USDA Natural Resources Conservation Service

Ecological site R064XY024NE
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.

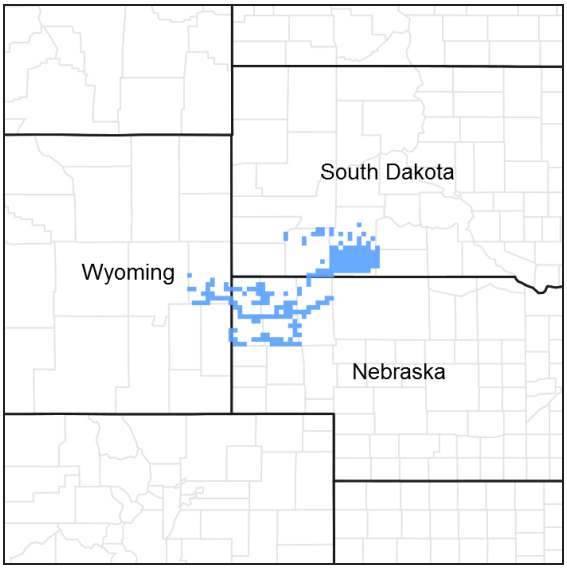

Figure 1. Mapped extent

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 Subirrigated ecological site is throughout MLRA 64. It is a run-in site on nearly level alluvial fans, stream terraces, and flood plains. Slopes range from 0 to 3 percent. The soils are very deep and formed in loamy or sandy alluvium of mixed origin. The surface layer is 4 to 15 inches thick and is silt loam to fine sandy loamy. The soils are somewhat poorly drained and have moderately slow to rapid permeability. The subsurface layers range from silty clay loam to sand. A seasonal high water table occurs within a depth of 1 to 3 feet. The water table is non-saline and non-alkaline.

Vegetation in the Reference State (1.0) is dominated by tall- and mid-stature warm-season grasses. Forbs are common and diverse. Shrubs and trees are in scattered areas across the site.

Associated sites

R064XY022NE	**Wet Land** The Wet Land ecological site is adjacent to the Subirrigated ecological site but is subject to permanent or seasonal flooding.
R064XY029NE	**Sandy Lowland** The Sandy Lowland ecological site is on low terraces above the Subirrigated ecological site.

Similar sites

R064XY025NE	**Saline Subirrigated** The Saline Subirrigated ecological site is in landscape positions similar to those of the Subirriagted site. The Saline Subirigated plant community has more salt-tolerant species and lower forage production than the Subirrigated ecological site.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Andropogon gerardii* (2) *Schizachyrium scoparium*

Physiographic features

The Subirrigated ecological site is on nearly level flood plains adjacent to streams, springs, and ponds. A water table is generally within reach of the plants for some portion of the growing season.

Table 2. Representative physiographic features

Landforms	(1) Alluvial fan (2) Flood plain (3) Stream terrace
Runoff class	Negligible to medium
Flooding duration	Brief (2 to 7 days)
Flooding frequency	Occasional to frequent
Ponding frequency	None
Elevation	2,900–5,000 ft
Slope	0–3%
Water table depth	18–36 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. 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 speed averages 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) HARRISON 20 SSE [USW00094077], Harrison, NE
- (2) ALLIANCE 1WNW [USC00250130], Alliance, NE
- (3) HARRISON [USC00253615], Harrison, NE
- (4) HEMINGFORD [USC00253755], Hemingford, NE
- (5) INTERIOR 3 NE [USC00394184], Interior, SD
- (6) MARTIN [USC00395281], Martin, SD
- (7) WOOD [USC00399442], Wood, SD
- (8) LUSK 2 SW [USC00485830], Lusk, WY
- (9) TORRINGTON 29N [USC00488997], Jay Em, WY
- (10) CHADRON 3NE [USC00251578], Chadron, NE
- (11) GLENDO 6NE [USC00483936], Glendo, WY

Influencing water features

The Subirrigated ecological site has a combination of physical and hydrological features that provides season-long ground water within 3 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 occasional flooding.

Wetland description

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

Soil features

The soils on this site commonly have a surface layer of silt loam to fine sandy loam. Slopes range from 0 to 3 percent. Soils are somewhat poorly drained and formed in loamy or sandy alluvium. The surface layer is 4 to 15 inches thick. Subsurface layers range from silty clay loam to sand. A fluctuating water table occurs within 1 to 3 feet for the length of the growing season. The water table is non-saline and non-alkaline.

Soils Correlated to the Subirrigated Site: Elsmere, Lamo, Las Animas, and an unnamed Torrifluvent in Niobrara County, Wyoming

The Subirrigated site typically has no evidence of rills, wind-scoured areas, or pedestalled plants. Water flow patterns are indistinguishable. The soil surface is stable and intact.

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

Table 4. Representative soil features

Parent material	(1) Alluvium–sandstone and siltstone (2) Alluvium–shale
Surface texture	(1) Silt loam (2) Very fine sandy loam (3) Fine sandy loam (4) Loam
Family particle size	(1) Sandy
Drainage class	Somewhat poorly drained
Permeability class	Moderately slow to rapid
Soil depth	80 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	3–8 in
Calcium carbonate equivalent (0-40in)	0–15%
Electrical conductivity (0-40in)	0–4 mmhos/cm
Sodium adsorption ratio (0-40in)	0
Soil reaction (1:1 water) (0-40in)	5.6–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–6%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

The 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.

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-Little Bluestem-Indiangrass-Prairie Cordgrass Plant Community (1.1). The abundance of species such as sand dropseed, needle and thread, and blue grama increases. The abundance of sand bluestem, prairie sandreed, and little bluestem decreases. Species such as Kentucky bluegrass, Baltic rush, scouring rush, and other various grass-like species increase in abundance, forming a cool-season dominated plant community. Grasses such as big bluestem, prairie cordgrass, Indiangrass, and switchgrass decrease in frequency and production and can eventually become removed from the site. Little bluestem and western wheatgrass initially increase in abundance and then begin to decrease. Kentucky bluegrass and sedges continue to increase in abundance and eventually become sod-bound. Plants such as Dalmatian toadflax, kochia, and leafy spurge can invade the site. Excessive litter, decadence, and plant mortality can result from non-use and an absence of fire.

Interpretations are primarily based on the Big Bluestem-Little Bluestem-Indiangrass-Prairie Cordgrass 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.

The following is a diagram that illustrates the common plant communities that can occur on the site and the transition pathways between communities. The ecological processes will be discussed in more detail in the plant community descriptions following the diagram.

State and transition model

Subirrigated – R064XY024NE 3/1/19

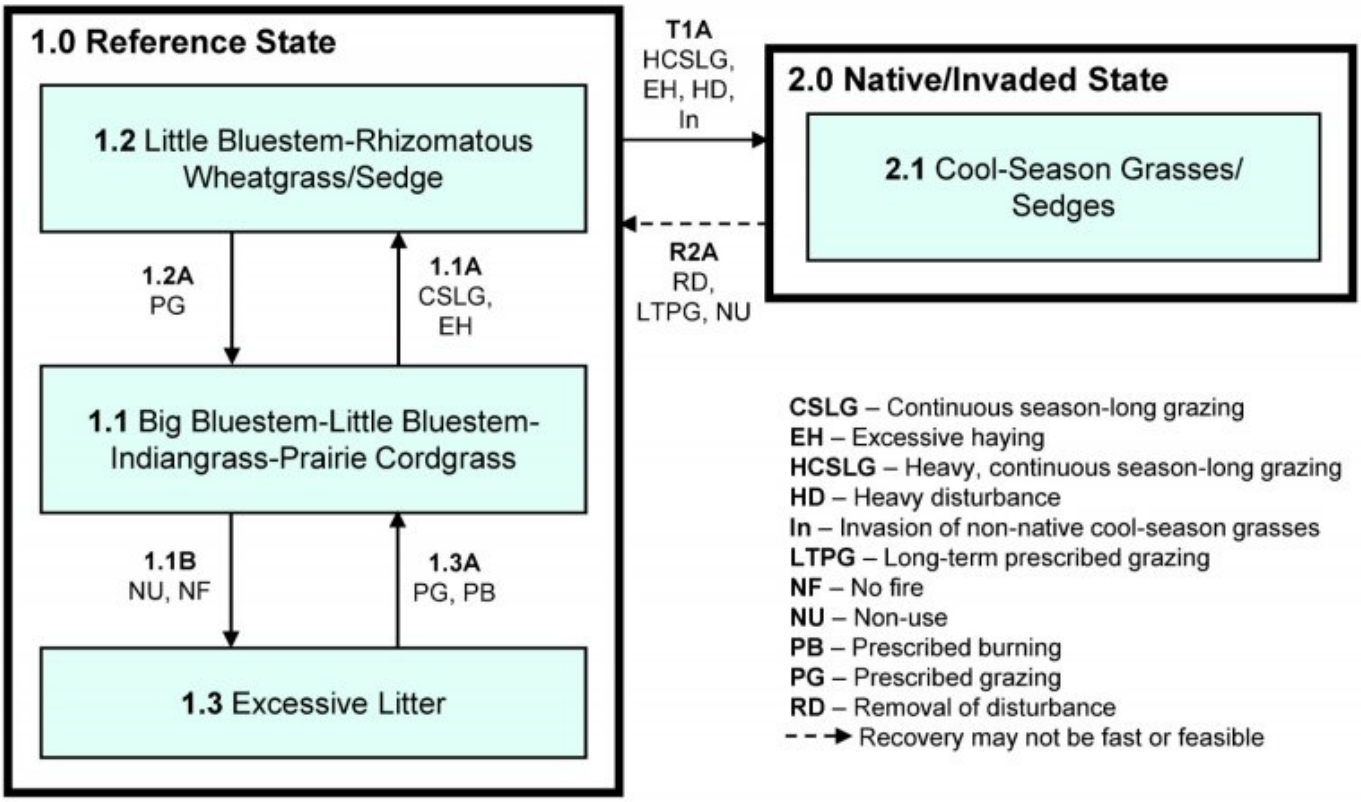

Diagram Legend: Subirrigated - R064XY024NE

T1A	1.0 to 2.0	Heavy, continuous season-long grazing without change in season of use or adequate recovery period; excessive haying; or heavy disturbance.
R2A	2.0 to 1.0	Removal of management induced disturbance followed by long-term prescribed grazing, including proper stocking rates, change in season of use, and adequate recovery periods. Long- or short-term rest (non-use) may be required. Recovery may not be fast or meet management objectives.
1.1A	1.1 to 1.2	Continuous season-long grazing without change in season of use or adequate recovery time; or excessive haying.
1.1B	1.1 to 1.3	Non-use and no fire.
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.
1.3A	1.3 to 1.1	Prescribed grazing, including proper stocking rates, change in season of use, and adequate time for rest and recovery; possibly prescribed burning.

State 1
Reference State

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

Community 1.1
Big Bluestem-Little Bluestem-Indiangrass-Prairie Cordgrass

Interpretations are primarily based on the Big Bluestem-Little Bluestem-Indiangrass-Prairie Cordgrass Plant Community (1.1). This is also considered to be the Reference Plant Community (1.1). This plant community is in areas that are properly managed with grazing or prescribed burning and in some areas receiving occasional short periods of rest. Historically, fires occurred infrequently. The potential vegetation by air-dry weight is about 80 percent grasses and grass-like species, 10 percent forbs, and 10 percent woody plants. Tall- and mid-stature warm-season grasses dominate this community. The major grasses include big bluestem, little bluestem, prairie cordgrass, Indiangrass, and switchgrass. Other grasses and grass-like speices in the community include western wheatgrass, Canada wildrye, Baltic rush, spikerushes, and bulrushes. Key forbs and shrubs include American licorice, Maximilian sunflower, goldenrod, clovers, milk vetches, and willows. 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	3290	3762	4110
Forb	210	322	450
Shrub/Vine	0	108	220
Tree	0	108	220
Total	**3500**	**4300**	**5000**

Figure 9. 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 1.2
Little Bluestem-Rhizomatous Wheatgrass/Sedge

This plant community developed under continuous season-long grazing without periodic rest or under excessive haying. The abundance of big bluestem, prairie cordgrass, Indiangrass, switchgrass, and Canada wildrye are significantly reduced. Little bluestem may initially increase or decrease in abundance depending upon the season of use. Kentucky bluegrass may have begun to invade. This plant community is at risk of losing tall warm-season grasses, palatable forbs, and shrubs. This community indicates key management concerns. Prescribed grazing in this phase stabilizes the community at or near the Big Bluestem-Little Bluestem-Indiangrass-Prairie Cordgrass Plant Community (1.1). Increased disturbance can easily move the community to a more degraded state. Although plant diversity is reduced, the soil is stable. The water cycle, nutrient cycle, and energy flow are slightly reduced but continue to adequately function.

Table 6. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	2255	2625	2965
Forb	145	225	325
Shrub/Vine	0	75	155
Tree	0	75	155
Total	**2400**	**3000**	**3600**

Figure 11. Plant community growth curve (percent production by month). NE6408, Pine Ridge/Badlands, lowland cool-season/warm-season co-dominant. Cool-season, warm-season co-dominant, lowland.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		5	12	20	25	19	11	5	3		

Community 1.3
Excessive Litter

This plant community develops after an extended period of non-use and where fire has been eliminated. The dominant plants tend to be similar to those found in the Big Bluestem-Little Bluestem-Indiangrass-Prairie Cordgrass Plant Community (1.1); however, in advanced stages, frequency and production can be lower. Increase amounts of litter cause plants to become decadent. Much of the plant nutrients are tied up in excessive litter. Organic matter oxidizes in the air rather than being incorporated into the soil due to the absence of animal impact. Typically, bunchgrasses (little bluestem) develop dead centers and rhizomatous grasses (big bluestem and prairie cordgrass) form small colonies because of a lack of tiller stimulation. This plant community is not resistant to change. Grazing or prescribed fire can easily move it toward the Big Bluestem-Little Bluestem-Indiangrass-Prairie Cordgrass Plant Community (1.1). Soil erosion is not a concern due to increased litter levels and landscape position.

Table 7. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	2825	3060	3265
Forb	175	270	375
Tree	0	180	375
Shrub/Vine	0	90	185
Total	**3000**	**3600**	**4200**

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

Plant Community 1.1 is converted to the Little Bluestem-Rhizomatous Wheatgrass/Sedge Plant Community (1.2) by continuous grazing without adequate recovery periods or by excessive haying.

Pathway 1.1B
Community 1.1 to 1.3

Long-term non-use and no fire convert Plant Community 1.1 to the Excessive Litter Plant Community (1.3). Initially, excess litter begins to build-up. Eventually, native plants can show signs of mortality and decadence.

Pathway 1.2A
Community 1.2 to 1.1

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-Little Bluestem-Indiangrass-Prairie Cordgrass Plant Community (1.1).

Conservation practices

Prescribed Grazing

Pathway 1.3A
Community 1.3 to 1.1

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 Big Bluestem-Little Bluestem-Indiangrass-Prairie Cordgrass Plant Community (1.1).

Conservation practices

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 species. The non-native cool-season grasses, primarily Kentucky bluegrass, make up 15 to 30 percent of the total annual production. This state is the result of heavy, continuous grazing, excessive haying, or heavy disturbance that can create soil compaction. The Native/Invaded State is very resilient and resistant to change.

Community 2.1
Cool-Season Grasses/Sedges

This plant community develops because of further heavy, continuous season-long grazing, excessive haying, or heavy disturbance. The plant community is predominantly cool-season grasses and grass-like species. Kentucky bluegrass has invaded the community and persists in a sod-bound condition. Baltic rush, various sedges, and foxtail barley have increased in abundance. Remnant amounts of western wheatgrass can persist in localized colonies. Big bluestem, little bluestem, prairie cordgrass, Indiangrass, and switchgrass have been removed. Forbs such as kochia and Russian thistle have also increased in abundance. Invasive species such as leafy spurge and cheatgrass can invade the site if prescribed grazing management is not implemented. This community remains stable but has lost much of its production and diversity. The nutrient cycle is impaired due to the loss of warm-season grass species, deep-rooted forbs (legumes and others), and shrubs. Soil compaction can be a concern if the community is continuously grazed during wet cycles. A long time is required to bring this plant community back to the Reference State (1.0) by management alone. Renovation is very costly due to the high water table.

Table 8. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	1125	1384	2030
Forb	75	160	250
Shrub/Vine	0	40	85
Tree	0	16	35
Total	**1200**	**1600**	**2400**

Figure 15. Plant community growth curve (percent production by month). NE6407, Pine Ridge/Badlands, cool-season dominant, warm-season sub-dominant. Cool-season dominant, warm-season sub-dominant, lowland.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		5	8	25	30	15	10	2	5		

Transition T1A
State 1 to 2

The invasion of non-native cool-season grasses in combination with heavy, continuous season-long grazing with no recovery opportunity, excessive haying with no recovery opportunity, or heavy disturbance transition this state to the Native/Invaded State (2.0). This transition is most likely to originate from either the Little Bluestem-Rhizomatous Wheatgrass/Sedge Plant Community (1.2) or the Excessive Litter Plant Community (1.3).

Restoration pathway R2A
State 2 to 1

Removal of management-induced disturbance coupled with long-term prescribed grazing, including periods of non-use, can eventually move the Native/Invaded State (2.0) toward the Reference State (1.0). This transition pathway requires an adequate seed and vegetative source. This process may require a long period of time to accomplish and may be difficult to attain depending on the degree of degradation.

Conservation practices

Prescribed Burning
Prescribed Grazing

Additional community tables

Table 9. 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**			2150–3225	
	big bluestem	ANGE	*Andropogon gerardii*	645–1075	–
	little bluestem	SCSC	*Schizachyrium scoparium*	430–645	–
	prairie cordgrass	SPPE	*Spartina pectinata*	430–645	–
	Indiangrass	SONU2	*Sorghastrum nutans*	430–645	–
	switchgrass	PAVI2	*Panicum virgatum*	215–645	–
	sand bluestem	ANHA	*Andropogon hallii*	0–215	–
2	**Cool-Season Mid-Grasses**			0–430	
	western wheatgrass	PASM	*Pascopyrum smithii*	0–430	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–430	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–215	–
	Canada wildrye	ELCA4	*Elymus canadensis*	0–215	–
3	**Other Native Grasses**			0–215	
	alkali sacaton	SPAI	*Sporobolus airoides*	0–215	–
	foxtail barley	HOJU	*Hordeum jubatum*	0–215	–
	spiked muhly	MUGL3	*Muhlenbergia glomerata*	0–215	–
	Grass, perennial	2GP	*Grass, perennial*	0–215	–
4	**Grass-Likes**			215–430	
	sedge	CAREX	*Carex*	215–430	–
	bulrush	SCHOE6	*Schoenoplectus*	0–86	–
	scouringrush horsetail	EQHY	*Equisetum hyemale*	0–86	–
	rush	JUNCU	*Juncus*	0–86	–
	spikerush	ELEOC	*Eleocharis*	0–86	–
5	**Non-Native Cool-Season Grasses**			0	
Forb					

6	**Forbs**			215–430	
	American licorice	GLLE3	*Glycyrrhiza lepidota*	43–129	–
	goldenrod	SOLID	*Solidago*	43–129	–
	blazing star	LIATR	*Liatris*	0–86	–
	Forb, perennial	2FP	*Forb, perennial*	0–86	–
	Forb, annual	2FA	*Forb, annual*	0–86	–
	clover	TRIFO	*Trifolium*	0–86	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–86	–
	false boneset	BREU	*Brickellia eupatorioides*	0–86	–
	white heath aster	SYER	*Symphyotrichum ericoides*	43–86	–
	Maximilian sunflower	HEMA2	*Helianthus maximiliani*	43–86	–
	milkvetch	ASTRA	*Astragalus*	0–86	–
	knotweed	POLYG4	*Polygonum*	0–86	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–86	–
Shrub/Vine					
7	**Shrubs**			0–215	
	rose	ROSA5	*Rosa*	0–215	–
	silver buffaloberry	SHAR	*Shepherdia argentea*	0–215	–
	western snowberry	SYOC	*Symphoricarpos occidentalis*	0–215	–
	chokecherry	PRVI	*Prunus virginiana*	0–215	–
	dwarf false indigo	AMNA	*Amorpha nana*	0–215	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–215	–
Tree					
8	**Trees**			0–215	
	willow	SALIX	*Salix*	0–215	–

Table 10. 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**			600–1350	
	little bluestem	SCSC	*Schizachyrium scoparium*	150–600	–
	prairie cordgrass	SPPE	*Spartina pectinata*	150–300	–
	switchgrass	PAVI2	*Panicum virgatum*	150–300	–
	big bluestem	ANGE	*Andropogon gerardii*	150–300	–
	sand bluestem	ANHA	*Andropogon hallii*	0–150	–
	Indiangrass	SONU2	*Sorghastrum nutans*	0–150	–
2	**Cool-Season Mid-Grasses**			150–450	
	western wheatgrass	PASM	*Pascopyrum smithii*	150–450	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–150	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–150	–
	Canada wildrye	ELCA4	*Elymus canadensis*	0–150	–
3	**Other Native Grasses**			150–450	
	foxtail barley	HOJU	*Hordeum jubatum*	0–150	–
	spiked muhly	MUGL3	*Muhlenbergia glomerata*	0–150	–

	Grass, perennial	2GP	*Grass, perennial*	0–150	–
	alkali sacaton	SPAI	*Sporobolus airoides*	0–60	–
4	**Grass-Likes**			150–600	
	sedge	CAREX	*Carex*	150–600	–
	bulrush	SCHOE6	*Schoenoplectus*	0–60	–
	scouringrush horsetail	EQHY	*Equisetum hyemale*	0–60	–
	rush	JUNCU	*Juncus*	0–60	–
	spikerush	ELEOC	*Eleocharis*	0–60	–
5	**Non-Native Cool-Season Grasses**			0–300	
	Kentucky bluegrass	POPR	*Poa pratensis*	0–300	–
	cheatgrass	BRTE	*Bromus tectorum*	0–150	–
	field brome	BRAR5	*Bromus arvensis*	0–150	–
Forb					
6	**Forbs**			150–300	
	American licorice	GLLE3	*Glycyrrhiza lepidota*	30–150	–
	clover	TRIFO	*Trifolium*	0–150	–
	white heath aster	SYER	*Symphyotrichum ericoides*	30–150	–
	knotweed	POLYG4	*Polygonum*	0–150	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	30–150	–
	goldenrod	SOLID	*Solidago*	60–150	–
	blazing star	LIATR	*Liatris*	0–60	–
	Forb, perennial	2FP	*Forb, perennial*	0–60	–
	milkvetch	ASTRA	*Astragalus*	0–60	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–60	–
	false boneset	BREU	*Brickellia eupatorioides*	0–60	–
	Maximilian sunflower	HEMA2	*Helianthus maximiliani*	0–30	–
Shrub/Vine					
7	**Shrubs**			0–150	
	rose	ROSA5	*Rosa*	0–150	–
	silver buffaloberry	SHAR	*Shepherdia argentea*	0–150	–
	western snowberry	SYOC	*Symphoricarpos occidentalis*	0–150	–
	chokecherry	PRVI	*Prunus virginiana*	0–150	–
	dwarf false indigo	AMNA	*Amorpha nana*	0–150	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–90	–
Tree					
8	**Trees**			0–150	
	willow	SALIX	*Salix*	0–150	–

Table 11. 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**			180–360	
	prairie cordgrass	SPPE	*Spartina pectinata*	180–540	–
	Indiangrass	SONU2	*Sorghastrum nutans*	180–360	–

	switchgrass	PAVI2	*Panicum virgatum*	180–360	–
	big bluestem	ANGE	*Andropogon gerardii*	180–360	–
	little bluestem	SCSC	*Schizachyrium scoparium*	180–360	–
	sand bluestem	ANHA	*Andropogon hallii*	0–36	–
2	**Cool-Season Mid-Grasses**			0–360	
	western wheatgrass	PASM	*Pascopyrum smithii*	0–360	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–180	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–180	–
	Canada wildrye	ELCA4	*Elymus canadensis*	0–180	–
3	**Other Native Grasses**			0–180	
	foxtail barley	HOJU	*Hordeum jubatum*	0–180	–
	spiked muhly	MUGL3	*Muhlenbergia glomerata*	0–180	–
	Grass, perennial	2GP	*Grass, perennial*	0–180	–
	alkali sacaton	SPAI	*Sporobolus airoides*	0–72	–
4	**Grass-Likes**			180–720	
	sedge	CAREX	*Carex*	180–720	–
	bulrush	SCHOE6	*Schoenoplectus*	0–72	–
	scouringrush horsetail	EQHY	*Equisetum hyemale*	0–72	–
	rush	JUNCU	*Juncus*	0–72	–
	spikerush	ELEOC	*Eleocharis*	0–72	–
5	**Non-Native Cool-Season Grasses**			180–540	
	Kentucky bluegrass	POPR	*Poa pratensis*	180–540	–
	cheatgrass	BRTE	*Bromus tectorum*	0–180	–
	field brome	BRAR5	*Bromus arvensis*	0–180	–
Forb					
6	**Forbs**			180–360	
	American licorice	GLLE3	*Glycyrrhiza lepidota*	36–180	–
	knotweed	POLYG4	*Polygonum*	0–180	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	36–180	–
	goldenrod	SOLID	*Solidago*	72–180	–
	white heath aster	SYER	*Symphyotrichum ericoides*	36–180	–
	milkvetch	ASTRA	*Astragalus*	0–72	–
	blazing star	LIATR	*Liatris*	0–72	–
	Forb, perennial	2FP	*Forb, perennial*	0–72	–
	clover	TRIFO	*Trifolium*	0–72	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–72	–
	false boneset	BREU	*Brickellia eupatorioides*	0–72	–
	Forb, annual	2FA	*Forb, annual*	0–36	–
	Maximilian sunflower	HEMA2	*Helianthus maximiliani*	0–36	–
Shrub/Vine					
7	**Shrubs**			0–180	
	rose	ROSA5	*Rosa*	0–180	–
	silver buffaloberry	SHAR	*Shepherdia argentea*	0–180	–
	western snowberry	SYOC	*Symphoricarpos occidentalis*	0–180	

	western snowberry	SYOC	*Symphoricarpos occidentalis*	0–180	–
	chokecherry	PRVI	*Prunus virginiana*	0–180	–
	dwarf false indigo	AMNA	*Amorpha nana*	0–180	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–108	–
Tree					
8	**Trees**			0–360	
	willow	SALIX	*Salix*	0–360	–

Table 12. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Warm-Season Mid- Tall Grasses**			32–160	
	little bluestem	SCSC	*Schizachyrium scoparium*	32–160	–
	prairie cordgrass	SPPE	*Spartina pectinata*	0–80	–
	switchgrass	PAVI2	*Panicum virgatum*	0–80	–
	Indiangrass	SONU2	*Sorghastrum nutans*	0–32	–
	big bluestem	ANGE	*Andropogon gerardii*	0–32	–
2	**Cool-Season Mid-Grasses**			16–160	
	western wheatgrass	PASM	*Pascopyrum smithii*	16–160	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–16	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–16	–
	Canada wildrye	ELCA4	*Elymus canadensis*	0–16	–
3	**Other Native Grasses**			80–160	
	foxtail barley	HOJU	*Hordeum jubatum*	80–160	–
	spiked muhly	MUGL3	*Muhlenbergia glomerata*	0–80	–
	Grass, perennial	2GP	*Grass, perennial*	0–80	–
	alkali sacaton	SPAI	*Sporobolus airoides*	0–16	–
4	**Grass-Likes**			160–480	
	sedge	CAREX	*Carex*	160–480	–
	spikerush	ELEOC	*Eleocharis*	80–160	–
	rush	JUNCU	*Juncus*	0–80	–
	bulrush	SCHOE6	*Schoenoplectus*	0–32	–
	scouringrush horsetail	EQHY	*Equisetum hyemale*	0–32	–
5	**Non-Native Cool-Season Grasses**			240–480	
	Kentucky bluegrass	POPR	*Poa pratensis*	240–480	–
	cheatgrass	BRTE	*Bromus tectorum*	0–80	–
	field brome	BRAR5	*Bromus arvensis*	0–80	–
Forb					
6	**Forbs**			80–240	
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	16–160	–
	goldenrod	SOLID	*Solidago*	32–80	–
	knotweed	POLYG4	*Polygonum*	0–80	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–80	–
	white heath aster	SYER	*Symphyotrichum ericoides*	16–80	–

	American licorice	GLLE3	*Glycyrrhiza lepidota*	16–80	–
	clover	TRIFO	*Trifolium*	0–32	–
	false boneset	BREU	*Brickellia eupatorioides*	0–32	–
	Forb, perennial	2FP	*Forb, perennial*	0–32	–
	Forb, annual	2FA	*Forb, annual*	0–32	–
	Maximilian sunflower	HEMA2	*Helianthus maximiliani*	0–16	–
	milkvetch	ASTRA	*Astragalus*	0–16	–
	blazing star	LIATR	*Liatris*	0–16	–
Shrub/Vine					
7	**Shrubs**			0–80	
	rose	ROSA5	*Rosa*	0–80	–
	silver buffaloberry	SHAR	*Shepherdia argentea*	0–80	–
	western snowberry	SYOC	*Symphoricarpos occidentalis*	0–80	–
	chokecherry	PRVI	*Prunus virginiana*	0–80	–
	dwarf false indigo	AMNA	*Amorpha nana*	0–80	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–16	–
Tree					
8	**Trees**			0–32	
	willow	SALIX	*Salix*	0–32	–

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 supported 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 Subirrigated ecological site provides upland grassland cover and associated forb, shrub, and tree components. The site was typically part of an expansive grassland landscape that included combinations of 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 that are commonly or exclusively on this site 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 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 for sharp-tailed grouse broods.

Big Bluestem-Little Bluestem-Indiangrass-Prairie Cordgrass (1.1) and Excessive Litter (1.3): These plant communities are dominated by big bluestem, little bluestem, Indiangrass, and prairie cordgrass. The shrub community is generally dominated by willow species. The robust forb and shrub community 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, 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.

Because of extended periods of non-use or no fire, the plant community becomes decadent and litter accumulates. As plant litter accumulates, the grassland nesting bird composition can shift to favor those species that prefer dense litter (non-shortgrass species); otherwise, the wildlife community remains largely unchanged.

Little Bluestem-Rhizomatous Wheatgrass/Sedge (1.2): Because of continuous season-long grazing without periodic grazing deferment, little bluestem and wheatgrass species dominate. The reduction in abundance of tall warm-season grasses, the increases in sedge species, and the invasion of Kentucky bluegrass limits wildlife forage and cover. Forb diversity and abundance remain relatively unchanged. The shift to shorter plants and additional sedges favors short-grass nesting songbirds and seed-eating small mammals. Sharp-tailed grouse may benefit from this site. Mammalian and raptor predation may increase at this site due to the increase in number of prey and the increase in grassland patchiness. The shrub component of the plant community is not changed, and wildlife continues to have benefits similar to those in areas of the Reference Plant Community (1.1).

Cool-Season Grasses/Sedges (2.1): Because of heavy, continuous season-long grazing or excessive haying, Kentucky bluegrass dominates. Both warm- and cool-season tall- and medium-height plant communities are removed or significantly diminished. Forbs and grass-like species (e.g., sedges and rushes) increase in abundance. Plant species from adjacent ecological sites may become minor components of this plant community. The community is susceptible to invasion of annual bromegrasses and other non-native species due to severe soil disturbances and a relatively high percent of bare ground. The shorter cover favors shortgrass nesting bird species. Small mammals use these sites due to the prevalence of grass and weed seeds; however, limited prey populations limit the number of predators that use these sites. Pollinators may increase use of these sites due to the increase in the abundance of flowering forbs. Sharp-tailed grouse may use the sites as lek areas if adequate habitat is available at adjacent sites.

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-Little Bluestem-Indiangrass-Prairie Cordgrass (1.1)
Average Production (lb/acre, air-dry): 4,300
Stocking Rate (AUM/acre): 1.18

Plant Community: Little Bluestem-Rhizomatous Wheatgrass/Sedge (1.2)
Average Production (lb/acre, air-dry): 3,000
Stocking Rate (AUM/acre): 0.82

*Plant Community: Excessive Litter (1.3)
Average Production (lb/acre, air-dry): 3,600
Stocking Rate (AUM/acre): 0.99

*Plant Community: Cool-Season Grasses/Sedges (2.1)
Average Production (lb/acre, air-dry): 1,600
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 mostly in Hydrologic Soil Group C but may include soils in Group D and localized areas in Group A. Although most of these soils are very permeable, water tables provide subirrigation of grasses and other vegetation. Surrounding upland areas tend to also have permeable soils, and surface inflow peaks on these sites are often muted. These sites are subject to rare or occasionally flooding. 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 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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Approval

Suzanne Mayne-Kinney, 12/16/2024

Acknowledgments

This ecological site was reviewed and approved at the Provisional Level by David Kraft, Regional ESS, Salina, KS on 2/15/2019.

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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 are not expected on this site.

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2. **Presence of water flow patterns:** None. Water flow patterns are not expected on this site.

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3. **Number and height of erosional pedestals or terracettes:** None. Pedestals or terracettes are not expected on this site.

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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.

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

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

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7. **Amount of litter movement (describe size and distance expected to travel):** Litter should fall in place. Litter movement is not expected on this site.

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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. Surface organic matter adheres to the soil surface. Soil surface fragments will typically retain their structure indefinitely when dipped in distilled water.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** The A-horizon should be 4 to 15 inches (10.2 to 38 cm) thick. Soil colors range from very dark gray, dark gray, dark grayish brown, to gray (values of 3 to 5) when dry and black, very dark grayish brown, to dark gray (values of 2 to 4) when moist. Structure typically is medium to fine granular in the upper A-horizon.

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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 and tall rhizomatous and tufted perennial cool season grasses) with fine and coarse roots positively influences infiltration. Invasion of introduced cool-season grasses such as Kentucky bluegrass and annual brome may have an adverse impact infiltration and runoff.

    Relative composition is approximately 80 percent grasses or grass-like plants, 10 percent forbs, and 10 percent shrubs. The grass and grass-like component is composed of C4 tall, rhizomatous grasses (40-60%), C4, mid, bunch grasses (10-20%), C3, bunch grasses (0-10%), C3, rhizomatous grasses (0-10%), and grass-likes (5-10%).

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None.

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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, C4, tallgrass, 1720-2570 #/ac, 40-60% (4 species minimum): big bluestem, Indiangrass, prairie cordgrass, sand bluestem, switchgrass.

    Phase 1.2
    1. Native, perennial, C4, tallgrass, 450-1200 #/ac, 15-40% (3 species minimum): big bluestem, prairie cordgrass, Indiangrass, switchgrass, sand bluestem.

    Phase 1.3
    1. Native grass-likes, 180-720 #/ac, 5-20% (1 species minimum): sedge, bulrush, rush, spikerush.

    Sub-dominant: Phase 1.1
    1. Native, perennial C4, midgrasses, 430-860 #/ac, 10-20% (1 species minimum): alkali sacaton, little bluestem.

    Phase 1.2
    1. Native, perennial, C4, midgrass, 150-600 #/ac, 5-20% (1 species minimum): little bluestem, alkali sacaton.
    2. Native grass-likes, 150-600 #/ac, 5-20% (1 species minimum): sedge, bulrush, rush, spikerush.
    3. Native perennial, C3 rhizomatous grass, 150-450 #/ac, 5-15% (1 species minimum): western wheatgrass.

    Phase 1.3
    1. Non-native C3 grass, 180-540 #/ac, 5-15% (1 species minimum): smooth brome, cheatgrass, field brome.

    Other: Minor - Phase 1.1
    1. Native, grass-likes, 215-430 #/ac (5-10%): Baltic rush, bulrush, rush, sedge, spikerush.

2. Native, perennial and annual forbs, 215-430 #/ac (5-10%): forbs present will vary with location.
3. Native, perennial, C3, bunchgrass, 0-430 #/ac (0-10%): foxtail barley, Canada wildrye, slender wheatgrass, needle and thread.
4. Native, perennial, C3, rhizomatous grasses, 0-430 #/ac (0-10%): western wheatgrass, marsh muhly.
5. Shrubs, 0-215 #/ac (0-5%): shrubs present will vary from location to location.
6. Native deciduous trees, 0-215 #/ac, 0-5%: willow

Minor - Phase 1.2
1. Non-native, C3 grass, 0-300 #/ac, 0-10%: smooth brome, cheatgrass, field brome.
2. Native, perennial, C3, bunchgrass, 0-150 #/ac, 0-5%: foxtail barley, spiked muhly, needle and thread.
3. Native, perennial and annual forbs, 150-300 #/ac, 5-10%: forbs present vary from location to location.
4. Shrubs, 0-150 #/ac, 0-5%: shrubs present vary from location to location.
5. Native deciduous trees, 0-150 #/ac, 0-5%: willow.

Minor - Phase 1.3
1. Native, perennial, C4, tallgrass, 180-360 #/ac, 5-10%: big bluestem, prairie cordgrass, Indiangrass, switchgrass, sand bluestem.
2. Native, perennial, C4, midgrass, 180-360 #/ac, 5-10%: little bluestem, alkali sacaton.
3. Native, perennial and annual forbs, 180-360 #/ac, 5-10%: forbs present vary from location to location.
4. Native, perennial, C3, rhizomatous grasses, 0-360 #/ac, 0-10% (1 species minimum): western wheatgrass.
5. Native, perennial, C3, bunchgrass, 0-360 #/ac, 0-10%: foxtail barley, spiked muhly.
6. Shrubs, 0-180 #/ac, 0-5%: shrubs present vary from location to location.
7. Native deciduous trees, 0-360 #/ac, 0-5%: willow.

Additional: The Reference Community or Big Bluestem-Little Bluestem-Indiangrass-Prairie Cordgrass includes eight F/S groups. These groups, in order of abundance, include native, perennial, rhizomatous, C4, tallgrass; native, perennial, C4, mid-, bunchgrass, native, grass-likes = native, perennial and annual forbs; native, perennial C3, rhizomatous grasses = native, perennial, C3, bunchgrass; shrubs = native trees.

The Little Bluestem-Rhizomatous Wheatgrass/Sedge Community (1.2) includes nine F/S groups. These groups, in order of abundance, include native, perennial, C4, rhizomatous, tallgrass; native, perennial, C4, mid, bunchgrass = native grass-likes; native, perennial, C3, rhizomatous grasses; native, perennial and annual forbs; non-native C3 grass, native, perennial, C3 bunchgrass= shrubs = native trees.

The Excessive Litter Community (1.3) includes nine F/S groups. The dominant group is grass-likes while the subdominant group is non-native, C3 grasses.

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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 80 to 90 percent and at a depth of 0.50 to 1 inch (1.3-2.6 cm). Kentucky bluegrass excessive litter can negatively impact the functionality of this site.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** Annual-production is 4,300 pounds per acre in a year with normal precipitation and temperatures. Low and High production years should yield 3,500 and 5,000 pounds per acre respectively.

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. Annual bromes, Kentucky bluegrass, quackgrass, reed canarygrass, saltcedar, and Russian olive 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.

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.