USDA Natural Resources Conservation Service

Ecological site R067AY104WY
Clayey (Cy)

Last updated: 12/10/2024
Accessed: 05/10/2025

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.

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 Clayey Ecological Site Description was developed by an earlier version of the Clayey ESD (2005, updated 2008). The earlier version of the Clayey (Cy) 12-17" Precipitation Zone ESD was based on input from NRCS (formerly Soil Conservation Service) and historical information obtained from the Clayey(Cy) Range Site Description (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 Clayey Ecological Site is a run-off site that is not saline or alkaline with soil depths ranging from 20 to greater than 60 inches. It does not have a high volume of coarse fragments on the surface, lies on gentle to nearly level slopes, and has soil textures ranging from clay loam to silt clay. Soil cracking is common during dry summer

months.

Associated sites

R067AY106WY	**Closed Depression (Cd)** This ecological site is commonly adjacent.

Similar sites

R067AY122WY	**Loamy (Ly)** The Loamy Ecological Site does not have clayey soil textures.
R067AY150WY	**Sandy (Sy)** The Sandy Ecological Site does not have clayey soil textures.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Atriplex canescens* (2) *Krascheninnikovia lanata*
Herbaceous	(1) *Pascopyrum smithii* (2) *Nassella viridula*

Physiographic features

This site occurs on nearly level to slightly sloping fans or on level terraces of dissected plains or uplands.

Table 2. Representative physiographic features

Landforms	(1) Fan (2) Terrace
Runoff class	Medium to very high
Flooding frequency	None
Ponding frequency	None
Elevation	3,500–6,500 ft
Slope	0–9%
Water table depth	80–200 in
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)	16-17 in
Frost-free period (actual range)	84-123 days
Freeze-free period (actual range)	116-137 days
Precipitation total (actual range)	14-18 in
Frost-free period (average)	103 days
Freeze-free period (average)	128 days
Precipitation total (average)	16 in

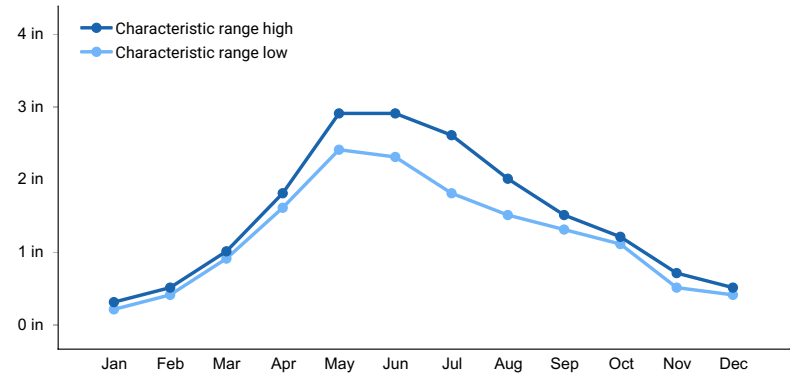


Figure 1. Monthly precipitation range

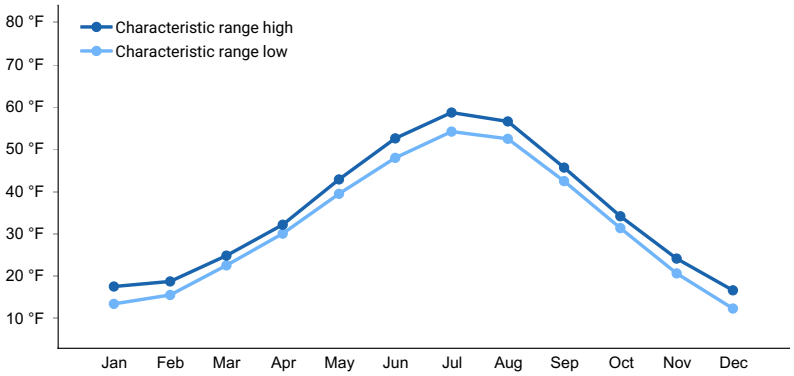


Figure 2. Monthly minimum temperature range

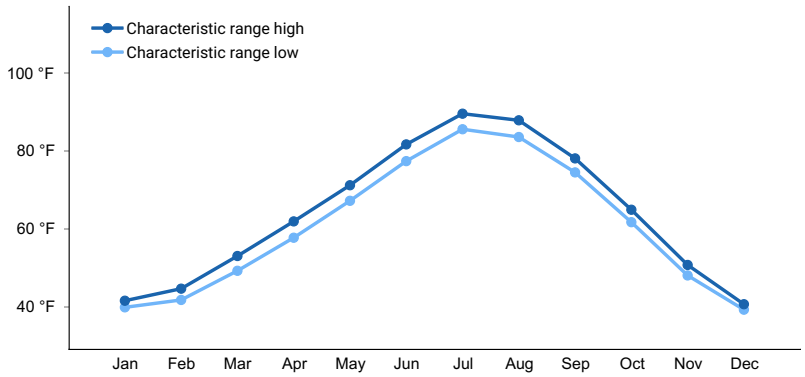


Figure 3. Monthly maximum temperature range

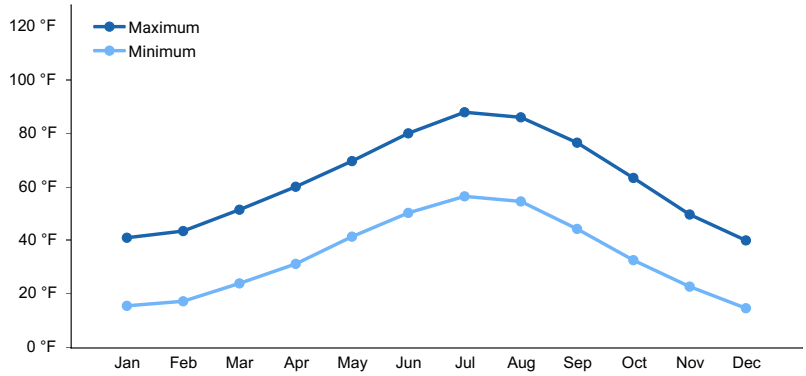


Figure 4. Monthly average minimum and maximum temperature

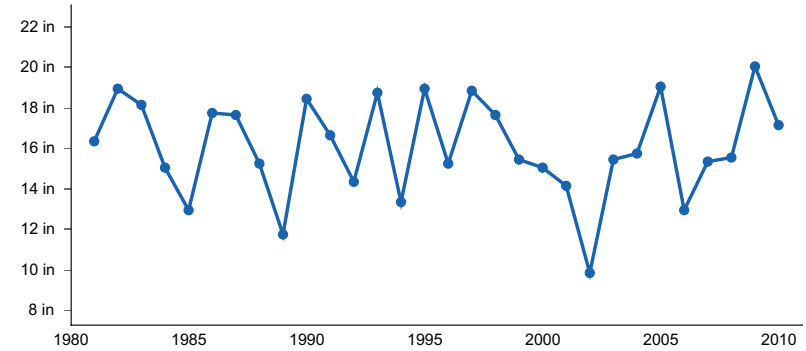


Figure 5. Annual precipitation pattern

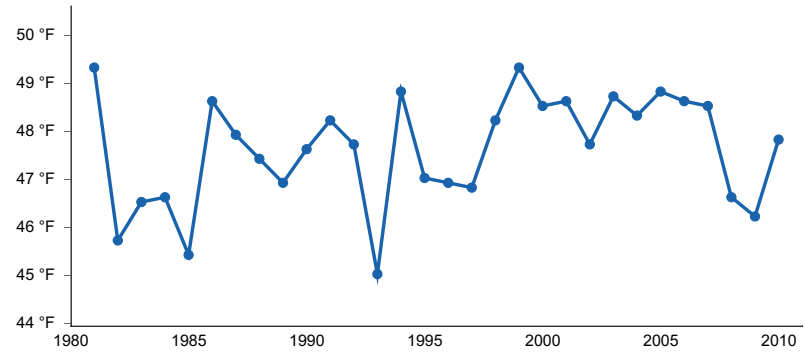


Figure 6. Annual average temperature pattern

Climate stations used

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

Influencing water features

There are no water features of the ecological site or adjacent wetland or riparian regimes that influence the vegetation or management of the site.

Soil features

The soils on this site are very deep, well drained soils that formed from clayey alluvium or slope alluvium derived from shale. They have a slow to moderately slow permeability class. The available water capacity is moderate but ranges from low to high. The soil moisture regime is aridic ustic but may include ustic aridic. The soil temperature regime is mesic.

The surface layer of the soils in this site are silty clay loam, silty clay, or clay, but may include clay loam or loam. The surface layer ranges from a depth of 2 to 10 inches thick. The subsoil is typically silty clay, clay, silty clay loam, or clay loam. Soils in this site typically have carbonates at the surface, but a few soils may be leached to 15 inches. These soils are susceptible to erosion by water and wind. The potential for water erosion accelerates with increasing slope.

The surface soil structure is very fine to fine granular, and the structure below the surface is prismatic and/or angular or subangular blocky.

Major soil series correlated to this ecological site include: Heldt and Nuncho.

Other soil series that have been correlated to this site include: Chivington and Pinelli.

The attributes listed below 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 7. Heldt silty clay loam, Morgan County, CO

Table 4. Representative soil features

Parent material	(1) Alluvium–shale (2) Slope alluvium–shale
Surface texture	(1) Silty clay loam (2) Silty clay (3) Clay
Drainage class	Well drained
Permeability class	Slow to moderately slow
Soil depth	80 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	5–10 in

Calcium carbonate equivalent (0-40in)	0–10%
Electrical conductivity (0-40in)	0–2 mmhos/cm
Sodium adsorption ratio (0-40in)	0–5
Soil reaction (1:1 water) (0-40in)	6.6–8.4
Subsurface fragment volume <=3" (Depth not specified)	0%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

The Clayey ecological site is characterized by four states: Reference, Sod-bound, Increased *Bare Ground*, and Tilled. The Reference State is characterized by cool-season rhizomatous midgrass (western wheatgrass), cool-season mid- bunchgrasses (green needlegrass), and warm-season stoloniferous shortgrass (buffalograss).

Other grasses and grass-likes include prairie Junegrass, alkali (Sandberg) bluegrass, and threadleaf sedge. A minor component of forbs such as purple or white prairie clover, penstemon, and American vetch, and shrubs such as winterfat are also present. The Sod-bound State is characterized by warm-season shortgrass (blue grama and buffalograss). The Increased *Bare Ground* State is characterized by annual grasses (sixweeks fescue), forbs (curlycup gumweed, hairy goldenaster, and annuals), and shrubs (fringed sagewort, snakeweed, and pricklypear). Invasives include cheatgrass.

As the Clayey site begins to deteriorate from a combination of frequent and severe grazing during the growing season, bunchgrasses such as green needlegrass and rhizomatous wheatgrasses begin to decrease in both frequency and production. Grasses such as blue grama and buffalograss increase. 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 can eventually be removed from the plant community. Over the long-term, this heavy, continuous use 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.

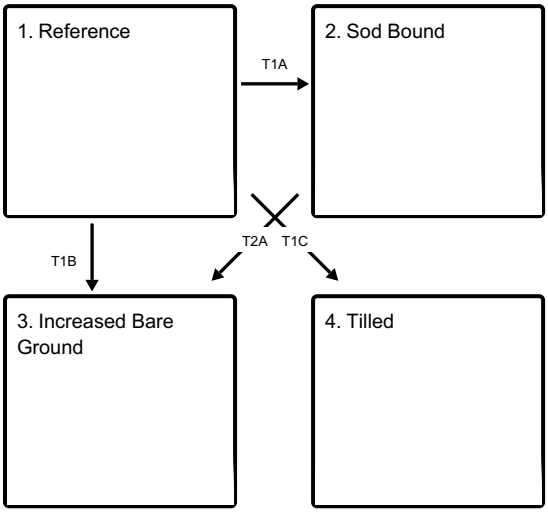
Recurrent drought has historically impacted the vegetation of this region. Changes in species composition vary depending upon the duration and severity of the drought cycle and prior grazing management. Drought events since 2002 have significantly increased mortality of blue grama and buffalograss in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

State and transition model

Ecosystem states



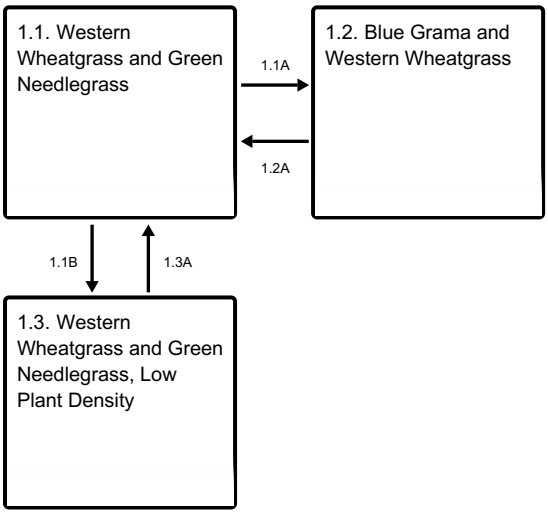
T1A - Excessive grazing. Lack of fire.

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

2.1. Blue Grama and Buffalograss

State 3 submodel, plant communities

3.1. Broom Snakeweed, Pricklypear, Blue Grama, and Purple Threeawn

State 4 submodel, plant communities

4.1. Russian Thistle, Burningbush, Cheatgrass, and Sixweeks Fescue, Go-Back Land

4.2. Seeded

State 1
Reference

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

- fourwing saltbush (*Atriplex canescens*), shrub
- winterfat (*Krascheninnikovia lanata*), shrub
- western wheatgrass (*Pascopyrum smithii*), grass
- green needlegrass (*Nassella viridula*), grass

Community 1.1
Western Wheatgrass and Green Needlegrass

Community 1.1 is the interpretive plant community for the Clayey 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. The Reference 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 90 percent grasses and grass-likes, 5 to10 percent forbs, and 5 to10 percent woody plants. In the western portion of the MLRA, this plant community consists predominately of cool-season mid-grasses, with a significant component of warm-season mid-grasses. In the eastern portion of the MLRA, the plant community is predominantly warm-season with a significant cool-season component. The major grasses include western wheatgrass, green needlegrass, and blue grama. Secondary and minor grasses include prairie Junegrass, alkali bluegrass (Sandberg bluegrass), buffalograss, and little bluestem. Forbs such as dotted blazing star (dotted gayfeather), penstemon, American vetch, and prairie coneflower occur. Shrubs such as winterfat and fourwing saltbush also occur. 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

- fourwing saltbush (*Atriplex canescens*), shrub
- winterfat (*Krascheninnikovia lanata*), shrub
- western wheatgrass (*Pascopyrum smithii*), grass
- green needlegrass (*Nassella viridula*), grass

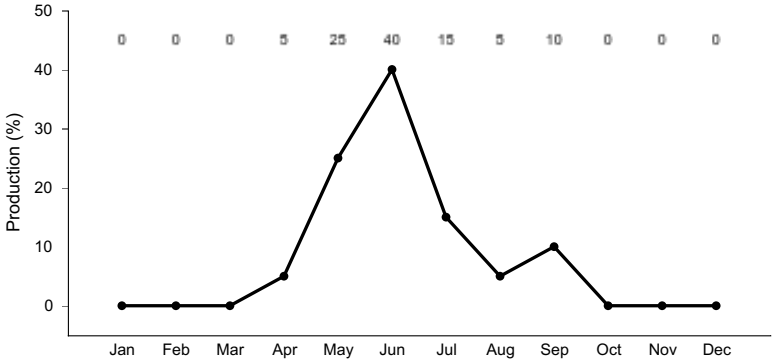


Figure 9. Plant community growth curve (percent production by month). WY1101, 12-14SP Upland sites w/o warm seasons. 12-14" Precipitation Zone, Southern Plains (SP) without warm season (grass) species.

Community 1.2
Blue Grama and Western Wheatgrass

Grazing-tolerant species such as blue grama and buffalograss have noticeably increased. Needle and thread may initially increase or decrease depending upon 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 goldenaster, slimflower scurfpea, fringed sagewort, and broom snakeweed have increased. Total aboveground biomass has been reduced. Reduction of rhizomatous wheatgrasses and nitrogen-fixing forbs and increased warm-season shortgrasses have begun to alter the biotic integrity of this community. The 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

- fourwing saltbush (*Atriplex canescens*), shrub
- broom snakeweed (*Gutierrezia sarothrae*), shrub
- blue grama (*Bouteloua gracilis*), grass
- western wheatgrass (*Pascopyrum smithii*), grass

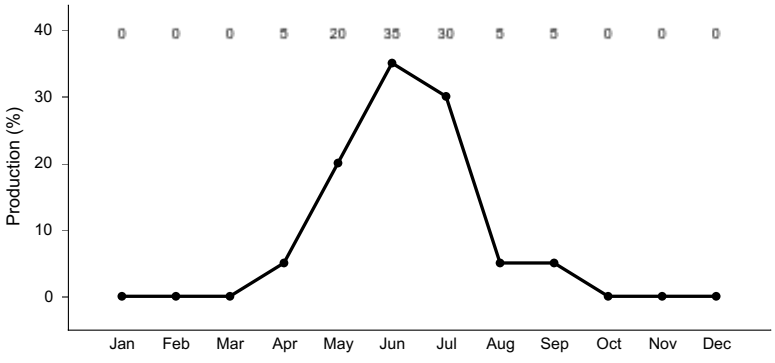


Figure 10. Plant community growth curve (percent production by month). WY1104, 12-14SP upland sites w/ warm. 12-14" Precipitation Zone, Southern Plains (SP) with warm-season (grass) species.

Community 1.3
Western Wheatgrass and Green Needlegrass, Low Plant Density

Plant species resemble the community 1.1 but the frequency and production are reduced. Eventually, litter levels become high enough to cause decadence and mortality of the stand. Bunchgrasses typically develop dead centers and rhizomatous grasses 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. If a seed source is readily available, noxious weeds such as leafy spurge and Dalmatian toadflax may invade. Invasive grasses such as cheatgrass and Kentucky bluegrass tend to encroach under these conditions. Water flow patterns and pedestalling becomes 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.

Dominant plant species

- fourwing saltbush (*Atriplex canescens*), shrub
- winterfat (*Krascheninnikovia lanata*), shrub
- western wheatgrass (*Pascopyrum smithii*), grass
- green needlegrass (*Nassella viridula*), grass

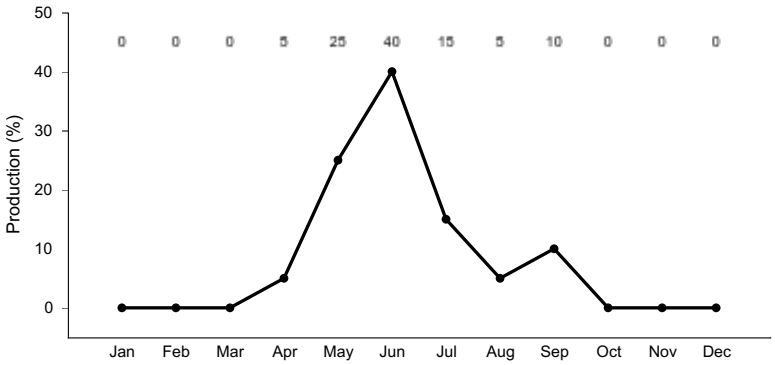


Figure 11. Plant community growth curve (percent production by month). WY1101, 12-14SP Upland sites w/o warm seasons. 12-14" Precipitation Zone, Southern Plains (SP) without warm season (grass) species.

Pathway 1.1A
Community 1.1 to 1.2

Heavy, continuous grazing and lack of fire shift this plant community to the 1.2 Community. Biotic integrity, water, and nutrient cycles may become impaired.

Pathway 1.1B
Community 1.1 to 1.3

Non-use and lack of fire causes the Reference Plant Community to shift toward the1.3 Plant Community. Plant decadence and standing dead plant material impedes energy flow. Initially, excess litter increases. Eventually, native plant density begins to decrease and introduced species may begin to invade. Water and nutrient cycles become impaired.

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 to 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 or normal fire frequency shift 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

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. The loss of functional/structural groups such as cool-season midgrasses reduces the biodiversity and productivity of this site. 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 nutrient cycling.

Dominant plant species

- prairie sagewort (*Artemisia frigida*), shrub
- plains pricklypear (*Opuntia polyacantha*), shrub
- blue grama (*Bouteloua gracilis*), grass
- buffalograss (*Bouteloua dactyloides*), grass

Community 2.1
Blue Grama and Buffalograss

The midgrasses and palatable forbs and shrubs have been eliminated. The dominant species are blue grama, and buffalograss. These species have developed into a sod-bound condition occurring in localized colonies and exhibit a mosaic appearance. Perennial species such as purple threeawn have increased. Forbs such as scarlet globemallow, wild onion, death camas, slim-flower scurfpea, and skeletonplant remain. Shrubs that continue to increase are broom snakeweed, fringed sagewort, and pricklypear. Plant diversity is very low. Energy flow and water and mineral cycles have been negatively affected. Litter levels are very low and unevenly distributed. The Sod Bound 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

- prairie sagewort (*Artemisia frigida*), shrub
- plains pricklypear (*Opuntia polyacantha*), shrub
- blue grama (*Bouteloua gracilis*), grass
- buffalograss (*Bouteloua dactyloides*), grass

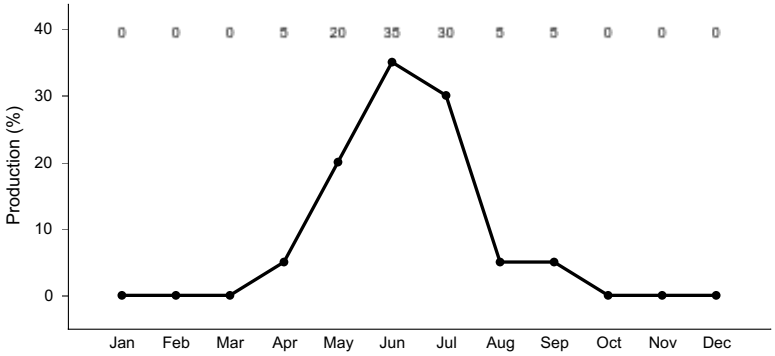


Figure 12. Plant community growth curve (percent production by month). WY1104, 12-14SP upland sites w/ warm. 12-14" Precipitation Zone, Southern Plains (SP) with warm-season (grass) species.

State 3
Increased Bare Ground

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

Dominant plant species

- broom snakeweed (*Gutierrezia sarothrae*), shrub
- plains pricklypear (*Opuntia polyacantha*), shrub
- blue grama (*Bouteloua gracilis*), grass
- Fendler threeawn (*Aristida purpurea var. longiseta*), grass

Community 3.1
Broom Snakeweed, Pricklypear, Blue Grama, and Purple Threeawn

The dominant grasses include blue grama and purple 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 goldenaster. Broom snakeweed and pricklypear are increasing.

Dominant plant species

- broom snakeweed (*Gutierrezia sarothrae*), shrub
- plains pricklypear (*Opuntia polyacantha*), shrub
- blue grama (*Bouteloua gracilis*), grass
- Fendler threeawn (*Aristida purpurea var. longiseta*), grass

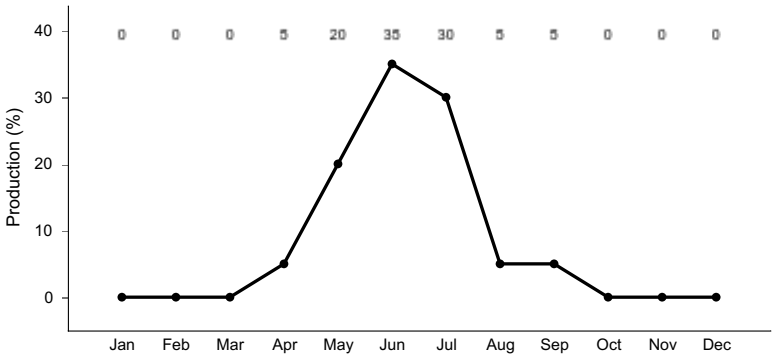


Figure 13. Plant community growth curve (percent production by month). WY1104, 12-14SP upland sites w/ warm. 12-14" Precipitation Zone, Southern Plains (SP) with warm-season (grass) species.

State 4
Tilled

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 soil tillage. Physical, chemical, and biological soil properties have been dramatically altered. No restorative pathway is known at this time.

Dominant plant species

- cheatgrass (*Bromus tectorum*), grass
- sixweeks fescue (*Vulpia octoflora*), grass
- Russian thistle (*Salsola*), other herbaceous
- burningbush (*Bassia scoparia*), other herbaceous

Community 4.1
Russian Thistle, Burningbush, Cheatgrass, and Sixweeks Fescue, Go-Back Land

Go-back land is created when the soil is tilled or farmed (sodbusted) and abandoned. All of the native plants are eliminated, soil organic matter is reduced, soil structure is altered, 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 (non-native and native), such as Russian thistle, burningbush, stickseed, cheatgrass, sixweeks fescue, 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, alkali bluegrass (also known as Sandberg bluegrass), buffalograss, and other early perennials can dominate the plant community for five to eight years or more. Perennial forbs can include Cuman ragweed (also known as western ragweed), and sweetclover. Significant shrubs in this community include broom snakeweed and green rabbitbrush. Pricklypear cactus is typically absent. Eventually western wheatgrass, blue grama, and other natives become re-established. Plant diversity is low and production is highly variable.

Dominant plant species

- cheatgrass (*Bromus tectorum*), grass
- sixweeks fescue (*Vulpia octoflora*), grass
- Russian thistle (*Salsola*), other herbaceous
- burningbush (*Bassia scoparia*), other herbaceous

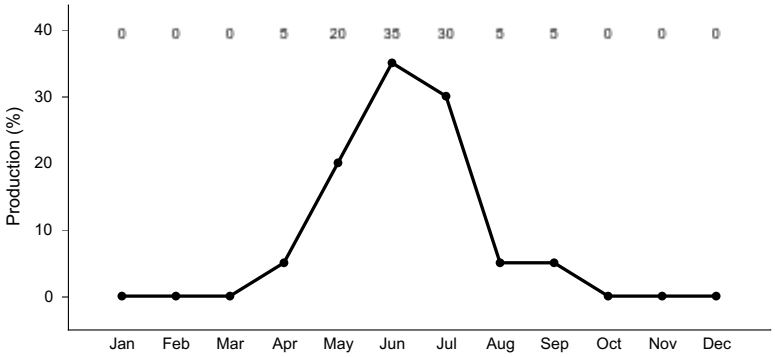


Figure 14. Plant community growth curve (percent production by month). WY1104, 12-14SP upland sites w/ warm. 12-14" Precipitation Zone, Southern Plains (SP) with warm-season (grass) species.

Community 4.2
Seeded

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

Transition T1A
State 1 to 2

Continuous, heavy grazing and lack of fire shifts this state across an ecological threshold to the Sod-bound State. Biotic integrity and hydrologic function are impaired.

Transition T1B
State 1 to 3

Long-term, heavy, continuous grazing and lack of fire 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 causes an immediate transition across an ecological threshold to the Tilled State. This transition can occur from any plant community within the Clayey ecological site and is irreversible.

Transition T2A
State 2 to 3

Long-term, heavy, continuous grazing and lack of fire cause a shift across an ecological threshold to the Increased *Bare Ground* State. Erosion and loss of organic matter and carbon reserves are concerns. 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 (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**12"-14"**			495–550	
	western wheatgrass	PASM	*Pascopyrum smithii*	495–550	–
2	**12"-14"**			165–275	
	green needlegrass	NAVI4	*Nassella viridula*	165–275	–
3	**12"-14"**			55–110	
	blue grama	BOGR2	*Bouteloua gracilis*	55–110	–
4	**12"-14"**			110–220	
	Grass, perennial	2GP	*Grass, perennial*	0–55	–
	threadleaf sedge	CAFI	*Carex filifolia*	0–55	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–55	–
	Sandberg bluegrass	POSE	*Poa secunda*	0–55	–
	little bluestem	SCSC	*Schizachyrium scoparium*	0–55	–
	threeawn	ARIST	*Aristida*	0–22	–
7	**15"-17"**			585–650	
	western wheatgrass	PASM	*Pascopyrum smithii*	585–650	–
8	**15"-17"**			195–325	
	green needlegrass	NAVI4	*Nassella viridula*	195–325	–
9	**15"-17"**			65–130	
	blue grama	BOGR2	*Bouteloua gracilis*	65–130	–
10	**15"-17"**			130–260	
	Grass, perennial	2GP	*Grass, perennial*	0–65	–
	threadleaf sedge	CAFI	*Carex filifolia*	0–65	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–65	–
	Sandberg bluegrass	POSE	*Poa secunda*	0–65	–
	little bluestem	SCSC	*Schizachyrium scoparium*	0–65	–
	threeawn	ARIST	*Aristida*	0–26	–
Forb					
5	**12"-14"**			55–165	
	Forb, perennial	2FP	*Forb, perennial*	0–55	–
	textile onion	ALTE	*Allium textile*	0–22	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–22	–

	field sagewort	ARCA12	*Artemisia campestris*	0–22	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–22	–
	milkvetch	ASTRA	*Astragalus*	0–22	–
	white prairie clover	DACA7	*Dalea candida*	0–22	–
	purple prairie clover	DAPU5	*Dalea purpurea*	0–22	–
	larkspur	DELPH	*Delphinium*	0–22	–
	scarlet beeblossom	GACO5	*Gaura coccinea*	0–22	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	0–22	–
	dotted blazing star	LIPU	*Liatris punctata*	0–22	–
	desertparsley	LOMAT	*Lomatium*	0–22	–
	Indian breadroot	PEDIO2	*Pediomelum*	0–22	–
	beardtongue	PENST	*Penstemon*	0–22	–
	scurfpea	PSORA2	*Psoralidium*	0–22	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–22	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–22	–
	American vetch	VIAM	*Vicia americana*	0–22	–
	meadow deathcamas	ZIVE	*Zigadenus venenosus*	0–22	–
11	**15"-17"**			65–195	
	Forb, perennial	2FP	*Forb, perennial*	0–65	–
	textile onion	ALTE	*Allium textile*	0–26	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–26	–
	field sagewort	ARCA12	*Artemisia campestris*	0–26	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–26	–
	milkvetch	ASTRA	*Astragalus*	0–26	–
	white prairie clover	DACA7	*Dalea candida*	0–26	–
	purple prairie clover	DAPU5	*Dalea purpurea*	0–26	–
	larkspur	DELPH	*Delphinium*	0–26	–
	scarlet beeblossom	GACO5	*Gaura coccinea*	0–26	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	0–26	–
	dotted blazing star	LIPU	*Liatris punctata*	0–26	–
	desertparsley	LOMAT	*Lomatium*	0–26	–
	Indian breadroot	PEDIO2	*Pediomelum*	0–26	–
	beardtongue	PENST	*Penstemon*	0–26	–
	scurfpea	PSORA2	*Psoralidium*	0–26	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–26	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–26	–
	American vetch	VIAM	*Vicia americana*	0–26	–
	meadow deathcamas	ZIVE	*Zigadenus venenosus*	0–26	–
Shrub/Vine					
6	**12"-14"**			55–110	
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–55	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–55	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–55	–
	leadplant	AMCA6	*Amorpha canescens*	0–22	–

	prairie sagewort	ARFR4	*Artemisia frigida*	0–22	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–22	–
	prairie rose	ROAR3	*Rosa arkansana*	0–22	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–22	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	0–22	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–22	–
12	**15"-17"**			65–130	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–65	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–65	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–65	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–26	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	0–26	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–26	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–26	–
	prairie rose	ROAR3	*Rosa arkansana*	0–26	–
	leadplant	AMCA6	*Amorpha canescens*	0–26	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–26	–

Animal community

Wildlife Interpretations

Reference Plant Community - Western Wheatgrass, Green Needlegrass, 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 will utilize this community for nesting and foraging. This community is especially favorable for ground-nesting birds because of the abundant residual vegetation available in the spring for nesting, escape and thermal cover.

1.2 Community – Decreased Western Wheatgrass and Green Needlegrass, and Increased Blue Grama

The reduction in midgrasses 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 plant community. Pronghorn may forage in this community.

1.3 Community - 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. Prairie dogs and jackrabbits are frequent users of this community.

2.1 Community - Blue Grama, Buffalograss, Fringed Sagewort, and Pricklypear:

This community provides limited foraging for antelope and other grazers. Horned lark, killdeer, McCown's longspur, and ferruginous hawk are still found. Long-billed curlews use this community if standing water is present nearby.

3.1 Community – Blue Grama, Fendler's Threeawn, Annual Grasses and Forbs, Cheatgrass and Other Invasives:

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. Burrowing owls may occur here if the community is occupied by prairie dogs. Pronghorn may find limited forage in this community.

4.1 Community – Threeawn, Annual Grasses and Forbs, Cheatgrass and other Invasives:

The wildlife species found here is similar to the Increased *Bare Ground* Community.

4.2 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 Clayey Ecological Site. These are conservative estimates for initial planning. On-site conditions 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 (National 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 – (1100) (.30)
1,100 lbs. per acre X 25% Harvest Efficiency = 275 lbs. forage demand for one month. Then, 275 lbs. per acre/912 demand per AUM =.30
Plant Community (PC) Production (lbs.ac), and Stocking Rate (AUM/Acre)
12-14 Inch PZ:
Reference PC - (1100) (0.30)
At-Risk PC - (800) (0.22)
Sod-Bound PC - (500) (0.14)
15-17 Inch PZ
Reference PC – (1300) (0.36)
At-Risk PC – (950) (0.26)
Sod-bound PC – (600) (0.16)
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.

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 short-grasses 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 1-2 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).

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.

Livestock Interpretations: Stocking Rate table updated.

Wildlife Interpretations: Plant community names updated. Narrative is from “Previously Approved” ESD (2008). Hydrology, Recreational Uses, Wood Products, Other Products, and Plant Preferences table carried over from previously “Approved” ESD (2008).

Existing NRI or 417 Inventory Data References is limited. 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

Information presented here has been derived from data collection on private and federal lands using:
• Double Sampling (clipped 2 of 5 plots)*
• Rangeland Health**
• Soil Stability**
• Line Point Intercept : Foliar canopy, basal cover (forb, graminoid, shrub, subshrub, lichen, moss, rock fragments, bare ground, percentage of litter)***
• Soil pedon descriptions collected on site****
*NRCS 528-Prescribed Grazing Standard job sheets.
**Interpreting Indicators of Rangeland Health, Version 4, 2005
***Monitoring Manual for Grassland, Shrubland and Savanna Ecosystems, Volume II, 2005
****Field Book for Describing and Sampling Soils, Version 3, 2012
NRI- Natural Resource Inventory data
SCS-RANGE-417 Production & Composition Record for Native Grazing Lands
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.

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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	11/23/2020
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.

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3. **Number and height of erosional pedestals or terracettes:** Essentially non-existent

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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 less than 10 percent occurring in smal patches (2 to 3 inches or 5 to 7.6 cm) and scattered throughout site.

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5. **Number of gullies and erosion associated with gullies:** None. Wind-scoured and/or depositional areas are not present on the site.

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6. **Extent of wind scoured, blowouts and/or depositional areas:** None

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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.

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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Soil 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.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** The surface layer ranges from 2 to 10 inches (5 to 25.4 cm) thick. Soil colors are grayish brown or light grayish brown (values of 5 to 6) when dry and very dark grayish brown, dark brown, dark grayish brown, or grayish brown (values of 3 to 5) when moist. Soil surface structure is very fine to fine granular. Soils typically contain carbonates at the surface, but on some sites, this may be leached below the surface.

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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 90 percent perennial grasses and grass-likes, 5 to 10 percent forbs, and 5 to 10 percent shrubs and trees.

    The grass and grass-like component is made up of cool-season, bunch grasses (15-30%); cool-season, rhizomatous grasses (45-50%), warm-season short grasses (5-10%); warm-season mid-grasses (0-5%); and grass-likes (0-5%).

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

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

Dominant: 12-14” PZ:
1. Native, C3, rhizomatous grasses – 495-550 (45-50%), 1 species minimum

15-17” PZ:
1. Native, C3, rhizomatous grasses – 585-650 (45-50%), 1 species minimum

Sub-dominant: 12-14” PZ:
2. Native, C3, bunch grasses – 165-330 #/ac (15-30%), 1 species minimum
3. Native, Perennial and Annual Forbs – 55-165 #/ac (5-15%), 3 species minimum

15-17” PZ:
2. Native, C3, bunch grasses – 195-390 #/ac (15-30%), 1 species minimum
3. Native, Perennial and Annual Forbs – 65-195 #/ac (5-15%), 3 species minimum

Other: 12-14” PZ:
4. Minor: Native, C4, short grasses – 55-110 #/ac (5-10%)
5. Minor: Shrubs, Vines, Cacti – 55-110 #/ac (5-10%)
6. Minor: Native, C4, mid-grasses – 0-55 #/ac (0-5%)
7. Minor: Grass-likes – 0-55 #/ac (0-5%)

15-17” PZ:
4. Minor: Native, C4, short grasses – 65-130 #/ac (5-10%)
5. Minor: Shrubs, Vines, Cacti – 65-130 #/ac (5-10%)
6. Minor: Native, C4, mid-grasses – 0-65 #/ac (0-5%)
7. Minor: Grass-likes – 0-65 #/ac (0-5%)

Additional: 12a. Relative Dominance:
Community 1.1: Native, C3, rhizomatous grasses > Native, C3 bunch grasses > Native, Annual or Perennial Forbs > Native, C4, short grasses = Shrubs, Cacti, Vines > Native, C4, mid-grasses = 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: 5

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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 of up to 15 percent mortality in the 12-14” PZ and up to 10 percent mortality in the 15-17” 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 40 to 50 percent. Litter depth is expected to be 0.25 to 0.50 inches (0.65-1.30 cm).

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 1,450 pounds per acres (air dry basis). Average annual production is 1,100 pounds per acre under normal precipitation and weather conditions.

    In the 15-17” Precipitation Zone, annual production ranges from 900 to 1,700 pounds per acre (air dry basis). Average annual production is 1,300 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:** Dalmatian toadflax, annual bromes, Russian thistle, curlycup gumweed, green sagewort, hairy goldaster, fringed sagewort, pricklypear 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.
