

Ecological site R067AY174WY Subirrigated (Sb)

Last updated: 9/07/2023
Accessed: 05/03/2024

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.

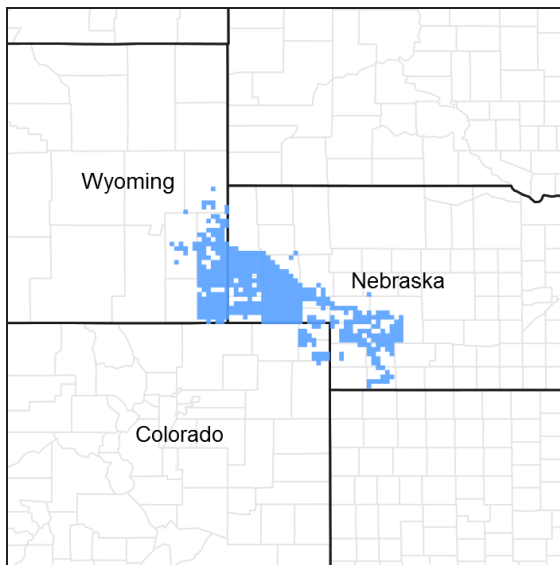


Figure 1. Mapped extent

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): 067A–Central High Plains, Northern Part

MLRA 67A-Central High Plains, Northern Part is located in southeastern Wyoming (58 percent), the southwestern portion of the Nebraska panhandle (38 percent), and extreme northeastern Colorado (4 percent). It is comprised of rolling plains, upland breaks, and river valleys. The major rivers are the North Platte and Laramie. The headwaters of these systems are in the Rocky Mountains. Other tributaries include Crow, Horse, and Lodgepole Creeks. This MLRA is traversed by Interstate 25 and Interstate 80, and by U.S. Highways 26, 30 and 85. Major land uses include rangeland (71 percent), cropland (21 percent), pasture and hayland (1 percent), urban (3 percent), and miscellaneous (4 percent). Cities in this area include Cheyenne, Torrington, and Wheatland, WY; and Kimball, Oshkosh, and Scottsbluff, NE. Land ownership is mostly private. Areas of interest include Scotts Bluff National Monument, Chimney Rock and Fort Laramie National Historic Sites; Hawk Springs, Lake Minatare, and Wildcat Hills State Recreation Areas; Ash Hollow and Guernsey State Parks.

The elevations in MLRA 67A range from approximately 3,300 to 6,200 feet. The average annual precipitation in this area ranges from 13 to 17 inches per year, but may increase up to 18 inches per year, in localized areas. Precipitation occurs mostly during the growing season from rapidly developing thunderstorms. Mean annual air temperature ranges from 47 degrees Fahrenheit in the western part to 52 degrees Fahrenheit in the eastern part. Summer temperatures may exceed 100 degrees Fahrenheit. Winter temperatures may drop to sub-zero, and snowfall varies from 20 to 50 inches per year.

Classification relationships

MLRA 67A is in the Western Great Plains Range and Irrigation Land Resource Region. It is in the High Plains Section, of the Great Plains Province, of the Interior Plains (USDA, 2006). MLRAs can be defined by climate, landscapes, geology, and annual precipitation zones (PZ). Other features such as landforms, soil properties, and key vegetation further refine these concepts, and are described at the Ecological Site Description (ESD) level.

Revision Notes

The Subirrigated (SS) 12-17 inch PZ Ecological Site was developed by an earlier version of the Subirrigated (SS) ESD (2005, updated 2008). The earlier version of the Subirrigated (SS) 12-17 inch Precipitation Zone ESD was based on input from NRCS (formerly Soil Conservation Service) and historical information obtained from the Subirrigated (SS) Range Site Description (1988) and earlier (1970). This ESD meets the Provisional requirements of the National Ecological Site Handbook (NESH). This ESD will continue refinement towards an Approved status according to the NESH.

Ecological site concept

The Subirrigated site is a run-on site that is not saline or alkaline and has a water table that ranges from 6 to 36 inches during part of the growing season.

Associated sites

R067AY124WY	Loamy Lowland (LyL) This ecological site is commonly adjacent.
R067AY152WY	Sandy Lowland (SyL) This ecological site is commonly adjacent.
R067AY178WY	Wetland (WL) This ecological site is commonly adjacent.

Similar sites

R067AY142WY	Saline Subirrigated (SS) The Saline Subirrigated Ecological Site is saline or alkaline.
-------------	---

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) <i>Salix</i>
Herbaceous	(1) <i>Andropogon gerardii</i> (2) <i>Schizachyrium scoparium</i>

Physiographic features

This site typically occurs on the floodplains, flood-plain steps, or drainageways of the river valleys; but may also occur in seeps, swales, or interdunes.

Table 2. Representative physiographic features

Landforms	(1) Flood plain (2) Flood-plain step (3) Drainageway
Runoff class	Negligible to low
Flooding duration	Brief (2 to 7 days) to long (7 to 30 days)
Flooding frequency	Occasional to frequent

Ponding frequency	None
Elevation	1,067–1,981 m
Slope	0–3%
Water table depth	15–91 cm
Aspect	Aspect is not a significant factor

Climatic features

Wide fluctuations in precipitation may occur from year to year, as well as occasional periods of drought (longer than one year in duration). Two-thirds of the annual precipitation occurs during the growing season from April to September. The mean annual air temperature (MAAT) ranges from 47 degrees Fahrenheit in the western part to 52 degrees Fahrenheit in the eastern part. Cold air outbreaks from Canada in winter move rapidly from northwest to southeast and account for extreme minimum temperatures. Chinook winds may also occur in winter and bring rapid rises in temperature. Extreme storms may occur during the winter, but most severely affect ranch operations during the late winter and spring months. High-intensity afternoon thunderstorms may arise in summer. Wind speed averages about 8 miles per hour, ranging from 10 during the spring to 7 during late summer. Daytime winds are generally stronger than nighttime and occasional strong storms may bring brief periods of high winds with gusts to more than 75 mph. The average length of the freeze-free period (28 degrees Fahrenheit) is 150 days from May 4 to October 1. The average frost-free period (32 degrees Fahrenheit) is 128 days from May 16 to September 21. Growing season increases from west to east (Wyoming to Nebraska). Growth of native cool-season plants begins about April 1 and continues to mid-June. Native warm-season plants begin growth about May 15 and continue to about August 15. Regrowth of cool-season plants occur in September in most years, depending upon moisture.

Table 3. Representative climatic features

Frost-free period (characteristic range)	85-117 days
Freeze-free period (characteristic range)	119-135 days
Precipitation total (characteristic range)	406-432 mm
Frost-free period (actual range)	84-123 days
Freeze-free period (actual range)	116-137 days
Precipitation total (actual range)	356-457 mm
Frost-free period (average)	103 days
Freeze-free period (average)	128 days
Precipitation total (average)	406 mm

Climate stations used

- (1) BRIDGEPORT [USC00251145], Bridgeport, NE
- (2) HARRISBURG 12WNW [USC00253605], Harrisburg, NE
- (3) KIMBALL 2NE [USC00254440], Kimball, NE
- (4) OSHKOSH [USC00256385], Oshkosh, NE
- (5) CHUGWATER [USC00481730], Chugwater, WY
- (6) PHILLIPS [USC00487200], LaGrange, WY
- (7) WHEATLAND 4 N [USC00489615], Wheatland, WY
- (8) CHEYENNE [USW00024018], Cheyenne, WY
- (9) SCOTTSBLUFF HEILIG AP [USW00024028], Scottsbluff, NE
- (10) OLD FT LARAMIE [USC00486852], Yoder, WY

Influencing water features

The Subirrigated site has a seasonal water table that influences the kinds and amounts of vegetation on this site. The water table in some areas is anthropogenic, caused by seepage from nearby irrigation ditches, canals, and

reservoirs. Some soils in this ESD are hydric soils; most map units in this ESD have a minor (1 to 10 percent) hydric component associated with them. Some map units have a major (35 to 60 percent) hydric component associated with them.

Wetland description

Wetland Description (Cowardin System)

System Subsystem Class

Palustrine N/A Emergent Wetland

Soil features

The soils on the Subirrigated site are typically very deep, poorly to somewhat poorly drained soils, that formed from alluvium. They typically have a moderate to moderately rapid permeability class. The available water capacity is very low to moderate. Available water is the portion of water in a soil that can be readily absorbed by plant roots. This is the amount of water released between the field capacity and the permanent wilting point. The soil moisture regime is typically aquic. The soil temperature regime is mesic.

The surface layer of the soils in this site are typically loam or fine sandy loam but may include very fine sandy loam or silt loam. The surface layer ranges from a depth of 4 to 10 inches thick. The subsoil is typically loam, fine sandy loam, very fine sandy loam, or fine sand, but may include strata of sand, sandy loam, or coarse sand. The subsoil typically contains 0 to 5 percent rock fragments, but some soils may have up to 30 percent. Soils in this site have carbonates at the surface but may be leached to 10 inches in a few soils. These soils are typically not susceptible to erosion by water and wind due to the wetness of the soil profile by the seasonal water table. However, these areas may have the hazard of wind erosion if these areas are drained and the surface is not protected by vegetation.

Surface soil structure is typically granular, and structure below the surface ranges from subangular blocky to massive and single grain. Soil structure describes the manner in which soil particles are aggregated and defines the nature of the system of pores and channels in a soil.

Major soil series correlated to this ecological site include: Fluvaquents, Gering, Gothenburg, Las Animas, McGrew, Merden (cool), Platte, Torrfluents, Whetsoon, and Yockey.

Other soil series that have been correlated to this site include: Anvil, Bayard (variant), Bayard (wet), Clarkelen (wet), Els, Featherlegs (wet), Forkwood (wet), Ipage, Maintier (wet), Mitchell (variant), Otero (variant), Seep, and Sweatbee (wet).

The attributes listed below represent 0-40 inches in depth or to the first restrictive layer.

Note: Revisions to soil surveys are ongoing. For the most recent updates, visit the Web Soil Survey, the official site for soils information: <http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx>.



Figure 8. Soils Profile Image.—Yockey silt loam, Scotts Bluff County, NE

Table 4. Representative soil features

Parent material	(1) Alluvium
Surface texture	(1) Loam (2) Fine sandy loam
Drainage class	Poorly drained to somewhat poorly drained
Permeability class	Moderate to moderately rapid
Soil depth	203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	6.1–18.29 cm
Calcium carbonate equivalent (0-101.6cm)	0–15%
Electrical conductivity (0-101.6cm)	0–4 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–10
Soil reaction (1:1 water) (0-101.6cm)	6.6–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–30%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

The information in this ESD, including the State-and-Transition Model (STM) diagram, was developed using archeological and historical data, professional experience, and scientific studies. The information is representative of a dynamic set of plant communities that represent the complex interaction of several ecological processes. The plant composition has been determined by study of rangeland relic areas, areas protected from excessive disturbance, seasonal use pastures, short duration and time-controlled grazing strategies, and historical accounts.

The Subirrigated ecological site is characterized by three states: The Reference, Sod-bound, and Increased *Bare Ground*. The Reference State is characterized by warm-season rhizomatous tall and mid-grasses (big bluestem and prairie cordgrass), and warm-season bunch mid-grasses (little bluestem and switchgrass). Secondary grasses include warm-season bunch tallgrass (Indiangrass), cool-season bunch mid-grass (slender wheatgrass), and rhizomatous midgrass (western wheatgrass). A minor component of grass-likes such as rush, spikerush, and bulrush species; forbs and shrubs are also present. See the species composition list in this ESD. The Sod-bound State is characterized by Kentucky bluegrass, an invasive introduced species. The Increased *Bare Ground* State is characterized by remnant Kentucky bluegrass, increased foxtail barley, invasive annuals such as burningbush, and noxious weeds such as Dalmatian toadflax and leafy spurge.

As this site deteriorates from a combination of frequent and severe grazing, species such as mountain rush (also known as Baltic rush), scouring rush, and other grass-likes increase to form a cool-season dominated plant community. Kentucky bluegrass invades and eventually becomes sod-bound. Grasses such as big bluestem, little bluestem, prairie cordgrass, Indiangrass, and switchgrass decrease in frequency and production, and can eventually be removed from the site. As the site continues to deteriorate, bare ground may increase depending on water table depth. Kentucky bluegrass persists in a broken sod appearance. Noxious weeds also invade. Once these events have occurred, it is difficult for native perennial plants to reestablish. Trees such as Russian olive may also invade if a seed source is available.

The degree of grazing has a significant impact on the ecological dynamics of the site. This region was historically

occupied by large grazing animals, such as bison, elk, pronghorn, and mule deer. Grazing by these large herbivores, along with climatic and seasonal weather fluctuations, had a major influence on the ecological dynamics of the site. Deer and pronghorn are widely distributed throughout the MLRA. Secondary influences of herbivory by species such as prairie dogs and other small rodents, insects, and root-feeding organisms continues to impact the vegetation.

Historically, grazing patterns by herds of large ungulates were driven by water distribution, precipitation events, drought events, and fire. It is believed that grazing periods would have been shorter, followed by longer recovery periods. These large migrating herds impacted the ecological processes of nutrient and hydrologic cycles, by urination, trampling (incorporation of litter into the soil surface), and breaking of surface crust, (which increases water infiltration).

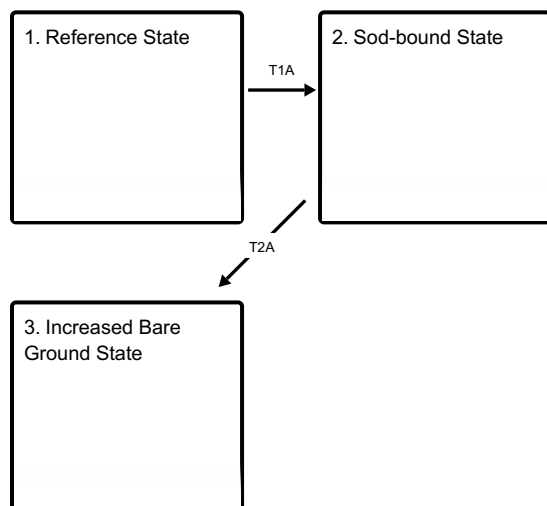
Today, livestock grazing, especially beef cattle has been a major influence on the ecological dynamics of the site. Grazing management, coupled with the effects of annual climatic variations, largely dictates the plant communities for the site.

Recurrent drought has historically impacted the vegetation of this region. Changes in species composition vary depending upon the duration and severity of the drought cycle and prior grazing management. Drought events since 2002 have significantly increased mortality of blue grama and buffalograss in some locales.

This site developed with occasional fire as part of the ecological processes. Historic fire frequency (pre-industrial) is estimated at 10 to 14 years (Guyette, 2012), randomly distributed, and started by lightning at various times throughout the growing season. Early human inhabitants also were likely to start fires for various reasons (deliberate or accidental). It is believed that fires were set as a management tool for attracting herds of large migratory herbivores (Stewart, 2002). The impact of fire over the past 100 years has been relatively insignificant due to the human control of wildfires and the lack of acceptance of prescribed fire as a management tool.

State and transition model

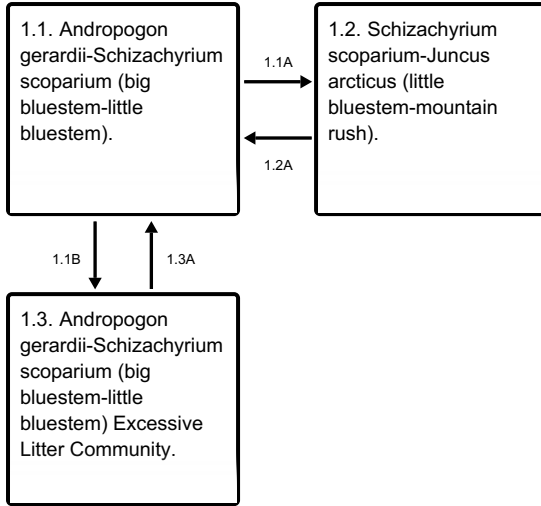
Ecosystem states



T1A - Excessive grazing. Lack of fire.

T2A - Excessive grazing. Lack of fire.

State 1 submodel, plant communities



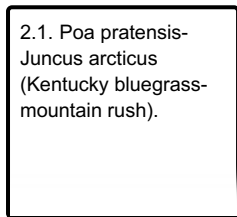
1.1A - Excessive grazing. Lack of fire.

1.1B - Non-use. Lack of fire.

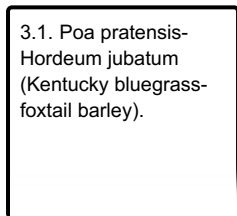
1.2A - Prescribed grazing. Prescribed fire.

1.3A - Prescribed grazing. Prescribed fire.

State 2 submodel, plant communities



State 3 submodel, plant communities



State 1 Reference State

The Reference State is characterized by three distinct plant community phases. The plant communities, and various successional stages between them, represent the natural range of variability within the Reference State.

Dominant plant species

- willow (*Salix*), shrub
- big bluestem (*Andropogon gerardii*), grass
- little bluestem (*Schizachyrium scoparium*), grass
- prairie cordgrass (*Spartina pectinata*), grass

Community 1.1

Andropogon gerardii-Schizachyrium scoparium (big bluestem-little bluestem).

This is the interpretive plant community for the Subirrigated Ecological Site. This community developed with grazing by large herbivores and is suited to grazing by domestic livestock. Historically, fires likely occurred infrequently, and were randomly distributed. This plant community can be found on areas where grazed plants receive adequate periods of recovery during the growing season. The potential vegetation is about 80 to 95 percent grasses and

grass-likes, 5 to 10 percent forbs, and 0 to 10 percent woody plants. The major grasses include big bluestem, little bluestem, prairie cordgrass, Indiangrass, and switchgrass. Minor grasses include slender and western wheatgrass, basin wildrye, Canada wildrye, and foxtail barley. A minor component of grass-likes such as mountain rush (also known as Baltic rush), spikerush, and bulrush species, forbs such as horsetail, Pursh seepweed, and arrowgrass; Maximilian sunflower, white heath aster Pennsylvania smartweed, and false boneset; white sagebrush (also known as cudweed sagewort), Cuman ragweed, and milkvetch; and a minor component of shrubs, such as silver buffaloberry, western snowberry, Woods' rose, and willows are also present. In the 12 to 14 inch precipitation zone (PZ), the total annual production (air-dry weight) is about 3,400 pounds per acre during an average year, but ranges from about 3,500 pounds per acre in unfavorable years to about 4,500 pounds per acre in above-average years. In the 15 to 17 inch PZ, the total annual production (air-dry weight) is about 4,500 pounds per acre during an average year, but ranges from about 4,000 pounds per acre in unfavorable years to about 5,000 pounds per acre in above-average years. Community dynamics (nutrient and water cycles, and energy flow) are functioning properly. Infiltration rates are moderate, and soil erosion is low. Litter is properly distributed where vegetative cover is continuous. Decadence and natural plant mortality are low. This community is resistant to many disturbances except heavy, continuous grazing, tillage or development into urban or other uses.

Dominant plant species

- willow (*Salix*), shrub
- big bluestem (*Andropogon gerardii*), grass
- little bluestem (*Schizachyrium scoparium*), grass
- prairie cordgrass (*Spartina pectinata*), grass

Figure 10. Plant community growth curve (percent production by month). WY1106, 12-14SP Free water sites w/warm - WL, Sb, SS.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	5	15	20	30	20	10	0	0	0

Community 1.2

Schizachyrium scoparium-Juncus arcticus (little bluestem-mountain rush).

Big bluestem, prairie cordgrass, Indiangrass, switchgrass, and Canada wildrye have been significantly reduced. Little bluestem may initially increase or decrease depending upon season of use. Grass-likes such as Mountain rush (also known as Baltic rush), has increased. Kentucky bluegrass has begun to invade. Forbs and shrubs are still present in small amounts. This plant community is at risk of losing tall warm-season grasses, palatable forbs, and shrubs. In the 12 to 14 inch PZ, the total annual production (air-dry weight) is about 2,800 pounds per acre during an average year, but ranges from about 2,200 pounds per acre in unfavorable years to about 3,400 pounds per acre in above-average years. In the 15 to 17 inch PZ, the total annual production (air-dry weight) is about 3,200 pounds per acre during an average year, but ranges from about 2,600 pounds per acre in unfavorable years to about 3,800 pounds per acre in above-average years. Total aboveground biomass has been reduced. Reduction of tall warm-season grasses and cool-season rhizomatous wheatgrasses, nitrogen-fixing forbs, and increased sod-forming grasses and grass-likes, have begun to alter the biotic integrity of this community. Water and nutrient cycles may be impaired. Nearly all plant species typically found in the Reference Plant Community are present and will respond to changes in grazing management.

Dominant plant species

- willow (*Salix*), shrub
- little bluestem (*Schizachyrium scoparium*), grass
- mountain rush (*Juncus arcticus* ssp. *littoralis*), grass

Figure 11. Plant community growth curve (percent production by month). WY1103, 12-14SP Free water w/o warm - WL, Sb, SS.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	5	20	25	25	15	10	0	0	0

Community 1.3

Andropogon gerardii-Schizachyrium scoparium (big bluestem-little bluestem) Excessive Litter Community.

This plant community developed under the absence of grazing and fire. Plant species resemble the Reference Plant Community however, frequency and production are reduced. Standing dead canopy prevents sunlight from reaching plant crowns. Much of the available nutrients are tied up in standing dead plant material and litter. Eventually, litter levels can become high enough to cause decadence and mortality of the stand. Bunchgrasses, such as little bluestem, slender wheatgrass, Indiangrass, and switchgrass, typically develop dead centers and rhizomatous grasses can form small decadent communities due to a lack of impact by grazing animals. The semiarid environment and the absence of animal traffic to break down litter slows nutrient recycling. Water flow patterns and pedestalling become apparent. Infiltration is reduced and runoff is increased. In advanced states of non-use or lack of fire, bare areas increase causing an erosion concern. In the 12 to 14 inch PZ, the total annual production (air-dry weight) is about 3,500 pounds per acre during an average year, but ranges from about 3,100 pounds per acre in unfavorable years to about 3,900 pounds per acre in above-average years. In the 15 to 17 inch PZ, the total annual production (air-dry weight) is about 3,800 pounds per acre during an average year, but ranges from about 3,400 pounds per acre in unfavorable years to about 4,200 pounds per acre in above-average years. Total annual production can vary substantially.

Dominant plant species

- willow (*Salix*), shrub
- big bluestem (*Andropogon gerardii*), grass
- little bluestem (*Schizachyrium scoparium*), grass
- prairie cordgrass (*Spartina pectinata*), grass

Figure 12. Plant community growth curve (percent production by month).
WY1103, 12-14SP Free water w/o warm - WL, Sb, SS.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	5	20	25	25	15	10	0	0	0

Pathway 1.1A Community 1.1 to 1.2

Frequent and severe defoliation without adequate recovery between grazing events and lack of fire shifts this plant community to the 1.2 Community. Drought accelerates this process. Recurring spring seasonal grazing decreases cool-season plants. Conversely, recurring summer grazing decreases warm-season plants and tends to increase cool-season plants over time. Biotic integrity and the water and nutrient cycles may become impaired as a result of this community pathway.

Pathway 1.1B Community 1.1 to 1.3

Non-use and lack of fire cause the Reference Plant Community to shift to the 1.3 Community. Plant decadence and standing dead plant material impede energy flow. Initially, excess litter increases. Eventually, native plant density begins to decrease and annuals and introduced species may begin to invade. Water and nutrient cycles are impaired as a result of this community pathway.

Pathway 1.2A Community 1.2 to 1.1

Grazing that allows for adequate recovery between grazing events, proper stocking rates, and prescribed fire shift this community back toward the Reference Plant Community.

Conservation practices

Prescribed Burning
Prescribed Grazing

Pathway 1.3A Community 1.3 to 1.1

The return of grazing with adequate recovery and normal fire frequency shifts this plant community toward the Reference Plant Community. This change can occur in a relatively short time frame with the return of these disturbances.

Conservation practices

Prescribed Burning
Prescribed Grazing

State 2 Sod-bound State

An ecological threshold has been crossed and a significant amount of production and diversity has been lost when compared to the Reference State. Significant biotic and soil changes have negatively impacted energy flow and the nutrient and hydrologic cycles. This is a very stable state, resistant to change due to the high tolerance of Kentucky bluegrass to grazing, the development of a shallow root system (root pan), and subsequent changes in hydrology and nutrient cycling. The loss of other functional/structural groups such as warm and cool-season bunch and rhizomatous grasses, forbs, and shrubs reduces the biodiversity productivity of this site.

Dominant plant species

- Kentucky bluegrass (*Poa pratensis*), grass
- mountain rush (*Juncus arcticus ssp. littoralis*), grass

Community 2.1 Poa pratensis-Juncus arcticus (Kentucky bluegrass-mountain rush).

The tall and mid-grasses, and palatable forbs have been eliminated. Kentucky bluegrass has fully invaded the community and persists in a sod-bound condition. Mountain rush, various sedges, and foxtail barley have increased. Remnant amounts of western wheatgrass may still persist in localized colonies. Big bluestem, little bluestem, prairie cordgrass, Indiangrass, and switchgrass have been removed. Annual weeds such as burningbush and Russian thistle have also invaded. The plant community lacks diversity and is resistant to change. Energy flow and water and mineral cycles have been negatively affected. Litter levels are very low and unevenly distributed. In the 12 to 14 inch PZ, the total annual production (air-dry weight) is about 2,000 pounds per acre during an average year, but ranges from about 1,600 pounds per acre in unfavorable years to about 2,400 pounds per acre in above-average years. In the 15 to 17 inch PZ, the total annual production (air-dry weight) is about 2,300 pounds per acre during an average year, but ranges from about 1,800 pounds per acre in unfavorable years to about 2,800 pounds per acre in above-average years.

Dominant plant species

- Kentucky bluegrass (*Poa pratensis*), grass
- mountain rush (*Juncus arcticus ssp. littoralis*), grass

Figure 13. Plant community growth curve (percent production by month).
WY1103, 12-14SP Free water w/o warm - WL, Sb, SS.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	5	20	25	25	15	10	0	0	0

State 3 Increased Bare Ground State

An ecological threshold has been crossed. The Increased *Bare Ground* State denotes changes in infiltration, runoff, aggregate stability, and species composition. The changes in water movement and the plant community affect

changes in hydrologic functionality, biotic integrity, and soil and site stability. Infiltration, runoff, and soil erosion vary depending upon the vegetation present. Erosion and loss of organic matter and carbon reserves are concerns.

Dominant plant species

- Kentucky bluegrass (*Poa pratensis*), grass
- foxtail barley (*Hordeum jubatum*), grass
- burningbush (*Bassia scoparia*), other herbaceous
- Russian thistle (*Salsola*), other herbaceous

Community 3.1

Poa pratensis-Hordeum jubatum (Kentucky bluegrass-foxtail barley).

Kentucky bluegrass and foxtail barley dominate this community; however, areas of sod have been removed, resulting in a broken sod-bound appearance. Bare ground may be a concern if water table levels are low. Annual invasive forbs and grasses include burningbush, Russian thistle, and cheatgrass. Noxious weeds, such as Dalmatian toadflax and leafy spurge may invade. Forage palatability for livestock is low. In the 12 to 14 inch PZ, the total annual production (air-dry weight) is about 1,600 pounds per acre during an average year, but ranges from about 1,300 pounds per acre in unfavorable years to about 1,900 pounds per acre in above-average years. In the 15 to 17 inches PZ, the total annual production (air-dry weight) is about 1,800 pounds per acre during an average year, but ranges from about 1,400 pounds per acre in unfavorable years to about 2,200 pounds per acre in above-average years. This plant community is very resistant to change because of the lack of native species and the amount of invasive species present. Wind and water erosion may occur if bare ground has increased. Litter amounts are greatly reduced. Mineral crusting caused by raindrop impact disrupts surface soil aggregates, increasing ponding and slowing infiltration. Continued heavy use will cause severe compaction problems.

Dominant plant species

- Kentucky bluegrass (*Poa pratensis*), grass
- foxtail barley (*Hordeum jubatum*), grass
- burningbush (*Bassia scoparia*), other herbaceous
- Russian thistle (*Salsola*), other herbaceous

Figure 14. Plant community growth curve (percent production by month). WY1103, 12-14SP Free water w/o warm - WL, Sb, SS.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	5	20	25	25	15	10	0	0	0

Transition T1A

State 1 to 2

Frequent and severe defoliation without adequate recovery periods between grazing events and lack of fire shifts this plant community across an ecological threshold to the Sod-bound State. Biotic integrity and hydrologic function are impaired because of this transition.

Transition T2A

State 2 to 3

Long-term frequent and severe defoliation without adequate recovery between grazing events and lack of fire cause a shift across an ecological threshold to the Increased Bare Ground State. Erosion and loss of organic matter along with invasion of introduced plants and noxious weeds are resource concerns.

Additional community tables

Table 5. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					

1	12			2690-2914	
	big bluestem	ANGE	<i>Andropogon gerardii</i>	897-1121	-
	little bluestem	SCSC	<i>Schizachyrium scoparium</i>	673-897	-
	Indiangrass	SONU2	<i>Sorghastrum nutans</i>	224-673	-
	prairie cordgrass	SPPE	<i>Spartina pectinata</i>	448-673	-
	switchgrass	PAVI2	<i>Panicum virgatum</i>	224-448	-
2	12			448-897	
	slender wheatgrass	ELTR7	<i>Elymus trachycaulus</i>	224-448	-
	basin wildrye	LECI4	<i>Leymus cinereus</i>	0-448	-
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	224-448	-
3	12			224-448	
	sedge	CAREX	<i>Carex</i>	224-448	-
	spikerush	ELEOC	<i>Eleocharis</i>	0-90	-
	mountain rush	JUARL	<i>Juncus arcticus ssp. littoralis</i>	0-90	-
	bulrush	SCIRP	<i>Scirpus</i>	0-90	-
4				224-448	
	Grass, perennial	2GP	<i>Grass, perennial</i>	0-224	-
	Canada wildrye	ELCA4	<i>Elymus canadensis</i>	0-224	-
	foxtail barley	HOJU	<i>Hordeum jubatum</i>	0-224	-
	bluegrass	POA	<i>Poa</i>	0-224	-
	alkali sacaton	SPAI	<i>Sporobolus airoides</i>	0-224	-
7	15			3026-3278	
	big bluestem	ANGE	<i>Andropogon gerardii</i>	1009-1261	-
	little bluestem	SCSC	<i>Schizachyrium scoparium</i>	757-1009	-
	Indiangrass	SONU2	<i>Sorghastrum nutans</i>	252-757	-
	prairie cordgrass	SPPE	<i>Spartina pectinata</i>	504-757	-
	switchgrass	PAVI2	<i>Panicum virgatum</i>	252-504	-
8	15			504-1009	
	slender wheatgrass	ELTR7	<i>Elymus trachycaulus</i>	252-504	-
	basin wildrye	LECI4	<i>Leymus cinereus</i>	0-504	-
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	252-504	-
9	15			252-504	
	sedge	CAREX	<i>Carex</i>	252-504	-
	spikerush	ELEOC	<i>Eleocharis</i>	0-101	-
	rush	JUNCU	<i>Juncus</i>	0-101	-
	bulrush	SCIRP	<i>Scirpus</i>	0-101	-
10				252-504	
	Grass, perennial	2GP	<i>Grass, perennial</i>	0-252	-
	Canada wildrye	ELCA4	<i>Elymus canadensis</i>	0-252	-
	foxtail barley	HOJU	<i>Hordeum jubatum</i>	0-252	-
	bluegrass	POA	<i>Poa</i>	0-252	-
	alkali sacaton	SPAI	<i>Sporobolus airoides</i>	0-252	-
Forb					
5	12			224-448	

	Forb, perennial	2FP	<i>Forb, perennial</i>	0–224	–
	Cuman ragweed	AMPS	<i>Ambrosia psilostachya</i>	0–90	–
	white sagebrush	ARLU	<i>Artemisia ludoviciana</i>	0–90	–
	milkvetch	ASTRA	<i>Astragalus</i>	0–90	–
	false boneset	BREU	<i>Brickellia eupatorioides</i>	0–90	–
	horsetail	EQUIS	<i>Equisetum</i>	0–90	–
	American licorice	GLLE3	<i>Glycyrrhiza lepidota</i>	0–90	–
	Maximilian sunflower	HEMA2	<i>Helianthus maximiliani</i>	0–90	–
	Pennsylvania smartweed	POPE2	<i>Polygonum pensylvanicum</i>	0–90	–
	Pursh seepweed	SUCA2	<i>Suaeda calceoliformis</i>	0–90	–
	white heath aster	SYER	<i>Symphotrichum ericoides</i>	0–90	–
	arrowgrass	TRIGL	<i>Triglochin</i>	0–90	–
11	15			252–504	
	Forb, perennial	2FP	<i>Forb, perennial</i>	0–252	–
	Cuman ragweed	AMPS	<i>Ambrosia psilostachya</i>	0–101	–
	white sagebrush	ARLU	<i>Artemisia ludoviciana</i>	0–101	–
	milkvetch	ASTRA	<i>Astragalus</i>	0–101	–
	false boneset	BREU	<i>Brickellia eupatorioides</i>	0–101	–
	horsetail	EQUIS	<i>Equisetum</i>	0–101	–
	American licorice	GLLE3	<i>Glycyrrhiza lepidota</i>	0–101	–
	Maximilian sunflower	HEMA2	<i>Helianthus maximiliani</i>	0–101	–
	Pennsylvania smartweed	POPE2	<i>Polygonum pensylvanicum</i>	0–101	–
	Pursh seepweed	SUCA2	<i>Suaeda calceoliformis</i>	0–101	–
	white heath aster	SYER	<i>Symphotrichum ericoides</i>	0–101	–
	arrowgrass	TRIGL	<i>Triglochin</i>	0–101	–
Shrub/Vine					
6				0–448	
	willow	SALIX	<i>Salix</i>	0–448	–
	silver buffaloberry	SHAR	<i>Shepherdia argentea</i>	0–224	–
	western snowberry	SYOC	<i>Symphoricarpos occidentalis</i>	0–224	–
	Shrub (>.5m)	2SHRUB	<i>Shrub (>.5m)</i>	0–224	–
	rose	ROSA5	<i>Rosa</i>	0–224	–
12				0–504	
	willow	SALIX	<i>Salix</i>	0–504	–
	silver buffaloberry	SHAR	<i>Shepherdia argentea</i>	0–252	–
	western snowberry	SYOC	<i>Symphoricarpos occidentalis</i>	0–252	–
	Shrub (>.5m)	2SHRUB	<i>Shrub (>.5m)</i>	0–252	–
	rose	ROSA5	<i>Rosa</i>	0–252	–

Animal community

Reference Plant Community—Big Bluestem, Little Bluestem, Prairie Cordgrass:

Common birds expected in the Reference Plant Community include lark and grasshopper sparrow, chestnut collared longspur, lark bunting, western meadowlark, and ferruginous and Swainson's hawks. This site provides

excellent nesting habitat for pheasant and waterfowl if other habitat elements, such as cropland and shallow water are nearby.

1.2 Community— Reduced Warm-season Tall and Midgrasses, Increased Cool-season Grasses and Grass-likes:

All Reference Plant Community species are expected in these plant communities. However, the reduction in the tall grass species in these plant communities make them less diverse, and thus, less apt to meet all seasonal needs.

1.3 Community—Excessive Litter, Decadent Plants, and Standing Dead Canopy:

This community has reduced habitat value for most wildlife species found in the Reference Plant Community.

2.1 Community— Kentucky Bluegrass-Invaded:

The shift away from tallgrasses to short and midgrasses and grass-like species results in a change in bird species to killdeer, McCown's longspur, horned lark, and long-billed curlew.

3.1 Community— Kentucky Bluegrass, Foxtail Barley, Annual Forbs, Noxious Weeds:

This community has low habitat value for most wildlife species.

Grazing Interpretations:

The following table is a guide to stocking rates for the plant communities described in the Subirrigated site. These are conservative estimates for initial planning. On-site conditions will vary, and stocking rates should be adjusted based on range inventories, animal kind/class, forage availability (adjusted for slope and distance to water), and the type of grazing system (number of pastures, planned moves, etc.), all of which is determined in the conservation planning process.

The following stocking rates are based on the total annual forage production in a normal year multiplied by 25 percent harvest efficiency of preferred and desirable forage species, divided by 912 pounds of ingested air-dry vegetation for an animal unit per month (Natl. Range and Pasture Handbook, 1997). An animal unit month (AUM) is defined as the amount of forage required by one mature cow, for one month.

Plant Community (PC) Production (total lbs. /acre in a normal year) and Stocking Rate (AUMs/acre) are listed below:

Example: Reference PC – (4000) (1.1)

$4,000 \text{ lbs. per acre} \times 25\% \text{ Harvest Efficiency} = 1,000 \text{ lbs. forage demand for one month. Then, } 1,000 \text{ lbs. per acre} / 912 \text{ demand per AUM} = 1.1$

Plant Community (PC) Production (lbs.ac), and Stocking Rate (AUM/Acre)

12-14" PZ:

Reference PC - (4000) (1.1)

1.2 PC - (2800) (0.77)

2.1 PC - (2000) (0.55)

15-17" PZ

Reference PC - (4500) (1.23)

1.2 PC - (3200) (0.88)

2.1 PC - (2300) (0.63)

Grazing by domestic livestock is one of the major income-producing industries in the area. Rangelands in this area provide year-long forage under prescribed grazing for cattle, sheep, horses, and other herbivores. During the dormant period, livestock may need supplementation based on reliable forage analysis.

An on-site inventory is required prior to developing a grazing plan.

Hydrological functions

Climate is the principal factor limiting forage production on this site. This site is dominated by soils in hydrologic group B and C, with localized areas in Hydrologic group D. Infiltration ranges from moderately slow to moderately rapid. Runoff potential for this site varies from moderate to high depending on soil hydrologic group and ground cover. In many cases, areas with greater than 75 percent ground cover have the greatest potential for high infiltration and lower runoff. An example of an exception would be where shortgrasses form a strong sod and dominate the site. Areas where ground cover is less than 50 percent have the greatest potential to have reduced infiltration and higher runoff (refer to NRCS Section 4, National Engineering Handbook (USDA–NRCS, 1972–2012) for runoff quantities and hydrologic curves).

Rills and gullies should not typically be present. Water flow patterns should be barely distinguishable if at all present. Pedestals are only slightly present in association with bunchgrasses. Litter typically falls in place, and signs of movement are not common. Chemical and physical crusts are rare to non-existent. Cryptogamic crusts are present, but only cover 1 to 2 percent of the soil surface.

Recreational uses

This site provides hunting, hiking, photography, bird watching, and other opportunities. The wide varieties of plants that bloom from spring until fall have an aesthetic value that appeals to visitors.

Wood products

No appreciable wood products are present on the site.

Other products

Site Development & Testing Plan

General Data (MLRA and Revision Notes, Hierarchical Classification, Ecological Site Concept, Physiographic, Climate, and Water Features, and Soils Data):

Updated. All “Required” items complete to Provisional level.

Community Phase Data (Ecological Dynamics, STM, Transition & Recovery Pathways, Reference Plant Community, Species Composition List, Annual Production Table):

Updated. All “Required” items complete to Provisional level.

Annual Production Table is from the “Previously Approved” ESD (2008).

Growth Curves are from the “Previously Approved” ESD (2008).

The Annual Production Table, Species Composition List, and Growth Curves will be reviewed for future updates at Approved level.

Each Alternative State/Community:
Complete to Provisional level

Supporting Information (Site Interpretations, Assoc. & Similar Sites, Inventory Data References, Agency/State Correlation, References):

Updated. All “Required” items complete to Provisional level.

Wildlife Interpretations: Plant community names updated. Narrative is from “Previously Approved” ESD (2008). Wildlife species will need to be updated at the next Approved level.

Livestock Interpretations: Plant community names and stocking rates updated.

Hydrology, Recreational Uses, Wood Products, and Other Products carried over from previously "Approved" ESD (2008).

Plant Preferences tabled removed. Will be released as a technical guide notice by NE and WY state offices in the future.

Existing NRI or 417 Inventory Data References updated. More field data collection is needed to support this site concept.

Reference Sheet:

Rangeland Health Reference Sheet carried over from previously "Approved" ESD (2008).

It will be updated at the next "Approved" level.

"Future work, as described in a project plan, to validate the information in this provisional ecological site description is needed. This will include field activities to collect low and medium intensity sampling, soil correlations, and analysis of that data. Annual field reviews should be done by soil scientists and vegetation specialists. A final field review, peer review, quality control, and quality assurance reviews of the ESD will be needed to produce the final document." (NI 430_306 ESI and ESD, April, 2015)

Inventory data references

Data Source: 417s

Number of Records: 1

Sample Period: 1980

States: NE

Counties: Morrill

Information presented here has been derived from data collection on private and federal lands using:

- Double Sampling (clipped 2 of 5 plots)*
- Rangeland Health (Pellant et al., 2005)
- Soil Stability (Pellant et al., 2005)
- Line Point Intercept : Foliar canopy, basal cover (Forb, Graminoid, Shrub, subshrub, Lichen, Moss, Rock fragments, bare ground, % Litter) (Herrick et al., 2005)
- Soil pedon descriptions collected on site (Schoeneberger et al., 2012)

*NRCS double-sampling method, CO NRCS Similarity Index Worksheet 528(1).

Additional reconnaissance data collection using numerous ocular estimates and other inventory data; NRCS clipping data for USDA program support; Field observations from experienced range trained personnel. Specific data information is contained in individual landowner/user case files and other files located in county NRCS field offices.

References

Guyette, R.P., M.C. Stambaugh, D.C. Dey, and R. Muzika. 2012. Predicting Fire Frequency with Chemistry and Climate. *Ecosystems* 15:322–335.

Stewart, O.C., H.T. Lewis, and M.K. Anderson. 2002. *Forgotten Fires: Native Americans and the Transient Wilderness*. University of Oklahoma Press, Norman, OK. 351p.

Other references

Anderson, R.C. 2006. Evolution and origin of the central grassland of North America: Climate, fire, and mammalian grazers. *Journal of the Torrey Botanical Society* 133:626–647.

Bragg, T.B. 1995. The physical environment of the Great Plains grasslands. In: A. Joern and K.H. Keeler (eds.) *The*

changing prairie, Oxford University Press, Oxford, UK. pp. 49–81.

Branson, D.H., and G.A. Sword. 2010. An experimental analysis of grasshopper community responses to fire and livestock grazing in a northern mixed-grass prairie. *Environmental Entomology* 39:1441–1446.

Brinson, M.M. 1993. A hydrogeomorphic classification for wetlands. Technical Report WRP–DE–4. U.S. Army Corps of Engineers Waterways Experiment Station, Vicksburg, MS.

Cleland, D., P. Avers, W.H. McNab, M. Jensen, R. Bailey, T. King, and W. Russell. 1997. National Hierarchical Framework of Ecological Units, published in *Ecosystem Management: Applications for Sustainable Forest and Wildlife Resources*, Yale University Press

Coupland, R.T. 1958. The effects of fluctuations in weather upon the grasslands of the Great Plains. *Botanical Review* 24:273–317.

Davis, S.K., R.J. Fisher, S.L. Skinner, T.L. Shaffer, and R.M. Brigham. 2013. Songbird abundance in native and planted grassland varies with type and amount of grassland in the surrounding landscape. *Journal of Wildlife Management* 77:908–919.

DeLuca, T.H. and P. Lesica. 1996. Long-term harmful effects of crested wheatgrass on Great Plains grassland ecosystems. *Journal of Soil and Water Conservation* 51:408–409.

Derner, J.D. and R.H. Hart. 2007. Grazing-induced modifications to peak standing crop in northern mixed-grass prairie. *Rangeland Ecology and Management* 60:270–276.

Derner, J.D. and A.J. Whitman. 2009. Plant interspaces resulting from contrasting grazing management in northern mixed-grass prairie: Implications for ecosystem function. *Rangeland Ecology and Management* 62:83–88.

Derner, J.D., W.K. Lauenroth, P. Stapp, and D.J. Augustine. 2009. Livestock as ecosystem engineers for grassland bird habitat in the western Great Plains of North America. *Rangeland Ecology and Management* 62:111–118.

Dillehay, T.D. 1974. Late Quaternary bison population changes on the southern Plains. *Plains Anthropologist* 19:180–196.

Dormaar, J.F. and S. Smoliak. 1985. Recovery of vegetative cover and soil organic matter during revegetation of abandoned farmland in a semiarid climate. *Journal of Range Management* 38:487–491.

Fenneman, N.M., and D.W. Johnson. 1946. Physical divisions of the United States. U.S. Geological Survey, Physiographic Committee. Scale 1:700,000.

Harmoney, K.R. 2007. Grazing and burning Japanese brome (*Bromus japonicus*) on mixed grass rangelands. *Rangeland Ecology and Management* 60:479–486.

Heitschmidt, R.K. and L.T. Vermeire. 2005. An ecological and economic risk avoidance drought management decision support system. In: J.A. Milne (ed.) *Pastoral systems in marginal environments*, 20th International Grasslands Congress, July 2005. p. 178.

Knopf, F.L. 1996. Prairie legacies—Birds. In: F.B. Samson and F.L. Knopf (eds.) *Prairie conservation: Preserving North America's most endangered ecosystem*, Island Press, Washington, DC. pp. 135–148.

Knopf, F.L. and F.B. Samson. 1997. Conservation of grassland vertebrates. In: F.B. Samson and F.L. Knopf (eds.) *Ecology and conservation of Great Plains vertebrates: Ecological Studies 125*, Springer-Verlag, New York, NY. pp. 273–289.

Lauenroth, W.K., O.E. Sala, D.P. Coffin, and T.B. Kirchner. 1994. The importance of soil water in recruitment of *Bouteloua gracilis* in the shortgrass steppe. *Ecological Applications* 4:741–749.

Laycock, W.A. 1988. History of grassland plowing and grass planting on the Great Plains. In: J.E. Mitchell (ed.)

- Impacts of the Conservation Reserve Program in the Great Plains—symposium proceedings, September 16–18, 1987. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, General Technical Report RM-158.
- Malloch, D.W., K.A. Pirozynski, and P.H. Raven. 1980. Ecological and evolutionary significance of mycorrhizal symbioses in vascular plants (a review). *Proceedings of the National Academy of Sciences* 77:2113–2118.
- Ogle, S.M., W.A. Reiners, and K.G. Gerow. 2003. Impacts of exotic annual brome grasses (*Bromus* spp.) on ecosystem properties of the northern mixed grass prairie. *American Midland Naturalist* 149:46–58.
- Roath, L.R. 1988. Implications of land conversions and management for the future. In: J.E. Mitchell (ed.) *Impacts of the Conservation Reserve Program in the Great Plains—symposium proceedings, September 16–18, 1987*. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, General Technical Report RM-158.
- Smoliak, S. and J.F. Dormaar. 1985. Productivity of Russian wildrye and crested wheatgrass and their effect on prairie soils. *Journal of Range Management* 38:403–405.
- Smoliak, S., J.F. Dormaar, and A. Johnston. 1972. Long-term grazing effects on *Stipa-Bouteloua* prairie soils. *Journal of Range Management* 25:246–250.
- Soil Science Division Staff. 2017. *Soil survey manual*. C. Ditzler, K. Scheffe, and H.C. Monger (eds.) USDA Handbook 18. Government Printing Office, Washington, DC.
- Soil Survey Staff. *Official Soil Series Descriptions*. USDA Natural Resources Conservation Service. Available online. https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053587. Accessed 15 November, 2017.
- Soil Survey Staff. *Soil Survey Geographic (SSURGO) database*. USDA Natural Resources Conservation Service.
- Soil Survey Staff. 2014. *Keys to Soil Taxonomy*, 12th edition. USDA Natural Resources Conservation Service, Washington, DC.
- Soil Survey Staff. 2018. *Web Soil Survey*. USDA Natural Resources Conservation Service. Available online. <https://websoilsurvey.nrcs.usda.gov/app/>. Accessed 15 February, 2018.
- Soller, D.R. 2001. Map showing the thickness and character of Quaternary sediments in the glaciated United States east of the Rocky Mountains. U.S. Geological Survey Miscellaneous Investigations Series I-1970-E, scale 1:3,500,000.
- U.S. Army Corps of Engineers. 1987. *Corps of Engineers wetlands delineation manual*. Wetlands Research Program Technical Report Y-87-1. Available online. <http://www.lrh.usace.army.mil/Portals/38/docs/USACE%2087%20Wetland%20Delineation%20Manual.pdf>. Waterways Experiment Station, Vicksburg, MS.
- U.S. Department of Agriculture, Natural Resources Conservation Service. *Glossary of landform and geologic terms*. National Soil Survey Handbook, Title 430-VI, Part 629.02c. Available online. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/ref/?cid=nrcs142p2_054242. Accessed 16 January, 2018.
- U.S. Department of Agriculture, Natural Resources Conservation Service. 2010a. *Field indicators of hydric soils in the United States*, version 7.0. L.M. Vasilas, G.W. Hurt, and C.V. Noble (eds.) USDA-NRCS, in cooperation with the National Technical Committee for Hydric Soils.
- U.S. Department of Agriculture, Natural Resources Conservation Service. 2013a. *Climate data*. National Water and Climate Center. Available online. <http://www.wcc.nrcs.usda.gov/climate>. Accessed 13 October, 2017.
- U.S. Department of Agriculture, Natural Resources Conservation Service. 2013b. *National Soil Information System*. Available online. https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/survey/geo/?cid=nrcs142p2_053552. Accessed 30 October, 2017.

U.S. Department of the Interior, Geological Survey. 2008. LANDFIRE 1.1.0 Vegetation Dynamics Models. Available online. <http://landfire.cr.usgs.gov/viewer/>.

U.S. Department of the Interior, Geological Survey. 2011. LANDFIRE 1.1.0 Existing Vegetation Types. Available online. <http://landfire.cr.usgs.gov/viewer/>.

Willeke, G.E. 1994. The national drought atlas [CD ROM]. U.S. Army Corps of Engineers, Water Resources Support Center, Institute for Water Resources Report 94-NDS-4.

Wilson, S.D. and J.M. Shay. 1990. Competition, fire, and nutrients in a mixed-grass prairie. *Ecology* 71:1959–1967.

With, K.A. 2010. McCown's longspur (*Rhynchophanes mccownii*). In: A. Poole (ed.) *The birds of North America* [online], Cornell Lab of Ornithology, Ithaca, NY. Available online. <https://birdsna.org/Species-Account/bna/home>.

Additional References

Augustine, D.J., J. Derner, D. Milchunas, D. Blumenthal, and L. Porensky. 2017. Grazing moderates increases in C3 grass abundance over seven decades across a soil texture gradient in shortgrass steppe. *Journal of Vegetation Science*, Doi:10.1111/jvs.12508, International Association of Vegetative Science

Augustine, D.J., J. Derner, J.K. Detling. 2014. Testing for thresholds in a semiarid grassland: The influence of prairie dogs and plague. *Rangeland Ecology & Management* 67(6)

U.S. Dept. of Agriculture, Natural Resources Conservation Service 1997, revised 2003. *National Range and Pasture Handbook*. Available online. <http://www.glti.nrcs.usda.gov/technical/publications/nrph.html>. Accessed 26 February, 2018.

Clark, J., E. Grimm, J. Donovan, S. Fritz, D. Engrstom, and J. Almendinger. 2002. Drought cycles and landscape responses to past aridity on prairies of the Northern Great Plains, USA. *Ecology*, 83(3), 595-601.

Collins, S. and S. Barber. (1985). Effects of disturbance on diversity in mixed-grass prairie. *Vegetatio*, 64, 87-94.

Cooperative climatological data summaries. NOAA. Western Regional Climate Center: Reno, NV. Web. Available online. <http://www.wrcc.dri.edu/climatedata/climsum>. Accessed 16 November, 2017.

Egan, Timothy. 2006. *The Worst Hard Time*. Houghton Mifflin Harcourt Publishing Company: New York, NY.

Hart, R. and J. Hart. 1997. Rangelands of the Great Plains before European Settlement. *Rangelands*, 19(1), 4-11.

Hart, R. 2001. Plant biodiversity on shortgrass steppe after 55 years of zero, light, moderate, or heavy cattle grazing. *Plant Ecology*, 155, 111-118.

Pellant, M., P. Shaver, D.A. Pyke, J.E. Herrick. (2005) *Interpreting Indicators of Rangeland Health, Version 4*. BLM National Business Center Printed Materials Distribution Service: Denver, CO.

Mack, Richard N., and J.N. Thompson. 1982. Evolution in Steppe with Few Large, Hooved Mammals. *The American Naturalist*. 119, No. 6, 757-773

Reyes-Fox, M., Stelzer H., Trlica M.J., McMaster, G.S., Andales, A.A., LeCain, D.R., and Morgan J.A. 2014. Elevated CO2 further lengthens growing season under warming conditions. *Nature*, April 23, 2014 Available online. <http://www.nature.com/nature/journal/v510/n7504/full/nature13207.html>. Accessed 1 March, 2017.

Schoeneberger, P.J., D.A. Wysockie, E.C. Benham, and Soil Survey Staff. 2012. *Field book for describing and sampling soils, Version 3.0*. Natural Resources Conservation Service, National Soil Survey Center: Lincoln, NE.

Stahl, David W., E.R. Cook, M.K. Cleaveland, M.D. Therrell, D.M. Meko, H.D. Grissino-Mayer, E. Watson, and B.H. Luckman. Tree-ring data document 16th century megadrought over North America. 2000. *Eos*, 81(12), 121-125.

Zelikova, Tamara Jane, D.M. Blumenthal, D.G. Williams, L. Souza, D.R. LeCain, J.Morgan. 2014. Long-term exposure to elevated CO₂ enhances plant community stability by suppressing dominant plant species in a mixed-grass prairie. *Ecology*, 2014. Available online. www.pnas.org/cgi/doi/10.1073/pnas.1414659111.

U.S. Dept. of Agriculture, Natural Resources Conservation Service. 2009. Part 630, Hydrology, National Engineering Handbook.

U.S. Dept. of Agriculture, Natural Resources Conservation Service. 1972-2012. National Engineering Handbook Hydrology Chapters. Available online. <http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/water/?&cid=stelprdb1043063>. Accessed August, 2015.

U.S. Dept. of Agriculture, Natural Resources Conservation Service. National Soil Survey Handbook title 430-VI. Available online. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/ref/?cid=nrcs142p2_054242.

U.S. Dept. of Agriculture, Natural Resources Conservation Service. Web Soil Survey. Available online. <http://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx>. Accessed 15 November, 2017.

Data collection for this ecological site was done in conjunction with the progressive soil surveys within the 67A Central High Plains (Northern Part) of Nebraska, Wyoming, and Colorado. It has been mapped and correlated with soils in the following soil surveys:

U.S. Dept. of Agriculture. 1994. Soil Survey of Banner County, Nebraska.

U.S. Dept. of Agriculture. 1997. Soil Survey of Cheyenne County, Nebraska.

U.S. Dept. of Agriculture. 1999. Soil Survey of Garden County, Nebraska.

U.S. Dept. of Agriculture. 2005. Soil Survey of Kimball County, Nebraska.

U.S. Dept. of Agriculture. 1985. Soil Survey of Morrill County, Nebraska.

U.S. Dept. of Agriculture. 1968 Soil Survey of Scotts Bluff County, Nebraska.

U.S. Dept. of Agriculture. 2013. Soil Survey of Scotts Bluff National Monument, Nebraska.

U.S. Dept. of Agriculture. 1998. Soil Survey of Sioux County, Nebraska.

U.S. Dept. of Agriculture. 1981. Soil Survey of Goshen County, Northern Part, Wyoming.

U.S. Dept. of Agriculture. 1971. Soil Survey of Goshen County, Southern Part, Wyoming.

U.S. Dept. of Agriculture. 1983. Soil Survey of Laramie County, Eastern Part, Wyoming.

U.S. Dept. of Agriculture. 2001. Soil Survey of Laramie County, Western Part, Wyoming.

U.S. Dept. of Agriculture. 2003. Soil Survey of Platte County, Wyoming.

U.S. Dept. of Agriculture. 1982. Soil Survey of Weld County, Northern Part, Colorado.

For manuscripts of archived soil surveys, see: <https://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx>.

Contributors

Kimberly Diller, Ecological Site Specialist, NRCS MLRA SSO, Pueblo CO

Andy Steinert, MLRA 67B Soil Survey Leader, NRCS MLRA SSO, Fort Morgan, CO

Doug Whisenhunt, Ecological Site Specialist, NRCS MLRA SSO, Pueblo CO

Approval

Kirt Walstad, 9/07/2023

Acknowledgments

Partners/Contributors:

David Cook, Rangeland Management Specialist, NRCS, Oshkosh, NE
George Gamblin, Rangeland Management Specialist, NRCS, Wheatland, WY
Cameron Clark, Resource Soil Scientist, NRCS, Douglas, WY
Angie Elg, Resource Soil Scientist, NRCS, Scottsbluff, NE
Tim Becket, Area Resource Conservationist, Douglas, WY
Mitchell Stephenson, Ph.D. Rangeland Management Specialist, UNL-Panhandle Research Station, Scottsbluff, NE
Kristin Dickinson, District Conservationist, NRCS, Sidney, NE
Rick Peterson, Ecological Site Inventory Specialist, SD-NRCS-MLRA SSO, Rapid City, SD

Program Support:

Nadine Bishop, NE State Rangeland Management Specialist/ QC, NRCS, Imperial, NE
John Hartung, WY State Rangeland Management Specialist/ QC, NRCS, Casper, WY
David Kraft, NRCS MLRA Ecological Site Specialist-QA, Emporia, KS
James Bauchert, WY State Soil Scientist, WY-NRCS, Casper, WY
Neil Dominy, NE State Soil Scientist, NRCS, Lincoln, NE
Britt Weiser, NE State Resource Conservationist, NRCS, Lincoln, NE
Clayton Schmitz, WY State Resource Conservationist, NRCS, Casper, WY
Carla Green Adams, Editor, NRCS-SSR5, Denver, CO
Chad Remley, Regional Director, N. Great Plains Soil Survey, Salina, KS

Those involved in developing the 2008 version: Chuck Ring, Rangeland Management Specialist, WY-NRCS, and Everett Bainter, WY State Rangeland Management Specialist, WY-NRCS

Non-discrimination statement

In accordance with Federal civil rights law and U.S. Department of Agriculture (USDA) civil rights regulations and policies, the USDA, its Agencies, offices, and employees, and institutions participating in or administering USDA programs are prohibited from discriminating based on race, color, national origin, religion, sex, gender identity (including gender expression), sexual orientation, disability, age, marital status, family/parental status, income derived from a public assistance program, political beliefs, or reprisal or retaliation for prior civil rights activity, in any program or activity conducted or funded by USDA (not all bases apply to all programs). Remedies and complaint filing deadlines vary by program or incident.

Persons with disabilities who require alternative means of communication for program information (e.g., Braille, large print, audiotope, American Sign Language, etc.) should contact the responsible Agency or USDA's TARGET Center at (202) 720-2600 (voice and TTY) or contact USDA through the Federal Relay Service at (800) 877-8339. Additionally, program information may be made available in languages other than English.

To file a program discrimination complaint, complete the USDA Program Discrimination Complaint Form, AD-3027, found online at [How to File a Program Discrimination Complaint](#) and at any USDA office or write a letter addressed to USDA and provide in the letter all of the information requested in the form. To request a copy of the complaint form, call (866) 632-9992. Submit your completed form or letter to USDA by: (1) mail: U.S. Department of Agriculture, Office of the Assistant Secretary for Civil Rights, 1400 Independence Avenue, SW, Washington, D.C. 20250-9410; (2) fax: (202) 690-7442; or (3) email: program.intake@usda.gov.

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)	Dave Cook, Kristin Dickinson, George Gamblin, John Hartung, Andy Steinert, Nadine Bishop
Contact for lead author	
Date	11/23/2020
Approved by	Kirt Walstad
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** None. Rills are not expected on the site.

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

3. **Number and height of erosional pedestals or terracettes:** None. Erosional pedestals and/or terracettes are not expected on the site.

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 on this site.

6. **Extent of wind scoured, blowouts and/or depositional areas:** None. Wind-scoured and/or depositional areas are not present on the site.

7. **Amount of litter movement (describe size and distance expected to travel):** Litter should fall in place. Slight amount of movement of fine litter from water is possible, but not normal. Litter movement from wind is not expected.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Soil aggregated stability ratings should typically be 5 to 6. Surface organic matter adheres to the soil surface. Soil surface peds will typically retain their 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 surface layer ranges from 4 to 10 inches (10.2-25.4 cm) thick. Soil colors range from dark gray, gray, grayish brown, brown, gray, light brownish gray, dark grayish brown, or dark grayish brown (values of 4 to 6) when dry and very dark gray, very dark grayish brown, dark brown, dark gray, or dark grayish brown (value 3 to 4) when moist. Soil surface structure is typically granular.

-
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. Combination of shallow and deep rooted species (mid & tall rhizomatous and tufted perennial cool season grasses) with fine and coarse roots positively influences infiltration. The expected composition of the plant community is 80 to 95 percent perennial grasses and grass-likes, 5 to 10 percent forbs, and 0 to 10 percent shrubs and trees.

In the 12-14" PZ, the grass and grass-like component is made up of warm-season tall rhizomatous grasses (50-60%); warm-season, tall and mid, bunch grasses (20-30%); cool-season, rhizomatous grasses (10-20%); cool-season, bunch grasses (6-12%); grass-likes (6-12%).

In the 15-17" PZ, the grass and grass-like component is made up of warm-season tall and mid, rhizomatous grasses (45-50%); warm-season, tall and mid, bunch grasses (20-30%); cool-season, rhizomatous grasses (5-10%); cool-season, bunch grasses (5-10%); grass-likes (5-10%).

-
11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None. A compaction layer is not expected on this site.

-
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: 12-14" PZ: Community 1.1

1. Native, C4, tall, rhizomatous grasses – 1700-2050 #/ac (50-60%), 4 species minimum

15-17" PZ: Community 1.1

1. Native, C4, tall, rhizomatous grasses – 1800-2250 #/ac (40-50%), 4 species minimum

Sub-dominant: 12-14" PZ: Community 1.1

2. Native, C4, tall, and mid- bunch grasses – 700-1050 #/ac (20-30%), 1 species minimum

3. Native, C4, tall, and mid- bunch grasses – 700-1050 #/ac (20-30%), 1 species minimum

15-17" PZ: Community 1.1

2. Native, C4, tall and mid, bunch grasses – 675-1125 #/ac (15-25%), 1 species

Other: Minor:

12-14" PZ: Community 1.1

4. Grass-likes – 170-340 #/ac (5-10%)

5. Native, C3, bunch grasses – 170-340 #/ac (5-10%)

6. Native, Perennial and Annual Forbs – 170-340 #/ac (5-10%)

7. Shrubs, Vines, Cacti – 0-340 #/ac (0-10%)

15-17" PZ: Community 1.1

3. Native, C3, rhizomatous grasses – 225-450 (5-10%)

4. Native, C3, bunch grasses – 225-450 (5-10%)

5. Grass-likes – 225-450 (5-10%)

6. Native, Perennial and Annual Forbs – 225-450 (5-10%)

7. Shrubs, Vines, Cacti – 0-450 #/ac (0-10%)

Additional: 12-14" PZ: Community 1.1

12a. Relative Dominance:

Native, C4, tall, rhizomatous grasses >> Native, C4, tall and mid- bunch grasses > Native, C3, rhizomatous grasses > Grass-likes = Native, C3, bunch grasses = Native, Annual or Perennial Forbs > Shrubs, Cacti, Vines

12b. F/S Groups not expected for the site: Introduced annual grasses, perennial introduced and naturalized grasses, trees.

12c. Number of F/S Groups: 7

12d. Species number in Dominant and Sub-dominant F/S Groups: 6

15-17" PZ: Community 1.1

12a. Relative Dominance:

Native, C4, tall, rhizomatous grasses >> Native, C4, tall and mid, bunch grasses > Native, C3, rhizomatous grasses = Native, C3, bunch grasses = Grass-likes = Native, Annual or Perennial Forbs > Shrubs, Cacti, Vines

12b. F/S Groups not expected for the site: Introduced annual grasses, perennial introduced and naturalized grasses, trees.

12c. Number of F/S Groups: 7

12d. Species number in Dominant and Sub-dominant F/S Groups: 5

-
13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Very little evidence of decadence or mortality. Bunch grasses have strong, healthy centers with less than 3 percent mortality and shrubs have few dead stems.
-

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. Litter depths range from 0.50 to 1 inch (1.3-2.6 cm). Kentucky bluegrass excessive litter can negatively impact the functionality of this site.
-

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** In the 12-14" precipitation zone, annual production ranges from 3,500 to 4,500 pounds per acres (air dry basis). Average annual production is 3,400 pounds per acre under normal precipitation and weather conditions.

In the 15-17" Precipitation Zone, annual production ranges from 4,000 to 5,000 pounds per acre (air dry basis). Average annual production is 4,500 pounds per acre under normal precipitation and weather conditions.

No significant reduction is expected the growing season following wildfire.

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: Kentucky bluegrass, quackgrass, reed canarygrass, leafy spurge, Canada thistle, musk thistle, Russian olive, saltcedar (tamarix), and others as they become known.

See:

Colorado Department of Agriculture Invasive Species Website:

<https://www.colorado.gov/pacific/agconservation/noxious-weed-species>

Wyoming Weed and Pest Council Website: <https://wyoweed.org/>

Nebraska Invasive Species website: <https://neinvasives.com/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.
-