers can work independently of one another. 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-Switchgrass Plant Community (1.1). Species such as switchgrass, slender wheatgrass, Scribner panicum, western wheatgrass, foxtail barley, and prairie cordgrass increase in abundance. Warm-season grasses, such as big bluestem and Indiangrass, decrease in frequency and production. This site is also susceptible to invasion or encroachment of non-native cool-season grasses.

Interpretations are primarily based on the Big Bluestem-Switchgrass Plant Community (1.1). The community was 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 were also used. Plant communities, states, transitional pathways, and thresholds were 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

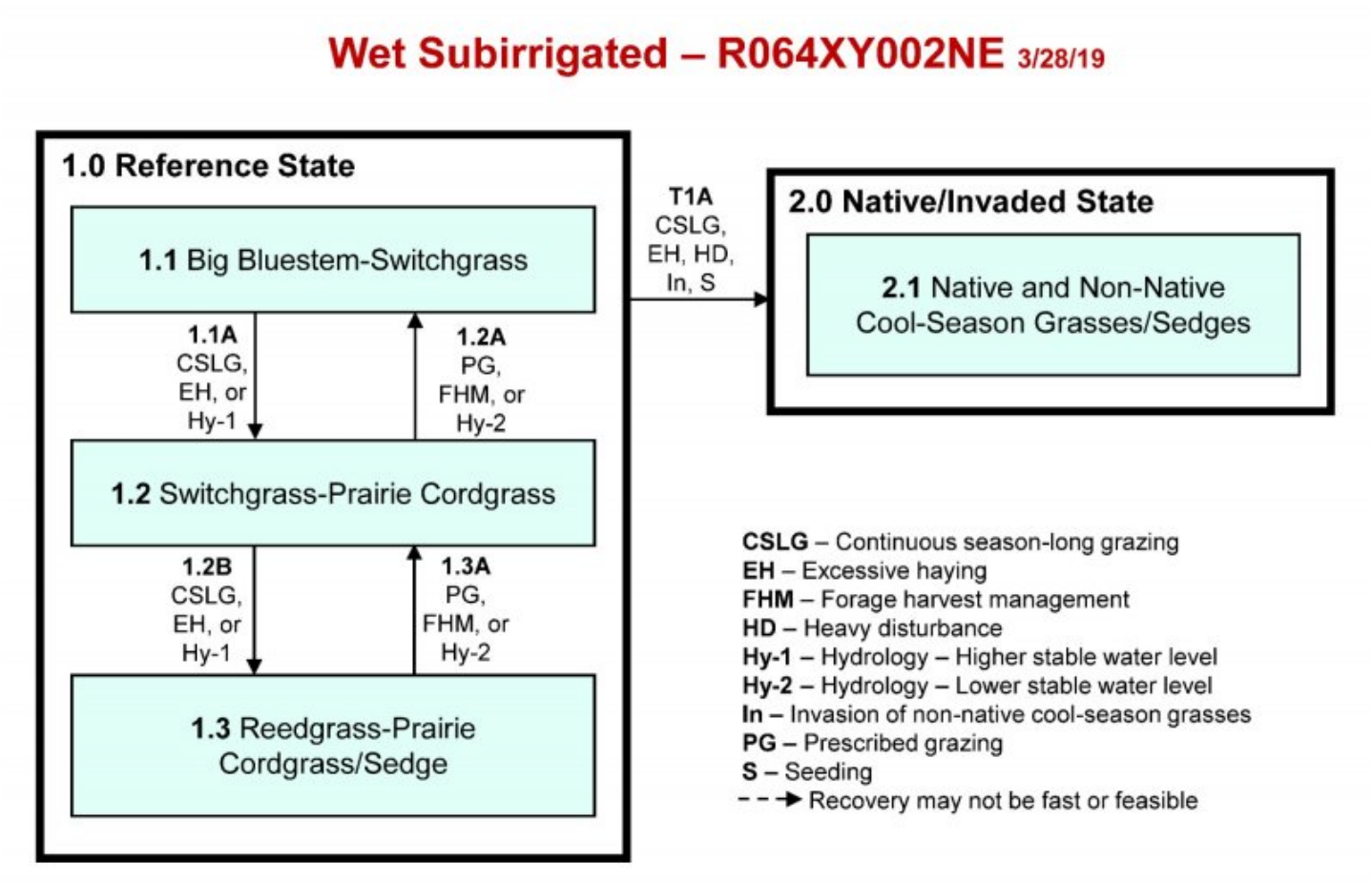

Diagram Legend: Wet Subirrigated - R064XY002NE

T1A	1.0 to 2.0	Continuous season-long grazing without change in season of use or adequate recovery period; excessive haying; heavy disturbance; invasion of non-native cool-season grasses; or seeding to non-native cool-season grasses and legumes.
1.1A	1.1 to 1.2	Continuous, season-long grazing without change in season of use or adequate recovery time; excessive haying; or a change to a wetter hydrologic cycle with higher stable water levels.
1.2A	1.2 to 1.1	Prescribed grazing, including proper stocking rates, change in season of use, and adequate time for rest and recovery; proper forage harvest management; or a change to a wetter hydrologic cycle with higher stable water levels.
1.2B	1.2 to 1.3	Continuous, season-long grazing without change in season of use or adequate recovery time; excessive haying; or a change to a drier or normal hydrologic cycle with lower stable water levels.
1.3A	1.3 to 1.2	Prescribed grazing, including proper stocking rates, change in season of use, and adequate time for rest and recovery; proper forage harvest management; or a change to a drier or normal hydrologic cycle with lower stable water levels.

State 1
Reference State

The Reference State (1.0) represents the best estimate of the natural range of variability that dominated the dynamics of the Wet Subirrigated ecological site prior to European settlement. This site is dominated by warm-season grasses. In pre-European settlement times, the primary disturbances included grazing by large ungulates and small mammals, drought, and a fluctuating water table. Favorable growing conditions occurred during the spring and the warm months of June through August. Today, a similar state can be found in areas where proper livestock use has occurred.

Community 1.1
Big Bluestem-Switchgrass

Interpretations are primarily based on the Big Bluestem-Switchgrass Plant Community (1.1). This is also considered the Reference Plant Community (1.1). This plant community is in areas that are properly managed with grazing and in some cases prescribed burning. Harvesting hay at a different time during the growing season each year allows this plant community to persist. The potential vegetation by air-dry weight is about 85 percent grasses, 10 percent grass-like plants, and 5 percent forbs. Tall warm-season grasses dominate the plant community. The major grasses include big bluestem, Indiangrass, switchgrass, bluejoint reedgrass, northern reedgrass, and prairie cordgrass. Other grasses in this plant community include slender wheatgrass, plains bluegrass, and western wheatgrass. This plant community is diverse, stable, productive, and well adapted to the Northern Great Plains. The high-water table supplies much of the moisture for plant growth. Plant litter is properly distributed with little movement. Natural plant mortality is very low. This is a sustainable plant community in terms of soil stability, watershed function, and biologic integrity.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	4455	4850	5225
Forb	45	150	275
Total	**4500**	**5000**	**5500**

Figure 9. Plant community growth curve (percent production by month). NE6409, Pine Ridge/Badlands, warm-season dominant, cool-season sub-dominant. Warm-season dominant, cool-season sub-dominant, lowlands.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		3	8	18	27	23	12	6	3		

Community 1.2
Switchgrass-Prairie Cordgrass

This plant community evolved under annual haying or under moderate, continuous, season-long grazing followed by heavy grazing in the fall. A higher water table level can also cause this plant community shift. The potential vegetation is about 80 percent grasses, 15 percent grass-like plants, and 5 percent forbs. Dominant grasses include switchgrass, prairie cordgrass, big bluestem, and forbs such as smartweed and ironweed. When compared to the Big Bluestem-Switchgrass Plant Community (1.1), switchgrass and prairie cordgrass are increased in abundance and big bluestem and Indiangrass are decreased. Plant diversity has decreased. The desirable, more palatable grasses are suppressed due to heavier use. This plant community is somewhat resistant to change. The herbaceous species are well adapted to grazing; however, species composition can be altered through long-term overgrazing. If the herbaceous component is intact, it tends to be resilient if the disturbance is not long-term.

Table 6. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	3960	4365	4770
Forb	40	135	230
Total	**4000**	**4500**	**5000**

Figure 11. Plant community growth curve (percent production by month). NE6410, Pine Ridge/Badlands, lowland warm-season dominant. Warm-season dominant, lowland.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		3	7	15	25	25	17	6	2		

Community 1.3
Reedgrass-Prairie Cordgrass/Sedge

This plant community evolved under long-term annual haying in the mid-summer. Cool-season grasses make up a majority of the plant community. The balance is made up of warm-season grasses and miscellaneous forbs. The shift to this phase can also be due to a wetter hydrologic cycle that includes a higher stable water table. The potential vegetation is about 70 percent grasses, 20 percent grass-like plants, and 10 percent forbs. Dominant grasses include bluejoint and northern reedgrass, which are acceptable grasses on this plant community. The reedgrasses become aggressive and increase in abundance, crowding out the warm-season plants: big bluestem, Indiangrass, and switchgrass. Grasses of secondary importance include prairie cordgrass, slender wheatgrass, and western wheatgrass. Common forbs in this plant community include red clover and white clover. Compared to the Big Bluestem-Switchgrass Plant Community (1.1), this phase has an increased abundance of bluejoint reedgrass, northern reedgrass, slender wheatgrass, and prairie cordgrass. Big bluestem and Indiangrass are decreased in abundance. This plant community is moderately resistant to change. The herbaceous species are well adapted to grazing; however, species composition can be altered through long-term overgrazing. If the

Table 7. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	3265	3589	3910
Forb	35	111	190
Total	**3300**	**3700**	**4100**

Figure 13. Plant community growth curve (percent production by month). NE6409, Pine Ridge/Badlands, warm-season dominant, cool-season sub-dominant. Warm-season dominant, cool-season sub-dominant, lowlands.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		3	8	18	27	23	12	6	3		

Pathway 1.1A
Community 1.1 to 1.2

Continuous grazing without adequate recovery periods; excessive haying; or a wetter hydrologic cycle with a higher stable water table convert Plant Community (1.1) to the Switchgrass-Prairie Cordgrass Plant Community (1.2).

Pathway 1.2A
Community 1.2 to 1.1

Proper forage harvest management and prescribed grazing that includes proper stocking rates, change in season of use, and adequate time for plant recovery shift Plant Community 1.2 to the Big Bluestem-Switchgrass Plant Community (1.1). Haying or grazing prior to the onset of active warm-season grass growth improves warm-season grass vigor. This early haying also reduces cool-season grass competition and improves the quality of the hay. Waiting to graze after a killing frost in the fall also helps to reduce the abundance of cool-season grasses while improving the vigor of the warm-season grasses. A return to a normal or drier hydrologic cycle can result in Plant Community 1.2 shifting to a community dominated by warm-season plants.

Conservation practices

Forage Harvest Management
Prescribed Grazing

Pathway 1.2B
Community 1.2 to 1.3

Continuous grazing without adequate recovery periods; excessive haying; or a higher stable water table convert Plant Community 1.2 to the Reedgrass-Prairie Cordgrass/Sedge Plant Community (1.3).

Pathway 1.3A
Community 1.3 to 1.2

Proper forage harvest management and prescribed grazing that includes proper stocking rates, change in season of use, and adequate time for plant recovery shift Plant Community 1.3 to the Switchgrass-Prairie Cordgrass Plant Community (1.2). Haying or grazing prior to the onset of active warm-season grass growth improves warm-season grass vigor. This early haying also reduces cool-season grass competition and improves the quality of the hay. Waiting to graze after a killing frost in the fall reduces the abundance of cool-season grasses while improving the vigor of the warm-season grasses. A return to a normal or drier hydrologic cycle can result in Plant Community 1.3 shifting to a community dominated by warm-season plants.

Conservation practices

Forage Harvest Management
Prescribed Grazing

State 2
Native/Invaded State

The Native/Invaded State (2.0) is dominated by native and non-native cool-season grasses and grass-like plants. The non-native cool-season grasses are primarily reed canarygrass and in some places creeping meadow foxtail. This state is the result of the invasion of non-native cool-season grasses in combination with continuous grazing, excessive haying, or heavy disturbance. The species that invaded may have also been seeded or escaped from adjacent haylands. The Native/Invaded State (2.0) is very resilient and resistant to change.

Community 2.1
Native and Non-Native Cool-Season Grasses/Sedges

This plant community developed from the invasion of cool-season grasses in combination with further continuous season-long grazing, excessive haying, or heavy disturbance. The plant community is predominantly cool-season grasses and grass-like plants. Reed canarygrass and in some places creeping meadow foxtail have invaded and become established in the plant community. Remnant stands of big bluestem, switchgrass, and prairie cordgrass are in scattered areas throughout the site. Once reed canarygrass and creeping meadow foxtail become established in this plant community, it is difficult to alter due to their aggressive behavior. This community remains stable but has lower productivity and diversity. The nutrient cycle is impaired due to the loss of warm-season grass species and deep-rooted forbs. It is unlikely that this plant community can be returned to the Reference State (1.0).

Figure 14. Plant community growth curve (percent production by month). NE6406, Pine Ridge/Badlands, lowland cool-season dominant. Cool-season dominant, lowland.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		5	13	28	28	12	5	6	3		

Transition T1A
State 1 to 2

The invasion of non-native cool-season grasses in combination with continuous season-long grazing and no recovery opportunity, excessive haying and no recovery opportunity, or heavy disturbance transition State 1.0 to the Native/Invaded State (2.0). Seeding to reed canarygrass or creeping meadow foxtail also transition the Reference State (1.0) to the Native Invaded State (2.0).

Additional community tables

Table 8. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Warm-Season Mid- Tall Grasses**			2000–3750	
	big bluestem	ANGE	*Andropogon gerardii*	750–1500	–
	prairie cordgrass	SPPE	*Spartina pectinata*	750–1500	–
	switchgrass	PAVI2	*Panicum virgatum*	750–1250	–
	Indiangrass	SONU2	*Sorghastrum nutans*	250–750	–
	spiked muhly	MUGL3	*Muhlenbergia glomerata*	0–250	–
2	**Cool-Season Mid-Grasses**			500–1500	
	bluejoint	CACA4	*Calamagrostis canadensis*	250–500	–
	northern reedgrass	CASTI3	*Calamagrostis stricta ssp. inexpansa*	250–500	–
	plains bluegrass	POAR3	*Poa arida*	250–500	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	100–500	–
	western wheatgrass	PASM	*Pascopyrum smithii*	0–250	–
	foxtail barley	HOJU	*Hordeum jubatum*	0–100	–
3	**Other Native Grasses**			0–250	
	Grass, perennial	2GP	*Grass, perennial*	0–250	–
4	**Grass-Likes**			250–500	
	sedge	CAREX	*Carex*	50–500	–
	rush	JUNCU	*Juncus*	0–250	–
	bulrush	SCHOE6	*Schoenoplectus*	0–250	–
	spikerush	ELEOC	*Eleocharis*	0–150	–
5	**Non-Native Cool-Season Grasses**			0	
Forb					
6	**Forbs**			50–250	
	Forb, perennial	2FP	*Forb, perennial*	0–100	–
	American licorice	GLLE3	*Glycyrrhiza lepidota*	0–50	–
	blackeyed Susan	RUHI2	*Rudbeckia hirta*	0–50	–
	cinquefoil	POTEN	*Potentilla*	0–50	–
	goldenrod	SOLID	*Solidago*	0–50	–
	white heath aster	SYER	*Symphyotrichum ericoides*	0–50	–
	ironweed	VERNO	*Vernonia*	0–50	–
	Pennsylvania smartweed	POPE2	*Polygonum pensylvanicum*	0–50	–
	scouringrush horsetail	EQHY	*Equisetum hyemale*	0–50	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–50	–
7	**Non-Native Forbs**			0	

Table 9. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Warm-Season Mid- Tall Grasses**			1800–2700	
	prairie cordgrass	SPPE	*Spartina pectinata*	900–1800	–
	switchgrass	PAVI2	*Panicum virgatum*	900–1800	–
	big bluestem	ANGE	*Andropogon gerardii*	450–900	–
	Indiangrass	SONU2	*Sorghastrum nutans*	0–225	–
	spiked muhly	MUGL3	*Muhlenbergia glomerata*	0–225	–
2	**Cool-Season Mid-Grasses**			450–1350	
	bluejoint	CACA4	*Calamagrostis canadensis*	225–450	–
	northern reedgrass	CASTI3	*Calamagrostis stricta ssp. inexpansa*	225–450	–
	plains bluegrass	POAR3	*Poa arida*	225–450	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	90–450	–
	western wheatgrass	PASM	*Pascopyrum smithii*	0–450	–
	reed canarygrass	PHAR3	*Phalaris arundinacea*	0–225	–
	foxtail barley	HOJU	*Hordeum jubatum*	0–135	–
3	**Other Native Grasses**			0–225	
	Grass, perennial	2GP	*Grass, perennial*	0–225	–
4	**Grass-Likes**			225–675	
	sedge	CAREX	*Carex*	45–450	–
	rush	JUNCU	*Juncus*	0–225	–
	bulrush	SCHOE6	*Schoenoplectus*	0–225	–
	spikerush	ELEOC	*Eleocharis*	0–135	–
5	**Non-Native Cool-Season Grasses**			0–90	
	creeping meadow foxtail	ALAR	*Alopecurus arundinaceus*	0–90	–
	Kentucky bluegrass	POPR	*Poa pratensis*	0–45	–
Forb					
6	**Forbs**			45–225	
	blackeyed Susan	RUHI2	*Rudbeckia hirta*	0–90	–
	white heath aster	SYER	*Symphyotrichum ericoides*	0–90	–
	ironweed	VERNO	*Vernonia*	0–90	–
	Pennsylvania smartweed	POPE2	*Polygonum pensylvanicum*	0–90	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–90	–
	Forb, perennial	2FP	*Forb, perennial*	0–90	–
	scouringrush horsetail	EQHY	*Equisetum hyemale*	0–45	–
	cinquefoil	POTEN	*Potentilla*	0–45	–
	goldenrod	SOLID	*Solidago*	0–45	–
	American licorice	GLLE3	*Glycyrrhiza lepidota*	0–45	–
7	**Non-Native Forbs**			0–90	
	red clover	TRPR2	*Trifolium pratense*	0–90	–
	white clover	TRRE3	*Trifolium repens*	0–45	–

Table 10. Community 1.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Warm-Season Mid- Tall Grasses**			740–1665	
	prairie cordgrass	SPPE	*Spartina pectinata*	555–1295	–
	switchgrass	PAVI2	*Panicum virgatum*	185–555	–
	big bluestem	ANGE	*Andropogon gerardii*	0–555	–
	Indiangrass	SONU2	*Sorghastrum nutans*	0–185	–
	spiked muhly	MUGL3	*Muhlenbergia glomerata*	0–74	–
2	**Cool-Season Mid-Grasses**			1110–2775	
	bluejoint	CACA4	*Calamagrostis canadensis*	370–925	–
	northern reedgrass	CASTI3	*Calamagrostis stricta ssp. inexpansa*	370–925	–
	plains bluegrass	POAR3	*Poa arida*	370–925	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	74–555	–
	reed canarygrass	PHAR3	*Phalaris arundinacea*	0–555	–
	western wheatgrass	PASM	*Pascopyrum smithii*	0–370	–
	foxtail barley	HOJU	*Hordeum jubatum*	0–185	–
3	**Other Native Grasses**			0–185	
	Grass, perennial	2GP	*Grass, perennial*	0–185	–
4	**Grass-Likes**			185–740	
	sedge	CAREX	*Carex*	74–555	–
	rush	JUNCU	*Juncus*	37–185	–
	bulrush	SCHOE6	*Schoenoplectus*	0–185	–
	spikerush	ELEOC	*Eleocharis*	0–185	–
5	**Non-Native Cool-Season Grasses**			0–185	
	creeping meadow foxtail	ALAR	*Alopecurus arundinaceus*	0–185	–
	Kentucky bluegrass	POPR	*Poa pratensis*	0–74	–
Forb					
6	**Forb**			37–185	
	white heath aster	SYER	*Symphyotrichum ericoides*	0–111	–
	ironweed	VERNO	*Vernonia*	0–111	–
	Pennsylvania smartweed	POPE2	*Polygonum pensylvanicum*	0–74	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–74	–
	Forb, perennial	2FP	*Forb, perennial*	0–74	–
	blackeyed Susan	RUHI2	*Rudbeckia hirta*	0–74	–
	cinquefoil	POTEN	*Potentilla*	0–37	–
	goldenrod	SOLID	*Solidago*	0–37	–
	scouringrush horsetail	EQHY	*Equisetum hyemale*	0–37	–
	American licorice	GLLE3	*Glycyrrhiza lepidota*	0–37	–
7	**Non-Native Forbs**			0–185	
	red clover	TRPR2	*Trifolium pratense*	0–185	–
	white clover	TRRE3	*Trifolium repens*	0–74	–

Animal community

Wildlife Interpretations:
MLRA 64 is in the drier areas of a northern mixed-grass prairie ecosystem in which sagebrush steppes to the west yield to grassland steppes to the east. Prior to European settlement, this MLRA suppported diverse grassland 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, and 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 species of small mammals and insects, were the primary consumers linking the grassland resources to large predators, such as the wolf, mountain lion, and grizzly bear, and to smaller carnivores, such as the coyote, bobcat, fox, and raptors. The prairie dog was once abundant and remains a keystone species within its range. The black-footed ferret, burrowing owl, ferruginous hawk, mountain plover, and swift fox are associated with prairie dog complexes.

Historically, the northern mixed-grass prairie was a disturbance-driven ecosystem in which fire, herbivory, and climate functioned 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 affected plant and animal communities. The bison was a historical keystone species but has been extirpated in this area as a free-ranging herbivore. The loss of the bison and the 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 reduced habitat quality for area-sensitive species.

Within MLRA 64, the Wet Subirrigated ecological site provides upland grassland cover and an associated forb component. The site was typically part of an expansive grassland landscape that included combinations of Badlands, Thin Breaks, Clayey, Claypan, Dense Clay, Loamy, Saline, Sandy, Shallow, Overflow, and Terrace ecological sites.

This site provides habitat for species requiring unfragmented grassland. Important habitat features and components found commonly or exclusively on this site may include leks for sharp-tailed grouse, upland nesting habitat for grassland birds, forbs and insects for brood habitat, and a forage source for small and large herbivores. Populations are declining for many bird species that nest in grasslands and shrub steppes. Extirpated species include free-ranging American bison, grizzly bear, gray wolf, black-footed ferret, mountain plover, Rocky Mountain locust, and swift fox.

The Wet Subirrigated ecological site has remained relatively intact but may be subject to haying under drier conditions. This site receives surface and subsurface water from adjacent upland sites during precipitation events. The site provides important wetter habitat for birds, small rodents, bats, mammalian predators, reptiles, amphibians, and insects. These sites may provide forage sites for sharp-tailed grouse broods.

Big Bluestem-Switchgrass (1.1) and Switchgrass-Prairie Cordgrass (1.2): These plant communities are dominated by big bluestem, switchgrass, and prairie cordgrass. The grass-like plants and forb communities may contain species likely to grow in wetlands. Raptors such as red-tailed hawk, Swainson’s hawk, American kestrel, and great-horned owl may use this site. Insects, including pollinators, play a limited role in maintaining the forb community but provide a significant forage base for birds and other species. Sharp-tailed grouse may benefit from this site. Diverse prey populations are available for grassland raptors and mammalian predators, especially bobcat.

The diversity of grasses, forbs, and shrubs provides high nutritional levels for small and large herbivores, including voles, mice, spotted ground squirrel, desert cottontail, white-tailed jackrabbit, black-tailed jackrabbit, and deer. These plant communities provide excellent fawning habitat for white-tailed deer. The relatively tall stature of this plant community provides suitable thermal, protective, and escape cover for small and large mammals. Predators utilizing this plant community include coyote, American badger, red fox, and short-tailed weasel, and long-tailed weasel. This plant community provides limited habitat for amphibians, mostly toads (i.e., Great Plains, Woodhouse’s, and Plains spade-foot). Prey abundance and shade opportunities can attract multiple reptile species such as gopher snake, milk snake, and prairie rattlesnake to this site.

Switchgrass becomes dominant as a result of annual haying or summer grazing. The shift from big bluestem to switchgrass does not significantly change the wildlife community. The diversity and abundance of forbs and grass-

like plants remain relatively unchanged.

Native and Non-Native Cool-Season Grasses/Sedge (2.1): This state, in which cool-season grass species dominate, results from continued annual haying, summer grazing, or both. The reduction in abundance of the medium and tall warm-season grasses plus the invasion of reed canarygrass substantially limits wildlife forage and cover. The diversity and abundance of forbs remain relatively unchanged, but introduced clover species may become a wildlife food source.

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-Switchgrass (1.1)
Average Production (lb/acre, air-dry): 5,000
Stocking Rate (AUM/acre): 1.37

Plant Community: Switchgrass-Prairie Cordgrass (1.2)
Average Production (lb/acre, air-dry): 4,500
Stocking Rate (AUM/acre): 1.23

Plant Community: Reedgrass-Prairie Cordgrass/Sedge (1.3)
Average Production (lb/acre, air-dry): 3,700
Stocking Rate (AUM/acre): 1.01

*Plant Community: Native and Non-Native Cool-Season Grasses/Sedges (2.1)
Average Production (lb/acre, air-dry): Variable
Stocking Rate (AUM/acre): Variable

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 have been reduced 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

Moisture conditions are ideal for forage production on this site. Soils on this site are in Hydrologic Soil Group C due to the high water tables. Although soils are permeable, high water tables limit infiltration in wet seasons. Surrounding upland areas tend to have permeable soils, and surface inflow peaks on these sites are often muted.

Many areas are seasonally flooded for short periods in wet weather. 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 upland game hunting, bird watching, and other activities. 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 present on the 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 the it meets the 2014 NESH standards for a provisional ecological site description.

This ESD is an updated “Previously Approved” ESD that represented a first-generation tier of documentation that, prior to the release of the 2014 National Ecological Site Handbook (NESH), met all requirements as an “Approved” ESD as laid out in the 1997 National Range and Pasture Handbook (NRPH). The document fully described the reference state and community phase in the state-and-transition model. All other alternative states are at least described in narrative form. The “Previously Approved” ESD has been field-tested for a minimum of 5 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 continued refinement toward an “Approved” status is expected.

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 include: Stan Boltz, range management specialist (RMS), NRCS; Jill Epley, RMS, NRCS; Rick Peterson, RMS, NRCS; David Steffen, RMS, NRCS; Jeff Vander Wilt; RMS, NRCS; Phil Young, soil scientist, NRCS; and George Gamblin, RMS, NRCS.

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Contributors

Rick L. Peterson
Stan C. Boltz

Approval

Suzanne Mayne-Kinney, 12/16/2024

Acknowledgments

This ecological site was reviewed and approved at the Approved Level by David Kraft, Regional ESS, Salina, KS on 6/06/2019.

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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, Mitch Faulkner, Emily Helms, John Hartung, Ryan Murray, George Gamblin, Rick Peterson, Nadine Bishop, Jeff Nichols
Contact for lead author	jeffrey.nichols@usda.gov
Date	12/16/2024
Approved by	Suzanne Mayne-Kinney
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** None. Rills should not be present.

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2. **Presence of water flow patterns:** None. Water flow patterns should not be present.

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3. **Number and height of erosional pedestals or terracettes:** None. Pedestals or terracettes should not be present.

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

5. **Number of gullies and erosion associated with gullies:** None. Gullies should not be present.

6. **Extent of wind scoured, blowouts and/or depositional areas:** None. Wind scoured areas and depositional areas should not be present.

7. **Amount of litter movement (describe size and distance expected to travel):** None. Litter falls into place. Litter movement is not expected on this site.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Soil 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):** The thickness of the A-horizon varies significantly with soil series and ranges from 6 to 50 inches (15 – 127 cm) thick. Soil colors may be very dark gray, dark gray, gray, or grayish brown (10YR 2 to 6/0, 1 or 2 or 2.5Y 3/2 or 5Y 4/1) when dry and black, very dark gray, dark gray, very dark grayish brown (10YR 2 to 4/1 or 2 or 5Y 3/1 or N 2.5/) when moist.

   Soil structures are weak fine subangular blocky parting to weak fine granular, weak medium subangular blocky parting to weak fine granular, moderate fine prismatic structure parting to moderate fine subangular blocky weak fine or weak fine and medium granular, or weak thin platy.

   See Official Soils Descriptions for additional details; major soil series correlated to the site are Calco, Arlo, Barney, Kezan, James, Loup, Zook, Baltic, Norway, Clarno, Clamo, Colo, and Lamo.

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** The functional/structural groups provide a combination of rooting depths and structure which positively influences infiltration. Invasion of introduced cool-season grasses such as reed canarygrass and creeping foxtail may have an adverse impact infiltration and runoff.

    Plant community composition is approximately 80-95 percent grasses or grass-like plants, 5 to 10 percent forbs, and 0-5 percent shrubs and trees which optimizes infiltration on the site. The grass and grass-like component is composed of warm-season (C4), tallgrass, grass-likes, cool-season (C3) bunchgrasses, cool-season (C3) rhizomatous grasses, and warm-season (C4), midgrass.

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** Typically, none. Physical impact during wet or ponded periods may cause temporary compaction, but this limited compaction will not restrict root development in the reference state.

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: Phase 1.1

1. Native, perennial, warm-season tallgrass (4 species minimum): big bluestem, switchgrass, Indiangrass, composite dropseed, prairie cordgrass.
2. Grass-likes (4 species minimum): rushes, sedges, bullrushes, spike-sedges.

Phase 1.2
1. Native, perennial, warm-season tallgrass (3 species minimum): big bluestem, switchgrass, Indiangrass, prairie cordgrass.
2. Grass-likes (4 species minimum): rushes, sedges, bullrushes, spike-sedges.

Sub-dominant: Phase 1.1
1. Native, perennial, cool-season bunchgrass (2 species minimum): bluejoint reedgrass, northern reedgrass, plains bluegrass.

Phase 1.2
1. Native, perennial, cool-season bunchgrass (2 species minimum): bluejoint reedgrass, northern reedgrass, plains bluegrass.
2. Native, perennial, cool-season, rhizomatous grass (1 species minimum): western wheatgrass, reed canarygrass.
3. Native, perennial, warm-season midgrass: little bluestem, sideoats grama.

Other: Minor - Phase 1.1
1. Native, perennial, cool-season, rhizomatous grass: western wheatgrass, reed canarygrass.
2. Native, perennial, warm-season midgrass: little bluestem, sideoats grama
3. Native forbs: forbs present vary from location to location.
4. Shrubs: willows, indigobush, and other shrubs that vary from location to location.

Minor - Phase 1.2
1. Native forbs: forbs present vary from location to location.
2. Shrubs: shrubs present vary from location to location.

Additional: The Big Bluestem – Switchgrass - Indiangrass Community or Reference Community (1.1) includes seven F/S groups which include in order of relative abundance, native, perennial, warm-season tallgrass; grass-likes; native, perennial, cool-season, bunchgrass; native, perennial, cool-season, rhizomatous grass; native, perennial, warm-season midgrass; native forbs; and shrubs.

The Prairie Cordgrass – Switchgrass Community (1.2) includes seven F/S groups which include in order of relative abundance, native, perennial, warm-season tallgrass; native, perennial, cool-season bunchgrass; grass-likes; native, perennial, cool-season, rhizomatous grass; native, perennial, warm-season mid-grass; native forbs; and shrubs.

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Bunchgrasses have strong, healthy centers with few (less than 3 percent) dead centers. Shrubs may show some dead branches (less than 5 percent) as plants age.

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14. **Average percent litter cover (%) and depth (in):** Plant litter cover is evenly distributed throughout the site and is expected to be 60 to 75 percent and at a depth of approximately 0.25 to 0.5 inch (0.65 to 1.3 cm). Reed canarygrass, creeping foxtail, and other cool-season introduced grass excessive litter can negatively impact the functionality of the site.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-**

production): The representative value (RV) for annual production is 5,750 pounds per acre in a year with normal precipitation and temperatures. Low and High production years should yield 5,250 and 6,250 pounds per acre respectively.

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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:** No non-native invasive species are present. Reed canarygrass, creeping foxtail, leafy spurge, quackgrass, and Canada thistle are known invasives that have the potential to become dominant or co-dominant on this site. Consult the state noxious weed and state watch lists for potential invasive species. Note: species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants.

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17. **Perennial plant reproductive capability:** All perennial species exhibit high vigor relative to recent weather conditions. Perennial grasses should have vigorous rhizomes or tillers; vegetative and reproductive structures are not stunted. All perennial species should be capable of reproducing annually.
