USDA Natural Resources Conservation Service

Ecological site R067AY122WY
Loamy (Ly)

Last updated: 9/07/2023
Accessed: 05/19/2024

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.

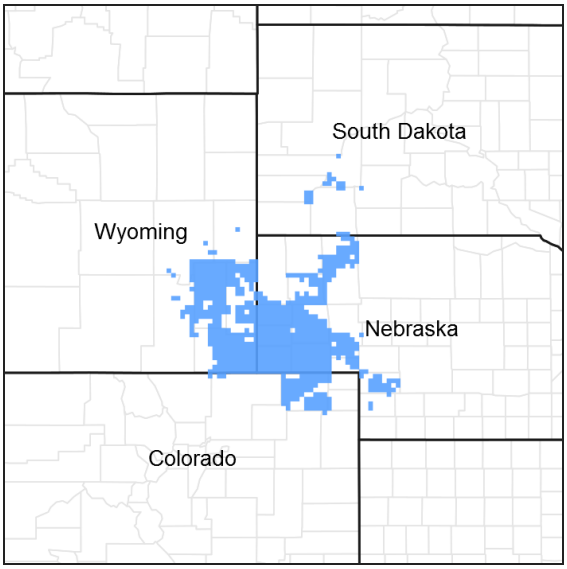


Figure 1. Mapped extent

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 to17 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). MLRA's 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 Loamy 12 to 17 inch Precipitation Zone (PZ) site was developed by an earlier version of the Loamy (Ly) 12 to 17 inch ESD (2005, updated 2008). The earlier version of the Loamy ESDs were based on input from NRCS (formerly Soil Conservation Service) and historical information obtained from the Loamy 12 to14 Southern Plains (SP) and Loamy 15 to17 SP Range Site Descriptions (1988). 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 Loamy site is an upland site on soils more than 20 inches deep. It is not saline or alkaline, does not have a high volume of coarse fragments on the surface, occurs on nearly level to slightly sloping fans, interfluves, or hills or on nearly level terraces. The surface soil textures are loam, very fine sandy loam, or fine sandy loam, but may include silt loam. Subsoil textures are loam, clay loam, or sandy clay loam.

Associated sites

R067AY162WY	**Shallow (Sw)** This ecological site is commonly adjacent.

Similar sites

R067AY150WY	**Sandy (Sy)** The Sandy Ecological Site does not have subsoil textures that are loam, clay loam, or sandy clay loam.
R067AY126WY	**Loamy Overflow (LyO)** The Loamy Overflow Ecological Site is a run-on site.
R067AY104WY	**Clayey (Cy)** The Clayey Ecological Site surface soil textures are silty clay loam, silty clay, clay, clay loam, or loam.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Artemisia tridentata* (2) *Krascheninnikovia lanata*
Herbaceous	(1) *Hesperostipa comata* (2) *Pascopyrum smithii*

Physiographic features

This site occurs on nearly level to slightly sloping fans, interfluves, or terraces, and on footslopes or backslopes of hills on dissected plains or uplands.

Table 2. Representative physiographic features

Landforms	(1) Fan (2) Hill (3) Interfluve (4) Terrace

Runoff class	Negligible to medium
Flooding frequency	None
Ponding frequency	None
Elevation	914–1,981 m
Slope	0–9%
Ponding depth	0 cm
Water table depth	203–508 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) HARRISBURG 12WNW [USC00253605], Harrisburg, NE
- (2) CHUGWATER [USC00481730], Chugwater, WY
- (3) OLD FT LARAMIE [USC00486852], Yoder, WY
- (4) PHILLIPS [USC00487200], LaGrange, WY
- (5) WHEATLAND 4 N [USC00489615], Wheatland, WY
- (6) CHEYENNE [USW00024018], Cheyenne, WY
- (7) SCOTTSBLUFF HEILIG AP [USW00024028], Scottsbluff, NE
- (8) BRIDGEPORT [USC00251145], Bridgeport, NE
- (9) KIMBALL 2NE [USC00254440], Kimball, NE
- (10) OSHKOSH [USC00256385], Oshkosh, NE

Influencing water features

There are no water features associated with this ecological site.

Soil features

The soils on this site are typically deep to very deep, but include moderately deep, well drained soils that formed from alluvium, eolian deposits, or loess; and moderately deep soils formed from residuum derived from sandstone or siltstone. They typically are in moderate to moderately rapid permeability classes, but range to moderately slow in some soils. The available water capacity is moderate but may range to low in some soils. The soil moisture regime is typically aridic ustic. The soil temperature regime is mesic.

The surface layer of the soils in this site are typically loam, very fine sandy loam, or fine sandy loam, but may include silt loam. The surface layer ranges from a depth of 5 to 12 inches thick. The subsoil is typically loam, clay loam, or sandy clay loam, but may include very fine sandy loam or silt loam. Rock fragments typically number 0 to 10 percent in the subsoil but may range up to 45 percent in some soils. Soils in this site are typically leached of carbonates from 6 to 40 inches or more; a few soils may have carbonates within 6 inches of the surface. These soils are susceptible to erosion by water and wind. The potential for water erosion accelerates with increasing slope.

Surface soil structure in the Loamy 12 to 17 inch PZ ecological site is fine to medium granular, and structure below the surface is prismatic and/or subangular blocky.

Major soil series correlated to this ecological site include: Albinas, Alliance, Altvan, Ascalon, Creighton, Duroc, Featherlegs, Hargreave, Hemingford, Keith, Noden, Norka, Nucla, Recluse, Rosebud, Satanta, Tripp, Wages, Weld, and Wolf.

Other soil series that have been correlated to this site include: Angora, Bridget, Cedak, Deight, Goshen, Keith-variant, Luman, Selpats, Thirtynine, and Ulysses.

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

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

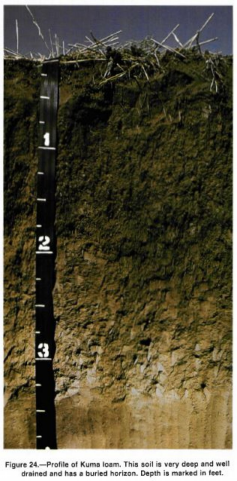


Figure 24.—Profile of Kuma loam. This soil is very deep and well drained and has a buried horizon. Depth is marked in feet.

Figure 8. Kuma loam, Cheyenne Co., NE

Table 4. Representative soil features

Parent material	(1) Alluvium (2) Eolian deposits (3) Loess

Surface texture	(1) Loam (2) Very fine sandy loam (3) Fine sandy loam
Drainage class	Well drained
Permeability class	Moderate to moderately rapid
Soil depth	51–203 cm
Surface fragment cover <=3"	0–5%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	12.19–22.35 cm
Calcium carbonate equivalent (0-101.6cm)	0–10%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–5
Soil reaction (1:1 water) (0-101.6cm)	6.6–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–45%
Subsurface fragment volume >3" (Depth not specified)	0–5%

Ecological dynamics

The information in this ESD, including the state-and-transition (STM) model 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/time controlled grazing strategies, and historical accounts.

The Loamy ecological site is characterized by four states: Reference, Sod-bound, Increased *Bare Ground*, and Tilled. The Reference State is characterized by cool-season mid bunchgrasses (needle and thread), cool-season mid- rhizomatous grasses (western wheatgrass and streambank, also known as thickspike wheatgrass), and warm-season shortgrass (blue grama). Secondary grasses and grass-likes include prairie Junegrass, alkali (Sandberg) bluegrass, and threadleaf sedge. Green needlegrass is found in greater abundance, in 15 to 17 precipitation zones, and on finer-textured soils. A minor component of forbs and shrubs are also present. The Sod-bound State is characterized by warm-season shortgrass (blue grama and buffalograss) and grasslikes (threadleaf sedge). The Increased *Bare Ground* State is characterized by annual grasses (sixweeks fescue), forbs (curlycup gumweed, hairy false goldenaster, and annuals), and shrubs (fringed sagewort, snakeweed, and pricklypear). Invasives include cheatgrass.

As this site begins to deteriorate from a combination of frequent and severe grazing during the growing season, bunchgrasses such as needle and thread and green needlegrass decrease in both frequency and production. Grasses such as blue grama and threadleaf sedge increase. Under continued frequent and severe defoliation with no rest periods, rhizomatous wheatgrasses also begin to decrease. Forbs and shrubs such as hairy goldenaster, fringed sagewort, and broom snakeweed also increase. If continued, the plant community becomes sod-bound, and all midgrasses may eventually be removed from the plant community. Over the long-term, this continuous use in combination with high stock densities results in a broken sod, with areas of bare ground developing, and species such as broom snakeweed and annual bromes (cheatgrass), invading.

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.

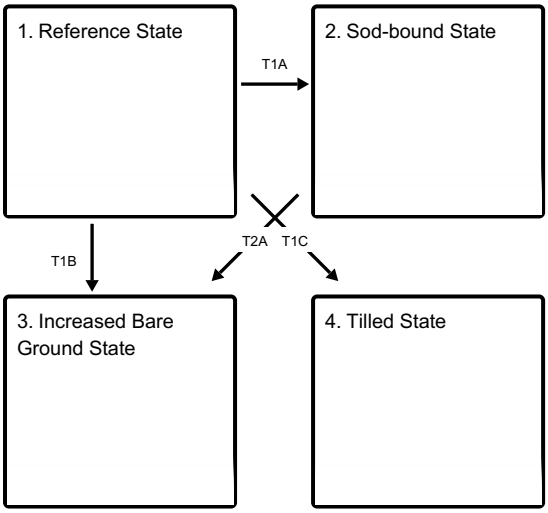
Recurrent drought has historically impacted the vegetation of this region. Changes in species composition vary depending upon the duration and severity of the drought cycle and prior grazing management. Drought events since 2002 have significantly increased mortality of blue grama and buffalograss in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

This site developed with occasional fire as part of the ecological processes. Historic fire frequency (pre-industrial) is estimated at 10 to14 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.

Mechanical treatment consisting of contour pitting, furrowing, terracing, chiseling, and disking has been practiced in the past. It was theorized that the use of this high-input technology would improve production and plant composition on rangeland. These high-cost practices have shown to have no significant long-term benefits on production or plant composition and have only resulted in a permanently rough ground surface. Prescribed grazing that mimics the historic grazing of herds of migratory herbivores, as described earlier, has been shown to result in desired improvements based on management goals for this ecological site.

State and transition model

Ecosystem states



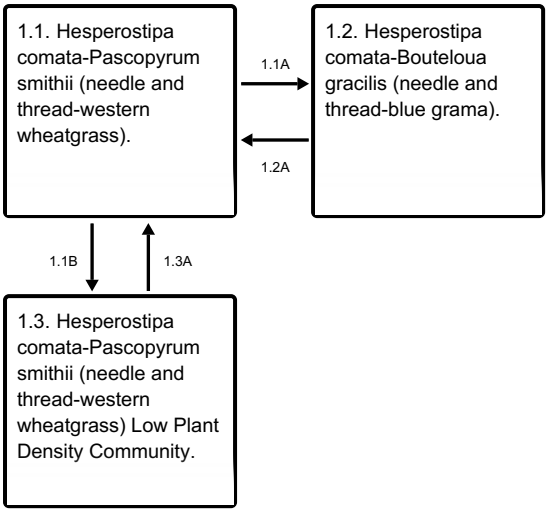
T1A - Excessive grazing. Lack of fire.

T1B - Excessive grazing. Lack of fire.

T1C - Mechanical tillage.

T2A - Excessive grazing. Lack of fire.

State 1 submodel, plant communities



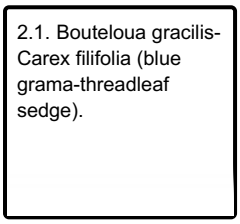
1.1A - Excessive grazing. Lack of fire.

1.1B - Non-use. Lack of fire.

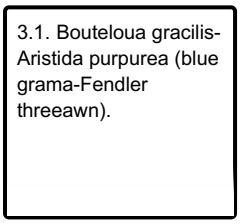
1.2A - Prescribed grazing. Prescribed fire.

1.3A - Prescribed grazing. Prescribed fire.

State 2 submodel, plant communities



State 3 submodel, plant communities



State 4 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

- big sagebrush (*Artemisia tridentata*), shrub
- winterfat (*Krascheninnikovia lanata*), shrub
- needle and thread (*Hesperostipa comata ssp. comata*), grass
- western wheatgrass (*Pascopyrum smithii*), grass

Community 1.1
Hesperostipa comata-Pascopyrum smithii (needle and thread-western wheatgrass).

Figure 9. Loamy 10-17" PZ Ecological Site, Cheyenne Co., NE

This is the interpretive plant community for this site. It is well adapted to the Northern Great Plains climate. 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 75 to 90 percent grasses and grass-likes, 5 to15 percent forbs, and 5 to10 percent woody plants. In the western portion of the MLRA, the plant community is predominately cool-season midgrasses, with a significant component of warm-season midgrasses. In the eastern portion of the MLRA, the plant community is predominantly warm-season with a significant cool-season component. The major grasses/grass-likes include needle and thread, blue grama, and rhizomatous wheatgrasses such as western wheatgrass. Secondary grasses include prairie Junegrass, streambank (thickspike) wheatgrass, alkali (Sandberg) bluegrass, green needlegrass and buffalograss. A variety of forbs and half-shrubs also occur, as shown in the Species Composition List. Shrubs are not abundant. Plant diversity is high. In the 12 to 14 inch Precipitation Zone (PZ), the total annual production (air-dry weight) is 1,300 pounds per acre during an average year, but it ranges from 750 pounds per acre in unfavorable years to 1,750 pounds per acre in above-average years. In the 15 to 17 inch PZ, the total annual production (air-dry weight) is 1,500 pounds per acre during an average year, but ranges from 1,000 pounds per acre in unfavorable years to 2,000 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

- big sagebrush (*Artemisia tridentata*), shrub
- winterfat (*Krascheninnikovia lanata*), shrub
- needle and thread (*Hesperostipa comata ssp. comata*), grass
- western wheatgrass (*Pascopyrum smithii*), grass

Figure 11. Plant community growth curve (percent production by month). WY1101, 12-14SP Upland sites w/o warm seasons. 12-14" Precipitation Zone, Southern Plains (SP) without warm season (grass) species.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	5	25	40	15	5	10	0	0	0

Community 1.2
Hesperostipa comata-Bouteloua gracilis (needle and thread-blue grama).

Grazing-tolerant species such as blue grama and threadleaf sedge have noticeably increased. Needle and thread may initially increase or decrease depending on the season of grazing use. Green needlegrass is nearly absent.

Prairie clover species and other palatable forbs such as dotted gayfeather and penstemon are present in reduced amounts. Hairy false goldenaster, slimflower scurfpea, fringed sagewort, and broom snakeweed have increased. In the 12 to 14 inch PZ, the total annual production (air-dry weight) is 900 pounds per acre during an average year, but ranges from 600 pounds per acre in unfavorable years to 1,200 pounds per acre in above-average years. In the 15 to 17 inch PZ, the total annual production (air-dry weight) is 1,100 pounds per acre during an average year, but ranges from 750 pounds per acre in unfavorable years to 1,450 pounds per acre in above-average years. Total aboveground biomass has been reduced. Reduction of rhizomatous wheatgrasses, nitrogen-fixing forbs, and increased warm-season shortgrasses 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

- big sagebrush (*Artemisia tridentata*), shrub
- broom snakeweed (*Gutierrezia sarothrae*), shrub
- needle and thread (*Hesperostipa comata ssp. comata*), grass
- blue grama (*Bouteloua gracilis*), grass

Figure 12. Plant community growth curve (percent production by month). WY1101, 12-14SP Upland sites w/o warm seasons. 12-14" Precipitation Zone, Southern Plains (SP) without warm season (grass) species.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	5	25	40	15	5	10	0	0	0

Community 1.3
Hesperostipa comata-Pascopyrum smithii (needle and thread-western wheatgrass) Low Plant Density Community.

This plant community developed under many years of non-use and lack of fire. Plant species resemble the Reference Plant Community however, frequency and production are reduced. Eventually, litter levels can become high enough to cause decadence and mortality of the stand. Bunchgrasses typically develop dead centers and rhizomatous grasses can form small decadent communities due to a lack of impact by grazing animals. Much of the available nutrients are tied up in standing dead plant material and increased amounts of litter. The semiarid environment and the absence of animal traffic to break down litter slows nutrient recycling. Cool-season grasses and pricklypear have typically increased. Blue grama is reduced. Noxious weeds such as Canada thistle, leafy spurge, and Dalmatian toadflax may invade if a seed source is readily available. Invasive grasses such as cheatgrass tend to encroach under these conditions. Water flow patterns and pedestalling may become apparent. Infiltration is reduced and runoff is increased. In advanced stages 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 1,200 pounds per acre during an average year, but ranges from 800 pounds per acre in unfavorable years to 1,600 pounds per acre in above-average years. In the 15 to 17 inch PZ, the total annual production (air-dry weight) is 1,400 pounds per acre during an average year, but ranges from 950 pounds per acre in unfavorable years to 1,850 pounds per acre in above-average years.

Dominant plant species

- big sagebrush (*Artemisia tridentata*), shrub
- winterfat (*Krascheninnikovia lanata*), shrub
- needle and thread (*Hesperostipa comata ssp. comata*), grass
- western wheatgrass (*Pascopyrum smithii*), grass

Figure 13. Plant community growth curve (percent production by month). WY1101, 12-14SP Upland sites w/o warm seasons. 12-14" Precipitation Zone, Southern Plains (SP) without warm season (grass) species.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	5	25	40	15	5	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 toward the 1.2 Community. Drought accelerates this process. Biotic integrity, water, and nutrient cycles may become impaired.

Conservation practices

Prescribed Burning
Prescribed Grazing

Pathway 1.1B
Community 1.1 to 1.3

Non-use and lack of fire cause the Reference Plant Community to shift toward the Low Plant Density Plant 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.

Conservation practices

Prescribed Burning
Prescribed Grazing

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 the 1.2 Community to the Reference Plant Community. Recurrent drought has historically impacted the vegetation of this region. Changes in species composition and production, will vary depending upon the duration and severity of the drought cycle, and prior grazing management.

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 to 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 nutrient and the hydrologic cycles. This is a very stable state, resistant to change due to the high tolerance of blue grama and buffalograss to grazing, the development of a shallow root system (root pan), and subsequent changes

in hydrology and the nutrient cycling. The loss of other functional/structural groups such as cool-season bunch and rhizomatous grasses, forbs, and shrubs reduces the biodiversity productivity of this site.

Dominant plant species

- big sagebrush (*Artemisia tridentata*), shrub
- prairie sagewort (*Artemisia frigida*), shrub
- blue grama (*Bouteloua gracilis*), grass
- threadleaf sedge (*Carex filifolia*), grass

Community 2.1
Bouteloua gracilis-Carex filifolia (blue grama-threadleaf sedge).

The mid-grasses and palatable forbs have been eliminated. The dominant species are blue grama, threadleaf sedge, and buffalograss. These species have developed into a sod-bound condition occurring in localized colonies exhibiting a mosaic appearance. Perennial threeawn species such as Fendler threeawn, have increased. Forbs such as scarlet globemallow, wild onion, death camas, slim-flower scurfpea, and skeletonplant remain. Forbs and shrubs that continue to increase are Cuman ragweed (western ragweed), hairy false goldenaster, fringed sagewort, and pricklypear. Plant diversity is very low. Energy flow, water cycle, and mineral cycle 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 500 pounds per acre during an average year, but ranges from 350 pounds per acre in unfavorable years to 650 pounds per acre in above-average years. In the 15 to 17 inch PZ, the total annual production (air-dry weight) is 700 pounds per acre during an average year, but ranges from 500 pounds per acre in unfavorable years to 900 pounds per acre in above-average years. This plant community is extremely resistant to change. Many plant species are missing and a seed source is not readily available. Also, sod-forming grasses tend to maintain themselves due to their resistance to any further overgrazing.

Dominant plant species

- big sagebrush (*Artemisia tridentata*), shrub
- prairie sagewort (*Artemisia frigida*), shrub
- blue grama (*Bouteloua gracilis*), grass
- threadleaf sedge (*Carex filifolia*), grass

Figure 14. Plant community growth curve (percent production by month). WY1104, 12-14SP upland sites w/ warm. 12-14" Precipitation Zone, Southern Plains (SP) with warm-season (grass) species.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	5	20	35	30	5	5	0	0	0

State 3
Increased Bare Ground State

An ecological threshold has been crossed. Erosion and loss of organic matter and carbon reserves are concerns. The hazard of soil erosion has increased due to the increase of bare ground. Runoff is typically high and infiltration is low. All ecological functions are impaired.

Dominant plant species

- big sagebrush (*Artemisia tridentata*), shrub
- prairie sagewort (*Artemisia frigida*), shrub
- blue grama (*Bouteloua gracilis*), grass
- Fendler threeawn (*Aristida purpurea var. longiseta*), grass

Community 3.1
Bouteloua gracilis-Aristida purpurea (blue grama-Fendler threeawn).

The plant composition is made of annuals with a few species of perennial forbs and grasses that are very tolerant to frequent and severe defoliation. The dominant grasses include blue grama, threadleaf sedge, and threeawn.

Annuals such as sixweeks fescue, Russian thistle, burningbush and cheatgrass have increased or invaded. The dominant forbs include curlycup gumweed, green sagewort, and hairy false goldenaster. Broom snakeweed and pricklypear are increasing. In the 12 to 14 inch PZ, the total annual production (air-dry weight) is 500 pounds per acre during an average year, but ranges from 350 pounds per acre in unfavorable years to 650 pounds per acre in above-average years. In the 15 to 17 inch PZ, the total annual production (air-dry weight) is 700 pounds per acre during an average year, but ranges from 450 pounds per acre in unfavorable years to 950 pounds per acre in above-average years.

Dominant plant species

- big sagebrush (*Artemisia tridentata*), shrub
- prairie sagewort (*Artemisia frigida*), shrub
- blue grama (*Bouteloua gracilis*), grass
- Fendler threeawn (*Aristida purpurea var. longiseta*), grass

Figure 15. Plant community growth curve (percent production by month). WY1104, 12-14SP upland sites w/ warm. 12-14" Precipitation Zone, Southern Plains (SP) with warm-season (grass) species.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	5	20	35	30	5	5	0	0	0

State 4
Tilled State

The Tilled State is the result of mechanical farming operations on the site. An ecological threshold has been crossed due to complete removal of vegetation and years of soil tillage. Physical, chemical, and biological soil properties have been dramatically altered. There is no restorative pathway known at this time.

Dominant plant species

- cheatgrass (*Bromus tectorum*), grass
- Fendler threeawn (*Aristida purpurea var. longiseta*), grass
- sand dropseed (*Sporobolus cryptandrus*), grass
- Russian thistle (*Salsola*), other herbaceous
- burningbush (*Bassia scoparia*), other herbaceous

Community 4.1
Salsola-Bassia scoparia/Bromus tectorum-Aristida purpurea (Russian thistle-burningbush/cheatgrass-Fendler threeawn).

Go-back land is created when the soil is tilled or farmed (sodbusted) and abandoned. All of the native plants are removeded, soil organic matter is reduced, soil structure is degraded, and a plowpan or compacted layer is formed. Residual synthetic chemicals often remain from past farming operations, and erosion processes may be active. Go-back land evolves through several plant communities beginning with an early annual plant community, which initiates the revegetation process. Plants such as Russian thistle, burningbush, and other annuals begin to establish. These plants give some protection from erosion and start to build minor levels of soil organic matter. This early annual plant community lasts for two to several years. Threeawn, sand dropseed, and several other early perennials can dominate the plant community for five to eight years or more. Buffalograss establishes next and dominates for many years. Eventually western wheatgrass, blue grama, and other native plants become re-established. Where go-back land has eroded to parent material, the slow process of soil development and re-establishment of vegetation will start. This is a very slow process (100 years or more). A new ecological site may evolve depending upon the severity of soil erosion and parent material.

Dominant plant species

- cheatgrass (*Bromus tectorum*), grass
- Fendler threeawn (*Aristida purpurea var. longiseta*), grass
- sand dropseed (*Sporobolus cryptandrus*), grass
- Russian thistle (*Salsola*), other herbaceous

- burningbush (*Bassia scoparia*), other herbaceous

Community 4.2
Seeded Community

This plant community can vary considerably depending upon how eroded the soil was, the species seeded, how long ago the stand was established, and the management of the stand since establishment.

Transition T1A
State 1 to 2

Frequent and severe defoliation without adequate recovery periods between grazing events and lack of fire will shift this plant community across an ecological threshold to the Sod-bound State. Biotic integrity and hydrologic function will be impaired as a result of this transition.

Transition T1B
State 1 to 3

Long-term heavy, defoliation without adequate recovery periods and lack of fire will shift this plant community across an ecological threshold to the Increased *Bare Ground* State. Erosion and loss of organic matter and carbon reserves are concerns. Non-native exotic plants are likely to invade.

Transition T1C
State 1 to 4

Mechanical tillage of this ecological site will cause an immediate transition across an ecological threshold to the Tilled State. This transition can occur from any plant community in this ecological site and is irreversible.

Transition T2A
State 2 to 3

Long-term frequent and severe defoliation without adequate recovery periods and lack of fire will cause a shift across an ecological threshold to the Increased *Bare Ground* State. Erosion and loss of organic matter and carbon reserves are constraints to recovery. Annual plants are likely to increase or invade as a result of this transition.

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**			437–583	
	needle and thread	HECO26	*Hesperostipa comata*	364–437	–
	green needlegrass	NAVI4	*Nassella viridula*	73–146	–
2	**12**			291–364	
	western wheatgrass	PASM	*Pascopyrum smithii*	291–364	–
	thickspike wheatgrass	ELLA3	*Elymus lanceolatus*	0–146	–
3	**12**			146–219	
	blue grama	BOGR2	*Bouteloua gracilis*	146–219	–
4	**12**			73–146	
	little bluestem	SCSC	*Schizachyrium scoparium*	0–29	–
5	**12**			146–219	
	Graminoid (grass or grass-	2GRAM	*Graminoid (grass or grass-*	0–73	–

	like)		*like)*		
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–73	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–73	–
	threadleaf sedge	CAFI	*Carex filifolia*	0–73	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–73	–
	Sandberg bluegrass	POSE	*Poa secunda*	0–73	–
	threeawn	ARIST	*Aristida*	0–29	–
8	**15**			504–673	
	needle and thread	HECO26	*Hesperostipa comata*	420–504	–
	green needlegrass	NAVI4	*Nassella viridula*	84–168	–
9	**15**			336–420	
	western wheatgrass	PASM	*Pascopyrum smithii*	336–420	–
	thickspike wheatgrass	ELLA3	*Elymus lanceolatus*	0–168	–
10	**15**			168–252	
	blue grama	BOGR2	*Bouteloua gracilis*	168–252	–
11	**15**			84–168	
	little bluestem	SCSC	*Schizachyrium scoparium*	0–34	–
12	**15**			168–252	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–84	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–84	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–84	–
	threadleaf sedge	CAFI	*Carex filifolia*	0–84	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–84	–
	Sandberg bluegrass	POSE	*Poa secunda*	0–84	–
	threeawn	ARIST	*Aristida*	0–34	–
Forb					
6	**12**			73–219	
	Forb, perennial	2FP	*Forb, perennial*	0–73	–
	textile onion	ALTE	*Allium textile*	0–29	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–29	–
	field sagewort	ARCA12	*Artemisia campestris*	0–29	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–29	–
	milkvetch	ASTRA	*Astragalus*	0–29	–
	white prairie clover	DACA7	*Dalea candida*	0–29	–
	purple prairie clover	DAPU5	*Dalea purpurea*	0–29	–
	larkspur	DELPH	*Delphinium*	0–29	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	0–29	–
	sanddune wallflower	ERCA14	*Erysimum capitatum*	0–29	–
	buckwheat	ERIOG	*Eriogonum*	0–29	–
	scarlet beeblossom	GACO5	*Gaura coccinea*	0–29	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	0–29	–
	dotted blazing star	LIPU	*Liatris punctata*	0–29	–
	desertparsley	LOMAT	*Lomatium*	0–29	–

	Indian breadroot	PEDIO2	*Pediomelum*	0–29	–
	beardtongue	PENST	*Penstemon*	0–29	–
	woolly plantain	PLPA2	*Plantago patagonica*	0–29	–
	slimflower scurfpea	PSTE5	*Psoralidium tenuiflorum*	0–29	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–29	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–29	–
	American vetch	VIAM	*Vicia americana*	0–29	–
	meadow deathcamas	ZIVE	*Zigadenus venenosus*	0–29	–
13	**15**			84–252	
	Forb, perennial	2FP	*Forb, perennial*	0–84	–
	textile onion	ALTE	*Allium textile*	0–34	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–34	–
	field sagewort	ARCA12	*Artemisia campestris*	0–34	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–34	–
	milkvetch	ASTRA	*Astragalus*	0–34	–
	white prairie clover	DACA7	*Dalea candida*	0–34	–
	purple prairie clover	DAPU5	*Dalea purpurea*	0–34	–
	larkspur	DELPH	*Delphinium*	0–34	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	0–34	–
	sanddune wallflower	ERCA14	*Erysimum capitatum*	0–34	–
	buckwheat	ERIOG	*Eriogonum*	0–34	–
	scarlet beeblossom	GACO5	*Gaura coccinea*	0–34	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	0–34	–
	dotted blazing star	LIPU	*Liatris punctata*	0–34	–
	desertparsley	LOMAT	*Lomatium*	0–34	–
	Indian breadroot	PEDIO2	*Pediomelum*	0–34	–
	beardtongue	PENST	*Penstemon*	0–34	–
	woolly plantain	PLPA2	*Plantago patagonica*	0–34	–
	slimflower scurfpea	PSTE5	*Psoralidium tenuiflorum*	0–34	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–34	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–34	–
	American vetch	VIAM	*Vicia americana*	0–34	–
	meadow deathcamas	ZIVE	*Zigadenus venenosus*	0–34	–
Shrub/Vine					
7	**12**			73–146	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–73	–
	big sagebrush	ARTR2	*Artemisia tridentata*	0–73	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–73	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–29	–
	prairie rose	ROAR3	*Rosa arkansana*	0–29	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–29	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–29	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	0–29	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–29	–

	silver sagebrush	ARCA13	*Artemisia cana*	0–29	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–29	–
14	**15**			84–168	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–84	–
	big sagebrush	ARTR2	*Artemisia tridentata*	0–84	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–84	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–34	–
	prairie rose	ROAR3	*Rosa arkansana*	0–34	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–34	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	0–34	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–34	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–34	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–9	–

Animal community

Wildlife Interpretations

Reference Plant Community - Needle and Thread, Western Wheatgrass, Blue Grama:

The predominance of grasses plus high forb diversity in this community favors large grazers such as pronghorn and elk. Suitable thermal and escape cover for mule deer is limited due to low shrub cover. White and black- tailed jackrabbit, badger, and coyote commonly use this community. The Reference Plant Community also provides habitat for a wide array of smaller mammals, so diverse prey populations are available for raptors such as ferruginous and Swainson’s hawks. Birds such as western kingbird, western meadowlark, lark bunting, and grasshopper sparrow utilize this community for nesting and foraging.

1.2 Community - Threadleaf Sedge, Blue Grama, with Remnant Mid-grasses:
The reduction in taller grasses in this community results in decreased use by lark buntings and western meadowlarks. Use by long-billed curlew increases, provided there is standing water within one-quarter mile. Killdeer, horned larks, and McCown’s longspurs also make significant use of this community. Pronghorn may forage in this community.

1.3 Community - Low Plant Density, Increased Litter, Decadent Plants, and Standing Dead Canopy:

This community has low habitat value for most wildlife species. Horned larks may nest in this community.

2.1 Community - Blue Grama, Buffalograss, Threadleaf Sedge, Fringed sagewort, Pricklypear:

This community provides limited foraging for antelope and other grazers. Ground-nesting birds that favor sparse vegetation may use this community. Long-billed curlews use the 2.1 Community if standing water is present within one-quarter mile. Generally, this is not a target vegetative community for wildlife habitat management.

3.1 Community – Broom Snakeweed,
Annual Grasses and Forbs, Threadleaf Sedge, Cheatgrass, Invasives, and *Bare Ground*:

Sparse vegetation and greater amounts of bare ground provide suitable habitat for prairie dogs, horned larks, and McCown’s longspurs. However, a lack of complex vegetation structure and residual cover makes this community poor habitat in general for most ground-nesting birds and big game species.

4.1 Community:
The wildlife species found here are similar to the Increased *Bare Ground* Community.

Seeded Community (Adapted Seed Mixes):

Wildlife use of tilled and replanted fields is dependent upon the plant species used in the planted seed mix. Purpose of the seeding (i.e. reclamation, soil erosion control, livestock grazing, targeted wildlife species, etc.) affects the usability for wildlife. If wildlife use is a primary concern, then seed mixes must be formulated to meet species specific habitat requirements.

Grazing Interpretations

The following table is a guide to stocking rates for the plant communities described in the Loamy 12 to 17 inch PZ 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, 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 (AUM/acre) are listed below:
Example:
Reference PC – (1300) (.36)

1,300 lbs. per acre X 25% percent Harvest Efficiency = 325 lbs. forage demand for one month. 325 lbs. per acre/912 demand per AUM =.36 AUMs/ac.

12-14" PZ
Reference PC - (1300) (.36)
1.2 PC - (900) (.25)
2.1 PC - (500) (.14)
1.3 PC (1200)(.33)

15-17" PZ

Reference PC – (1500) (.41)
1.2 PC – (1100) (0.30)
2.1 PC (700) (.19)
1.3 PC - (1400) (.38)

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

Water 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 moderate. Runoff potential for this site varies from low to moderate 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 (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 1-2 percent of the soil surface.

Recreational uses

This site provides hunting, hiking, photography, bird watching, and other recreational 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).

The Annual Production Table and Species Composition List 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 NRCS NE and WY state offices in the future.

Existing NRI or 417 Inventory Data References updated.

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: NRI Number of Records: 37
Sample Period: 2006-2016
States: NE, WY, CO
Counties: Banner, Garden, Kimball, Morrill, Scotts Bluff (NE);
Goshen, Laramie, Platte (WY); Weld (CO)

NRI: references to Natural Resource Inventory data
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)

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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.

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Contact for lead author	
Date	11/04/2020
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.

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

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3. **Number and height of erosional pedestals or terracettes:** None. Erosional 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 5 to 10 percent, and patches less than 2 to 3 inches in diameter. Multi-year drought can cause bare ground to increase to 10 to 15 percent.

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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 aggregate stability ratings should typically be 5 to 6, normally 6. Surface organic matter adheres to the soil surface. Soil surface peds will typically retain structure indefinitely when dipped in distilled water.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** The surface layer ranges from 5 to 12 inches (12.7-30.5 cm) thick. Soil colors range from grayish brown to dark grayish brown (values of 4 to 5) when dry and dark grayish brown or very dark grayish brown (values of 3 to 4) when moist. Soil surface structure is fine to medium 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 75 to 90 percent perennial grasses and grass-likes, 5 to 15 percent forbs, and 5 to 10 percent woody plants. The grass and grass-like component is made up of cool-season, bunch grasses (30-45%); cool-season, rhizomatous grasses (20-25%), warm-season short grasses (10-15%); warm-season mid-grasses (5-10%); and grass-likes (0-5%).

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, C3 grasses – 390-630 #/ac (30-45%), 2 species minimum

    15-17” PZ: Community 1.1
    Native, C3, bunch grasses – 450-675 #/ac (30-45%), 2 species minimum

    Sub-dominant: 12-14” PZ: Community 1.1
    2. Native, C3, rhizomatous grasses – 260-325 (20-25%), 1 species minimum
    3. Native, C4, short grasses – 130-195 #/ac (10-15%), 1 species minimum
    4. Native, Perennial and Annual Forbs – 65-195 #/ac (5-15%), 3 species minimum

    15-17” PZ: Community 1.1

2. Native, C3, rhizomatous grasses – 300-375 (20-25%), 1 species minimum
3. Native, C4, short grasses – 150-225 #/ac (10-15%), 1 species minimum
4. Native, Perennial and Annual Forbs – 75-225 #/ac (5-15%), 3 species minimum

Other: 12-14" PZ: Community 1.1
5. Minor: Native, C4, mid-grasses – 65-130 #/ac (5-10%)
6. Minor: Shrubs, Vines, Cacti – 65-130 #/ac: (5-10%)
7. Minor: Grass-likes – 0-65 #/ac (0-5%)

15-17" PZ: Community 1.1
5. Minor: Native, C4, mid-grasses – 75-150 #/ac (5-10%)
6. Minor: Shrubs, Vines, Cacti – 75-150 #/ac: (5-10%)
7. Minor: Grass-likes – 0-75 #/ac (0-5%)

Additional: 12-14" PZ: Community 1.1
12a. Relative Dominance:
Community 1.1: Native, C3 bunch grasses > Native, C3, rhizomatous grasses > C4, short grasses > Native, Perennial and Annual Forbs > Native, C4, mid-grasses = Shrubs, cacti, vines > Grass-likes.

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: 7

15-17" PZ: Community 1.1
12a. Relative Dominance:
Community 1.1: Native, C3 bunch grasses > Native, C3, rhizomatous grasses > C4, short grasses = Native, Perennial and Annual Forbs > Native, C4, mid-grasses = Shrubs, cacti, vines > Grass-likes.

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: 7

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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. The exception is the potential for up to 10 percent mortality in the 15-17" PZ and up to 15 percent mortality in the 12-14" PZ of mid and short, warm-season bunch grasses during multi-year drought cycles.

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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 50 to 70 percent. Litter depth is expected to be 0.25 to 0.50 inches (0.65-1.30 cm).

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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 750 to 1750 pounds per acres (air dry basis). Average annual production is 1,300 pounds per acre under normal precipitation and weather conditions.

In the 15-17” Precipitation Zone, annual production ranges from 1000 to 2000 pounds per acre (air dry basis). Average annual production is 1,500 pounds per acre under normal precipitation and weather conditions.

No significant reduction is expected the growing season following wildfire.

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16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:** Annual bromes, fringed sagewort, green sagewort, hairy goldaster (especially in the 12-14” PZ), prickly pear 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.

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