USDA Natural Resources Conservation Service

Ecological site R067AY106WY
Closed Depression (Cd)

Last updated: 12/10/2024
Accessed: 05/13/2025

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.

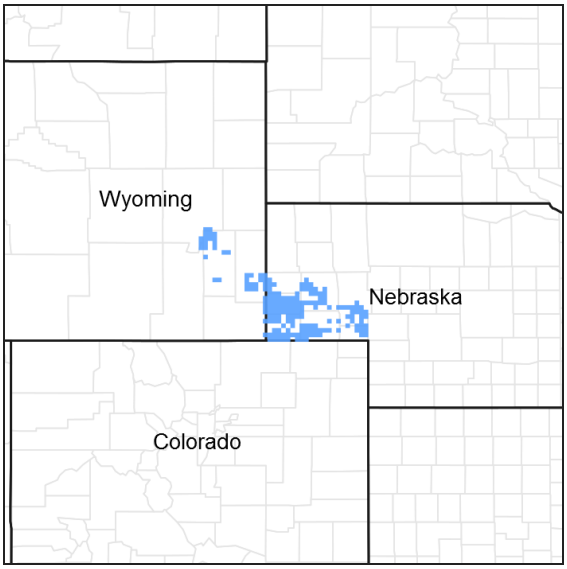


Figure 1. Mapped extent

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

Ecological site concept

The Closed Depression Ecological Site is a non-saline, non-alkaline site that receives water as run-on from uplands It has no connection with the water table and is in a closed depression. This ecological site has silty clay, silty clay loam, clay, or clay loam subsurface textures.

Associated sites

R067AY104WY	**Clayey (Cy)** This ecological site is commonly adjacent.

Similar sites

R067AY126WY	**Loamy Overflow (LyO)** The Loamy Overflow Ecological Site has loamy subsurface soil textures and is not in a closed depression.
R067AY104WY	**Clayey (Cy)** The Clayey Ecological Site is a run-off site and is not in a closed depression.

Table 1. Dominant plant species

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

Physiographic features

This ecological site occurs in playas, closed depressions on dissected plains, or uplands. It receives water as runoff from adjacent uplands. This site is ponded, from occasionally to frequently, for very brief to long periods from run-in water, but is not subject to flooding. The surface layer may be saturated for periods of long duration due to surface ponding that ranges from +0.5 to 2.0 feet in depth.

Table 2. Representative physiographic features

Landforms	(1) Playa (2) Closed depression
Runoff class	Negligible to low
Flooding frequency	None

Ponding duration	Very brief (4 to 48 hours) to long (7 to 30 days)
Ponding frequency	Occasional to frequent
Elevation	1,219–1,646 m
Slope	0–1%
Ponding depth	15–61 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) WHEATLAND 4 N [USC00489615], Wheatland, WY
- (2) KIMBALL 2NE [USC00254440], Kimball, NE
- (3) SCOTTSBLUFF HEILIG AP [USW00024028], Scottsbluff, NE
- (4) CHEYENNE [USW00024018], Cheyenne, WY
- (5) CHUGWATER [USC00481730], Chugwater, WY
- (6) OSHKOSH [USC00256385], Oshkosh, NE
- (7) BRIDGEPORT [USC00251145], Bridgeport, NE
- (8) HARRISBURG 12WNW [USC00253605], Harrisburg, NE
- (9) OLD FT LARAMIE [USC00486852], Yoder, WY
- (10) PHILLIPS [USC00487200], LaGrange, WY

Influencing water features

This ecological site has no surface drainage outlet. It is located in a receiving position that collects runoff from adjacent uplands in response to precipitation events. The water escapes only by evaporation or subsurface drainage. The kinds and amount of vegetation existing here are influenced by the amount and timing of precipitation events, as well as the duration of ponding. A few of the map units in this ESD have a 1 percent to 5 percent hydric component for the playa floors.

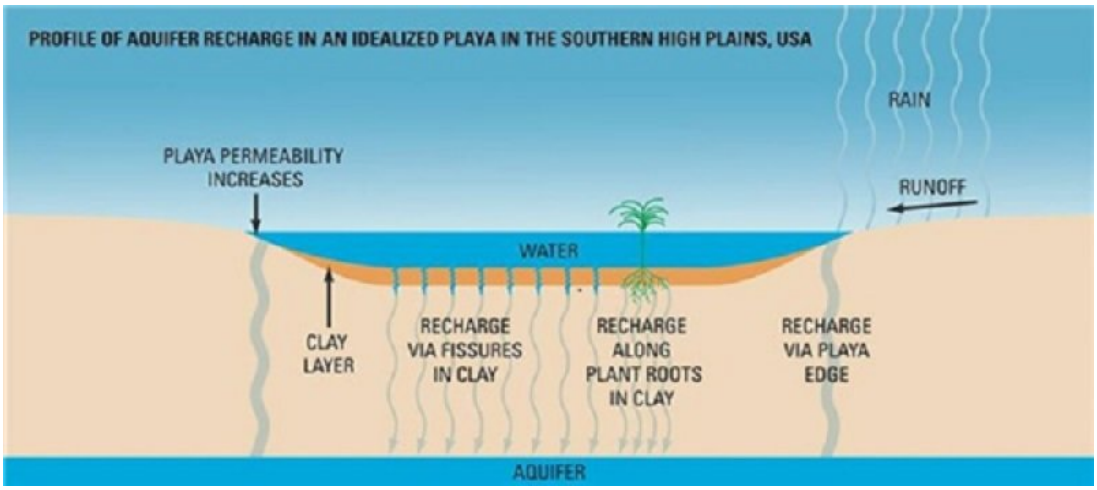


Figure 8. Hydrologic Image - Recharge of a Playa

Soil features

The soils on this ecological site are very deep, somewhat poorly drained soils that formed from loess or local alluvium. They have slow permeability resulting in a ponded condition during some part of the growing season in most years. The available water capacity is moderate to high. The soil moisture regime is aridic ustic. The soil temperature regime is mesic.

The surface layer of the soils are silty clay loam, silt loam, or loam. The surface layer ranges from a depth of 2 to 8 inches thick. The subsoil is silty clay or silty clay loam but may include clay or clay loam. These soils crack when dry due to the high shrink-swell of the clay in the subsoil textures. Soils are leached of carbonates to below 40 inches; but some may have carbonates at 30 inches. These soils are susceptible to erosion by water and wind. The potential for erosion increases where vegetative cover is inadequate.

Surface soil structure is fine granular, and structure below the surface is prismatic and/or strong angular or subangular blocky. Soil structure describes the manner in which soil particles are aggregated and defines the nature of the system of pores and channels in a soil.

Major soil series correlated to this ecological site include: Lodgepole.

Other soil series that have been correlated to this site: None.

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

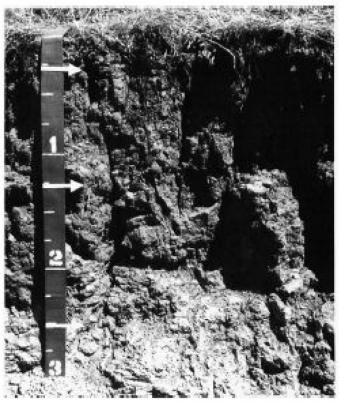


Figure 24.—A profile of a soil in the Lodgepole series. Because of the high content of clay, the subsoil has a high shrink-swell potential. The markers indicate the horizon boundaries.

Figure 9. Lodgepole Series, Garden County, NE

Table 4. Representative soil features

Parent material	(1) Alluvium (2) Loess
Surface texture	(1) Silty clay loam (2) Silt loam (3) Loam
Drainage class	Somewhat poorly drained
Permeability class	Slow
Soil depth	203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	15.24–30.48 cm
Calcium carbonate equivalent (0-101.6cm)	0–5%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	6.1–8.4
Subsurface fragment volume <=3" (Depth not specified)	0%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

The Closed Depression Ecological Site is characterized by two states: Reference and Increased *Bare Ground*. The Reference State is characterized by cool-season rhizomatous midgrass (western wheatgrass), cool-season bunch midgrass (green needlegrass), and warm-season stoloniferous shortgrass (buffalograss). Other cool-season grasses and grass-likes include prairie Junegrass, alkali (Sandberg) bluegrass, slender wheatgrass, Canada wildrye, and threadleaf sedge. Warm-season grasses are buffalograss, blue grama, and switchgrass. A minor component of forbs such as purple or white prairie clover, penstemon, and American vetch; and shrubs such as fourwing saltbush and 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 Fendler's threeawn, cuman ragweed (also known as western ragweed), curlycup gumweed, Rocky Mountain beeplant, seepweed, and other

annual grasses and forbs. Species such as prickly lettuce and Kentucky bluegrass may invade.

As the Closed Depression ecological site begins to deteriorate from 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. If continued, the plant community becomes sod-bound and all midgrasses are eventually removed from the plant community. Over the long-term, this continuous use in combination with high stock densities results in a broken sod, bare ground, and species such as Kentucky bluegrass invading. Dugouts are occasionally constructed to supply livestock water but are not a reliable source of water. The immediate area of the dugout is affected due to soil disturbance and increased animal impact. This has an impact on the overall integrity and ecological functioning of the site and is applicable to any of the plant community phases.

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.

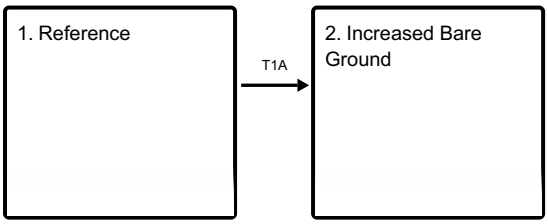
Recurrent drought has historically impacted the vegetation of this region. Changes in species composition vary depending upon the duration and severity of the drought cycle and prior grazing management. Drought events since 2002 have significantly increased mortality of blue grama and buffalograss in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

Eastern Colorado was strongly affected by extended drought conditions in the “Dust Bowl” period of the 1930’s, with recurrent drought cycles in the 1950s and 1970s. Extreme to exceptional drought conditions have re-visited the area from 2002 to 2012, with brief interludes of near normal to normal precipitation years. Long-term effects of these latest drought events have yet to be determined. Growth of native cool-season plants begins about April 1 and continues to mid-June. Native warm-season plants begin growth about May 1 and continue to about August 15. Regrowth of cool-season plants occurs in September in most years, depending on the availability of moisture.

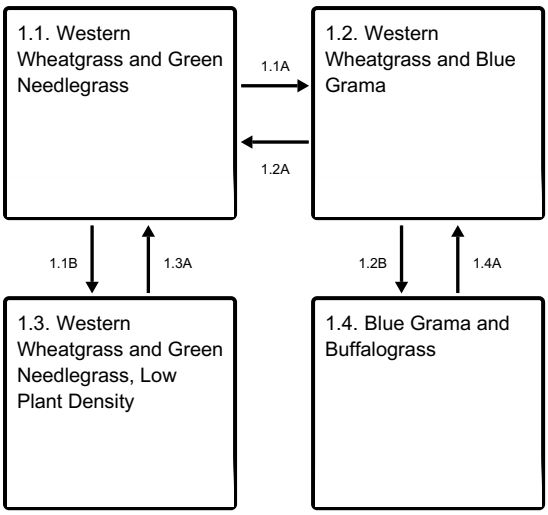
State and transition model

Ecosystem states



T1A - Excessive grazing. Lack of fire.

State 1 submodel, plant communities



1.1A - Excessive grazing. Lack of fire.

1.1B - Non-use. Lack of fire.

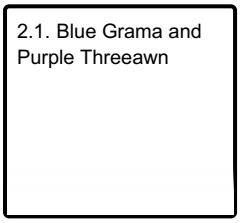
1.2A - Prescribed grazing. Prescribed fire.

1.2B - Excessive grazing. Lack of fire.

1.3A - Prescribed grazing. Prescribed fire.

1.4A - Prescribed grazing. Prescribed fire.

State 2 submodel, plant communities



State 1
Reference

The Reference state is characterized by four distinct plant community phases. The plant communities and the various successional stages between them represent the natural range of variability.

Dominant plant species

- big sagebrush (*Artemisia tridentata*), shrub
- fourwing saltbush (*Atriplex canescens*), shrub
- western wheatgrass (*Pascopyrum smithii*), grass
- green needlegrass (*Nassella viridula*), grass

Community 1.1
Western Wheatgrass and Green Needlegrass

The Reference Plant Community is the interpretive community for the Closed Depression Ecological Site. It 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 consists of 85 to 95 percent grasses and grass-likes, 5 to 10 percent forbs and 0 to 5 percent woody plants. Big sagebrush, silver sagebrush, and fourwing saltbush are the dominant shrubs while western wheatgrass and green needlegrass are the dominant grasses. 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
- fourwing saltbush (*Atriplex canescens*), shrub
- silver sagebrush (*Artemisia cana*), shrub
- western wheatgrass (*Pascopyrum smithii*), grass
- green needlegrass (*Nassella viridula*), grass

Figure 11. Plant community growth curve (percent production by month). WY1102, 12-14SP Extra water w/o warm - LL, Ov, CyO, SL. 12-14" Precipitation Zone, Southern Plains (SP), without warm-season (grasses); sites which receive additional water (run-on position), from adjacent sites..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	5	25	30	20	15	5	0	0	0

Community 1.2
Western Wheatgrass and Blue Grama

Western wheatgrass is reduced and green needlegrass is nearly absent. Blue grama increases. Other grasses present may include buffalograss and prairie Junegrass. Prairie clover species and other palatable forbs such as dotted gayfeather, American vetch, and Penstemon are present in reduced amounts. Hairy false goldenaster, slimflower scurfpea, scarlet globemallow, and cuman ragweed have increased. Palatable shrubs such as fourwing saltbush and winterfat have decreased. Plant frequency, production, and litter have been reduced. 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
- silver sagebrush (*Artemisia cana*), shrub
- western wheatgrass (*Pascopyrum smithii*), grass
- blue grama (*Bouteloua gracilis*), grass

Figure 12. Plant community growth curve (percent production by month). WY1105, 12-14SP Extra water w/warm - LL, Ov, CyO, SL. 12-14" Precipitation Zone, Southern Plains (SP), with warm-season (grasses); sites which receive additional water (run-on position, from adjacent sites)..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	5	20	25	30	15	5	0	0	0

Community 1.3
Western Wheatgrass and Green Needlegrass, Low Plant Density

This plant community developed under many years of non-use and lack of fire. Plant species resemble community 1.1 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 cycling. In advanced stages of non-use or lack of fire, bare areas increase, causing an erosion concern. The introduction of grazing or fire can quickly change this plant community.

Dominant plant species

- big sagebrush (*Artemisia tridentata*), shrub
- fourwing saltbush (*Atriplex canescens*), shrub
- silver sagebrush (*Artemisia cana*), shrub
- western wheatgrass (*Pascopyrum smithii*), grass
- green needlegrass (*Nassella viridula*), grass

Figure 13. Plant community growth curve (percent production by month). WY1102, 12-14SP Extra water w/o warm - LL, Ov, CyO, SL. 12-14" Precipitation Zone, Southern Plains (SP), without warm-season (grasses); sites which receive additional water (run-on position), from adjacent sites..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	5	25	30	20	15	5	0	0	0

Community 1.4
Blue Grama and Buffalograss

Green needlegrass, American vetch, fourwing saltbush, and winterfat have been completely removed. Western wheatgrass may persist in trace amounts. Blue grama and buffalograss dominate the community and form a dense sod. Purple threeawn, ring muhly, hairy false goldenaster, broom snakeweed, and plains pricklypear increase. This plant community is resistant to change due to grazing tolerance of blue grama and buffalograss. A significant amount of production and diversity has been lost when compared to the Reference Plant Community. Loss of warm and cool-season grasses, fourwing saltbush and winterfat, and nitrogen fixing forbs have negatively impacted energy flow and nutrient cycling. Water infiltration is reduced significantly due to the massive shallow root system, (root pan), characteristic of sod-bound blue grama and buffalograss. This results in an increase of ponding duration which increases the amount of bare ground due to the loss of desirable grass and grass-like species.

Dominant plant species

- big sagebrush (*Artemisia tridentata*), shrub
- silver sagebrush (*Artemisia cana*), shrub
- blue grama (*Bouteloua gracilis*), grass
- buffalograss (*Bouteloua dactyloides*), grass

Figure 14. Plant community growth curve (percent production by month). WY1105, 12-14SP Extra water w/warm - LL, Ov, CyO, SL. 12-14" Precipitation Zone, Southern Plains (SP), with warm-season (grasses); sites which receive additional water (run-on position, from adjacent sites)..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	5	20	25	30	15	5	0	0	0

Pathway 1.1A
Community 1.1 to 1.2

Continuous, heavy grazing and lack of fire shifts this plant community to the 1.2 Community. Drought accelerates this process.

Pathway 1.1B
Community 1.1 to 1.3

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

Pathway 1.2A
Community 1.2 to 1.1

Prescribed grazing and prescribed fire shift this community back to the reference community.

Conservation practices

Prescribed Burning
Prescribed Grazing

Pathway 1.2B
Community 1.2 to 1.4

Heavy, continuous grazing without adequate recovery opportunity and lack of fire shifts this plant community to the 1.4 Community.

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

Pathway 1.4A
Community 1.4 to 1.2

Long-term prescribed grazing and prescribed fire move this plant community to the 1.2 Community and eventually to the Reference Community, assuming an adequate seed or vegetative source is available. Extended drought followed by normal precipitation can reduce the sod-bound condition and facilitate the shift in plant communities. This is a long-term community pathway requiring many years to accomplish.

Conservation practices

Prescribed Burning
Prescribed Grazing

State 2
Increased Bare Ground

Compared to the Reference state, perennial plants have been greatly reduced with only remnants of the most grazing tolerant species present. Annuals and non-native species have increased. Litter levels are extremely low. Wind erosion can be a hazard due to increased bare ground. Mineral crusting caused by raindrop impact magnifies the situation by disrupting surface soil aggregates decreasing infiltration. An ecological threshold has been crossed. Erosion and loss of organic matter and carbon reserves are resource concerns.

Dominant plant species

- big sagebrush (*Artemisia tridentata*), shrub
- silver sagebrush (*Artemisia cana*), shrub
- blue grama (*Bouteloua gracilis*), grass
- Fendler threeawn (*Aristida purpurea var. longiseta*), grass
- Russian thistle (*Salsola*), other herbaceous
- burningbush (*Bassia scoparia*), other herbaceous

Community 2.1
Blue Grama and Purple Threeawn

The plant composition is comprised 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, buffalograss, and purple threeawn. Annuals such as Russian thistle, burningbush, and cheatgrass have invaded.

Dominant plant species

- big sagebrush (*Artemisia tridentata*), shrub
- silver sagebrush (*Artemisia cana*), shrub
- blue grama (*Bouteloua gracilis*), grass
- Fendler threeawn (*Aristida purpurea var. longiseta*), grass
- Russian thistle (*Salsola*), other herbaceous
- burningbush (*Bassia scoparia*), other herbaceous

Figure 15. Plant community growth curve (percent production by month). WY1105, 12-14SP Extra water w/warm - LL, Ov, CyO, SL. 12-14" Precipitation Zone, Southern Plains (SP), with warm-season (grasses); sites which receive additional water (run-on position, from adjacent sites)..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	5	20	25	30	15	5	0	0	0

Transition T1A
State 1 to 2

Long-term, heavy, continuous grazing and lack of fire cause a shift across an ecological threshold to the Increased *Bare Ground* State. Erosion, loss of organic matter, and invasion of annual plants may delay recovery.

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"-14"**			1211–1513	
	western wheatgrass	PASM	*Pascopyrum smithii*	908–1009	–
	green needlegrass	NAVI4	*Nassella viridula*	303–504	–
2	**12"-14"**			0–202	
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–202	–
3	**12"-14"**			202–504	
	Grass, perennial	2GP	*Grass, perennial*	0–101	–
	blue grama	BOGR2	*Bouteloua gracilis*	0–101	–
	threadleaf sedge	CAFI	*Carex filifolia*	0–101	–
	Canada wildrye	ELCA4	*Elymus canadensis*	0–101	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–101	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–101	–
	switchgrass	PAVI2	*Panicum virgatum*	0–101	–
	Sandberg bluegrass	POSE	*Poa secunda*	0–101	–
	threeawn	ARIST	*Aristida*	0–40	–
6	**15"-17"**			1345–1681	
	western wheatgrass	PASM	*Pascopyrum smithii*	1009–1121	–
	green needlegrass	NAVI4	*Nassella viridula*	336–560	–
7	**15"-17"**			0–224	
	sideoats grama	BOCU	*Bouteloua curtipendula*	0–224	–

8	**15"-17"**			224–560	
	Grass, perennial	2GP	*Grass, perennial*	0–112	–
	blue grama	BOGR2	*Bouteloua gracilis*	0–112	–
	threadleaf sedge	CAFI	*Carex filifolia*	0–112	–
	Canada wildrye	ELCA4	*Elymus canadensis*	0–112	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–112	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–112	–
	switchgrass	PAVI2	*Panicum virgatum*	0–112	–
	Sandberg bluegrass	POSE	*Poa secunda*	0–112	–
	threeawn	ARIST	*Aristida*	0–45	–
Forb					
4	**12"-14"**			101–303	
	Forb, perennial	2FP	*Forb, perennial*	0–101	–
	textile onion	ALTE	*Allium textile*	0–40	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–40	–
	field sagewort	ARCA12	*Artemisia campestris*	0–40	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–40	–
	milkvetch	ASTRA	*Astragalus*	0–40	–
	white prairie clover	DACA7	*Dalea candida*	0–40	–
	purple prairie clover	DAPU5	*Dalea purpurea*	0–40	–
	larkspur	DELPH	*Delphinium*	0–40	–
	scarlet beeblossom	GACO5	*Gaura coccinea*	0–40	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	0–40	–
	dotted blazing star	LIPU	*Liatris punctata*	0–40	–
	desertparsley	LOMAT	*Lomatium*	0–40	–
	Indian breadroot	PEDIO2	*Pediomelum*	0–40	–
	beardtongue	PENST	*Penstemon*	0–40	–
	slimflower scurfpea	PSTE5	*Psoralidium tenuiflorum*	0–40	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–40	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–40	–
	American vetch	VIAM	*Vicia americana*	0–40	–
	meadow deathcamas	ZIVE	*Zigadenus venenosus*	0–40	–
	poison suckleya	SUSU2	*Suckleya suckleyana*	0–20	–
	silky sophora	SONU	*Sophora nuttalliana*	0–20	–
	Indiangrass	SONU2	*Sorghastrum nutans*	0–20	–
	oppositeleaf bahia	PIOP	*Picradeniopsis oppositifolia*	0–20	–
	wedgeleaf	PHCU3	*Phyla cuneifolia*	0–20	–
9	**15"-17"**			112–336	
	Forb, perennial	2FP	*Forb, perennial*	0–112	–
	textile onion	ALTE	*Allium textile*	0–45	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0–45	–
	field sagewort	ARCA12	*Artemisia campestris*	0–45	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–45	–

	milkvetch	ASTRA	*Astragalus*	0–45	–
	white prairie clover	DACA7	*Dalea candida*	0–45	–
	purple prairie clover	DAPU5	*Dalea purpurea*	0–45	–
	larkspur	DELPH	*Delphinium*	0–45	–
	scarlet beeblossom	GACO5	*Gaura coccinea*	0–45	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	0–45	–
	dotted blazing star	LIPU	*Liatris punctata*	0–45	–
	desertparsley	LOMAT	*Lomatium*	0–45	–
	Indian breadroot	PEDIO2	*Pediomelum*	0–45	–
	beardtongue	PENST	*Penstemon*	0–45	–
	slimflower scurfpea	PSTE5	*Psoralidium tenuiflorum*	0–45	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–45	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–45	–
	American vetch	VIAM	*Vicia americana*	0–45	–
	meadow deathcamas	ZIVE	*Zigadenus venenosus*	0–45	–
	poison suckleya	SUSU2	*Suckleya suckleyana*	0–22	–
	silky sophora	SONU	*Sophora nuttalliana*	0–22	–
	wedgeleaf	PHCU3	*Phyla cuneifolia*	0–22	–
	oppositeleaf bahia	PIOP	*Picradeniopsis oppositifolia*	0–22	–
Shrub/Vine					
5	**12"-14"**			0–40	
	silver sagebrush	ARCA13	*Artemisia cana*	0–101	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–101	–
	big sagebrush	ARTR2	*Artemisia tridentata*	0–101	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–101	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–40	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	0–40	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–40	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–40	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–40	–
	prairie rose	ROAR3	*Rosa arkansana*	0–40	–
	leadplant	AMCA6	*Amorpha canescens*	0–40	–
	prairie sagewort	ARFR4	*Artemisia frigida*	0–40	–
10	**15"-17"**			0–224	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–112	–
	silver sagebrush	ARCA13	*Artemisia cana*	0–112	–
	big sagebrush	ARTR2	*Artemisia tridentata*	0–112	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–112	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–45	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	0–45	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–45	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–45	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–45	–
	prairie rose	ROAR3	*Rosa arkansana*	0–45	–

	prairie sagewort	ARFR4	*Artemisia frigida*	0–45	–
	leadplant	AMCA6	*Amorpha canescens*	0–45	–

Animal community

Wildlife Interpretations:

Reference Plant Community - Western Wheatgrass, Green Needlegrass:

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. This 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. 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, Increased Blue Grama and Buffalograss:

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 – 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.

1.4 Community: Blue Grama and Buffalograss:

This community provides limited foraging for antelope and other grazers. Ground-nesting birds favoring sparse vegetation may use this community. Long-billed curlews use this community if standing water is present within one-quarter mile.

3.1 Community – Blue Grama, Fendler Threeawn, Annual Grasses, 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.

Grazing Interpretations:

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

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

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

Example: Reference PC – (1800) (.49)
1,800 lbs. per acre X 25% Harvest Efficiency = 450 lbs. forage demand for one month. Then, 450 lbs. per acre/912 demand per AUM =.49
Plant Community (PC) Production (lbs.ac), and Stocking Rate (AUM/Acre)

12-14” PZ:

Reference PC - (1800) (0.49)
1.2 PC - (1400) (0.38)
2.1 PC - (900) (0.25)

15-17” PZ:

Reference PC - (2000) (0.55)
1,2 PC - (1500) (0.41)
2.1 PC - (1000) (0.27)

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 Part 630, NRCS National Engineering Handbook for detailed hydrology information).

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

Recreational uses

This site provides hunting, hiking, photography, bird watching, and other 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 and Testing Plan

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

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

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

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

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

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

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

Each Alternative State/Community:

Complete to Provisional level.

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

Updated. All “Required” items complete to Provisional level.
Wildlife Interpretations: Plant community names updated. Narrative is from “Previously Approved” ESD (2008). Wildlife species must be updated at the next Approved level.

Livestock Interpretations: Plant community names and stocking rates updated.

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

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

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

Reference Sheet
Rangeland Health Reference Sheet carried over from previously “Approved” ESD (2008).
It will be updated at the next “Approved” level.

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

Inventory data references

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)

*NRCS double-sampling method, CO NRCS Similarity Index Worksheet 528(1).
Additional reconnaissance data collection using numerous ocular estimates and other inventory data; NRCS clipping data for USDA program support; Field observations from experienced range trained personnel. Specific data information is contained in individual landowner/user case files and other files located in county NRCS field offices.

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HYPERLINK "mailto:program.intake@usda.gov" program.intake@usda.gov.

Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	Dave Cook, Kristin Dickinson, George Gamblin, John Hartung, Andy Steinert, Nadine Bishop
Contact for lead author	
Date	11/19/2020
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 this site.

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

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground is typically less than 10 percent. After prolonged ponding, bare ground will increase for relatively short periods of time.

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.

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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 typically 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 a depth of 2 to 8 inches (5-20.3 cm). Soil colors are gray (5/1) dry and very dark gray (3/1) moist. Soil surface structure is typically granular. Soils tend to crack when dry.

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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 about 85 to 95 percent perennial grasses and grass-likes, 5 to 10 percent forbs, and 0 to 5 percent shrubs.

    The grass and grass-like component is made up cool-season, rhizomatous grasses (45-50%); cool-season bunch grasses (20-30%); warm-season, tall and mid-grasses (0-15%), warm-season short 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):** A compaction layer is not expected on this site.

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

    Dominant: Community 1.1 – 12-14” PZ:
    1. Native, C3, rhizomatous grasses – 810-900 #/ac (45-50%), 1 species minimum

    Community 1.1 – 15-17” PZ:
    1. Native, C3, rhizomatous grasses – 900-1000 #/ac (45-50%), 1 species minimum

    Sub-dominant: Community 1.1 – 12-14” PZ:
    2. Native, C3, bunch grasses – 360-540 #/ac (20-30%), 1 species minimum
    3. Native, Perennial and Annual Forbs – 100-270 #/ac (5-15%), 5 species minimum

    Community 1.1 – 15-17” PZ:
    2. Native, C3, bunch grasses – 400-600 #/ac (20-30%), 1 species minimum
    3. Native, Perennial and Annual Forbs – 100-300 #/ac (5-15%), 5 species minimum

Other: Community 1.1 – 12-14” PZ:
4. Minor: Native, C4, tall and mid-grasses – 0-270 #/ac (0-15%)
5. Minor: Grass-likes – 0-90 #/ac (0-5%)
6. Minor: Native, C4, short grasses – 0-90#/ac (0-5%)
7. Minor: Shrubs, vines, cacti – 0-90 #/ac (0-5%)

Community 1.1 – 15-17” PZ:
4. Minor: Native, C4, tall and mid-grasses – 0-300 #/ac (0-15%)
5. Minor: Shrubs, vines, cacti – 0-200 #/ac (0-10%)
6. Minor: Grass-likes – 0-100 #/ac (0-5%)
7. Minor: Native, C4, short grasses – 0-100#/ac (0-5%)

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

15-17” PZ: Community 1.1:
Community 1.1: Native, C3, rhizomatous grasses > Native, C3, bunch grasses > Native, Perennial and Annual Forbs > Native, C4, tall and mid-grasses > Shrubs, vines, cacti > Grass-likes = Native, C4, short grasses

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.

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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 0.50 to 1.50 inch (1.3 to 3.9 cm). Plant litter cover will vary with the length and duration of ponding.

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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 inch Precipitation Zone, annual production ranges from 900 to 2,700 pounds per acre on an air dry basis. Average annual production is 1,800 pounds per acre under normal precipitation and weather conditions.

    In the 15-17 inch precipitation zone, annual production ranges from 1,000 to 3,000 pounds per acre on an air dry basis. Average annual production is 2000 pounds per acre under normal precipitation and weather conditions.

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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, Canada thistle, Russian thistle, kochia, cottonwood trees (primarily in the eastern portion of the MLRA) 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.
